
VERIFICATION REPORT AND CERTIFICATION STATEMENT

KOE Environment Consultancy Inc. (Japan)

**Sulige Natural Gas based Power
Generation Project**

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13/06/2009		CCP.VOL0289		
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SGS United Kingdom Limited		KOE Environment consultancy Inc. (Japan)		
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Final Monitoring Version and Date:		Version 02, 20/04/2009		
Summary:				
SGS United Kingdom Ltd has performed the VCS verification of the Sulige Natural Gas based Power Generation Project (UNFCCC Ref. No. 1243 & SGS Ref. No. CCP.VOL0289) for the emission reductions achieved prior to its CDM crediting period against VCS2007. The verification includes an additional assessment of the compliance of the VCS PD against the requirements of VCS2007 guideline, the validation opinion of the revised monitoring plan, the assessment on the implementation of the revised monitoring plan and review of the application of the monitoring methodology as per the approved CDM methodology AM0029 Version 01. A site visit was conducted to verify the data submitted in the monitoring report. This project is a grid connected natural gas fired combined cycle power project which involves 2 sets of gas turbines PG9171E and steam turbines LZN60-5.7/0.58. The project aims to serve as a peak load balancing power plant and was designed to deliver an estimated amount of electricity of 1,196GWh per year to the North China Grid (NCG), thereby reducing CO₂ emissions. Annual consumption of natural gas by the project is estimated to be 247.8 million Nm³ and the electricity generated from the turbines was delivered to NCG via a 220kV substation in the plant. The first set of turbines started operations in April 2006 and both of the two generation sets were fully operational by January 2007. SGS confirms that the project is implemented in accordance with the validated Project Description. The monitoring system is in place and the emission reductions are calculated without material misstatements. Our opinion relates to the projects GHG emissions and the resulting GHG emission reductions reported and related to the valid and validated project baseline and monitoring and its associated documents. Based on the information received and reviewed SGS confirms that the implementation of the project has resulted in 888,578 tCO₂e Emission Reductions during the period 01/01/2007 up to 31/12/2007.				
Subject:				
VCS 2007.1 Project Verification				
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Abbreviations

CAR	Corrective Action Request
CDM	Clean Development Mechanism
CEF	Carbon Emission Factor
CER	Certified Emission Reductions
CO ₂	Carbon Dioxide
CO ₂ e	Carbon Dioxide Equivalent
CL	Clarification Request
DNA	Designated National Authority
DOE	Designated Operational Entity
DOL	Daily Operation Log
DRR	Daily Reading Record
ETN	Electricity Transaction Note
FAR	Forward Action Request
GHG	Greenhouse Gas(es)
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
MP	Monitoring Plan
MR	Monitoring Report
MRR	Monthly Reading Record
NCG	North China Grid
NGO	Non-governmental Organization
PD	Project Description
PP	Project Participant
PPA	Power Purchase Agreement
SGS	Société Générale de Surveillance
UNFCCC	United Nations Framework Convention on Climate Change
VCS	Voluntary Carbon Standard
VCU	Voluntary Carbon Unit
VR	Verification Report
VVM	Validation and Verification Manual

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1. Introduction

1.1 Objective

SGS United Kingdom Ltd has been contracted by KOE Environment consultancy Inc. (Japan) to perform an independent verification of its VCS project "Sulige Natural Gas based Power Generation Project". SGS has reviewed the GHG data collected for the period 01/01/2007 to 31/12/2007.

The purposes of this verification exercise are, by review of objective evidence, to independently review:

- Whether the project has resulted in emission reductions as declared by the organisation or GHG project's GHG assertion
- The data reported is accurate, complete, consistent, transparent and free of material error or omission.

1.2 Scope and Criteria

This engagement covers the verification of emission reductions from anthropogenic sources of greenhouse gases included within the project boundary of the "Sulige Natural Gas based Power Generation Project", as well as an additional confirmation of the compliance of VCS PD with the requirements of VCS2007.

Our approach is risk-based, drawing on an understanding of the risks associated with reporting GHG emissions data and the controls in place to mitigate these. Our examination includes assessment, on a test basis, of evidence relevant to the amounts and disclosures in relation to the project's GHG emission reductions for the defined reporting period.

The verification is not meant to provide any consulting towards the Client. However, stated requests for clarifications and/or corrective actions may provide input for improvement of the project design.

1.3 VCS project Description

This project is a grid connected natural gas fired combined cycle power project which involves 2 sets of gas turbines PG9171E and steam turbines LZN60-5.7/0.58. The project aims to serve as a peak load balancing power plant and was designed to deliver an estimated amount of electricity of 1,196GWh per year to the North China Grid (NCG), thereby reducing CO₂ emissions. Annual consumption of natural gas by the project is estimated to be 247.8 million Nm³ and the electricity generated from the turbines was delivered to NCG via a 220kV substation in the plant. The first set of turbines started operation in April 2006 and both generation sets were fully operational by January 2007.

1.4 Level of assurance

The level of assurance of the verification report is reasonable assurance engagements as picked by the Client.

1.5 Project Activity and Period Covered

This engagement covers emissions and emission reductions from anthropogenic sources of greenhouse gases included within the project boundary of the following project and period.

Title of Project Activity:	Sulige Natural Gas based Power Generation Project
SGS Reference No:	CCP.VOL0289
Monitoring Period Covered in this Report	From 01/01/2007 to 31/12/2007
Project Participants	Sulige Fuel Gas Power Generation Co., Ltd. of Inner Mongolia (P.R. China)
Location of the Project Activity:	Dabuchake Town , Wushen Banner, Erdos City, Inner Mongolia Autonomous Region, P.R.China

2. Methodology

2.1 General Approach

SGS' approach to the verification is a two-stage process.

In the first stage, SGS completed a strategic review and risk assessment of the projects activities and processes in order to gain a full understanding of:

- Activities associated with all the sources contributing to the project emissions and emission reductions, including leakage if relevant;
- Protocols used to estimate or measure GHG emissions from these sources;
- Collection and handling of data;
- Controls on the collection and handling of data;
- Means of verifying reported data; and
- Compilation of the monitoring report.

At the end of this stage, SGS produced a Verification Checklist which, based on the risk assessment of the parameters and data collection and handling processes for each of those parameters, describes the verification approach and the sampling plan.

Using the Verification Checklist, SGS verified the implementation of the Monitoring Plan and the data presented in the Monitoring Report for the period in question. This involved a site visit and a desk review of the Monitoring Report. This Verification Report describes the findings of this assessment.

2.2 Verification Team for this Assessment

Name	Role	SGS Office
Niclo Deng Wei	Lead Assessor	SGS CN
Ginger Jiang Yuan	Assessor	SGS CN
Karen Tong Yumei	Local Assessor	SGS CN
Lenore Yin Lei	Local Assessor	SGS CN

2.3 Means of Verification

2.3.1 Review of Documentation

The VCS PD, the Monitoring Report submitted by the client and additional background documents related to the project performance were reviewed. A complete list of all documents reviewed is attached in section 8 of this report.

2.3.2 Site Visits

As part of the verification, the following on-site inspections have been performed.

Location: Dabuchake Town , Wushen Banner, Erdos City, Inner Mongolia Autonomous Region, P.R.China	
Date: 24/11/2008~25/11/2008	
Coverage:	Source of Information / Persons Interviewed
Visual check of physical and spatial configurations of the project activity.	Mr. Li Xiangchun, Sulige Fuel Gas Power Generation Co., Ltd. of Inner Mongolia Mr. Tian Yonglin, Sulige Fuel Gas Power

Inspection of established practices. Review of information flows for generating, aggregating and reporting the monitoring parameters Interview with relevant personnel of project participants for the consistency between CDM monitoring procedure and registered MP. Review of Power Purchase Agreement, Grid Connection Agreement and NG Supply Agreement for this monitoring period. Collection of Calibration Certificates/Records of measurement instruments. Collection of sales receipts .	Generation Co., Ltd. of Inner Mongolia Mr. Qi Siqing, Sulige Fuel Gas Power Generation Co., Ltd. of Inner Mongolia Mr. Liu Zijing, Sulige Fuel Gas Power Generation Co., Ltd. of Inner Mongolia Mr. Ma Zhen, Sulige Fuel Gas Power Generation Co., Ltd. of Inner Mongolia Mr. Cui Jinbao, Sulige Fuel Gas Power Generation Co., Ltd. of Inner Mongolia Mr. Gao Zhiqiang, KOE Environment consultancy Inc. (Japan) Mr. Zhang Fan, KOE Environment consultancy Inc. (Japan) Miss. Kang Jiali, KOE Environment consultancy Inc. (Japan) Miss. Pan Tao, Additional Consulting and Engineering Miss Liu Yao, Additional Consulting and Engineering
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2.4 Reporting of Findings

As an outcome of the verification process, the team can raise different types of findings

In general, where insufficient or inaccurate information is available and clarification or new information is required the team shall raise a Clarification Request (CL) specifying what additional information is required.

Where a non-conformance arises the team shall raise a Corrective Action Request (CAR). A CAR is issued, where:

- I. the verification is not able to obtain sufficient evidence for the reported emission reductions or part of the reported emission reductions. In this case these emission reductions shall not be verified and certified;
- II. the verification has identified misstatements in the reported emission reductions. Emission reductions with misstatements shall be discounted based on the verifiers ex-post determination of the achieved emission reductions

The verification process may be halted until this information has been made available to the assessors' satisfaction. Failure to address a CL may result in a CAR. Information or clarifications provided as a result of an CL may also lead to a CAR.

Observations may be raised which are for the benefit of future projects and future verification actors. These have no impact upon the completion of the verification activity.

Corrective Action Requests and Clarification Requests are detailed in Verification Checklist. The Project Developer is given the opportunity to "close" outstanding CARs and respond to CLs and Observations.

2.5 Internal Quality Control

Following the completion of the assessment process and a recommendation by the Assessment Team, all documentation will be forwarded to a Technical Reviewer. The task of the Technical Reviewer is to check that all procedures have been followed and all conclusions are justified. The Technical Reviewer will either accept or reject the recommendation made by the assessment team.

3. Validation of VCS PD against VCS 2007 additional criteria

3.1 Project Description

This project is a grid connected natural gas fired combined cycle power project which involves 2 sets of gas turbines PG9171E and steam turbines LZN60-5.7/0.58 with corresponding power generators and auxiliary equipments. The project aims to serve as a peak load balancing power plant and was designed to deliver an estimated amount of electricity of 1,196GWh per year to the North China Grid (NCG), thereby reducing CO₂ emissions. The annual consumption of natural gas by the project is estimated to be 247.8 million Nm³ and the electricity generated from the turbines was delivered to NCG via a 220kV substation in the plant. The first set of turbines started operations on April 2006 and both sets of turbines were fully operational by January 2007.

Additional requirements of VCS 2007.1 are fulfilled as per validated VCS PD dated 20/10/2008, provided in annex to this report, with details as below:

The project takes place in China, where there is no emission reduction target; the project is not a micro or mega project.

The Chinese DNA issued the LoA (/3/) for the project in 22/05/2007. In the LoA, it is indicated that Sulige Fuel Gas Power Generation Co., Ltd. of Inner Mongolia is authorized as China's participant to voluntarily participate in and carry out the project activity. The Chinese DNA had examined the ownership of the project before it issued the LoA to the project participant. Through review of the LoA from the Chinese DNA, the valid business license of the project owner (/4/), PP's statement for the ownership of the project, it was confirmed that the project is not a grouped one and the project is a registered CDM project activity and not rejected under any GHG programs. It was also confirmed that the ownership of the VCU's will be transferred to KOE Environment consultancy Inc. (Japan) as per the emission reductions purchase agreement (/5/).

The project is not implemented to create GHG emissions primarily for the purpose of its subsequent removal or destruction and the project has not created another form of environmental credit other than carbon emission reductions credits.

The PP has confirmed that none of the information provided to SGS was financially sensitive. The project is a registered CDM project activity and the starting date of the first crediting period is 21/07/2008. There are no mandatory emission trading programmes in China and the PP has provided the statement and further confirmed in the VCS PD dated 20/10/2008 that during this monitoring period they are not involved in another voluntary emission trading programme.

3.2 Baseline Selection and Additionality

The CDM is a GHG scheme recognised by the VCS programme. Appropriate baseline scenario has been selected; and the project has proven to be additional to the CDM baseline scenario in the registered CDM PDD and its validation report.

3.3 Application of Baseline Methodology and Calculation of Emission Factors

The project was registered under the CDM on 21/07/2008. The emission factor shall be ex-post updated annually as per the registered CDM PDD. This is discussed in Section 4.9.

3.4 Application of Monitor Methodology and Monitor Plan

The CDM is a GHG scheme recognised by the VCS programme. According to the registered CDM PDD (/1/) and its Validation Report (/2/), appropriate Monitoring Plan has been established in accordance with applied monitoring methodology. Due to the meter change by the gas supplier, the Monitoring Plan for the VCS crediting period has been revised (as provided in the annexes of the , VCS PD) and this revision has been validated as follows:

The revision relates to the monitoring equipment and procedure of FC_{NG,y}. It was originally planned to install orifice gas flow meters at the gas supplier's end with an accuracy level of 0.5 but ultrasonic flow meters with accuracy level of 1.0 were actually installed and put into use from 08/09/2007. The meter readings used for ER calculation are based on the meters installed at supplier's end and cross-checked by the meters installed at project's end, as per NG purchase agreement (/16/). The revision of MP has been validated as follows:

1) According to the applied methodology AM0029 Version 01, it is required that $FC_{NG,y}$ shall be daily measured by the fuel flow meter at project boundary, and the total fuel consumption will be monitored both at supplier and at the project end for cross-verification. It is stated in the revised MP that the $FC_{NG,y}$ is monitored by the ultrasonic gas flow meter(s) installed at the Changqing Gas field (supplier end) and the total volume of $FC_{NG,y}$ over the monitoring period will be cross-checked against the data monitored by meter(s) installed at Gas Pressure Regulating Station (project end). The readings of meter(s) installed at supplier end and project end are all recorded daily. The compliance to the applied methodology by the revised MP has been validated.

2) As explained by PP (/7/), the orifice gas flow meters with accuracy level of 1.0, were installed and used before 29/08/2007 prior to the crediting period; their accuracy level is lower than the one specified in the registered PDD. Although it is the gas supplier's responsibility for the installation and maintenance of the meters, this resulted in a non compliance which is not able to be cast back. This issue is not discussed in the the Revised MP as per VVM version 01, thus it will be covered in Section 4.2 of this report. From 08/09/2007 onwards, the gas supplier adopted the ultrasonic gas flow meters with accuracy level of 1.0 instead of the orifice gas flow meters, due to the below reasons:

(a) The principal of how an orifice gas flow meter works is described as "when natural gas flows through a throttle device, the flow beam contracts locally at the orifice-plate, resulting in increase in flow speed and decrease in static pressure. Then, the flow of natural gas passes through the throttle device could be evaluated via measurement on the difference in static pressure (pressure difference) before and after the orifice". Conduction of orifice flow meters requires that

- i. The fluid should be single-phase, homogeneous Newtonian fluid. Phase transition and impurity precipitation do not happen when the fluid passes through the throttle device. Any form of material adhesion or conglomeration is not allowed in the throttle device;
- ii. The pipeline should be round. There is also limitation on the pipe diameter. There should be long straight pipe segments both upstream and downstream. Roughness and roundness of the inner surface of the 10D straight pipe segment upstream and 4D straight pipe segment downstream the throttling element should strictly satisfy specific regulations;
- iii. The stream should be continuous and stable, rather than impulsive.

However, the natural gas consumed in the Project contains a small quantity of liquid and impurity in transportation, thus it does not satisfy the above requirement i. The liquid may freeze and accumulate at the front of the orifice-plate flow meter, thus the pressure difference before and after the orifice-plate is not reliable.

According to the on-site data of natural gas consumption, the natural gas transported from Changqing Gas Field to the Project is neither continuous nor stable, thus not satisfying the above requirement iii. Due to the impurity of gas component and the unstable gas flow rate, the maximum uncertainty may not limited to 1.0% in the actual practice with orifice flow meter with accuracy level of 1.0 according to the character of gas. This problem exists when using the orifice flow meters with accuracy level of 0.5 as well.

(b) Unlike orifice flow meters, ultrasonic wave flow meters employ the method of absolute digital time difference and the theory of the time difference between co-current and counter-current transmission of high-frequency acoustic impulse is proportional to the gas flow speed to measure the gas flow. They are velocity-type flow meters. Precision of ultrasonic wave flow meters could hardly be affected by the liquid or impurity contained in the measured fluid, thus ensuring the accuracy.

The above statements can be supported by the response to " Application of change meters for gas flow rate measurement by Sulige natural gas power plant" by the gas supplier. The document evidence (/8/) has been validated by the verification team. Such arguments have also been supported by the academic paper published in Natural Gas Industry (/9/). Furthermore, according to GB/T18604-2001 (/44/), the maximum uncertainty of the ultrasonic flow meter installed at the pipe with a diameter smaller than DN300 is 1.0%. The diameters of pipes where the flow meters are installed at are DN250 and DN200 respectively which allow the accuracy level of meters to be 1.0 or higher. The accuracy level of meters stated in revised MP is in accordance with relevant national standard.

Thus, it can be concluded that the level of accuracy or completeness in the monitoring and verification is not reduced as a result of the revision of the MP.

3.5 Choice of Crediting Period

Emission reductions during the period from 01/01/2007 to 20/07/2008 prior to the first CDM crediting period is claimed for VCS certification. The start date of the crediting period is 01/01/2007 which is later than 28/03/2006, and the VCS 2007 validation has been contracted before 19/11/2008. The validation contract between SGS and KOE Environment consultancy Inc. (Japan) was signed on 23/10/2008 and this report with the attached certificate is valid if it is issued prior to 19/11/2009. This is the first monitoring period from 01/01/2007 to 31/12/2007.

3.6 Environment Impacts

The environment impacts have been assessed and validated in the registered CDM PDD and its validation report.

3.7 Local Stakeholder Comments

The local stakeholder comments have been addressed and validated in the registered CDM PDD and its validation report.

4. Verification Findings

4.1 Project Documentation and Compliance with the VCS PD

This is the verification for emission reductions achieved prior to its CDM crediting period against VCS 2007. Based on the registered PDD (/1/) and other corresponding information available on the UNFCCC website, <http://cdm.unfccc.int/Projects/DB/TUEV-SUED1184339707.46/view>, the project was registered under CDM program on 21/07/2008. The crediting period under VCS 2007 is from 01/01/2007 to 20/07/2008, as per validation opinion to the VCS PD as annexed. The present verification was for the first monitoring period from 01/01/2007 to 31/12/2007 in the annexed MR.

The project was registered against AM0029 Version 01 and ACM0002 Version 06 (/37/, /38/). The monitoring methodology has been correctly applied and the documents for this first periodic verification are complete and transparent. Due to the gap between the registered PDD and actual practice regarding monitoring of $FC_{NG,y}$, the revision of MP raised and validated by the verification team (Refer to Section 3.4 for detail). QA/QC procedure has been established as per registered PDD and well implemented. The project boundary is consistent with the registered PDD.

No findings were raised in this regard.

4.2 Monitoring Results

According to the registered MP, five main parameters to be monitored are listed in Table 1. Monitoring procedures and QA/QC procedures have been established as per CDM manual (/32/) in accordance with registered MP. Corresponding responsibilities have been allocated.

Table 1 Parameters

Parameter to be monitored	Description	Comment
$EG_{PJ,y}$	Net electricity delivered to the grid by the project	Continuously measured and monthly recorded. Sales receipts confirmed by both party used for cross check.
$EF_{BM,y}$	Baseline CO ₂ emission factor	As BM is selected as the baseline emission factor as per registered PDD, the emission factor shall be annually updated. $F_{i,m,y}$, $GEN_{m,y}$, $r_{m,y}$, NCV_i , $OXID_i$, $EF_{CO2,i}$, $FC_{adv,coal}$, and $FC_{adv,oil/gas}$ listed in the registered MP are all parameters used to calculate $EF_{BM,y}$, all parameters were cited from the publicly official data source for year y. $EF_{BM,y}$ is an external data discussed in Section 4.2.9
$FC_{NG,y}$	The total volume of natural gas combusted in the project plant	Continuously measured by natural gas flow meters and daily recorded by project owner. The total volume through the whole monitoring period will be cross check by two sets of data (one set from meters installed in the power plant, the other set from meters installed in the gas supplier site)
$NCV_{NG,y}$	Net Calorific Value per volume unit of natural gas	Measured and calculated by gas supplier as per AM0029 version 01. The project owner recorded once per two

		weeks. NCV _{NG,y} is also an external data discussed in Section 4.2.9
FC _{diesel,y}	The total volume of diesel combusted in the project plant	Continuously measured and monthly recorded by project owner. Double check against the sales receipts and storage record.
EG _{Gen,y}	The amount of electricity generated by the project	Measured continuously by meters installed at the outlet of generators and recorded per month. Cross check with the fuel consumption of the project.
Φ _{coal}	The share of coal fired generation in build margin generation	Parameter used to calculate Leakage, annually updated based on the publicly official data source. Φ _{coal} is also an external data discussed in Section 4.2.9

CL #2 was raised for requesting some of the calibration certificates and accreditation certificates of calibration entity, after the required documents were provided by the PP, and validated by the assessment team to be sufficient. **CL #2 is closed out.** Detail in annexed A.3 Findings Overview.

4.2.1 EG_{PJ,y} (Net Electricity delivered to the grid by the project, MWh)

Four bidirectional electric meters (Two main meters and two backup meters) have been installed at the 220kV substation in the power plant to measure the net electricity delivered to the grid by the project, PDM2000 and PSM-ID system were also installed for remote reading of the meters. The accuracy level of all the meters are 0.2S which is in accordance with registered PDD and national industrial regulation DL/T 448-2000 (/49/). EG_{PJ,y} was derived from the power delivered to the grid and power imported from the grid. The readings of backup meters will be used only in case of error or damage of main meters. During this monitoring period, the main meters worked properly without any error or damage, the backup meters only served as cross reference.

All the four meters have been calibrated by the Inner Mongolia Electric Power Research Institute accredited by the Quality and Technology Supervision Bureau of Inner Mongolia Autonomous. The calibrations were carried out in accordance with relevant national technical regulation JJG596-1999 (/50/) on 11/11/2005, with a 5-year validity period. The calibration procedure was verified to be in accordance with registered MP, and the conclusion of calibration reflects the eligibility of the meters for measurement. The calibration certificates dated 11/11/2005 (/20/), as well as the accreditation certificates of the calibration entity (/17/) have been obtained and verified by the assessment team and found to be acceptable.

The readings of the two main meters and the two backup meters were recorded by qualified members of staff on a daily basis. The readings were aggregated up to 24:00 hours of the last day of every month and were recorded and archived.

The local grid company is able to access the meters as well. Apart from the aforementioned four meters, another two meters have also been installed at the substation of the local grid company to measure the same parameter as power delivered to the grid and power imported from the grid. Monthly sales receipts were issued based on the values confirmed by both parties, generally the readings by the local grid company as per signed PPA. Taking the transmission loss and non-synchronous recording into account, the values on the sales receipts may not always be the same as the readings recorded by the power plant. For conservativeness, the lower value of the aggregated EG_{PJ,y} during this monitoring period between the MRRs and sales receipts was adopted for ERs calculation, i.e. the smaller values of power delivered to the grid and larger values of power imported from the grid were used for ERs calculation.

Monthly internal auditing was carried out by responsible persons of the power plant and the data related to CDM monitoring was also sent to the consultation company for checking.

The reported values of power delivered to the grid and power imported from the grid have been verified against the MRRs (/22/) and double checked against the sales receipts (/23/, /24/), showing the consistency between the reported values and the evidences. The magnification factor of meters has also been verified against the calibration certificates. Original Daily Operation Log (DOL) books of the 220kV substation (/23/) were randomly examined by the assessment team and were found to be accurate. The reported data for $EG_{PJ,y}$ in the annexed MR are complete, accurate, reliable and conservative.

No findings were raised in this regard.

4.2.2 $FC_{NG,y}$ (Total volume of natural gas combusted in the project plant, Nm^3)

This parameter was measured by three ultrasonic flow meters simultaneously. Two meters (Daniel 3400) with designed accuracy levels of 1.0 were installed parallel in the station of the gas supplier - Changqing Gas Field of PetroChina Co., Ltd. (hereafter referred to as CGFPC), serving as the main meters of which the readings were used for trading as per the signed Natural Gas Purchase Agreement (/16/). The other one (SICK MAIHAK FLOWSIC600) with a designed accuracy level of 0.2 was installed in at the Gas Pressure Regulating Station of the project site. All three meters have been installed correctly as per the national standard GB/T18603-2001 (/43/). The measured flow rate converts to normal conditions automatically by the flow meter system according to the measured temperature and static pressure.

The main meters (Daniel 3400) have been calibrated according to verification regulation JJG1030-2007 (/47/) by the National Metering Station for Crude Oil, which is accredited by National Quality and Technology Supervision Bureau, on 09/06/2007 with a 2-year validity. The meter (SICK MAIHAK FLOWSIC600) at the project end was calibrated by the manufacturer on 17/10/2005. Prior to the change of flow meters at CGFPC, the orifice flow meter installed at the CGFPC has also been calibrated according to verification regulation JJG640-1994 (/48/) on 06/08/2006 with a 2-year validity period. All the calibration certificates (/21/), as well as the accreditation certificates (/18/) have been obtained and verified, demonstrating the eligibility of meters.

CAR #1 was raised for further clarification regarding the change of the flow meter. It is clarified by the PP that the orifice flow meters installed at the supplier end with accuracy levels of 1.0 were installed prior to 30/08/2007, and they have been changed into ultrasonic meters with accuracy levels of 1.0, either of which is not in compliance with the registered PDD where it was prescribed that the orifice flow meter with an accuracy level of 0.5 shall be installed. In the period following 08/09/2007 (when the newly installed ultrasonic meters were put into use) a revision of the MP has been raised in annexed VCS PD where the real uncertainties of orifice flow meters and ultrasonic flow meters were compared and validated by the verification team in Section 3.4. For the period prior to 30/08/2007 (readings were zero during 30/08/2007~08/09/2007), the accuracy level of meters installed could not reach the required accuracy prescribed in the registered PDD, a discount on the final emission reduction was applied for conservativeness. **CAR #1 is closed out.**

$FC_{NG,y}$ was continuously measured by the flow meters. Qualified members of staff at the power plant recorded on a daily basis the readings of the meter at the project end in the Daily Operation Log (DOL) book of Gas Pressure Regulation Station. Qualified members of staff of the gas supplier recorded the readings of the meter at the supplier end in the Daily Reading Records (DRRs) every two hours. The daily transaction receipts reflecting the daily recorded readings by the gas supplier were issued to the power plant for trading as per the signed Natural Gas Purchase Agreement (/16/). The daily reading records by both the power plant and gas supplier, together with the daily transaction receipts have been obtained and verified by the assessment team and found to be accurate.

CAR #3 was raised for the inconsistency of the monitoring period for electricity and natural gas. In response to CAR #3 the PP revised the corresponding information in the MR. It has been verified that the reported monitoring period for electricity and natural gas was consistent (0:00 of 01/01/2007 to 24:00 of 31/12/2007). **CAR #3 is closed out.**

As required by AM0029 Version 01, the total fuel consumption shall be monitored both at the supplier and project end for cross-verification. **CL #4** was raised for lack of cross verification in version 01 of MR. In the annexed MR, the larger value of total fuel consumption during this monitoring period between the aggregated readings of meters at project end and supplier end was adopted for ERs calculation for conservativeness. By checking against the DOLs and DTRs, the compliance with the registered MP has been confirmed. **CL #4 is closed out.**

4.2.3 $FC_{\text{diesel},y}$ (Total volume of diesel combusted in the project plant for backup start off, t)

This parameter was measured by the content gauge (a kind of flow meter) installed at the inlet of the diesel power generator. There is neither a diesel consumption record nor sales receipts for the diesel purchased during this monitoring period. As per the FSR, the installed diesel is only for start up when a HV accident was taking place. The FSR has been verified by the verification team (/31/), and DOL confirmed that there no HV accident occurred during this monitoring period.

No findings were raised in this regard.

4.2.4 $EG_{\text{gen},y}$

As per AM0029 version 01, Electricity generation in the plant ($EG_{PJ,y}$) is adopted for calculation of leakage. However, $EG_{PJ,y}$ represents the net electricity delivered to the grid by the project and $EG_{\text{gen},y}$ represents the electricity generation in the plant as per the registered PDD. Thus, $EG_{\text{gen},y}$ was adopted for leakage calculation during this monitoring period, this is in accordance with the registered PDD and the definition in AM0029 version 01.

This parameter was measured by the meters installed at the outlet of the power generator. The accuracy level of the meters is 0.5S which is in conformity with the national standard DL/T448-2000. They are read and recorded daily by qualified members of staff of the power plant, and aggregated monthly.

To maintain the accuracy of the meters, calibrations have been carried out by Inner Mongolia Electric Power Research Institute accredited by the Quality and Technology Supervision Bureau of Inner Mongolia Autonomous in accordance with the national standard JJG596-1999 on 11/11/2005, with a 5-year validity period. Implemented calibration procedure was in conformity with the registered and/or revised MP. The calibration certificates and the accreditation have been obtained and verified by the verification team.

By checking against the original DOL, the reported values of $EG_{\text{gen},y}$ in annexed MR are verified.

No findings were raised in this regard.

4.3 Remaining Issues, CAR's, CL's from Previous Validation or Verification

This is the first monitoring period under the VCS crediting period, prior to the CDM crediting period. There is no remaining issue from CDM validation.

4.4 Project Implementation

This is the VCS verification prior to CDM crediting period. Two sets of turbines, relevant auxiliary equipments and relevant monitoring equipments were installed as per registered PDD.

Table 2 Project implementation

	Description in registered PDD	Verified actual practice	Comment
Gas turbine	PG917E, air-cooling	PG917E, air-cooling	Consistent, verified by site visiting
Gas turbine generator	QFR-135-2, air-cooling	QFR-135-2, air-cooling	
Steam turbine	LZN60-5.7/0.58	LZN60-5.7/0.58	
Steam turbine generator	QFW-60-2, air-cooling	QFW-60-2, air-cooling	
Electricity output	1,196GWh	1,978GWh	65% larger than estimated in registered PDD, which may impact the additionality.
Natural Gas consumption	247.8 million Nm^3	422.4 million Nm^3	70% larger than estimated in registered PDD, which may impact the additionality.

Emission reduction	593,981 tCO ₂ e	888,578 tCO ₂ e	50% larger than the ERs estimated in the registered PDD, due to the more power generation and NG consumption during this monitoring period.
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During this monitoring period, the electricity output and the natural gas consumption of the project has increased 65% and 70% respectively compared to the estimated amount as there is no power constrain to the project activity during this monitoring period, which bring in the possibility of change on the conclusion of additionality. Thus, a re-assessment of baseline scenario and additionality has been carried out in the annexed VCS PD. The assessment is exactly based on the validated PDD and IRR spreadsheet on UNFCCC website <http://cdm.unfccc.int/Projects/DB/TUEV-SUED1184339707.46/view>. It has been validated that the conclusion of the registered PDD regarding baseline scenario and additionality remains unchanged, when only the electricity output and natural gas consumption increase 65% and 70% respectively.

No findings were raised in this regard.

4.5 Completeness of Monitoring

The reporting procedures reflect the content of the monitoring plan. The monitoring mechanism is effective and reliable.

No findings were raised in this regard.

4.6 Accuracy of Emission Reduction Calculations

Two CLs and two CARs regarding accuracy of emission reduction calculation were raised for version 01 of the MR (CAR #1, CL #2, CAR #3 and CL #4). The responses to the CLs and CARs were satisfactory and the findings have been closed. The calculation of emission reduction in annexed version 02 of MR is found to be correct. The details of the reported and the verified values for all parameters are listed in section 5.

4.7 Quality of Evidence to Determine Emission Reductions

Critical parameters used for the determination of the Emission Reductions are discussed above in section 4.2 above. All the data recorded is in compliance with the monitoring report.

4.8 Management and Operational System and Quality Assurance

CDM manual in accordance with registered MP has been compiled. All the QA/QC procedures defined have been well implemented during this monitoring period. The management structure covering quality assurance and internal auditing for CDM monitoring plan implementation has been stipulated in the monitoring manuals and implemented during daily operation by assigned staffs. A Monitoring working group has been set up for responsibility of data collecting, processing, archiving and meter calibrating etc. under the supervision of CDM responsible person. Relevant training has been carried out for both power plant operation and CDM monitoring (/32/). The training records and qualifications of members of staff were verified by the verification team (/33/, /34/, /35/). Members of staff were also interviewed during site visiting to confirm their eligibility to perform tasks.

No findings were raised in this regard.

4.9 Data from External Source

Apart from the parameters ($NCV_{NG,y}$, $EF_{BM,y}$ and ϕ_{coal}) listed in the MP, there are some other parameters involved in the leakage calculation, of which the data come from external sources. They are also discussed under this section.

4.9.1 $NCV_{NG,y}$

This parameter was measured and calculated by gas supplied (CGFPC), and provided to the project owner once per two weeks. The project owner recorded and archived the bi-weekly data. Weight average $NCV_{NG,y}$ for the entire monitoring period was calculated and used for the ERs calculation.

By interviewing the staff of CGFPC who were responsible for the NCV testing, the following facts have been confirmed reflecting the accuracy, completeness and reliable of reported data:

- 1 Natural gas supplied to the project was sampled once every two weeks at the supplier end and the components of natural gas were analyzed by Gas Chromatography by qualified members of staff at CGFPC.
- 2 All the gas component analysis reports have been archived by the PP.
- 3 The Gas Chromatograph was calibrated according to JJG700-1999 (/46/) by Shaanxi Institute of Metrology Science accredited by Quality and Technology Supervision Bureau, which indicated the accuracy and reliability of NG composition analysis reports. The calibration certificate and accreditation certificate have been obtained and verified (/19/, /22/).
- 4 The NCV of samples were calculated automatically by the computer program installed at CGFPC, based on the gas components. The calculation is according to national standard GB/T 11062-1998 (/45/).

By checking against the gas component analysis report provided by CGFPC, and working through the weight average calculation, the reported values of $NCV_{NG,y}$ are verified.

4.9.2 $EF_{BM,y}$

As per the applied methodology AM0029 version 01, the calculation of $EF_{BM,y}$ shall be referred to the latest version of ACM0002, the prescription of BM calculation in ACM0002 was replaced by "Tool to calculate the emission factor for an electricity system (hereafter referred to as TOOL)". Thus, the TOOL shall be applied for the annual BM calculation.

As per the TOOL and guidance of AM_CLA_0038 (/40/), y-1 vintage data can be used for determining $EF_{BM,y}$ of year y due to the main data source for calculating BM in China (China Power Yearbook and China Energy Statistical Yearbook) is usually published more than one year later than generation occurs (2006 vintage data will be presented in Yearbook 2007 which is usually published in early 2008).

The $EF_{BM,y}$ for this monitoring period (01/01/2007~31/12/2007) was determined based on the 2006 vintage statistical data issued by the national authorities and calculated as per method used in the registered PDD. The calculation has been verified and the calculated $EF_{BM,y}$ was cross check against the national emission factor issued by the Chinese DNA, which ensured the accuracy and conservativeness of $EF_{BM,y}$.

4.9.3 ϕ_{coal} (the share of coal-fired generation in BM generation)

0.94616, statistical data cited from China Electric Power Yearbook, 2007

4.9.4 $EF_{NG,upstream,CH_4}$ (Emission factor for upstream fugitive methane emissions of natural gas from production, transportation and distribution, tCH_4/PJ)

296, default value in AM0029 version 01, fixed as per registered PDD.

4.9.5 $PGCC_{coal}$ (the power generation standard coal equivalent consumption of the most likely baseline technology, gCe/kWh)

320, statistical data issued by national authority, fixed as per registered PDD.

4.9.6 $EF_{coal,upstream,CH_4}$ (emission factor for fugitive upstream emissions for coal, tCH_4/kt)

13.4, default values in AM0029 version 01, fixed as per registered PDD.

4.9.7 $NCV_{coal}/NCV_{rawcoal}$ (non dimensional)

1.4, statistical data issued by national authority, fixed as per registered PDD.

4.9.8 GWP_{CH_4} (Global Warming Potential of methane, tCO_2e/tCH_4)

21 tCO_2e/tCH_4 , Default value of IPCC, fixed as per registered PDD

5. Calculation of Emission Reductions

Parameter	Reported Value (Monitoring Report)		Verified Value (Verification Report)	Comments
	Monitored	Cross reference		
EG _{PJ,y}	1,978,186 MWh	1,981,448 MWh	1,978,186 MWh	Error is 0.16%, due to the transmission loss and non-synchronous of the recording. Conservative value of reading records and sales receipts adopted. (smaller supplied electricity and larger imported electricity adopted)
EF _{BM,y}	0.8687 tCO ₂ e/MWh	0.8687 tCO ₂ e/MWh	0.8687 tCO ₂ e/MWh	Emission factor issued by China DNA
FC _{NG,y}	422,408,154 Nm ³	418,936,000 Nm ³	422,408,154 Nm ³	Error is 0.8%, due to the linepack and the non-synchronous of the recording. Conservative value between aggregated readings at project end and supplier end adopted
NCV _{NG,y}	0.03478296 GJ/Nm ³	N/A	0.03478296 GJ/Nm ³	Cross check is not required
EF _{CO2,NG,y}	0.0561 tCO ₂ /TJ	N/A	0.0561 tCO ₂ /TJ	Cross check is not required
OXID _{NG,y}	100%	N/A	100%	Cross check is not required
FC _{diesel,y}	0 t	No HV accident	0 t	Cross checked by daily operational log
EG _{gen,y}	2,027,423 MWh	N/A	2,027,423 MWh	Cross check is not required
φ _{coal}	0.94616	N/A	0.94616	Cross check is not required
EF _{NG,upstream,CH4}	296 tCH ₄ /PJ	N/A	296 tCH ₄ /PJ	Available at validation
PGCC _{coal,best}	320 gCe/kWh	N/A	320 gCe/kWh	Available at validation
EF _{coal,upstream,CH4}	13.4 tCH ₄ /ktCe	N/A	13.4 tCH ₄ /ktCe	Available at validation
NCV _{coal} /NCV _{rawcoal}	1.4	N/A	1.4	Available at validation
GWP _{CH4}	21	N/A	21	Available at validation

$$BE_y = EG_{PJ,y} * EF_{BM,y} = 1,978,186 \text{ MWh} * 0.8687 \text{ tCO}_2\text{e/MWh} = 1,718,450 \text{ tCO}_2\text{e}$$

$$PE_y = FC_{NG,y} * NCV_{NG,y} * EF_{CO2,NG,y} * OXID_{NG} = 422,408,154 \text{ Nm}^3 * 0.03478296 \text{ GJ/Nm}^3 * 0.0561 \text{ tCO}_2/\text{TJ} = 824,255 \text{ tCO}_2\text{e}$$

$$EF_{BL,upstream,CH4} = \phi_{coal} * PGCC_{coal,best} * EF_{coal,upstream,CH4} * NCV_{coal}/NCV_{rawcoal}$$

$$= 0.94616 * 320 \text{ gCe/kWh} * 13.4 \text{ tCH}_4/\text{ktCe} * 1.4$$

$$= 5.68 * 10^{-3} \text{ tCH}_4/\text{MWh}$$

$$LE_y = \text{Max} [(FC_{NG,y} * NCV_{NG,y} * EF_{NG,upstream,CH4} - EG_{gen,y} * EF_{BL,upstream,CH4}) * GWP_{CH4}, 0]$$

$$= \text{Max} [(422,408,154 \text{ Nm}^3 * 0.03478296 \text{ GJ/Nm}^3 * 296 * 10^{-6} \text{ tCH}_4/\text{GJ} - 2,027,423 \text{ MWh} * 5.68 * 10^{-3} \text{ tCH}_4/\text{MWh}) * 21 \text{ tCO}_2\text{e/tCH}_4, 0]$$

$$= \text{Max} (-150,501 \text{ tCO}_2\text{e}, 0)$$

$$= 0$$

$EF_{BL,upstream,CH_4}$ and LE_y are calculated in accordance with the registered MP.

$$ER_y = BE_y - PE_y - LE_y = 1,718,450tCO_2e - 824,255tCO_2e - 0 = 894,195tCO_2e$$

As per the PP's response to CAR #1, the accuracy level of orifice flow meters installed at CFPGC was 1.0 which is not in conformity with the registered MP where it is stated that the meters with accuracy level of 0.5 shall be installed. The emission induced by consumption of 1.0% of total $FC_{NG,y}$ during 01/01/2007 to 08/09/2007 was accounted for additional emissions and deducted by the PP as following calculation. As it is not able to reveal the actual uncertainty of each data measured by calibrated meters in the past, it is conservative enough to discount the maximum uncertainty of a calibrated meter (1.0% is the nameplate accuracy class of the orifice flow meters, which means the maximum uncertainty of the meter in normal operation) for the entire period prior to the change of meter.

$$\text{Uncertainty of } FC_{NG,y} = 287,810,303Nm^3 * 1.0\% = 2,878,104Nm^3$$

$$\text{Discount of ERs} = 2,878,104Nm^3 * 0.03478296GJ/Nm^3 * 0.0561tCO_2/TJ = 5,617tCO_2e$$

$$\text{Final Verified ERs} = 894,195tCO_2e - 5,617tCO_2e = 888,578tCO_2e$$

6. Recommendations for Changes in the Monitoring Plan

No recommendation was made during this verification.

7. VCU Certification Statement

The scope of the verification

We, SGS, have been engaged by KOE Environment consultancy Inc. (Japan) to independently verify that the greenhouse gas (GHG) emission reductions reported for Sulige Natural Gas based Power Generation Project for the period from 01/01/2007 to 31/12/2007 in the monitoring report version 02 dated 20/04/2009 are eligible for registration as Voluntary Carbon Units.

This engagement covers the verification of emission reductions from anthropogenic sources of greenhouse gases included within the project boundary of the Sulige Natural Gas based Power Generation Project, as well as confirmation of the compliance of the VCS PD with the requirements of VCS 2007.1.

Our approach is risk-based, drawing on an understanding of the risks associated with reporting GHG emissions data and the controls in place to mitigate these. Our examination includes assessment, on a test basis, of evidence relevant to the amounts and disclosures in relation to the project's GHG emission reductions for the defined reporting period.

The verification is not meant to provide any consulting towards the Client. However, stated requests for clarifications and/or corrective actions may provide input for improvement of the project design.

Conclusions of the verification

(a) We are an entity accredited by the United Nations Framework Convention for Climate Change (UNFCCC) to undertake certification and verification services in the sector in which the Project is undertaken. The accreditation is accepted by VCS Board as indicated in Clause 9 of VCS 2007.1.

(b) The monitoring report, together with other information examined, was prepared in full substance and form as required by the Voluntary Carbon Standard version 2007.1, published by the Climate Group as approved by the Voluntary Carbon Standard Steering Committee on 18/11/2008.

(c) The information in the Project's monitoring report together with other information examined by us, including all the information necessary for us to determine that the emission reductions achieved have been determined correctly.

(d) Based on our examination of the monitoring report and other relevant information, the Project meets all the requirements of the Voluntary Carbon Standard verification criteria contained in the VCS 2007.1.

(e) Based on our examination of the monitoring report and other relevant information, the claiming emission reductions during the monitoring period from 01/01/2007 to 31/12/2007 are verified as 888,578 tonnes CO₂ equivalent.

Liability statement with regards to the accuracy of the verification statement

The management of the project is responsible for the preparation of the GHG emissions data and the reported GHG emissions reductions. SGS is responsible for verification and confirming emission estimates for the project, as described in the monitoring report.

Our certification approach draws on an understanding of the risks associated with reporting GHG emissions data and the controls in place to mitigate these. Our examination includes an assessment of evidence, through desk review, and where necessary, interviews, stakeholder discussions and site visits, relevant to certifying the rightfulness of the amounts and disclosures in relation to the Project's GHG emission reductions.

We planned and performed our work to obtain the information and explanations that we considered necessary to provide sufficient evidence for us to give reasonable assurance that the amount of GHG emission reductions for the given period, prepared on the basis of the monitoring report, are fairly stated.

This assessment included:

- Collection of evidence supporting the reported data
- Checking whether the provisions of the Monitoring Plan in the VCS PD, were consistently and appropriately applied

We have verified whether the information included in the monitoring report representing the emission reductions achieved has been determined correctly for the given period from the baseline figure.

Certification statements

Based on process and procedures conducted, in our opinion, the monitoring report Version 02 dated 20/04/2009 on emission reductions for Sulige Natural Gas based Power Generation Project during the reporting period from 01/01/2007 to 31/12/2007 is materially correct and is a fair representation of the GHG data and information and the emission reductions are fairly stated. All relevant facts have been found correct by our examination. The GHG emission reductions were calculated correctly on the basis of AM0029 version 01, dated 19/05/2006.

Therefore, SGS is able to certify that the project is in full compliance with the Voluntary Carbon Standard 2007.1, and the quantity of the reported emission reductions during below reporting period are completely, comparably, accurately and correctly reported.

Reporting period: From 01/01/2007 to 31/12/2007

Verified emission in the above reporting period:

Project emissions	824,255	t CO ₂ equivalents
Baseline emissions	1,718,450	t CO ₂ equivalents
Emission reductions	888,578	t CO ₂ equivalents

(Including 5,617 tCO₂e discount of ERs due to the meter uncertainty)

Statement of Confidentiality

SGS will hold all information confidential until the client instructs otherwise or until it has been released in accordance with the VCS 2007.1 modalities and procedures.

Signed on behalf of the Verification Body by Authorized Signatory



Signature:

Name: Siddharth Yadav

Date: 26th June 2009

8. DOCUMENT REFERENCES

Documents provided by PP

- /1/ CDM PDD Version 5 dated 01/12/2007
<http://cdm.unfccc.int/UserManagement/FileStorage/T2OTUPEVN79W0A0RC7NMZM7HXFBLX6>
- /2/ Validation Report for 1243 “Sulige Natural Gas based Power Generation Project” issued by TUV-SUD
Revision No. 4 dated 09/07/2008. Report no. 905181
<http://cdm.unfccc.int/UserManagement/FileStorage/74LWBO2N2IWJYQ8DIUQUKTH6GZBFUS>
- /3/ LoA for 1243 “Sulige Natural Gas based Power Generation Project” issued by China DNA and Japan DNA
<http://cdm.unfccc.int/UserManagement/FileStorage/94UPKMS9J4SYQTNR46NK61HTFGDOKS>
<http://cdm.unfccc.int/UserManagement/FileStorage/XPOF3ZPJZSCPTOYD4AUH3LQEUSNERD>
- /4/ Business license of project owner
- /5/ VCU Purchase Agreement
- /6/ VCS PD dated 20/10/2008
- /7/ Statement of meter change
- /8/ Reply to “Application for changing ultrasonic flow meter to orifice flow meter”, by Gas supplier
- /9/ Application of gas ultrasonic flow meter in Changqing Gas Field, Wang D, Zhao Y.G, Bai Y. Yuan W.J, Natural Gas Industry, Vol. 27, No.5, 2007
- /10/ IRR spreadsheet
- /11/ Monitoring Report, Version 01 dated 27/11/2008, Version 02 dated 20/04/2009
- /12/ Emission Reduction Calculation Spreadsheet
- /13/ Installation Plan and Key physical component
- /14/ Power Purchase Agreement (PPA) dated January 2007 and January 2008
- /15/ Grid Connection Agreement
- /16/ Natural Gas Purchase Agreement
- /17/ Accreditation of the Inner Mongolia Electric Power Research Institute dated 02/01/2005, due 01/01/2009
- /18/ Accreditation of National Metering Station for Crude Oil dated 11/10/2004, due 11/10/2008
- /19/ Accreditation of Shaanxi Institute of Metrology Science dated 14/03/2007, due 14/03/2011
- /20/ Calibration Certificates of the electric meters, issued by Inner Mongolia Electric Power Research Institute (Certificate No. 2005-L284, 2005-L286, 2005-L287, 2005-L288, 2005-L291, 2005-L292, 2005-L293, 2005-L294)
- /21/ Calibration Certificates of the flow meters (orifice and ultrasonic) issued by National Metering Station for Crude Oil (Certificate No. GM20060806, GM20070290, GM20070291)
- /22/ Calibration Certificates of the Gas Chromatograph issued by Shaanxi Institute of Metrology Science (Certificate No. HX30061378J)
- /23/ Daily Operation Log (DOL) of 220kV Substation (Daily Production Report) from 01/01/2007 to 31/12/2007
- /24/ Monthly reading records (MRRs) of electricity delivered to and imported from the grid from 01/01/2007 to 31/12/2007
- /25/ Monthly Electricity Sales Invoices for electricity supplied to the grid from 01/01/2007 to 31/12/2007
- /26/ Monthly Electricity Sales Invoices for electricity imported from the grid from 01/01/2007 to 31/12/2007
- /27/ Daily Operation Log (DOL) of Gas Pressure Regulating Station (Daily Record of Natural Gas Usage) from

01/01/2007 to 31/12/2007

- /28/ Daily Reading Records (DRR) of flow meters at Changqing Gas Field of PetroChina Co., Ltd. (CGFPC) from 01/01/2007 to 31/12/2007
- /29/ Daily Transaction Receipts (DTR) for natural gas purchased from CFPGC from 01/01/2007 to 31/12/2007
- /30/ Bi-weekly Natural Gas component analysis report (including bi-weekly NCV) from 01/01/2007 to 31/12/2007
- /31/ Design of Diesel power generator in FSR
- /32/ CDM Manual and management procedure (including emergency plan)
- /33/ Training Plan and Record
- /34/ Qualification of Staff
- /35/ Equipment maintenance record

Other documents independently investigated by DOE

- /36/ Validation and Verification Manual Version 01
- /37/ AM0029 Version 01 dated 19/05/2006
<http://cdm.unfccc.int/UserManagement/FileStorage/74LWBO2N2IWJYQ8DIUQUKTH6GZBFUS>
- /38/ ACM0002 Version 06 dated 19/05/2006
http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_BW759ID58ST5YEEV6WUCN5744MN763
- /39/ Tool to calculate the emission factor for an electricity system Version 01 dated 19/10/2007
<http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v1.1.pdf>
- /40/ AM_CLA_0038, Clarification on data vintage if OM or BM emission coefficient is monitored ex-post
- /41/ China Power Yearbook, 2005, 2006, 2007
- /42/ China Energy Statistical Yearbook, 2005, 2006, 2007
- /43/ GB/T 18603-2001 Technical requirements of measuring systems for natural gas
- /44/ GB/T18604-2001 Measurement of natural gas flow by ultrasonic flow meter
- /45/ GB/T11062-1998 Natural gas – Calculation of calorific values, density, relative density and Wobbe index from composition
- /46/ JJG700-1999 Verification Regulation of Gas chromatograph
- /47/ JJG1030-2007 Verification Regulation of Ultrasonic Flowmeters
- /48/ JJG640-1994 Verification Regulation of Differential Pressure Type Flowmeters
- /49/ DL/T448-2000 Technical administrative code of electric energy metering
- /50/ JJG596-1999 Verification Regulation of Electronic watt-hour meter
- /51/ Emission factor published by China DNA, 2008 (Including data of 2006 vintage)

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A.1. Annex 1 Findings Overview

Findings Overview Summary

	CARs	CLs	FARs
Total Number raised	2	2	0

Date:	26/11/2008	Raised by:	Niclo Deng		
Type:	CAR	Number:	CAR #1	Reference:	VP Section 3
Lead Assessor Comment:			Date: 26/11/2008		
It is found by SGS assessor that the two ultrasonic flow meters with accuracy level of 1.0S were installed for Natural gas flow rate monitoring. However it is clearly stated in the registered PDD that orifice flow meters with accuracy level of 0.5S. Please make further clarification how the registered monitoring plan is satisfied and correction accordantly.					
Project Participant Response:			Date: 18/03/2009		
Detailed demonstration of the situation of the Project has been prepared in an independent document named "Revision on the Monitoring Plan – Demonstration for the Replacement on Natural Gas Flow Meters of Sulige Natural Gas Based Power Generation Project". In brief, “ The selection of the natural gas flow meters is determined by the gas supplier (China National Petroleum Corporation, CNPC) according to Natural Gas Purchase Agreement. The Project Owner has to use orifice-plate flow meters with a precision class of 1.0 prior to September, 2007 and use ultrasonic wave flow meters with a precision class of 1.0 after September, 2007. Therefore, the Project Owner has to accept the replacement and apply for revision on the monitoring plan accordingly. Fortunately, theoretical analysis and industrial practices prove that “employing ultrasonic wave flow meters is of a higher accuracy than orifice-plate flow meters in natural gas measurement in Sulige Project”. As a result, the revision on the monitoring plan will not reduce the accuracy of the monitored data of the amount of natural gas.” The “Revision on the Monitoring Plan” quoted in the VCS PD has been provided along with the revised Monitoring Report. At the same time, supporting documents relevant to the revision on the monitoring plan have been provided. Please refer to these documents for details. The accuracy level of orifice flow meters installed at CFPGC was 1.0 during 01/01/2007 to 08/09/2007 which is not in conformity with the registered MP where it is stated that the meters of 0.5 accuracy level shall be used. The orifice flow meters installed at the CGFPC have been calibrated for 2 years validity according to Code JJG640-1994 on 06/08/2006. Thus, emissions introduced by consumption of 1.0% of the measured total amount of natural gas consumption of the Project during 01/01/2007 to 08/09/2007 are accounted as additional emissions for conservativeness in the revised monitoring report submitted along with this response.					
Documentation Provided as Evidence by Project Participant:					
Statement of meter change Reply to “Application for changing ultrasonic flow meter to orifice flow meter”, by Gas supplier Application of gas ultrasonic flow meter in Changqing Gas Field, Wang D, Zhao Y.G, Bai Y. Yuan W.J, Natural Gas Industry, Vol. 27, No.5, 2007 GB/T18604-2001 Measurement of natural gas flow by ultrasonic flow meter Natural Gas Purchase Agreement					
Information Verified by Lead Assessor:					
Principle of flow meters (ultrasonic and orifice) Statement from gas supplier regarding the reason of meter change Date of meter change (30/08/2007~08/09/2007) Requirements of accuracy of flow meter in National standard GB/T18064-2001 Meter installation prior to the change of meter in Natural Gas Purchase Agreement					
Reasoning for not Acceptance or Acceptance and Close Out:					

The change of meter has been discussed in the Revision of MP in VCS PD and the validation opinion has been included in the section 3 of verification report.
For the period prior to the change of meter (01/01/2007 ~ 30/08/2007), the accuracy level of the orifice flow meter installed (1.0) is not in compliance with the registered MP 0.5. In order to complete the verification report, a theoretically maximum uncertainty (1%) was assumed and corresponding emission reductions was deducted from the reported emission reductions in the final version of MR, this is conservative. CAR #1 is closed out.

Acceptance and Close out by Lead Assessor: **Date:** 19/05/2009

Date:	26/11/2008	Raised by:	Niclo Deng
Type:	CL	Number:	CL #2
Reference:		VP Section 3	
Lead Assessor Comment:		Date: 26/11/2008	
Please provide the certificates for accreditation of flow meter calibration entity. Please further clarify how the calibration plan for electricity meter is satisfied as per registered MP. Please provide relative national standard, calibration certificates with validity period. Please provide the certificates for accreditation of electricity meter calibration entity. Please provide the calibration certificates for NCV of Natural gas supplied to the project. Please provide the certificates for accreditation of GC meter calibration entity.			
Project Participant Response:		Date: 18/03/2009	
1. Certificate of Metrological Authorization No.FJ[2006]0007 of National Metering Station for Crude Oil with High Flow Rate has been provided as the accreditation of the flow meter calibration entity. The calibration report has been provided by SICK MAIHAK to confirm the precision of the flow meters installed at the gas pressure regulating station within the Project Site. 2. As per the registered monitoring plant, the calibration of meters "should be implemented according to relevant national and local standards and rules." In the calibration reports issued by Electric Power Research Institute of Inner Mongolia, the name of relative national standard (No.JJG596-1999), the calibration certificate and its validity period (five years) have been provided. 3. In the calibration reports issued by Electric Power Research Institute of Inner Mongolia, the calibration certificate and its validity period (five years) have been provided. Detailed introduction of the calibration entity can be found at the website of http://www.chinarein.com/qkhc/detail.asp?id=24151. 4. Certificate No.HX30061378J of Shaanxi Institute of Metrology Science has been provided as the calibration certificates for the NCV of the natural gas supplied to the Project. 5. Certificate of Metrological Authorization No.FJ[2002]01013 of Shaanxi Institute of Metrology Science has been provided as the certificates for accreditation of GC meter calibration entity.			
Documentation Provided as Evidence by Project Participant:			
Accreditation certificate of National Metering Station for Crude Oil (FJ[2006]0007) Calibration certificates of electricity meters (2005-L284, 2005-L286, 2005-L287, 2005-L288, 2005-L291, 2005-L292, 2005-L293, 2005-L294) Accreditation certificate of Inner Mongolia Electric Power Research Institute (No. 15021) Calibration certificate of GC (No. HX30061378) Accreditation certificate of Shaanxi Institute of metrology science (No. FJ[2002]01013)			
Information Verified by Lead Assessor:			
Accreditation certificate of National Metering Station for Crude Oil Calibration certificates of electricity meters Accreditation certificate of Inner Mongolia Electric Power Research Institute Calibration certificate of GC Accreditation certificate of Shaanxi Institute of metrology science			
Reasoning for not Acceptance or Acceptance and Close Out:			
All required calibration certificates or accreditation certificates of the calibration entity have been provided and verified, reflecting the compliance with the registered MP. CL #2 is closed out.			
Acceptance and Close out by Lead Assessor:		Date: 19/05/2009	

Date:	26/11/2008	Raised by:	Niclo Deng
Type:	CAR	Number:	CAR #3
Reference:		VP Section 3	
Lead Assessor Comment:		Date: 26/11/2008	
The monitoring period for electricity and natural gas does not match. Please make accordant correction.			

Project Participant Response:	Date: 12/03/2009
Correction has been made and tracked in the revised Monitoring Report to ensure the monitoring periods of electricity and natural gas to be consistent with each other.	
Documentation Provided as Evidence by Project Participant:	
No further evidences	
Information Verified by Lead Assessor:	
MR has been revised	
Reasoning for not Acceptance or Acceptance and Close Out:	
MR has been revised, reflecting the consistency in the monitoring period for electricity and natural gas (0:00 of 01/01/2007 to 24:00 of 31/12/2007). Original recordings and sales receipts support the consistency. CAR #3 is closed out.	
Acceptance and Close out by Lead Assessor:	Date: 19/05/2009

Date:	26/11/2008	Raised by:	Niclo Deng		
Type:	CL	Number:	CL #4	Reference:	VP Section 4
Lead Assessor Comment:				Date: 26/11/2008	
As per requirement of AM0029, version 01. The total fuel consumption shall be monitored both at supplier and project end for cross-verification. The reading records of meter installed at supplier end have been provided already, please provide the reading records of meter install at project end for DOE's verification.					
Project Participant Response:				Date: 12/03/2009	
Revision has been made and tracked in the revised Monitoring Report to comply with the requirements of the methodology AM0029. The reading records of the meters installed at the Project end (the gas pressure regulating station within the Project Site) have been provided.					
Documentation Provided as Evidence by Project Participant:					
Meter readings of fuel consumption measured at project end Calibration certificates of the flow meters installed at the project end Accreditation of calibration entity					
Information Verified by Lead Assessor:					
The fuel consumption was measured by two ultrasonic flow meter installed at the Changqing gas field on a daily basis by the gas supplier. Total fuel consumption monitored at the supplier end was 422,408,154Nm ³ . The fuel consumption was also measured by a ultrasonic flow meter installed at the gas pressure regulating station on a daily basis by the project owner. Total fuel consumption monitored at the project end was 418,936,000Nm ³ .					
Reasoning for not Acceptance or Acceptance and Close Out:					
The fuel consumption has been measured by both the flow meters installed at supplier end (Changqing gas field) and project end (Gas pressure regulating station). By cross checking the total fuel consumption monitored at the project end, the total fuel consumption monitored at the supplier end during this monitoring period is a bit larger, due to the linepack and the allowed error of the meters. The larger one was selected for ERs calculation for conservativeness. Relevant original record readings from the gas supplier and project owner have been verified. CL #4 is closed out.					
Acceptance and Close out by Lead Assessor:				Date: 19/05/2009	

A.2. Annex 2 Statement of Competency

Statement of Competence

Name: Niclo Deng Wei

SGS Affiliate: SGS CN

Status

- Product Co-ordinator ☐
- Operations Co-ordinator ☐
- Technical Reviewer ☐
- Expert ☐

Validation

Verification

- Local Assessor ☒ ☒
- Lead Assessor ☒ ☒
- Assessor ☒ ☒
- / Trainee Lead Assessor

Scopes of Expertise

- | | |
|--|-------------------------------------|
| 1. Energy Industries (renewable / non-renewable) | ☒ |
| 2. Energy Distribution | ☐ |
| 3. Energy Demand | ☐ |
| 4. Manufacturing | ☐ |
| 5. Chemical Industry | ☒ |
| 6. Construction | ☐ |
| 7. Transport | ☐ |
| 8. Mining/Mineral Production | ☐ |
| 9. Metal Production | ☐ |
| 10. Fugitive Emissions from Fuels (solid, oil and gas) | ☐ |
| 11. Fugitive Emissions from Production and Consumption of Halocarbons and Sulphur Hexafluoride | ☐ |
| 12. Solvent Use | ☐ |
| 13. Waste Handling and Disposal | ☐ |
| 14. Afforestation and Reforestation | ☐ |
| 15. Agriculture | ☐ |

Approved Member of Staff by Joe Sun Date: 16/04/2009

Statement of Competence

Name: Ginger Jiang Yuan

SGS Affiliate: SGS CN

Status

- Product Co-ordinator ☐
- Operations Co-ordinator ☐
- Technical Reviewer ☐
- Expert ☐

Validation

Verification

- Local Assessor ☒
- Lead Assessor ☒
- Assessor ☒
- / Trainee Lead Assessor

Scopes of Expertise

1. Energy Industries (renewable / non-renewable) ☒
2. Energy Distribution ☐
3. Energy Demand ☐
4. Manufacturing ☐
5. Chemical Industry ☐
6. Construction ☐
7. Transport ☐
8. Mining/Mineral Production ☐
9. Metal Production ☐
10. Fugitive Emissions from Fuels (solid, oil and gas) ☐
11. Fugitive Emissions from Production and Consumption of Halocarbons and Sulphur Hexafluoride ☒
12. Solvent Use ☐
13. Waste Handling and Disposal ☒
14. Afforestation and Reforestation ☐
15. Agriculture ☐

Approved Member of Staff by Joe Sun Date: 25/04/2009

Statement of Competence

Name: Karen Tong Yumei

SGS Affiliate: SGS CN

Status

- Product Co-ordinator ☐
- Operations Co-ordinator ☐
- Technical Reviewer ☐
- Expert ☐

- | | Validation | Verification |
|---------------------------|-------------------------------------|-------------------------------------|
| - Local Assessor | ☒ | ☒ |
| - Lead Assessor | ☐ | ☐ |
| - Assessor | ☐ | ☐ |
| - / Trainee Lead Assessor | | |

Scopes of Expertise

- | | |
|--|--------------------------|
| 1. Energy Industries (renewable / non-renewable) | ☐ |
| 2. Energy Distribution | ☐ |
| 3. Energy Demand | ☐ |
| 4. Manufacturing | ☐ |
| 5. Chemical Industry | ☐ |
| 6. Construction | ☐ |
| 7. Transport | ☐ |
| 8. Mining/Mineral Production | ☐ |
| 9. Metal Production | ☐ |
| 10. Fugitive Emissions from Fuels (solid, oil and gas) | ☐ |
| 11. Fugitive Emissions from Production and Consumption of Halocarbons and Sulphur Hexafluoride | ☐ |
| 12. Solvent Use | ☐ |
| 13. Waste Handling and Disposal | ☐ |
| 14. Afforestation and Reforestation | ☐ |
| 15. Agriculture | ☐ |

Approved Member of Staff by Joe Sun Date: 07/04/2009

Statement of Competence

Name: Lenore Yin Lei

SGS Affiliate: SGS CN

Status

- Product Co-ordinator ☐
- Operations Co-ordinator ☐
- Technical Reviewer ☐
- Expert ☐

Validation

Verification

- Local Assessor ☒ ☒
- Lead Assessor ☐ ☐
- Assessor ☐ ☐
- / Trainee Lead Assessor

Scopes of Expertise

1. Energy Industries (renewable / non-renewable) ☐
2. Energy Distribution ☐
3. Energy Demand ☐
4. Manufacturing ☐
5. Chemical Industry ☐
6. Construction ☐
7. Transport ☐
8. Mining/Mineral Production ☐
9. Metal Production ☐
10. Fugitive Emissions from Fuels (solid, oil and gas) ☐
11. Fugitive Emissions from Production and
Consumption of Halocarbons and Sulphur Hexafluoride ☐
12. Solvent Use ☐
13. Waste Handling and Disposal ☐
14. Afforestation and Reforestation ☐
15. Agriculture ☐

Approved Member of Staff by Joe Sun Date: 07/04/2009



Voluntary Carbon Standard

Project Description Template

19 November 2007

Notes

The Project titled "Sulige Natural Gas Based Power Generation Project" has been registered by UNFCCC on 21/07/2008 (Ref. No. 1243) as a CDM project.

As per *Policy Announcement from the VCS Association* published on 19/03/2008,

"Projects registered under other VCS Program approved GHG Programs (such as the CDM) are eligible to create Voluntary Carbon Units (VCUs) for the emissions reductions or removals not registered under that GHG Program.

...

For example, when a project has been validated under the CDM, a further validation shall be completed of clauses 1.12, 1.13, 1.14, 8.1 and 8.2 of the VCS Project Description template (<http://v-c-s.org/docs/VCS%20PD.doc>). This validation can be completed when the Project Proponent undergoes a VCS Program verification of achieved emissions reductions or removals."

Therefore only clauses 1.12, 1.13, 1.14, 8.1 and 8.2 of the VCS Project Description template are filled as below.

The Project was started on 01/01/2007 and the CDM validation period of the Project is 30/10/2006~09/07/2008. The VCS validation contract of the Project was signed on 23/10/2008.

Date of the VCS PD: 20 October 2008

1. Description of Project:

1.1 Project title

Sulige Natural Gas Based Power Generation Project, which has been registered by UNFCCC on 21/07/2008 (Ref. No. 1243) as a CDM project.

1.2 Type/Category of the project

Neglected as per "Policy Announcement from the VCS Association" published on 19/03/2008.

1.3 Estimated amount of emission reductions over the crediting period including project size:

Neglected as per "Policy Announcement from the VCS Association" published on 19/03/2008.

1.4 A brief description of the project:

Neglected as per "Policy Announcement from the VCS Association" published on 19/03/2008.

1.5 Project location including geographic and physical information allowing the unique identification and delineation of the specific extent of the project:

Neglected as per "Policy Announcement from the VCS Association" published on 19/03/2008.

1.6 Duration of the project activity/crediting period:

Neglected as per "Policy Announcement from the VCS Association" published on 19/03/2008.

1.7 Conditions prior to project initiation:

Neglected as per "Policy Announcement from the VCS Association" published on 19/03/2008.

1.8 A description of how the project will achieve GHG emission reductions and/or removal enhancements:

Neglected as per "Policy Announcement from the VCS Association" published on 19/03/2008.

1.9 Project technologies, products, services and the expected level of activity:

Neglected as per "Policy Announcement from the VCS Association" published on 19/03/2008.

1.10 Compliance with relevant local laws and regulations related to the project:

Neglected as per "Policy Announcement from the VCS Association" published on 19/03/2008.

1.11 Identification of risks that may substantially affect the project's GHG emission reductions or removal enhancements:

Neglected as per "Policy Announcement from the VCS Association" published on 19/03/2008.

1.12 Demonstration to confirm that the project was not implemented to create GHG emissions primarily for the purpose of its subsequent removal or destruction.

As described in the registered PDD of the Project which has been validated by TUV-SUD, "the Project Activity is the construction and operation of a new natural gas fired grid-connected electricity generation plant". Therefore, it is not implemented to create GHG emissions primarily for the purpose of its subsequent removal or destruction.

1.13 Demonstration that the project has not created another form of environmental credit (for example renewable energy certificates).

The Project was registered as a CDM project on 21/07/2008. As per CDM rules, emission reduction

credits generated by the Project prior to 21/07/2008 can not be claimed as CERs. The Project Owner expects to claim these emission reduction credits as VCUs and will not applied for other environmental credits.

1.14 Project rejected under other GHG programs (if applicable):

Prior to the application for issuance of VCUs, the Project only implanted CDM development. It was registered as a CDM project on 21/07/2008. The Project has not been rejected by other GHG programs.

1.15 Project proponents roles and responsibilities, including contact information of the project proponent, other project participants:

Neglected as per "Policy Announcement from the VCS Association" published on 19/03/2008.

1.16 Any information relevant for the eligibility of the project and quantification of emission reductions or removal enhancements, including legislative, technical, economic, sectoral, social, environmental, geographic, site-specific and temporal information.):

Neglected as per "Policy Announcement from the VCS Association" published on 19/03/2008.

1.17 List of commercially sensitive information (if applicable):

Neglected as per "Policy Announcement from the VCS Association" published on 19/03/2008.

2.VCS Methodology:

2.1 Title and reference of the VCS methodology applied to the project activity and explanation of methodology choices:

Neglected as per "Policy Announcement from the VCS Association" published on 19/03/2008.

2.2 Justification of the choice of the methodology and why it is applicable to the project activity:

Neglected as per "Policy Announcement from the VCS Association" published on 19/03/2008.

2.3 Identifying GHG sources, sinks and reservoirs for the baseline scenario and for the project:

Neglected as per "Policy Announcement from the VCS Association" published on 19/03/2008.

2.4 Description of how the baseline scenario is identified and description of the identified baseline scenario:

Neglected as per "Policy Announcement from the VCS Association" published on 19/03/2008.

2.5 Description of how the emissions of GHG by source in baseline scenario are reduced below those that would have occurred in the absence of the project activity (assessment and demonstration of additionality):

The Project has been registered by UNFCCC on 21/07/2008 (Ref. No. 1243) as a CDM project. The additionality of the Project has been demonstrated in the registered PDD

(<http://cdm.unfccc.int/UserManagement/FileStorage/T2OTUPEVN79W0A0RC7NMZM7HXFBLX6>).

Detailed information regarding the demonstration is neglected as per "Policy Announcement from the VCS Association" published on 19/03/2008.

3.Monitoring:

3.1 Title and reference of the VCS methodology (which includes the monitoring requirements) applied to the project activity and explanation of methodology choices:

Neglected as per "Policy Announcement from the VCS Association" published on 19/03/2008.

3.2 Monitoring, including estimation, modelling, measurement or calculation approaches:

Neglected as per "Policy Announcement from the VCS Association" published on 19/03/2008.

3.3 Data and parameters monitored / Selecting relevant GHG sources, sinks and reservoirs for monitoring or estimating GHG emissions and removals:

For all the data and parameters listed in the monitoring plan of the registered PDD of the Project, only the monitoring method regarding the consumption of natural gas, i.e. the total volume of natural gas combusted in the project plant in year y ($FC_{NG,y}$), was revised during the monitoring period. Since the monitoring method regarding other data and parameters had been defined in the registered PDD of the Project and had not changed during the monitoring period, relevant description were neglected in this document as per "Policy Announcement from the VCS Association" published on 19/03/2008.

- As defined in methodology AM0029 version 01 under which the Project was registered as a CDM project, "the total fuel consumption will be monitored both at supplier and project end for cross-verification." Therefore, the monitoring point of the total volume of natural gas combusted in the project plant in year y ($FC_{NG,y}$) at project end was clearly defined as Gas Pressure Regulating Station of the Sulige Fuel Gas Power Generation Co., Ltd. of Inner Mongolia (Project Owner), and the "natural gas metering handover receipt and natural gas purchase record" were removed from the data source for cross-check (P39 on the registered PDD). The revision ensures the consistency between the monitoring plan and the requirements of methodology AM0029 version 01.
- Type and precision of gas flow meter used in the monitoring of the total volume of natural gas combusted in the project plant in year y ($FC_{NG,y}$) was not defined in methodology AM0029 version 01. The Project Owner had planned to employ orifice-plate flow meters, with a precision class of 0.5. As described on P35 of the registered PDD, the "precision of orifice meter used in the Project is 0.5". However according to Natural Gas Purchase Agreement, the gas supplier, Changqing Gas Field of China National Petroleum Corporation (hereafter referred to as CNPC), is responsible for installation, operation and maintenance of the natural gas flow meters employed by the Project. CNPC had decided to employ orifice-plate flow meters with a precision class of 1.0 to monitor the natural gas consumption of the Project since 2007 and then replaced the orifice-plate flow meters with ultrasonic wave flow meters with a precision class of 1.0 in September, 2007. The Project Owner had to accept the replacement and revise the monitoring plan as the "precision of the gas flow meter used in the Project shall not be lower than 1.0" thus to comply with the practice of the Project. Detailed demonstration regarding this revision had been submitted to the verifier.

Data / Parameter:	$FC_{NG,y}$
Data unit:	Nm ³
Description:	the total volume of natural gas combusted in the project plant in year(s) 'y'
Source of data to be used:	Data in the PDD is obtained from FSR and real data will be obtained based on measurement.
Value of data applied for the purpose of calculating expected emission reductions	247,805,250
Description of measurement methods and procedures to be applied:	Daily measured continuously by natural gas flow meters and monthly recording by the project owner.
QA/QC procedures to be applied:	The total volume of natural gas combusted in the project plant in year(s) 'y' will be monitored by the natural gas flow meter at the Changqing Gas Field, and cross checked against the monitoring results of the natural gas flow meter

	installed at the Gas Pressure Regulating Station. Precision of the gas flow meter used in the Project shall not be lower than 1.0. The gas flow meter will be maintained and tested in accordance with stipulation of the meter supplier to ensure accuracy. The readings will be double checked by the gas supply company.	
	Any comment:	-

3.4 Description of the monitoring plan

Neglected as per "Policy Announcement from the VCS Association" published on 19/03/2008.

4.GHG Emission Reductions:

4.1 Explanation of methodological choice:

Neglected as per "Policy Announcement from the VCS Association" published on 19/03/2008.

4.2 Quantifying GHG emissions and/or removals for the baseline scenario:

Neglected as per "Policy Announcement from the VCS Association" published on 19/03/2008.

4.3 Quantifying GHG emissions and/or removals for the project:

Neglected as per "Policy Announcement from the VCS Association" published on 19/03/2008.

4.4 Quantifying GHG emission reductions and removal enhancements for the GHG project:

Neglected as per "Policy Announcement from the VCS Association" published on 19/03/2008.

5.Environmental Impact:

Neglected as per "Policy Announcement from the VCS Association" published on 19/03/2008.

6.Stakeholders comments:

Neglected as per "Policy Announcement from the VCS Association" published on 19/03/2008.

7.Schedule:

Neglected as per "Policy Announcement from the VCS Association" published on 19/03/2008.

8.Ownership:

8.1 Proof of Title:

As defined in the Approval Letter of the Feasibility Study Report of the Project issued by Inner Mongolia Development and Reform Commission on 10/12/2004, the Project Owner of Sulige Natural Gas Based Power Generation Project is Sulige Fuel Gas Power Generation Co., Ltd. of Inner Mongolia.

The ownership of the Project Owner has been described in the registered PDD of the Project, which has been validated by TUV-SUD. The validation report issued by TUV-SUD can be found at: <http://cdm.unfccc.int/UserManagement/FileStorage/74LWBO2N2IWJYQ8DIUQUKTH6GZBFUS>. (Page A-1)

Letter of Approval issued by China's DNA for the Project could be another proof of the title of the Project Owner. It can be found at:

<http://cdm.unfccc.int/UserManagement/FileStorage/94UPKMS9J4SYQTNR46NK61HTFGDOKS>.

8.2 Projects that reduce GHG emissions from activities that participate in an emissions trading program (if applicable):

The Project was registered as a CDM project on 21/07/2008. As per CDM rules, emission reduction credits generated by the Project prior to 21/07/2008 can not be claimed as CERs. The Project Owner expects to claim these emission reduction credits as VCUs and has not applied for other environmental credits.



Voluntary Carbon Standard

Monitoring Report

Sulige Natural Gas Based Power Generation Project

Monitoring period (01/01/2007~31/12/2007)

(Version 02 finalized on 20/04/2009)

Sulige Fuel Gas Power Generation Co., Ltd.
of Inner Mongolia

Content

- A. General project activity and monitoring information
- B. Key monitoring activities
- C. Quality assurance and quality control measures
- D. Calculation of GHG emission reductions

Annex

Annex 1: Calculation of the build margin emission factor

SECTION A. General description of the project activity

A.1. Title of the project activity:

>>

Sulige Natural Gas Based Power Generation Project

A.2. Short description of the project activity:

>>

Sulige Natural Gas Based Power Generation Project (hereafter referred to as the Project) is sited within Dabuchake Town¹, Wushen Banner, Erdos City, Inner Mongolia Autonomous Region, P.R.China. The Project is a peak load balancing power plant including installation of two sets of air-cooling gas-steam combined cycle power generation equipments which use natural gas to generate electricity and then, deliver the electricity to North China Grid via two 220 kV outlet circuits. Key technical parameters of the key equipments used in the Project are listed in Table 1.

Table 1. Key technical parameters of the key equipments of the Project

	Equipment	Type	Manufacture
1	Gas turbine	PG9171E, air-cooling	GE, United States
2	Gas turbine generator	QFR-135-2, air-cooling, (GE and Brush technology)	Nanjing Turbine and Electric Machinery (Group) Co., Ltd.
3	Steam turbine	LZN60-5.7/0.58	
4	Steam turbine generator	QFW-60-2, air-cooling	

In the absence of the Project, equivalent amount of annual power output to the Project will be generated and supplied by North China Grid which the Project is connected to. North China Grid is dominated by coal fired power plants. It is expected that the Project as a clean energy source with less carbon content will generate emission reductions of about 888,578 tCO₂e from 01/01/2007 to 31/12/2007 by avoiding CO₂ emissions from the same amount of power generation from coal fired power plants which would have been built otherwise within North China Grid.

A.3. Status of the project activity:

>>

This Monitoring Report refers to the Project which has been registered as a CDM project on 21/07/2008 (Ref. No. 1243). Timeline of the Project prior to CDM registration is summarized in Table 2.

Table 2. Timeline of the Project

Date	Process
18/11/2004	Approval of Environmental Impact Assessment Report
10/12/2004	Approval of Feasibility Study Report
18/04/2005	Construction Started

1 The Dabuchake Town has been incorporated with the Galutu Town in 2006. (<http://www.ordosagri.gov.cn/news/about.asp?id=4731>).

08/11/2006	CDM GSP
01/01/2007	Put into operation
22/05/2007	LOA issued by China's Designated National Authority
18/06/2007	LOA issued by Japan's Designated National Authority
31/07/2007	CDM request for registration
21/07/2008	CDM registration

As per *Policy Announcement from the VCS Association* published on 19/03/2008, "projects registered under other VCS Program approved GHG Programs (such as the CDM) are eligible to create Voluntary Carbon Units (VCUs) for the emissions reductions or removals not registered under that GHG Program". As per CDM rules, emission reduction credits generated by the Project prior to 21/07/2008 can not be claimed as CERs. The Project Owner expects to claim emission reduction credits generated from 01/01/2007 to 20/07/2008 as VCUs and has not applied for other environmental credits.

As described in Section 1.6 of the VCS PD of the Project, the VCS project crediting period for the Project is 01/01/2007 to 20/07/2008. From 21/07/2008 to the date when CDM crediting period of the Project was closed, the Project Owner expects to claim the emission reductions generated by the Project as CERs. The Project Owner takes the responsibility to ensure no double issuance to occur for the GHG emission reductions generated by the Project.

A.4. Monitoring period:

>>

This Monitoring Report focuses on the emission reductions generated by the Project from 01/01/2007 to 31/12/2007.

A.5. Methodology applied to the project activity:

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AM0029.ver 01 – "Baseline Methodology for Grid Connected Electricity Generation Plants using Natural Gas" and "Grid Connected Electricity Generation Plants using Non-Renewable and Less GHG Intensive Fuel".

ACM0002.ver 06 – "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" and "Consolidated monitoring methodology for grid-connected electricity generation from renewable sources".

A.6. Person(s)/entity(ies) responsible for preparation and submission of the monitoring report:

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SECTION B. General Description of monitoring activities

B.1. Monitoring equipment:

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Information on the equipments used in the Project is summarized in Table 3 and Table 4.

Table 3. Equipments for monitoring the net electricity delivered to the grid

Parameter	Location	No.	Type	S/N	Precision	Manufacturer
EG _{PJ,y}	The point connecting the Project to the grid system through 220 kV transmission line (I)	84532928 (Main)	ZMU202c.4c-1r441r41z	433918870	0.2s	Landis & Gyr Metering (Zhuhai) Co., Ltd.
EG _{PJ,y}	The point connecting the Project to the grid system through 220 kV transmission line (I)	84532929 (Backup)	Ditto	Ditto	0.2s	Ditto
EG _{PJ,y}	The point connecting the Project to the grid system through 220 kV transmission line (II)	84532927 (Main)	Ditto	Ditto	0.2s	Ditto
EG _{PJ,y}	The point connecting the Project to the grid system through 220 kV transmission line (II)	84532930 (Backup)	Ditto	Ditto	0.2s	Ditto
EG _{gen,y}	Outlet of No.1 gas turbine	84532931	ZMU205c.4c-1r441r41z	Ditto	0.5s	Ditto
EG _{gen,y}	Outlet of No.2 gas turbine	84532932	Ditto	Ditto	0.5s	Ditto
EG _{gen,y}	Outlet of No.1 steam turbine	84532934	Ditto	Ditto	0.5s	Ditto
EG _{gen,y}	Outlet of No.2 steam turbine	84532935	Ditto	Ditto	0.5s	Ditto

Table 4. Equipments for monitoring the natural gas consumed

Parameter	Location	No.	Type	S/N	Precision	Manufacturer
Natural gas consumption	The point connecting the Project to the natural gas transmission line #1	1	3400-DN250	06-490268	1.0	DANIEL
Natural gas consumption	The point connecting the Project to the natural gas transmission line #2	2	3400-DN250	06-490271	1.0	DANIEL
Natural gas consumption	Gas Pressure Regulating Station within the project site	-	FLAWSIC-600	05398850	0.2	SICK MAIHAK

The metering points are given in Figure 1.

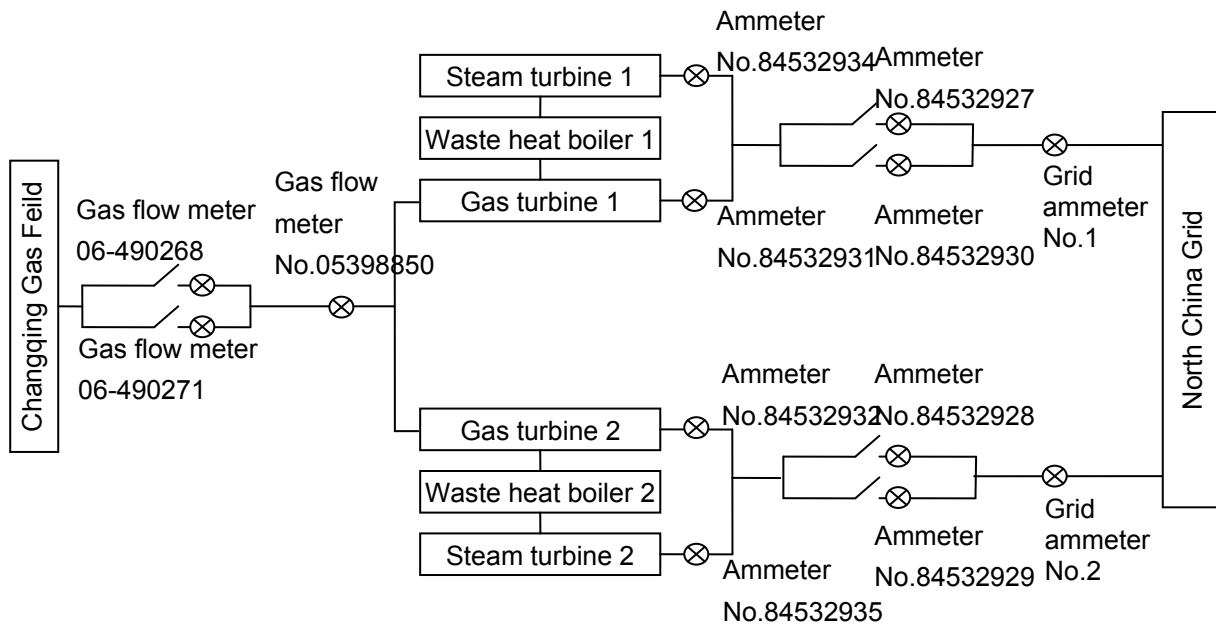


Figure 1. Metering points in the Project

B.2. Data collection:

B.2.1. Data and parameters that are fixed during the given monitoring period:

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The following data and parameters are fixed for the Project during the monitoring period as per the registered PDD of the Project.

Data/Parameter:	$EF_{NG,upstream,CH_4}$
Data unit:	tCH ₄ /PJ
Description:	The emission factor for upstream fugitive CH ₄ emissions of natural gas from production, transportation, distribution, in t CH ₄ per GJ fuel supplied to final consumers.
Source of data used:	"Other oil exporting countries/rest of world" provided in Table 2 of the methodology AM0029.
Value applied:	296
Justification of the choice of data or description of measurement methods and procedures actually applied :	Considering data availability, use defaults provided by the methodology AM0029.
Any comment:	-

Data/Parameter:	$EF_{coal,upstream,CH_4}$
Data unit:	tCH ₄ /kt
Description:	The emission factor for fugitive upstream emissions of coal
Source of data used:	"Underground coal production" provided in Table 2 of the methodology AM0029.
Value applied:	13.4
Justification of the choice of data or description of measurement methods and procedures actually applied :	Considering data availability, use defaults provided by the methodology AM0029.
Any comment:	-

Data/Parameter:	GWP_{CH_4}
Data unit:	tCO ₂ e/tCH ₄
Description:	The Global Warming Potential (GWP) of CH ₄ , valid for the relevant commitment period.
Source of data used:	Kyoto Protocol
Value applied:	21
Justification of the choice of data or description of measurement methods and procedures actually applied :	Kyoto Protocol is a reliable data source.
Any comment:	-

B.2.2. Data and parameters that are monitored during the given monitoring period:

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The following data and parameters were monitored for the Project during the monitoring period as per the registered PDD.

Data/Parameter:	$EG_{PJ,y}$
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Data unit:	MWh
Description:	The net electricity delivered to the grid by the Project from 01/01/2007 to 31/12/2007.
Source of data to be used:	Measurement record and electricity sales receipts/records to the grid.
Value of data applied for the purpose of calculating emission reductions:	1,978,186
Description of measurement methods and procedures applied:	Measured continuously by ammeters and monthly recorded by the Project Owner.
QA/QC procedures:	Sales receipts/records to the grid are used to ensure the consistency.
Any comment:	Electricity delivered by the Project to grid and electricity imported from grid to the Project were measured continuously by ammeters and monthly recorded. The data were cross-checked with relevant receipts..

Data / Parameter:	$EF_{BM,y}$
Data unit:	tCO ₂ /MWh
Description:	build margin emission factor of North China Grid
Source of data used:	Calculated over recently built power plants as defined in the baseline methodology
Value applied:	0.8687
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated based on data published by <i>China Electric Power Yearbook</i> and <i>China Energy Statistical Yearbook</i> , see Annex 3 for details. Update the data with the latest public available edition of <i>China Electric Power Yearbook</i> and <i>China Energy Statistical Yearbook</i> .
QA/QC procedures to be applied:	-
Any comment:	-

Data/Parameter:	$F_{i,m,y}$
Data unit:	mass or volume unit
Description:	Total amount of fuel i consumed by province m in year y.
Source of data to be used:	<i>China Energy Statistical Yearbook</i> from 2005 to 2007
Value of data applied for the purpose of calculating emission reductions:	See Annex 1 for details.
Description of measurement methods and procedures applied:	As per the registered PDD, the data is obtained from the latest publicly available edition of <i>China Energy Statistical Yearbook</i> .
QA/QC procedures:	-
Any comment:	-

Data/Parameter:	$GEN_{m,y}$
Data unit:	MWh
Description:	Electricity generated by province m in year y.
Source of data to be used:	<i>China Power Electric Yearbook</i> from 2005 to 2007
Value of data applied for the purpose of calculating emission reductions:	See Annex 1 for details.
Description of measurement methods and procedures applied:	As per the registered PDD, the data is obtained from the latest publicly available edition of <i>China Power Electric Yearbook</i> .
QA/QC procedures:	-
Any comment:	For calculation of electricity output to the grid by province m in year y.

Data/Parameter:	$r_{m,y}$
Data unit:	%
Description:	Auxiliary electricity consumption rate of province m in year y.
Source of data to be used:	<i>China Power Electric Yearbook</i> from 2005 to 2007
Value of data applied for the purpose of calculating emission reductions:	See Annex 1 for details.
Description of measurement methods and procedures applied:	As per the registered PDD, the data is obtained from the latest publicly available edition of <i>China Power Electric Yearbook</i> .
QA/QC procedures:	-
Any comment:	For calculation of the electricity output to the grid by province m in year y.

Data/Parameter:	NCV_i
Data unit:	MJ/t or 1000 m ³
Description:	Net calorific value of fuel i.
Source of data to be used:	<i>China Energy Statistical Yearbook</i> from 2005 to 2007
Value of data applied for the purpose of calculating emission reductions:	See Annex 1 for details.
Description of measurement methods and procedures applied:	As per the registered PDD, the data is obtained from the latest publicly available edition of <i>China Energy Statistical Yearbook</i> .
QA/QC procedures:	-
Any comment:	-

Data/Parameter:	$OXID_i$
Data unit:	%

Description:	Oxidation factor of the fuel i.
Source of data to be used:	<i>2006 IPCC Guidelines for National Greenhouse Gas Inventories</i>
Value of data applied for the purpose of calculating emission reductions:	100
Description of measurement methods and procedures applied:	As per the registered PDD, the data is obtained from the latest publicly available edition of <i>IPCC Guideline for National Greenhouse Gas Inventories</i> .
QA/QC procedures:	-
Any comment:	-

Data/Parameter:	$EF_{CO_2,i}$
Data unit:	tC/TJ
Description:	CO ₂ emission factor of the fuel i.
Source of data to be used:	<i>2006 IPCC Guidelines for National Greenhouse Gas Inventories</i>
Value of data applied for the purpose of calculating emission reductions:	See Annex 1 for details.
Description of measurement methods and procedures applied:	As per the registered PDD, the data is obtained from the latest publicly available edition of <i>IPCC Guideline for National Greenhouse Gas Inventories</i> .
QA/QC procedures:	-
Any comment:	-

Data/Parameter:	$FC_{adv,coal}$
Data unit:	gCe/kWh
Description:	Weighted average fuel consumption of power generation of top 30 sets of 600 MW coal fired power generation units built in 2006 (taken as the efficiency level of the best technology commercially available in China).
Source of data to be used:	<i>China's Regional Grid Baseline Emission Factors</i> (renewed on 18/07/2008)
Value of data applied for the purpose of calculating emission reductions:	329.94
Description of measurement methods and procedures applied:	As per the registered PDD, the data obtained from China's DNA are reliable. Therefore, the data are obtained from the latest version of <i>China's Regional Grid Baseline Emission Factors</i> (renewed on 18/07/2008).
QA/QC procedures:	-
Any comment:	-

Data/Parameter:	$FC_{adv,oil/gas}$
Data unit:	gCe/kWh
Description:	Weighted average fuel consumption of power generation of 200 MW oil/gas fired combined cycle power generation units (taken as the

	efficiency level of the best technology commercially available in China).
Source of data to be used:	<i>China's Regional Grid Baseline Emission Factors</i> (renewed on 18/07/2008)
Value of data applied for the purpose of calculating emission reductions:	252
Description of measurement methods and procedures applied:	As per the registered PDD, the data obtained from China's DNA are reliable. Therefore, the data are obtained from the latest version of <i>China's Regional Grid Baseline Emission Factors</i> (renewed on 18/07/2008).
QA/QC procedures:	-
Any comment:	-

Data/Parameter:	$FC_{NG,y}$
Data unit:	Nm ³
Description:	The total volume of natural gas combusted in the Project Plant from 01/01/2007 to 31/12/2007.
Source of data to be used:	Measured continuously by natural gas flow meter(s) and daily recording by the Project Owner.
Value of data applied for the purpose of calculating emission reductions:	422,408,154
Description of measurement methods and procedures applied:	Measured continuously by natural gas flow meter(s) and daily recording by the Project Owner.
QA/QC procedures:	The total volume of natural gas combusted in the Project Plant in year(s) 'y' will be measured by the natural gas flow meter(s) installed at the Changqing Gas Field, and cross checked against the monitoring results of the natural gas flow meter(s) installed at the Gas Pressure Regulating Station. Precision of the gas flow meter(s) used in the Project shall not be lower than 1.0. The gas flow meter(s) will be maintained and tested in accordance with stipulation of the meter supplier to ensure accuracy.
Any comment:	-

Data/Parameter:	$FC_{diesel,y}$
Data unit:	t
Description:	The total volume of diesel combusted in the Project Plant for backup start off from 01/01/2007 to 31/12/2007.
Source of data used:	Measurement record and receipts.
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the registered PDD, the data measured by the Project Owner is used to determine $FC_{diesel,y}$.

QA/QC procedures to be applied:	The total volume of diesel combusted in the project plant in year(s) 'y' will be monitored by flow meter and double checked against the diesel purchase receipts and storage record. Only one flow meter is employed by the Project. The flow meter is a liquid level meter.
Any comment:	According to the Feasibility Study Report, diesel is only used for start off when HV accident was taken place. As per operation record of the Project, no HV accident was taken place from 01/01/2007 to 31/12/2007.

Data/Parameter:	$NCV_{NG,y}$
Data unit:	GJ/Nm ³
Description:	The net calorific value per volume unit of natural gas.
Source of data to be used:	Gas component analysis reports provided by the natural gas supplier.
Value of data applied for the purpose of calculating emission reductions:	0.03478296 (weighted average from 01/01/2007 to 31/12/2007)
Description of measurement methods and procedures applied:	The net calorific value per volume unit of natural gas is measured by CGFPC periodically.
QA/QC procedures:	-
Any comment:	-

Data/Parameter:	$EG_{gen,y}$
Data unit:	MWh
Description:	The amount of electricity generated by the Project from 01/01/2007 to 31/12/2007.
Source of data to be used:	Measurement record.
Value of data applied for the purpose of calculating emission reductions:	2,027,423
Description of measurement methods and procedures applied:	Measured continuously by ammeters and monthly recorded by the Project Owner.
QA/QC procedures:	Cross-checked with fuel consumption of the Project.
Any comment:	Used to calculate the auxiliary electricity consumption of the Project with the amount of net electricity delivered to the grid.

Data/Parameter:	ϕ_{coal}
Data unit:	-
Description:	The share of coal fired generation in build margin generation.
Source of data to be used:	<i>China Electric Power Yearbook</i>
Value of data applied for the purpose of calculating emission reductions:	0.94616
Description of	As per the registered PDD, the data are obtained from the latest

measurement methods and procedures applied:	publicly available edition of <i>China Power Electric Yearbook</i> .
QA/QC procedures:	-
Any comment:	-

B.2.3. Monitored data and parameters:

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The total volume of the natural gas combusted in the Project is measured by the natural gas flow meter(s) installed at the Changqing Gas Field of PetroChina Co., Ltd. (hereafter referred to as CGFPC). The readings will be cross-checked by the monitoring results of the natural gas flow meter(s) installed at Gas Pressure Regulating Station. The natural gas flow meter(s) in CGFPC measured the volume of the natural gas combusted in the Project Plant and clear reading to zero on daily basis. Reading of the natural gas flow meter(s) at CGFPC were read and recorded every two hours by the staff of CGFPC and confirmed by the staff of the Project Owner on daily basis. The natural gas flow meter(s) installed at the Gas Pressure Regulating Station measured the volume of natural gas combusted in the Project Plant in accumulation. Reading of the natural gas flow meter(s) at the Gas Pressure Regulating Station were read and recorded every two hours by the staff of the Project Owner. The readings of the natural gas flow meter(s) at the Gas Pressure Regulating Station (Series 2 of Table 5) were used to crosscheck the readings of the natural gas flow meter(s) at CGFPC (Series 1 of Table 5).

The net electricity delivered to the grid by the Project is calculated based on the supplied electricity of the Project to the grid and the imported electricity from the grid to the Project. The supplied electricity and the imported electricity are measured continuously by the ammeters and monthly recorded. Sales receipts were received from the local authorities of taxation and used for crosscheck.

The net calorific value per volume unit of the natural gas was a weighted average one calculated based on the net calorific value of the nature gas in the gas component analysis reports provided by the natural gas supplier within each two weeks and the volume of the natural gas combusted in the Project Plant.

Table 5 below summarizes the monitored data and invoiced data of the Project from 01/01/2007 to 31/12/2007.

Table 5. Monitored data and data for crosscheck from 01/01/2007 to 31/12/2007

Item	Recorded data (series 1)	Recorded data (series 2)	Invoiced data
Gas consumption (Nm³)	422,408,154 (measured by flow meter installed at Changqing Gas Field of PetroChina Co., Ltd.)	418,936,000 (measured by flow meter installed at the Gas Pressure Regulating Station)	-
Net electricity delivered (MWh)	-	1,978,186	1,981,448
Weighted net calorific value (GJ/Nm³)	0.03478296	-	-

Comparison of two sets of data regarding gas consumption and net electricity delivered from 01/01/2007 to 31/12/2007 has been made for the Project. The relative difference of gas consumption between the two series of records is 0.82%; while the difference of net electricity delivered between records and invoices is 0.16%. Both of these differences satisfied the requirement of the precision of meters.

To be conservative, the lower data of net electricity delivered and the higher data of gas consumption have been adopted for determination of emission reductions of the Project.

B.2.4. Re-assessment of the additionality:

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The IRR calculation spreadsheet consistent with the registered PDD has been used to accomplish the re-assessment of the additionality of the Project regarding the electricity delivered to grid by the Project.

For the electricity delivered to grid by the Project, the data used in the registered PDD was 1,195,723 MWh per year. The actual electricity delivered to grid by the Project in 2007 was 1,978,186 MWh. Sensitivity analysis has been made for the Project with the electricity delivered to grid of 1,978,186 MWh. Even if the annual power generation increases 65% for the entire lifetime, the IRR was 7.90%, which is still lower than the benchmark IRR of 8%.

Electricity generation of the Project will fluctuate as a combined result of natural gas supply, electricity demand, and other relevant factors. In 2007, natural gas production of Changqing Gas Field increased a lot as a preparation of supplying natural gas to Beijing 2008 Olympic Games. Prior to supply natural gas to Beijing 2008 Olympic Games, more natural gas was supplied to the Project, which increased the electricity generation of the Project². In 2008, natural gas supply to the Project decreased and the electricity generation of the Project decreased. 2007 was a special year for the Project and the electricity generation of the Project could not keep that high over the whole operation period as it is constrained by the Natural Gas Purchase Agreement signed between the Project and the Changqing Gas Field of PetroChina Company Limited.

Therefore, the re-assessment confirms the additionality of the Project.

B.3. Data processing and archiving system:

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Electricity generated and supplied electricity:

The Project employs PDM2000 electricity metering and billing system and PSM-ID electricity remote terminal to process and archive the data relevant to the electricity generated and the supplied electricity, and to communicate with the grid company regarding them. The system is developed by China Electric Power Research Institute. By using state-of-art IT, the system can ensure the integrity, accuracy, uniqueness, security and reliability of the data of electricity.

2 [Http://news.cnpc.com.cn/system/2008/07/17/001190597.shtml](http://news.cnpc.com.cn/system/2008/07/17/001190597.shtml)

Imported electricity:

Imported electricity of the Project from grid is measured by the grid company at the grid side. The data is recorded monthly. Relevant records and receipts will be provided to the Project Owner. The records are achieved by the Accounting Department of the Project Owner along with relevant receipts.

Natural gas consumption and net calorific value of natural gas:

The natural gas consumption and the net calorific value of natural gas are monitored, recorded and archived as per the clauses of *Natural Gas Purchase Agreement* signed between the Project Owner and CGFPC. Daily records of natural gas consumption of the Project are achieved by the Accounting Department of the Project Owner along with receipts relevant to the natural gas consumption. Reports of the net calorific value of natural gas provided by CGFPC are achieved by the Planning Department of the Project Owner.

B.4. Special event log:

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No special event log occurred during the given monitoring period of this Monitoring Report.

SECTION C. Quality assurance and quality control

C.1. Operation, maintenance and calibration:

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An Operation Manual has been developed by the Project Owner which guides the daily operation of the Project. The Operation Manual incorporates natural gas-turbine technical standard guidelines with data recording and managing process. The on-duty (in shift) staff in the Operation Department, are responsible for data monitoring and recording in *Daily Production Report* and *Record of Natural Gas Usage*, especially the electricity generated, the net electricity delivered to North China Grid and the natural gas consumption.

The Project Owner has signed *Equipment Calibration and Maintenance Contract* with Inner Mongolia No.1 Electric Power Engineering Co., Ltd. According to the clauses of the contract, Inner Mongolia No.1 Electric Power Construction Engineering Co., Ltd. will take charge of daily calibration and maintenance of the equipments, including ammeters, of the Project. The objectives of the contract include well performance, stable operation and safety of the Project.

Additional to daily calibration and maintenance of the Project, an Emission Reduction Monitoring Team has been set up internally by Sulige Fuel Gas Power Generation Co., Ltd. of Inner Mongolia (hereafter referred to as the Project Owner). The Emission Reduction Monitoring Team is in charge, inter alia, of the implementation and management of the whole monitoring plan, including monitoring and management of the data relevant to the determination of GHG emission reductions.

The general manager of the Project Owner is the leader of the Emission Reduction Monitoring Team and is responsible for all the relevant activities during the operating and the maintaining period. Mr. Cui Jinbao, Director of the Planning Department of the Project Owner of Inner Mongolia is responsible for the supervision of the Emission Reduction Monitoring Team. The Director of the Production Department and the Director of the Maintenance Department are responsible for organizing and managing reading and recording of data. The Director of the Accounting Department is responsible for collecting and archiving the invoices.

As per the record of the Technological Department of the Project Owner, equipment calibration and maintenance activities from 01/01/2007 to 31/12/2007 have been summarized in Table 6.

Table 6. Equipment calibration and maintenance activities from 01/01/2007 to 31/12/2007

Date	Responsible party(ies)	Conclusion
07/04/2007~09/04/2007	Inner Mongolia No.1 Electric Power Engineering Co., Ltd.	Ok.
22/06/2007~24/06/2007	Inner Mongolia No.1 Electric Power Engineering Co., Ltd., supported by relevant equipments suppliers	Ok.
27/08/2007~07/09/2007	Inner Mongolia No.1 Electric Power Engineering Co., Ltd. and Daqing Feihong Gas Turbine Technology Development Co., Ltd.	Ok.

The Project Owner has signed an agreement with the gas supplier for the periodical calibration and testing of the precision of the gas metering devices, in order to ensure the monitoring accuracy of the natural gas consumption and its component analysis. The calibration and testing of the gas metering devices installed by the gas supplier have been outsourced by the gas supplier to be conducted by the National Metering Station for Crude Oil with High Flow Rate according to national measurement standards and regulations. Calibration Reports No. GM20060806, No.GM20070291 and No.20070290 have been issued to confirm the precision of the gas metering devices from 06/08/2006 to 08/06/2009. Calibration report has been provided by SICK MAIHAK to confirm the precision of the gas flow meter installed by the project owner from 17/10/2005 to 17/10/2009. The calibration and testing of the gas component analysis devices have been accomplished by Shaanxi Institute of Metrology Science in line with national measurement standards and regulations. Calibration Report No.HX30061378J has been issued to confirm the precision of the gas component analysis devices from 01/11/2006 to 31/10/2008.

The calibration and testing procedure regarding the precision of the ammeters is and will be periodically implemented. The calibration report for the ammeters had been conducted by the Inner Mongolia Electric Power Research Institute according to national measurement standards and regulations such as JJG596-1999. Calibration Report No.2005 L-284, No.2005 L-286, No.2005 L-287, No.2005 L-288, No.2005 L-291, No.2005 L-292, No.2005 L-293 and No.2005 L-294 have been issued to confirm the precision of the ammeters from 11/11/2005 to 11/11/2010.

C. 2. Training:

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Relevant staff of the Project Owner, including the Emission Reduction Monitoring Team, had been trained on correct operation and maintenance by the equipment manufacturing company, according to the training contract included in the equipment procurement contract. In addition, the Monitoring Manual has been provided to the Project Owner with training on the emission reduction monitoring procedures.

As per the record of the Operation Department of the Project Owner, training activities from 01/01/2007 to 31/12/2007 have been summarized in Table 7.

Table 7. Training activities from 01/01/2007 to 31/12/2007

Date	Training content
15/01/2007~28/02/2007	Study of production and operation management

Date	Training content
01/03/2007~31/07/2007	Training for operation staff on the basic theory
01/03/2007~30/09/2007	Training on on-site system and operation procedure
08/10/2007~30/12/2007	Post shifting training
01/01/2007~30/12/2007	Separate group training to improve the capability of dealing with emergency

C.3. Internal audits:

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The statistical staff in the Planning Department are in charge of verification and confirmation of the monitoring data records, which will be monthly aggregated and reported to the leader of the Emission Reduction Monitoring Team. After checking and ensuring no material mistakes, these data are archived and also sent to the Director of the Accounting Department which makes the financial clearance with the grid and the natural gas supplier on sale of electricity and purchase of gas respectively. The invoices are archived and managed by the Director of the Accounting Department.

C.4. Troubleshooting procedures:

>>

Possibly unexpected cases and relevant emergency responses are summarized in Table 8.

Table 8. Possibly unexpected cases and relevant emergency responses

No.	Unexpected case	Emergency response measure
1	Voltage loss of power supply at the data acquiring device	Measuring the power supply voltage, trying to find out the cause, removing the troubles, resuming power supply as soon as possible, reducing the loss of electricity.
2	Voltage loss of power supply at the ammeter	Measuring the power supply voltage at the ammeter and the electric circuit, trying to find out the cause, removing the troubles.
3	Strike of light at the electric current terminal	Shorting the current circuit, trying to find out the cause, removing the troubles.
4	Short circuit of the voltage loop	Turning off the small switch at the voltage transformer.
5	Malfunction of the communication system	Measuring the voltage at the communication terminals, trying to find out the cause, removing the troubles.

None of the unexpected cases listed above occurred during the given monitoring period. In 2007, the operation of the Project stopped twice for equipment calibration and maintenance.

SECTION D. Calculation of emission reductions

D.1. Emission reductions:

D.1.1. Baseline emissions:

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Baseline emissions are calculated by multiplying the net electricity delivered by the Project ($EG_{PJ,y}$) with a baseline emission factor ($EF_{BL,CO2,y}$), as follows:

$$BE_y = EG_{PJ,y} \cdot EF_{BL,CO2,y} \quad (1)$$

where:

BE_y is the baseline emissions due to displacement of electricity in year(s) y (tCO₂e),

$EG_{PJ,y}$: is the net electricity delivered by the Project in year(s) y (MWh);

$EF_{BL,CO2,y}$: is the baseline emission factor in year(s) y (tCO₂/MWh).

As per the methodology AM0029, in order to address this uncertainty in a conservative manner, Project Participants use for $EF_{BL,CO2,y}$ the lowest emission factor among the following three options:

Option 1. The build margin, calculated according to the methodology ACM0002;

Option 2. The combined margin, calculated according to the methodology ACM0002, using a 50/50 OM/BM weight; or

Option 3. The emission factor of the technology (and fuel) identified as the most likely baseline scenario.

As analyzed in the registered PDD of the Project, Option 1 among the three options is adopted to determine the baseline emission factor ($EF_{BL,CO2,y}$).

Option 1. The build margin, calculated according to the methodology ACM0002

Calculate the build margin emission factor ($EF_{BM,y}$) according to the methodology ACM0002 using equation (2):

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \cdot COEF_{i,m}}{\sum_m GEN_{m,y}} \quad (2)$$

where:

$EF_{BM,y}$ is the build margin emission factor in year y (tCO₂/MWh);

$F_{i,m,y}$ is the amount of fuel i consumed by relevant power source m in year(s) y (tCe);

$COEF_{i,m,y}$ is the CO₂ emission coefficient of fuel i, taking into account the carbon content of the fuels used by relevant power source m and the percent oxidation of the fuel in year(s) y (tCO₂/tCe); and

$GEN_{m,y}$ is the electricity delivered to the grid by source m (MWh).

According to the methodology ACM0002, Project Participants choose between one of the two options to

calculate the build margin emission factor ($EF_{BM,y}$). Option 1 provided in the methodology ACM0002 (calculate the build margin emission factor ($EF_{BM,y}$) ex-ante based on the most recent information available on plants already built for sample group m at the time of PDD submission) was selected for the Project in the registered PDD.

According to the methodology ACM0002, the sample group m consists of either (1) the five power plants that have been built most recently, or (2) the power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently. It is suggested that the sample group that comprises the larger annual generation should be used.

Considering data availability, EB accepts the following deviation in application of methodology³:

- 1) Use of capacity additions during the last 1~3 years for estimating the build margin emission factor for grid electricity.
- 2) Use of weights estimated using installed capacity in place of annual electricity generation.

And it is suggested to use the efficiency level of the best technology commercially available in the provincial/regional or national grid of China, as a conservative proxy.

Therefore for the Project: First, calculate the share of different power generation technology in recent capacity additions. Second, calculate the weight for capacity additions of each power generation technology. And finally calculate the emission factor using the efficiency level of the best technology commercially available in China.

Since the data of installed capacity can not be separated to coal based, oil based and gas based currently, the build margin emission factor is calculated with the following steps and formula:

Step a. Calculate the power generation emissions for solid, liquid and gas fuel and each share of total emissions based on *Energy Balance Table* of the most recent year.

$$\lambda_{Coal} = \frac{\sum_{i \in COAL, j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}} \quad (3)$$

$$\lambda_{Oil} = \frac{\sum_{i \in OIL, j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}} \quad (4)$$

$$\lambda_{Gas} = \frac{\sum_{i \in GAS, j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}} \quad (5)$$

where:

$F_{i,j,y}$ is the amount of fuel i consumed by power plant j in year(s) y (in a mass or volume unit),;

$COEF_{i,j,y}$ is the CO₂ emission coefficient of fuel i, taking into account the carbon content of the fuels used by power plant j and the percent oxidation of the fuel in year(s) y (tCO₂/tCe); and
COAL, OIL and GAS are footnote group for solid fuels, liquid fuels and gas fuels.

3 [Http://cdm.unfccc.int/Projects/Deviations](http://cdm.unfccc.int/Projects/Deviations).

Step b. Calculate the emission factor of thermal power generation in the grid based on the result of Step a and the efficiency level of the best technology commercially available in China.

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} \quad (6)$$

Where $EF_{Coal,Adv}$, $EF_{Oil,Adv}$ and $EF_{Gas,Adv}$ are emission factor proxies of efficiency level of the best coal based, oil based and gas based power generation technology commercially available in China.

Step c. Calculate the build margin emission factor of the grid based on the result of Step b and the share of thermal power of recent 20% capacity additions.

$$EF_{BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal} \quad (7)$$

Where CAP_{Total} is total capacity additions while $CAP_{Thermal}$ is capacity additions of thermal power.

The data on different fuel consumptions for power generation and the net calorific values of the fuels are updated with the data obtained from *China Energy Statistical Yearbook* from 2005 to 2007. The emission factors and oxidation factors are updated with the data obtained from *2006 IPCC Guidelines for National Greenhouse Gas Inventories*.

Referring to *China's Regional Grid Baseline Emission Factors*, the weighted average fuel consumption for power generation of top 30 sets of 600 MW coal fired power generation units built in 2006 (329.94 gCe/kWh) and the 200 MW oil/gas fired combined cycle power generation units (252 gCe/kWh) are taken as the efficiency level of the best technology commercially available in China.

Referring to *China's Regional Grid Baseline Emission Factors* (renewed on 18/07/2008), the build margin emission factor ($EF_{BM,y}$) of the North China Grid is calculated as 0.8687 tCO₂e/MWh (see Annex 1 for details). Therefore the baseline emission factor ($EF_{BL,CO_2,y}$) is 0.8687 tCO₂e/MWh.

Baseline emissions of the Project from 01/01/2007 to 31/12/2007 are summarized in Table 9.

Table 9. Baseline emissions of the Project from 01/01/2007 to 31/12/2007

Parameter	$EG_{PJ,y}$ (MWh)	$EF_{BL,CO_2,y}$ (tCO ₂ /MWh)	BE_y (tCO ₂ e)
Data	1,978,186	0.8687	1,718,450

D.1.2. Project emissions:

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According to the methodology AM0029, the Project Activity is on-site combustion of natural gas to generate electricity. Since there is no auxiliary fuel used in the Project besides natural gas, the project emissions are those emissions from on-site combustion of natural gas. The CO₂ emissions from electricity generation (PE_y) are calculated as follows:

$$PE_y = FC_{NG,y} * COEF_{NG,y} \quad (8)$$

where:

PE_y is the project emissions in year(s) y (tCO₂e);

$FC_{NG,y}$ is the total volume of natural gas combusted in the Project Plant in year(s) y (m³);

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

as:

$$COEF_{NG,y} = NCV_{NG,y} * EF_{CO_2,NG,y} * OXID_{NG} \quad (8a)$$

where:

$NCV_{NG,y}$ is the net calorific value (energy content) per volume unit of natural gas in year y (GJ/Nm³)

as determined from the fuel supplier, wherever possible;

$EF_{CO_2,NG,y}$ is the CO₂ emission factor per unit of energy of natural gas in year y (tCO₂/GJ);

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

For the Project, the net calorific value (energy content) per volume unit of natural gas in year y (GJ/Nm³) is obtained by the natural gas supplier and other parameters are obtained from *2006 IPCC Guidelines for National Greenhouse Gas Inventories*.

The project emissions of the Project from 01/01/2007 to 31/12/2007 are summarized in Table 10.

Table 10. Project emissions from 01/01/2007 to 31/12/2007

Parameter	$FC_{NG,y}$ (Nm ³)	$NCV_{NG,y}$ (GJ/Nm ³)	$EF_{CO_2,NG,y}$ (tCO ₂ /TJ)	$OXID_{NG}$	PE_y (tCO ₂ e)
Data	422,408,15 4	0.0347829 6	0.0561	100%	824,255

D.1.3. Leakage:

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Natural gas used in the Project is not liquid natural gas. According to the methodology AM0029, leakage emission (LE_y) sources considered in the Project include the fugitive CH₄ emissions ($LE_{CH_4,y}$) associated with fuel extraction, processing, transportation and distribution of natural gas used in the Project Plant and fossil fuels used in the grid in the absence of the Project Activity.

For the purpose of estimating fugitive CH₄ emissions, Project Participants multiply the quantity of natural gas consumed by the Project in year y with an emission factor for fugitive CH₄ emissions ($EF_{NG,upstream,CH_4}$) from natural gas consumption and subtract the emissions occurring from fossil fuels used in the absence of the Project Activity, as follows:

$$LE_{CH_4,y} = [FC_y \cdot NCV_y \cdot EF_{NG,upstream,CH_4} - EG_{PJ,y} \cdot EF_{BL,upstream,CH_4}] \cdot GWP_{CH_4} \quad (9)$$

where:

$LE_{CH_4,y}$ is the leakage due to fugitive upstream CH_4 emissions in year y (t CO_2e);

FC_y is the quantity of natural gas combusted in the Project Plant in year y (m^3);

$NCV_{NG,y}$ is the average net calorific value of the natural gas combusted in year y (GJ/ m^3);

$EF_{NG,upstream,CH_4}$ is the emission factor for upstream fugitive CH_4 emissions of natural gas from production, transportation, distribution, in t CH_4 per GJ fuel supplied to final consumers;

$EG_{PJ,y}$ is the electricity generation in the Project Plant in year y (MWh), replaced by $EG_{gen,y}$ as $EG_{gen,y}$ is the exact value of electricity generation in the project plant in year y ;

$EF_{BL,upstream,CH_4}$ is the emission factor for upstream fugitive CH_4 emissions occurring in the absence of the Project Activity in t CH_4 per MWh electricity generation in the Project Plant;

GWP_{CH_4} is the global warming potential of CH_4 valid for the relevant commitment period.

The emission factor for fugitive upstream emissions of natural gas ($EF_{NG,upstream,CH_4}$) including fugitive emissions from production, processing, transport and distribution of natural gas, is obtained from Table 2 “other oil exporting countries/rest of world” provided in the methodology AM0029.

According to the methodology AM0029, the emission factor for upstream fugitive CH_4 emissions occurring in the absence of the Project Activity ($EF_{NG,upstream,CH_4}$) should be calculated consistent with the baseline emission factor ($EF_{BL,CO_2,y}$) used above.

Since Option 1 (the build margin, calculated according to the methodology ACM0002) is selected for the calculation of the baseline emission factor, relevant emission factor for upstream fugitive CH_4 emissions ($EF_{BL,upstream,CH_4}$) is calculated as follows:

$$EF_{BL,upstream,CH_4} = \frac{\sum_j FF_{j,k} \cdot EF_{k,upstream,CH_4}}{\sum_j EG_j} \quad (10)$$

where:

$EF_{BL,upstream,CH_4}$ is the emission factor for upstream fugitive CH_4 emissions occurring in the absence of the Project Activity in t CH_4 per MWh electricity generation in the Project Plant;

j is the plants included in the build margin;

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

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

EG_j is the electricity generation in the plant j included in the build margin (MWh/yr).

The emission factor for fugitive upstream emissions of coal ($EF_{k,upstream,CH_4}$) including fugitive emissions from underground coal production, is obtained from Table 2 provided in the methodology AM0029.

In China, it is very difficult to obtain the data of the plant j. Therefore, according to the deviation in application of the methodology AM0005⁴ approved by CDM EB, recent 20% capacity additions of North China Grid during 2005~2006⁵ were used for estimating the build margin emission factor for grid electricity and the 600 MW sub-critical coal fired power generation unit was used as the proxy of efficiency level of the best technology in China⁶. Based on these data, formula (10) can be conservatively converted into formula (11)⁷:

$$EF_{BL,upstream,CH_4} = \varphi_{coal} \times PGCC_{coal,best} \times EF_{coal,upstream,CH_4} \times \frac{NCV_{coal}}{NCV_{Rawcoal}} \quad (11)$$

where,

φ_{coal} is the share of coal fired generation in BM generation (0.94616, see Annex 1 for details).

$PGCC_{coal,best}$ is the power generation standard coal equivalent consumption of the 600 MW sub critical coal fired power generation technology within the grid boundary.

$NCV_{Rawcoal}$ is the net calorific value of raw coal which is used for power generation in GJ/tCe⁸.

Since all the natural gas used in the Project is from the local area and no natural gas imported from other countries is used in the Project, upstream emissions occurring in Annex I countries that have ratified the Kyoto Protocol are not necessary to be excluded.

Leakage of the Project from 01/01/2007 to 31/12/2007 are summarized in Table 11.

Table 11. Leakage from 01/01/2007 to 31/12/2007

Parameter	$EG_{PJ,y}$ (MWh)	$FC_{NG,y}$ (Nm ³)	$NCV_{NG,y}$ (GJ/Nm ³)	φ_{coal}	$PGCC_{best}$ (gCe/kWh)
Data	1,978,186	422,408,154	0.03478296	0.94616	320

Table 11. Leakage from 01/01/2007 to 31/12/2007 (continued)

Parameter	$EF_{coal,upstream,CH_4}$ (tCH ₄ /kt)	$\frac{NCV_{coal}}{NCV_{Rawcoal}}$	$EF_{NG,upstream,CH_4}$ (tCH ₄ /PJ)	Auxiliary electricity consumption rate (%)	GWP_{CH_4} (tCO ₂ e/tCH ₄)	$LE_{CH_4,y}$ (tCO ₂ e)
Data	13.4	1.4	296	2.43	21	-150,501

Since the total net leakage are negative ($LE_{CH_4,y} < 0$), $LE_y = 0$ is assumed in the Project.

D.1.4. Summary of the emissions reductions during the given monitoring period:

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To calculate the emission reductions, the following equation is applied:

4 [Http://cdm.unfccc.int/Projects/Deviations](http://cdm.unfccc.int/Projects/Deviations).

5 Capacity additions during 2005~2006 are greater than and most close to 20% of the electricity system. See Annex 3 for details.

6 [Http://www.ccchina.gov.cn/source/fa/fa2002082803.html](http://www.ccchina.gov.cn/source/fa/fa2002082803.html).

7 The conservativeness of such switch has been demonstrated in Annex 3.

8 As per the data on P365 of *China Energy Statistical Yearbook 2005*, the calorific value of raw coal is 5000 kcal/kg and that of standard coal is 7000 kcal/kg.

$$ER_y = BE_y - PE_y - LE_y \quad (12)$$

where:

ER_y is the emissions reductions of the Project Activity in year y (tCO₂e),

BE_y is the baseline emissions due to displacement of electricity in year y (tCO₂e),

PE_y is the project emissions in year y (tCO₂e),

LE_y is the leakage in year y (tCO₂e).

Emission reductions of the Project from 01/01/2007 to 31/12/2007 are summarized in Table 12. An excel spreadsheet summarizing the calculation of emission reductions is prepared for verification.

Table 12. Emission reductions from 01/01/2007 to 31/12/2007

Parameter	BE_y (tCO ₂ e)	PE_y (tCO ₂ e)	LE_y (tCO ₂ e)	ER_y (tCO ₂ e)
Data	1,718,450	824,255	0	894,195

D.2. Description and consideration of measurement uncertainties

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Recorded data of different natural gas flow meter(s) have been cross-checked with each other for gas consumption. Recorded data and invoiced data have been cross-checked with each other for power generation. No significant differences in both gas consumption and power generation between the two sets of data were observed.

However, the accuracy level of orifice flow meters installed at CFP GC was 1.0 during 01/01/2007 to 08/09/2007 which is not in conformity with the registered MP where it is stated that the meters of 0.5 accuracy level shall be used. The orifice flow meters installed at the CGFPC have been calibrated for 2 years validity according to Code JJG640-1994 on 06/08/2006. Thus, emissions introduced by consumption of 1.0% of the measured total amount of natural gas consumption of the Project during 01/01/2007 to 08/09/2007 are accounted as additional emissions for conservativeness. Following amount discount of emission reduction has been applied as

Table 13. Determination of the amount of emission reductions from 01/01/2007 to 31/12/2007

Parameter	Natural gas consumption during 01/01/2007 to 08/09/2007 (Nm ³)	Uncertainty level	$NCV_{NG,y}$ (GJ/Nm ³)	$EF_{CO_2,NG,y}$ (tCO ₂ /TJ)	Discounted amount (tCO ₂ e)
Data	287,810,303	1.0%	0.03478296	0.0561	56,17

Therefore, the emission reductions achieved by the Project from 01/01/2007 to 31/12/2007 is conservatively determined as $894,195 \text{ tCO}_2\text{e} - 5,617 \text{ tCO}_2\text{e} = 888,578 \text{ tCO}_2\text{e}$.

Annex 1 - Calculation of the build margin emission factor

Table A1. Data and results of Step a.

Fuel	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total G= A+B+...+F	Emission factor (tC/TJ) H	NCV (MJ/t or 1000m ³) I	CO ₂ emission (tCO ₂ e) J
		A	B	C	D	E	F				
Raw coal	10 ⁴ t	796.63	1639.20	6867.99	6968.88	8404.05	10930.66	35607.41	25.8	20908	704,277,823
Washed coal	10 ⁴ t	0.00	0.00	0.00	0.00	0.00	39.77	39.77	25.8	26344	991,125
Other washed coal	10 ⁴ t	6.36	0.00	214.13	371.14	61.77	544.60	1198	25.8	8363	9,477,855
Briquette	10 ⁴ t	7.97	0.00	0.00	0.00	0.00	27.77	35.74	26.6	20908	728,820
Coke	10 ⁴ t	0.00	0.00	0.00	0.00	0.00	3.23	3.23	29.2	28435	98,335
Sub-total of solid fuel										715,573,958	
Crude oil	10 ⁴ t	0.00	0.00	0.00	0.00	0.74	0.00	0.74	20	41816	22,692
Gasoline	10 ⁴ t	0.00	0.00	0.01	0.00	0.00	0.00	0.01	18.9	43070	298
Diesel	10 ⁴ t	0.21	0.00	3.01	0.00	0.07	6.32	9.61	20.2	42652	303,589
Fuel oil	10 ⁴ t	6.38	0.00	0.08	0.00	0.00	4.10	10.56	21.1	41816	341,633
Other oil products	10 ⁴ t	0.00	0.00	0.00	0.00	0.00	0.28	0.28	20	38369	7,878
Sub-total of liquid fuel										676,091	
Coke oven gas	10 ⁸ m ³	0.38	0.63	5.80	22.32	0.64	5.79	35.56	12.1	16726	2,638,825
Other gas	10 ⁸ m ³	20.66	6.58	69.72	13.79	22.76	7.22	140.73	12.1	5227	3,263,593
LPG	10 ⁴ t	0.00	0.00	0.00	0.00	0.00	0.01	0.01	17.2	50179	316
Refinery gas	10 ⁴ t	0.00	0.00	2.43	0.00	0.00	2.32	4.75	15.7	46055	125,934
Natural gas	10 ⁸ m ³	3.41	0.73	0.00	0.53	0.00	0.00	4.67	15.3	38931	1,019,942
Sub-total of gas fuel										7,048,610	
Total										723,298,659	

Data source: China Energy Statistical Yearbook 2007.

Calculated with the data provided in Table A1 and formula (3)~(5), the value of λ_{Coal} is 98.93%, the value of λ_{Oil} is 0.09% and the value of λ_{Gas} is 0.98%.

Table A2. Emission factor of best technology

	Variable	Electricity supply efficiency	Emission factor of fuel (tC/TJ)	Oxidation Rate (%)	Emission factor Inner Mongolia (tCO2/MWh)
		A	B	C	D=3.6/A/10 ³ *B*C*44/12
Coal-based power plants	$EF_{Coal,Adv,y}$	37.28%	25.8	100	0.9135
Gas-based power plants	$EF_{Gas,Adv,y}$	48.81%	15.3	100	0.4138
Oil-based power plants	$EF_{Oil,Adv,y}$	48.81%	21.1	100	0.5706

Therefore, $EF_{Thermal,y} = \lambda_{Coal,y} \times EF_{Coal,Adv,y} + \lambda_{Oil,y} \times EF_{Oil,Adv,y} + \lambda_{Gas,y} \times EF_{Gas,Adv,y} = 0.9083 \text{ tCO}_2\text{e/MWh}$.

Table A3. Installed capacity of North China Grid in 2006

	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total
Thermal power (MW)	3984	6512	26087	26661	28899	49395	141538
Hydro power (MW)	1053	5	785	790	818	553	4004
Wind power and Others (MW)	24	24	218	0	565	106	937
Total (MW)	5061	6541	27090	27451	30282	50054	146479

Data source: China Electric Power Yearbook 2007.

Table A4. Installed capacity of North China Grid in 2005

	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total
Thermal power (MW)	3833.5	6149.9	22333.2	22246.8	19173.3	37332	111068.7
Hydro power (MW)	1025	5	784.5	783	567.9	50.8	3216.2
Wind power and Others (MW)	24	24	48	0	208.9	30.6	335.5
Total (MW)	4882.5	6178.9	23165.7	23029.8	19950.2	37413.4	114620.5

Data source: China Electric Power Yearbook 2006.

Table A5. Installed capacity of North China Grid in 2004

	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total
Thermal power (MW)	3458.5	6008.5	19932.7	17693.3	13641.5	32860.4	93594.9
Hydro power (MW)	1055.9	5	783.8	787.3	567.9	50.8	3250.7
Wind power and Others (MW)	0	0	13.5	0	111.7	12.3	137.5
Total (MW)	4514.4	6013.5	20730	18480.6	14321.2	32923.5	96983.2

Data source: China Electric Power Yearbook 2005.

Table A6. Calculation of the build margin emission factor of North China Grid

	Installed capacity in 2004 (MW) A	Installed capacity in 2005 (MW) B	Installed capacity in 2006 (MW) C	Capacity additions from 2005 to 2006 (MW) D=C-B	Share in total capacity additions
Thermal power	93594.9	111068.7	141538	30469.3	95.64%
Hydro power	3250.7	3216.2	4004	787.8	2.47%
Wind power and Others	137.5	335.5	937	601.5	1.89%
Total	96983.1	114620.4	146479	31858.6	100.00%
Share in the total installed capacity of 2006	66.21%	78.25%	100%		

Therefore, $EF_{grid,BM,y} = 0.9083 \times 95.64\% = 0.8687 \text{ tCO}_2\text{e/MWh}$.

As per Table A1, $\lambda_{Coal} = 98.93\%$. As per Table A6, $\frac{CAP_{Thermal}}{CAP_{Total}} = 95.64\%$. Therefore, $\varphi_{coal} = \frac{CAP_{Thermal}}{CAP_{Total}} \times \lambda_{Coal} = 98.93\% \times 95.64\% = 94.62\%$.