

Beijing Taiyanggong Gas-fired Thermal Power Company

CDM MONITORING REPORT

Beijing Taiyanggong CCGT Trigeneration Project

(UNFCCC project number: 1320)

1st Verification



Monitoring Period:

Start date: 24 February 2008

End date: 24 June 2008

Date of Report: 27 June 2008

Version 1



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1 Introduction

This Monitoring Report summarizes the operation of Beijing Taiyanggong CCGT Trigeneration Project and calculates the emission reductions achieved by the project activity during the period covered by this report. This report serves as the basis for the verification of these reductions and issuance of the CERs.

During this monitoring period, the project activity has achieved emission reductions of 128,031 t CO_{2e}.

The accumulated emission reductions achieved by this project is summarized in the following table.

Verification	Monitoring Period		Emission reductions by project activity (t CO _{2e})			
	Start date	End date	Baseline emissions	Project emissions	Leakage	Emission Reductions
1	24-Feb-08	24-Jun-08	251,010	122,979	0	128,031
2						0
3						0
4						0
5						0
6						0
7						0
8						0
9						0
10						0
11						0
12						0
Total			251,010	122,979	0	128,031



2 General Project Activity Information

2.1 Title of the Project Activity

Beijing Taiyanggong CCGT Trigeneration Project

2.2 Project Category

Sectoral Scope 1: Energy Industries (non-renewable resources)

2.3 Crediting period

Crediting period: 24 Feb 08 - 23 Feb 15 (Renewable)

2.4 Geographic Location

The project is located in Chaoyang District of Beijing, between the North Third Ring-road and the North Fourth Ring-road. The site is 0.5km from the Fourth Ring-road in the north and 0.5km from Laiguangying Road. The site is about 450m long from north to south and between 120 and 260m wide, from east to west. The total land area for the project is 76,000 m². The geographical co-ordinates are 39.967°N, 116.417°E

Figure 1: Map of China Showing Location of Beijing





electrical power.

Unit #1 & #2 were installed respectively in December of 2007 and January of 2008.

2.6 Methodology Applied to the Project Activity

The baseline and monitoring methodology used is AM0029: “Grid Connected Electricity Generation Plants using Natural Gas” (AM0029/ version 01.1, sectoral scope 01, 19 May 2006).

ACM0002: “Consolidated methodology for grid-connected electricity generation from renewable resources” (ACM0002/ version 06, sectoral scope 1, 19 May 2006) is used to calculate the build margin and combined margin.

For more information, see <http://cdm.unfccc.int/meth/approved>.

3 Monitoring plan and project monitoring

This section describes the implementation of the monitoring plan and the monitored data for this verification period.

3.1 Monitoring Methodology

According to the methodology and PDD, the parameters monitored by this project are listed in the following tables:

Data / Parameter	Description	Data unit	Comment
FC_{gas}	Natural gas consumption	Nm^3	
FC_{Diesel}	Diesel consumption	t	
EG_{γ}	Electricity supplied to the grid net of any on-site of parasitic usage	MWh	
NCV_{gas}	Net calorific value of natural gas	GJ/Nm^3	



3.2 Monitoring Activities

3.2.1 Monitoring system

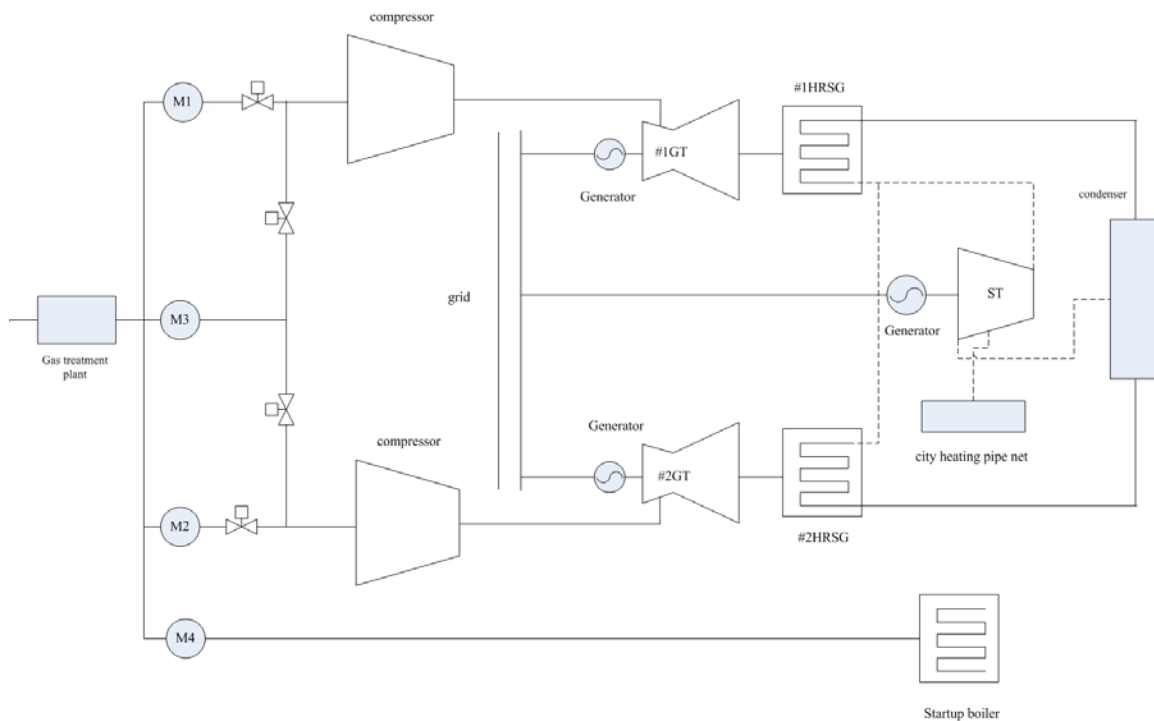
The monitoring system described in PDD has been installed. Refer to the following figures for a pictorial presentation of the monitoring system.

3.2.1.1 Gas consumption monitoring

There are four gas flow meters monitoring gas consumption: meters 1 and 2 measuring gas to each compressor and a third meter as back-up. Meter 4 measures gas to the start-up boiler.

As a further back-up, receipts of gas supplied by the gas company will be used.

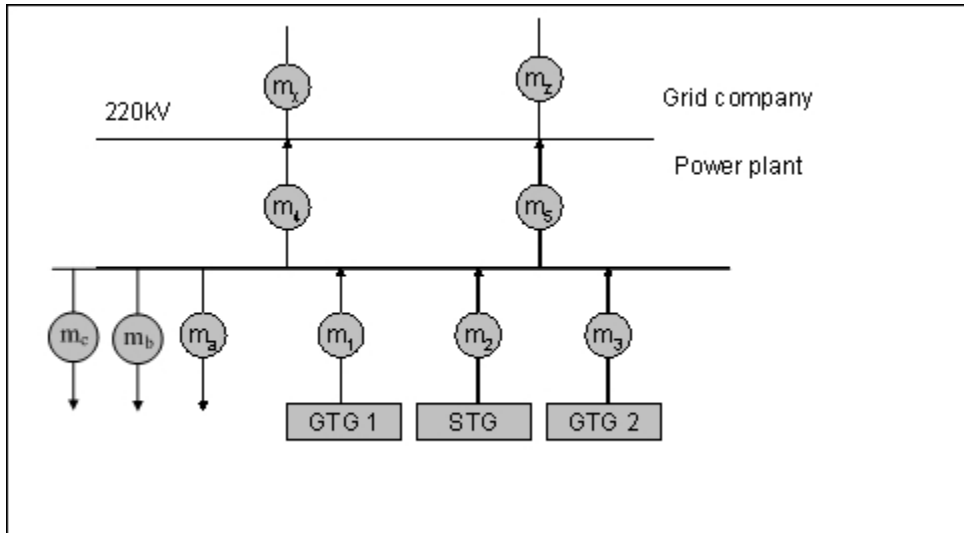
Figure 3: Monitoring System of Natural Gas Consumption





3.2.1.2 Net Electricity Generation monitoring

Figure4: Monitoring System of Electricity Sent to the Grid



There are 2 connections to the 220kV Beijing Power Grid, each with a meter (m₄ and m₅). These meters measure the total electricity sent to the grid.

Each of the 3 electricity producing generators has a meter to monitor the electricity produced and sent to the main internal line (m₁, m₂ and m₃). On-site, auxiliary use of power generated is measured by three separate meters (m_a, m_b, and m_c). Backup readings are taken from these meters.

Finally, there are two meters (m_x and m_z) owned by the Beijing Power grid company measuring the electricity supplied to the grid from the project. Readings from these can be used as a further backup, if necessary.

In summary,

$$\text{Net electricity generated} = m_4 + m_5 = (m_1 + m_2 + m_3) - (m_a - m_b - m_c)$$

3.2.1.3 Monitoring of diesel consumption

The diesel generators are used in an emergency only to supply electricity to shutdown turbines smoothly and safely. They also need to be tested periodically.



A volume flow meter is used to measure diesel consumption. The diesel is usually stored in an oil tank first and then consumed as needed. The meter is installed on the inlet of this diesel storage tank. Any diesel flowed into the storage tank is metered with this meter, and the metered volume is deemed as diesel consumed by the diesel generators in order to be conservative.

The measured volume of diesel can be converted to mass of diesel consumed using standard density of diesel (0.85 kg/litre).

As a back-up, receipts can be used to monitor diesel consumption.

3.2.1.4 Net Calorific value of natural gas

The natural gas is sampled and analysed periodically by the gas supply company.

3.3 Monitoring results

3.3.1 Natural gas consumption

Operation Period			Gas consumption (FC _{gas})
Month	Start Date	End Date	Nm ³
Mar	24-Feb-08	24-Mar-08	19,794,404.0
Apr	25-Mar-08	24-Apr-08	19,573,179.0
May	25-Apr-08	24-May-08	6,314,110.0
Jun	25-May-08	24-Jun-08	17,983,104.0
Total			63,664,797.0

3.3.2 Diesel consumption

The oil meter was added to the diesel supply system of the emergency diesel generators at the beginning of February, and there was already some diesel in the storage tank then. In order to be conservative, the diesel consumption for the current monitoring period is obtained as follows:

$$FC_{\text{Diesel}} = \text{Metered diesel consumption} + \text{volume of diesel storage tank} \times \text{density of diesel}$$



The size of the diesel storage tank is 1.9 m x 1.2m x1.8m, and thus the volume is 4.104 m³, which can store 4.104 x 8.5 = 3.49 t. The metered diesel consumption for March (24 February 2008 to 24 March 2008) is 0.15 t, and therefore the diesel consumption for this period is 3.64 t.

As described in section 3.2.1.3, the oil meter measures the diesel flow only when the diesel tank is being filled. As the diesel consumption is small, no diesel was filled into the storage tank in addition to March, and therefore the diesel consumption for the other months is 0 t.

Operation Period			Diesel consumption (FC _{Diesel})
Month	Start Date	End Date	t
Mar	24-Feb-08	24-Mar-08	3.64
Apr	25-Mar-08	24-Apr-08	0.00
May	25-Apr-08	24-May-08	0.00
Jun	25-May-08	24-Jun-08	0.00
Total			3.64

3.3.3 Electricity supplied to the grid by the project

Operation Period			Electricity supplied to the grid (EGy)
Month	Start Date	End Date	MWh
Mar	24-Feb-08	24-Mar-08	90,464.0
Apr	25-Mar-08	24-Apr-08	92,653.0
May	25-Apr-08	24-May-08	23,562.0
Jun	25-May-08	24-Jun-08	80,844.5
Total			287,523.5



3.3.4 Net calorific value of natural gas

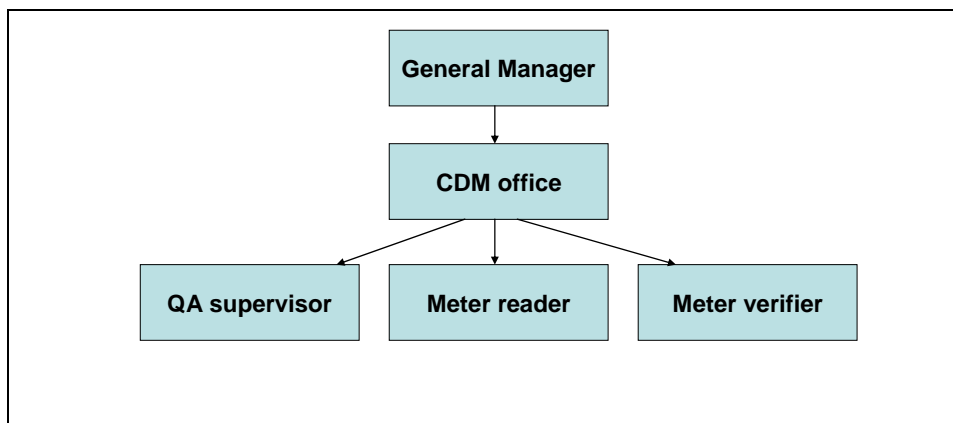
Operation Period			Net calorific value of gas (NCV _{gas})
Month	Start Date	End Date	GJ/Nm ³
Mar	24-Feb-08	24-Mar-08	0.03452
Apr	25-Mar-08	24-Apr-08	0.03446
May	25-Apr-08	24-May-08	0.03440
Jun	25-May-08	24-Jun-08	0.03430
Total			0.03442

4 Project Management and QA/QC

4.1 Project Management

The project owner has established a CDM office which will be responsible for monitoring project emissions and other CDM related activities. Refer to the following chart for the management organization.

Figure 5 Organization chart of CDM project management





4.2 Roles and Responsibilities

Roles and their responsibilities are assigned in accordance with the monitoring plan in the PDD. The responsibilities for the CDM management are outlined in the following table.

CDM Responsibility table

Activity	Responsible Division	Responsible Person	Date & name of responsible person if changed
<ul style="list-style-type: none"> - Overall Management - IT Systems Resourcing - CER Calculation - Preparation of External Reports 	Beijing Taiyanggong Gas-fired Thermal Co	Mr. Zhang Yandong Mr. Wang Yonggang	
<ul style="list-style-type: none"> - On site meter maintenance & calibrations - Record keeping of Copies of Meter Calibrations - Maintaining meter logs - Training in meter reading & error recognition 	Operations Department	Mr. Tang Renzong	
Data collection and processing <ul style="list-style-type: none"> - Recording of metered data - Process electronic data by algorithm on rolling basis - Send electronically recorded data (gas & power) and to CDM Manager monthly 	Operations Department	Mr. Guo Chun	
Fail safe and cross reference data	Finance Department	Ms. Song Hui	



4.3 Training

Before the operation of the project, the CDM project manager and all relevant staff attended training on CDM awareness and monitoring requirements. The training covered the followings:

- The CDM process and its broad aims
- The project management structure
- The project activity
- The principles of quality management applied to Emission Reductions
- Understanding and using the monitoring equipment
- Undertaking the procedures as described in the CDM quality manual

Besides, all the operators have also obtained the relevant technical training.

4.4 Quality Assurance (QA)/Quality Control (QC)

Quality Assurance (QA)/Quality Control (QC) procedures as described in PDD have been followed during the current period. Those procedures are included here for reference.

4.4.1 QA/QC Procedures

4.4.1.1 Error Handling Procedure

- In the event that a meter has lost calibration over the allowable error limit then this shall be corrected at the earliest opportunity and re-calibrated and the data recorded from this meter since the last successful calibration shall be ignored.
- In the event that there is uncertainty over the accuracy of the data set for net electricity generated from the main meters (e.g. the meter has lost calibration over the acceptable error limit) then the data from the back-up meters shall be used. In the event that there is uncertainty over the accuracy of the data set from the main and from the back-up meters, then power generated and delivered to the grid as evidenced by invoices and/or sales receipts shall then be used to evaluate the power generation.
- Similarly for gas consumption, if there is uncertainty over the accuracy of the data set for gas consumed from the main meter, then data from the back-up meters will be used. If there is uncertainty over the accuracy of both data sets, then invoices and/ or sales receipts shall be used.

4.4.1.2 External Reporting Procedure



After signing by the CDM Project Officer, the report is sent to the 3rd party verifier who is contracted to verify the emissions reductions during the crediting period of the project.

4.4.1.3 Procedure for corrective actions arising

The CDM Project Officer is responsible for identifying corrective actions arising from the above procedures and for liaising with the purchaser, the 3rd party verifiers and other stakeholders to take necessary steps to implement the corrective actions.

4.4.1.4 Emergency procedures

In the unlikely event of an emergency, set procedures will be followed to prevent unintended emissions of methane. Details of the procedures to be followed are described in the relevant Operation Manuals. The key points include:

- The Distributed Control System (DCS) will automatically shut off gas supply to areas where a leak could occur upon detecting an emergency.
- The operators can also remotely shut off the gas supply if they find an emergency situation has occurred.

Quality assurance and controlling measures were taken according to the above procedures and no errors happened during this monitoring period.

4.4.2 Calibration of Monitoring Meters

All the measurement equipment has been calibrated and checked for accuracy following industry standards and procedures.

Calibrations of the meters during the current monitoring period have been made on schedule. The calibration results show that all measurement equipment is within the accuracy specified in PDD or relevant industrial standards, and qualified to monitoring the power generation, natural gas flow, Diesel consumption and on-site power consumption.

All the certificates of calibration are available to the DOE for verification.



5 Emission Reductions Calculation for the Project

5.1 Fixed values for calculating emission reductions

In calculating the emission reductions achieved by the project activities, the following fixed data and parameters as validated in PDD are adopted.

Parameters	Description	Unit	Value applied	Source	Comments
Fixed parameters for calculating project emission					
$EF_{CO_2, gas}$	Emission of Gas	t CO ₂ /GJ	0.0561	IPCC	
$OXID_{gas}$	Oxidation Factor of Gas	%	100%	IPCC	
NCV_{Diesel}	Net calorific value of Diesel	TJ/Gg	43.00	IPCC	
$EF_{CO_2, Diesel}$	Emission of Diesel	t CO ₂ /GJ	0.0741	IPCC	
$OXID_{Diesel}$	Oxidation Factor of Diesel	%	100%	IPCC	
ρ_{Diesel}	Density of Diesel	t/m ³	0.85	PDD	
Fixed parameters for calculating baseline emission					
NCV_{coal}	Net calorific value of coal	GJ/t _{SCE}	29.3	National Standard	
$OXID_{coal}$	Oxidation Factor of Coal	%	100%	IPCC	
$COEF_{BL}$	Emission co-efficient of coal	t CO ₂ /GJ	0.0946	IPCC	
η_{BL}	Baseline efficiency of power generation	%	39.01%	Notional data	
Fixed parameters for calculating leakage emission					
$EF_{k, upstream, CH_4}$	Emission factor for upstream CH ₄ emissions due to mining	t CH ₄ /kt	13.4	IPCC	
$EF_{BL, upstream, CH_4}$	Upstream CH ₄ emissions due to mining in terms of per MWh	t CH ₄ /MWh	0.0042	PDD	
$EF_{NG, upstream, CH_4}$	Emission factor for upstream CH ₄ emissions of natural gas production	t CH ₄ /PJ	296	IPCC	
GWP_{CH_4}	Global warming potential for CH ₄	tCO _{2e} /tCH ₄	21	UNFCCC	

5.2 Baseline Emissions



Baseline emissions are calculated by the following formula:

$$BE_y = EG_y \times \left(\frac{COEF_{BL}}{\eta_{BL}} \times 3.6 \right) = EG_y \times \left(\frac{0.0946}{39.01\%} \times 3.6 \right) \quad (1)$$

Where,

- BE_y Baseline emissions in year y (t CO_{2e})
- EG_y Electricity supplied to grid by project in year y (MWh)
- COEF_{BL} Fuel emission-coefficient for coal, COEF_{BL} = 0.0946 t CO₂/GJ;
- η_{BL} Baseline efficiency of power generation, η_{BL} = 39.01%
- 3.6 Conversion factor from MWh to GJ

For the current monitoring period, the baseline emissions are calculated as follows:

A			B	C	D	E
Operation Period			Baseline Emissions Calculation BE = EG _y * (COEF _{BL} / η _{BL} * 3.6)			
Month	Start Date	End Date	EG _y	COEF _{BL}	η _{BL}	BE
			MWh	t CO _{2e} /GJ	%	(tCO _{2e})
			Measured	Fixed	Fixed	Calculated
Mar	24-Feb-08	24-Mar-08	90,464	0.0946	39.01%	78,976
Apr	25-Mar-08	24-Apr-08	92,653	0.0946	39.01%	80,887
May	25-Apr-08	24-May-08	23,562	0.0946	39.01%	20,570
Jun	25-May-08	24-Jun-08	80,845	0.0946	39.01%	70,578
Total						251,010

From the table shown above, the baseline emissions during this monitoring period are **251,010 t CO_{2e}**.

5.3 Project Emissions

5.3.1 Project emission from combustion of natural gas

$$PE_{gas} = FC_{gas} \times NCV_{gas} \times EF_{CO_2,gas} \times OXID_{gas} = FC_{gas} \times NCV_{gas} \times 0.0561 \times 100\% \quad (2)$$

Where,

- PE_{gas} project emission from combustion of natural gas in t CO_{2e}



- FC_{gas} the total volume of natural gas combusted in the power plant in Nm^3
- NCV_{gas} net calorific value of natural gas in GJ/Nm^3
- $EF_{CO_2,gas}$ the CO_2 emission coefficient of natural gas in $t CO_2/GJ$, $EF_{CO_2,gas} = 0.0561 t CO_2/GJ$
- $OXID_{gas}$ Oxidation factor of natural gas, $OXID_{gas}=100\%$

5.3.2 Project emission from combustion of Diesel

$$PE_{Diesel} = FC_{Diesel} \times NCV_{Diesel} \times EF_{CO_2,Diesel} \times OXID_{Diesel} = FC_{Diesel} \times 43.33 \times 0.0741 \times 100\% \quad (3)$$

Where,

- PE_{Diesel} project emission from combustion of Diesel in $t CO_{2e}$
- FC_{Diesel} the total volume of natural gas combusted in the power plant in Nm^3
- NCV_{Diesel} net calorific value of Diesel in TJ/Gg , $NCV_{Diesel} = 43.33 TJ/Gg$
- $EF_{CO_2, Diesel}$ the CO_2 emission coefficient of Diesel in $t CO_2/GJ$, $EF_{CO_2, Diesel} = 0.0741 t CO_2/GJ$
- $OXID_{Diesel}$ Oxidation factor of natural gas, $OXID_{Diesel}=100\%$

5.3.3 Total Project Emission

$$PE_y = PE_{Diesel} + PE_{gas} \quad (4)$$

The total project emissions for the project during this monitoring period are detailed in the following table.

A			B	C	D	E	F
Operation Period			Project Emissions Calculation ($PE = PE_{Gas} + PE_{Diesel}$)				
Month	Start Date	End Date	FC_{Gas}	PE_{Gas}	FC_{Diesel}	PE_{Diesel}	PE
			Nm^3	$t CO_{2e}$	tCH_4	$t CO_{2e}$	(tCO_{2e})
			Monitored	Formula (2)	Measured	Formula (3)	=C+E
Mar	24-Feb-08	24-Mar-08	19,794,404	38,336	4	12	38,347
Apr	25-Mar-08	24-Apr-08	19,573,179	37,842	0	0	37,842
May	25-Apr-08	24-May-08	6,314,110	12,185	0	0	12,185
Jun	25-May-08	24-Jun-08	17,983,104	34,605	0	0	34,605
Total							122,979



From the table shown above, the project emissions during this monitoring period are **122,979 t CO_{2e}**.

5.4 Leakage Emission

According to the methodology and PDD, the leakage for this project is calculated using the following formula,

$$L_Y = (FC_{gas} \times NCV_{gas} \times EF_{NG,upstream,CH4} - EG_Y * EF_{BL,upstream,CH4}) \times GWP_{CH4} \quad (5)$$

Where,

L_Y	Leakage emissions during the year y in t CO _{2e}
FC_{gas}	Quantity of natural gas combusted in the project plant in Nm ³
NCV_{gas}	Net calorific value of the natural gas combusted in the project plant in GJ/Nm ³
$EF_{NG,upstream,CH4}$	Emission factor for upstream fugitive methane emissions of natural gas from production, transportation, distribution, $EF_{NG,upstream,CH} = 296 \text{ t CH}_4/\text{PJ}$
EG_Y	Electricity supplied to the grid by the project plant in MWh
$EF_{BL,upstream,CH4}$	Emission factor for upstream fugitive methane emissions occurring in the absence of the project activity, $EF_{BL,upstream,CH4} = 0.0042 \text{ t CH}_4 \text{ per MWh electricity generation in the project plant}$
GWP_{CH4}	Global warming potential of methane, $GWP_{CH4} = 21 \text{ t CO}_2/\text{t CH}_4$

$$L_Y = (FC_{gas} \times NCV_{gas} \times 296 - EG_Y * 0.0042) \times 21 \quad (6)$$

According to methodology, if $L_Y < 0$, then $L_Y = 0$.

For the current monitoring period, the leakage is calculated as follows:



A			B	C	D	E
Operation Period			Leakage $L_y = (FC_y * NCV_{gas} * EF_{NG,upstream,CH_4} - EG_y * EF_{BL,upstream,CH_4}) * GWP_{CH_4}$			
Month	Start Date	End Date	FC_{Gas}	EG_y	L_y	
			Nm^3	MWh	(tCO _{2e})	
			Monitored	Monitored	Formular	if $L_y < 0$, $L_y = 0$
March	24-Feb-08	24-Mar-08	19,794,404	90,464	(3,731)	0
April	25-Mar-08	24-Apr-08	19,573,179	92,653	(3,972)	0
May	25-Apr-08	24-May-08	6,314,110	23,562	(723)	0
June	25-May-08	24-Jun-08	17,983,104	80,845	(3,272)	0
Total						0

5.5 Emission Reductions

According to the methodology, the formula for calculating emission reductions is as follow:

$$ER_y = BE_y - PE_y - L_y \quad (7)$$

Where,

- ER_y :** are the total emissions reductions during the monitoring period in tons of CO₂
- BE_y :** are the baseline emissions for the project activity during the monitoring period in tons of CO₂
- PE_y :** are the emissions from the project activity during the monitoring period in tons of CO₂
- L_y :** are the missions due to leakage during the monitoring period in tons of CO₂

Thus, for the current monitoring period, the emission reductions are calculated as follows:



A			B	C	D	E
Operation Period			Baseline Emissions	Project Emissions	Leakage	Emission Reductions
Month	Start Date	End Date	(tCO _{2e})	(tCO _{2e})	(tCO _{2e})	(tCO _{2e})
			From BEs	From PEs	From LEs	=B-C-D
Mar	24-Feb-08	24-Mar-08	78,976	38,347	0	40,629
Apr	25-Mar-08	24-Apr-08	80,887	37,842	0	43,045
May	25-Apr-08	24-May-08	20,570	12,185	0	8,385
Jun	25-May-08	24-Jun-08	70,578	34,605	0	35,973
Total			251,010	122,979	0	128,031

In conclusion, the project activity has achieved 128,031 t CO_{2e} of emission reductions during this monitoring period.



Following person with signature below confirms the Monitoring Report of Beijing Taiyanggong CCGT Trigeneration Project

Signed: 张燕东 (CDM Manager)

Mr. Zhang Yandong

Beijing Taiyanggong Gas-fired Thermal Co.

Date: June 27, 2008