Duerping Coal Mine Methane Utilization Project

Clean Development Mechanism (CDM)

CER Monitoring Report

Certified Emission Reductions

Monitoring Period: 27 October 2010 – 26 March 2011

CDM Registration No: 1900

Date: 28 March 2011
Version 01

A project designed to meet the baseline and monitoring requirements of UN CDM Approved Consolidated Methodology

ACM0008 Version 3
"Consolidated baseline methodology for coal bed methane and coal mine methane capture and use for power (electrical or motive) and heat and/or destruction by flaring"

MONITORING REPORT FORM (CDM-MR) *
Version 01 - in effect as of: 28/09/2010

CONTENTS

MONITORING REPORT

* as contained within the document entitled "Guidelines for completing the monitoring report form (CDM-MR)” (EB 54 meeting report, annex 34).

Version number: 01
Date 28/03/2011

Title of project activity: Duerping Coal Mine Methane Utilization Project
Reference number: 1900
Monitoring period number: 05
Monitoring period dates: 27/10/2010 - 26/03/2011 (inclusive)

SECTION A. General description of the project activity

A.1. Brief description of the project activity: >>

The purpose of the project activity is the utilization and abatement of coal mine methane (CMM) captured in underground coal mine workings to allow safe coal extraction at Duerping coal mine.

The project activity has installed the necessary power generation and abatement equipment; control, monitoring and safety systems; pipe-work and power connections to ensure that a high proportion of the coal mine methane that would normally be released to atmosphere is combusted.

Investment in generation plant is phased. Three 1.7 MW gensets (combined capacity of 5.1 MW) were delivered to the site in November 2007 for installation and they started operation in May 2008. Another four 1.7MW gensets (combined capacity of 6.8 MW) were delivered to the site in October 2009 for installation and started operation in November 2010. The total combined capacity of the plant is 11.9 MW (5.1 MW Phase 1 plus 6.8 MW Phase 2). This matches the final capacity of nearly 12.0 MW stated within the registered PDD. There will be no development of further phases.

Waste heat from the exhaust of the generators will be used to provide heat to warm the intake of the mine during the winter months/heating season. The heating season started on 2nd November 2010 and is expected to finish on 5th April 2011 after the end of monitoring period on 26th March 2011 covered in current verification.

The total emission reductions achieved in this monitoring period are 105,541 tCO2e.

A.2. Project Participants

The authorized project participants are:

Shanxi Coking Coal Group Company Ltd, a Chinese state-owned enterprise which was established under the laws of the People’s Republic of China and having its registered office at Xin Jin Si Road, Taiyuan, Shanxi, PRC (hereinafter referred to as “Jiaomei”).

Sindicatum Carbon Capital Ltd, a company incorporated under the laws of England and having its registered office at 33 Duke Street, London, W1U 1JY, United Kingdom (hereinafter referred to as “SCC”).

A.3. Location of the project activity:

The coal mine is located in Xingjiashe Town, 20 km west of Taiyuan, the capital of Shanxi Province of the People’s Republic of China

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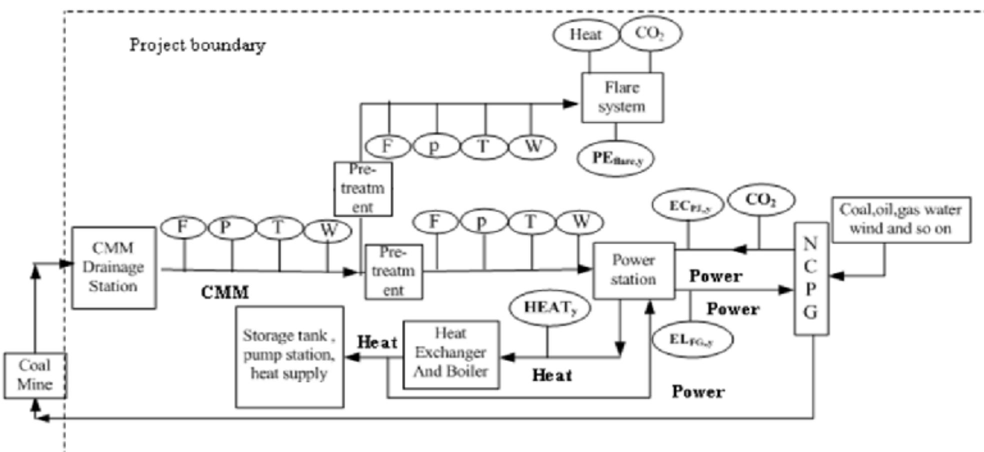
The project site lies 8 km south west of the main mine buildings. The coal mine reserves are located within the area: Latitude: North 112° 14’ 27”   Longitude: East 37° 46’ 52”

Figure A.3-1 Location of the project activity

A.4. Technical description of the project

This project involves container-type methane pre-treatment equipment, generator sets, power distribution system, enclosed flare as well as relevant monitoring meters. Detailed information is as the follows:



F = Gas flow meter
P = Gas pressure
T = Gas temperature
W = Methane concentration

$EC_{PJ,y}$ = Electricity consumed
$EL_{FG,y}$ = Electricity generated
$PE_{flare,y}$ = Project emissions flare
NCPG = North China power grid

Figure A.4-1 Flow diagram and project boundary

1. Generator sets

Generator sets adopted by the project activity are manufactured by Deutz from Germany. Technical specifications of the generator sets are shown in Table A.4-1.

Table A.4-1 Technology specifications of the generator sets

Items	Parameter
A. Gas engine	
Sets	7
Model	TCG 2020V20
Cylinder numbers	20
Exhaust temperature	442℃
Rated rotational speed	1,500rpm
Manufacturer	Deutz
B. Generator	
Sets	7
Model	DIG 130k/4
Rated capacity	1,750kW
Output voltage	6.3kV
Rated frequency	50Hz
Rated rotational speed	1,500rpm
Power generating efficiency	41.6%
Total efficiency	84.5%
Life time of the gensets	>30 years

2. Heat recovery system

The heat will be recovered from two sections of the project activity, one is the engine water cooling system (no monitoring process associated with this heat displacement) and another is the flue gas (ER calculated from continuous monitoring of hot oil circuit during winter season – therefore no heat displacement ER calculated during current monitoring period).

The excess heat from the cylinder cooling system will be recovered by the engine heat exchangers and provide hot water to the nearby drainage station heating system during winter months. This heat supply is not monitored and therefore no ER calculated as a consequence of the heat displacement.

Table A.4-2 Technical specifications for engine heat exchanger

Manufacturer	Incorporated in Deutz engines
Model	XG-40
Sets	7
Water flow rate	85t/h
Temperature of inlet water	70°C
Temperature of outlet water	78.5°C
Heat recovery capacity	850kW

The heat from the engine flue gas will be recovered by the flue gas/oil heat exchanger and then the heated oil will be transferred (in a closed circuit) to the coal mine shaft air intake during winter months by means of an oil/air heat exchanger.

Table A.4-3 Technical specifications for flue gas/oil heat exchanger

Manufacturer	Shanghai Eagle New Technology Engineering Co., Ltd
Sets	7
Model	EGS0.7-1.0/160/200-FF
Temperature of inlet gas	442°C
Temperature of outlet gas	≤180°C
Temperature of inlet oil	160°C
Temperature of outlet oil	200°C
Flow rate of inlet flue gas	9,480kg/h
Rated heat supply capacity	742kW

Table A.4-4 Technical specifications for oil/air heat exchanger

Manufacturer	Shanghai Eagle New Technology Engineering Co., Ltd
Sets	3
Model	EGS2-1.0/200/160-FF
Temperature of inlet air	-25°C
Temperature of outlet air	120°C
Temperature of inlet oil	200°C
Temperature of outlet oil	160°C
Flow rate of air	38,000Nm^3/h
Rated heat supply capacity	2,060kW

3. Flaring system

The surplus CMM that can't be utilized by gensets and CMM with CH_4 concentrations in the range of 25-30% will be destroyed by the enclosed flare. The combination of power generation and flaring will optimize the utilization of CMM.

The temperature of the flue gas of the enclosed flare will be continuously monitored in accordance with "Tool to determine project emissions from flaring gases containing methane" in order to ensure that the flare is in normal operation.

Detailed information on the specifications of the enclosed flare is described below:

Table A.4-5 Technical specifications for the Enclosed Flare

Manufacturer	Beijing Fairyland Environmental Technology CO., Ltd
Sets	1
Capacity	300-5,000 Nm^3/h
Methane concentration in CMM	>25%
Flare temperature	500-1,350 °C
Methane combustion efficiency (%)	>90%

4. Monitoring system

A complete monitoring system will be included in the project activity. The monitoring instruments to be installed include flow meters, methane meters, thermocouples, pressure and temperature gauges as well as electricity meters. All the monitoring instruments meet the relevant accuracy requirements and will be calibrated in accordance with the national standards or the manufacturers' specification.

A.5. Title, reference and version of the baseline and monitoring methodology applied to the project activity:

ACM0008 version 03 - "Consolidated methodology for coal bed methane and coal mine methane capture and use for power (electrical or motive) and heat and/or destruction by flaring".
ACM0002 version 06 - "Consolidated baseline methodology for grid-connected electricity generation from renewable sources"
"Tool for the demonstration and assessment of additionality" version 4
"Tool to determine project emissions from flaring gases containing methane"

A.6. Registration date of the project activity:

06/03/2009

A.7. Crediting period of the project activity and related information (start date and choice of crediting period):

The fixed 10 years crediting period is chosen for the project activity. The starting date of the crediting period is 06/03/2009 which is different from the date shown in the registered PDD (01/10/2008).

A.8. Name of responsible person(s)/entity(ies):

Mr. Gareth Phillips
Chief Climate Change Officer

Sindicatum Carbon Capital (SCC)
33 Duke Street, W1U 1JY
London, UK
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Mr. Sven JP Starckx
Senior Technical Advisor
Monitoring and Verification

SECTION B. Implementation of the project activity

B.1. Implementation status of the project activity

The implementation of the project activity has been divided into two phases. The first phase (with three 1.7 MW gensets) started operation in May 2008. The second phase (with four additional 1.7MW gensets and a gas pre-treatment unit) started gas load commissioning in November 2010. The total combined capacity of the plant is 11.9 MW. The waste heat from the installed generators will be recovered and displace the heat generated by coal stoves for heating the shaft air intake at the coal mine during the winter season.

During this monitoring period, no material changes occurred on Phase 1 of the project. Maintenance on en power plant gensets is presented in table below.

	Overhaul or reparation	From	To
Engine number 1	Deutz E50 maintenance	16th February	23rd of February
Engine number 2	Deutz E50 maintenance	20th November	5th of December
Engine number 3	Replace B8 cylinder	4th February	16th of February

Regular power plant maintenance takes place when necessary on the 5th, 15th and 25th of each month when the drainage station switch pumps and therefore gas is not drained and delivered to the power plant for approximately two hours during those dates. It is mainly during those stoppages that the power plant pre-treatment, flare or gensets undergo small maintenance checks. Second phase engines number 4, 6 and 7 started commissioning with gas load in November 2010. Engine number 5 is expected to start gas load commissioning in April 2011. Approximate running hours of individual Phase 2 engine is presented in table below.

	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11
Genset 4	18	434	672	658	581
Genset 5	7	0	0	0	0
Genset 6	3	178	367	617	445
Genset 7	10	0	563	657	577

There have not been any events or situations that occurred during this monitoring period which may impact the applicability of the methodology, other than those described above or in Annex 5.

B.2. Revision of the monitoring plan

Minor revisions to the initial monitoring plan included in the initial registered PDD were made on 18/02/ 2009. The revisions have been validated by TUV-Sued and their conclusions have been reported in validation report (nr. 600500291). A request for revision of the monitoring plan was submitted on 07/07/2009, and approval by the UNFCCC was given on 13/12/2009. This monitoring report has been completed using the revised monitoring plan.

B.3. Request for deviation applied to this monitoring period

No deviation applied to this monitoring period.

B.4. Notification or request of approval of changes

No notification or request of approval of changes from the project activity as described in the registered CDM-PDD.

SECTION C. Description of the monitoring system

In order to guarantee the quality of the data and data collection system, a detailed monitoring manual has been developed and implemented. This detailed monitoring manual (available for verification by a DOE) is based upon the requirements set out in the PDD and revised monitoring plan and addresses as a minimum the items listed below:

- SCC CDM engineers record the value from each CDM monitoring instrument daily using a remote web page system to verify that the readings are within the range set by the manufacturer. Net power values are recorded by Duerping mine operators every day and handed to SCC CDM engineers on monthly basis. The monitoring instrument data is logged daily and it is available during verification. If the incorrect value persists for more than one hour SCC CDM engineers will ask the on-site operator to check the installation of the instrument and if the problem persists SCC will contact the installation company to replace the faulty instrument with an approved calibrated instrument in the shortest time possible.

- Analysis of CH_4 mass flow against Gross power is performed every month to confirm the back-calculating CH_4 mass flow equations are consistent month to month.

Figure C-1 is the line diagrams showing all relevant monitoring points as per registered PDD. Detailed monitoring diagrams for Phase I and Phase II of the project are included in Annex 6

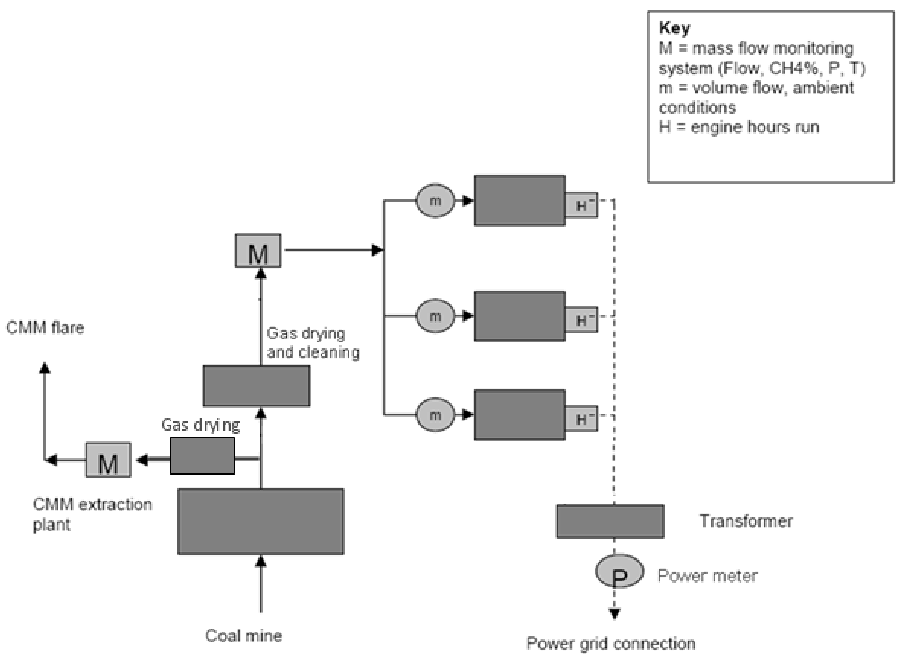

Figure C-1 Line diagram showing all relevant monitoring point

Figure C-2 is the organizational structure of the CDM team.

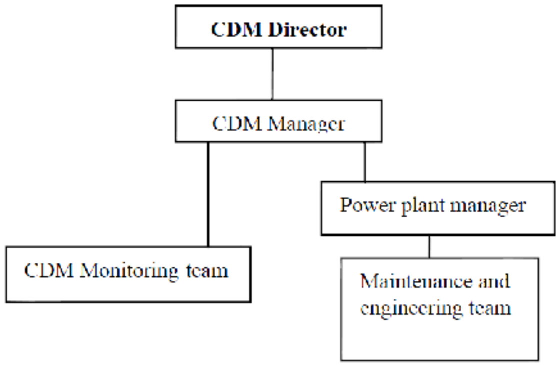

Figure C-2 Organizational structure

An overview of the data collection process is provided in Table C-1 and Annex 1.

Parameter	Reference	Procedure / Frequency	Registration	Check and correct primary measurements
Baseline Emissions	The baseline emissions are calculated using the formulae described in the PDD, section B6.1 - using the CDM spreadsheet	Primary data are electronically logged and stored together with keyboard entry data and processed electronically at the start of each month	CDM spreadsheet stored on SCC's Project File S-Server	The SCC project officer performs a consistency check based upon previous months. In case of irregularities data is double checked, corrected as necessary and the amendment logged
Leakage emissions	In accordance with ACM0008 version 3 no leakage is considered for the project activity			
Project Emissions	The project emissions are calculated using the formulae described in the PDD, section B6.1 - using the CDM spreadsheet	Primary data are electronically logged and stored together with keyboard entry data and processed electronically at the start of each month	CDM spreadsheet stored on SCC's Project File S-Server	The SCC project officer performs a consistency check based upon previous months. In case of irregularities data is double checked, corrected as necessary and the amendment logged
Emission Reductions	The emission reductions are calculated using the formulae described in the PDD, section B6.1 - using the CDM spreadsheet	Primary data are electronically logged and stored together with keyboard entry data and processed electronically at the start of each month	CDM spreadsheet stored on SCC's Project File S-Server	The SCC project officer performs a consistency check based upon previous month's records. In case of irregularities data is double checked, corrected as necessary and the amendment logged

Table C-1 Data collection process

Accuracy and calibration of instruments

All measurement devices are maintained to ensure a high level of accuracy. All meters are subject to a quality control regime that includes regular maintenance and are calibrated annually (in the case of V-cones biannually) by *Jiangsu Institute of Metrology* (flare thermocouples), *Institute of Metrological Supervision and Measurement of Hebei Province* (flare, oil heating circuit and engine v-cones and oil v-cone differential pressure transducer) and by *Shanxi Province institute of Metrology Supervision and verification* (rest of CDM instruments). A list of all CDM instruments, their accuracy levels and calibration certificate numbers are presented in Annex 2. Annex 3 presents all CDM instruments installation and removal dates during the period relevant to monitoring report.

A record is available showing the location and unique identification number of each meter, the calibration status of that meter (date of last calibration and date of next calibration). All CDM instruments have integrated a Serial Number which is used to track the calibration records and installation certificates.

All calibration records are retained two years after the end of the crediting period is over and are available for verification by the DOE.

Archiving of data

Data is archived periodically to a secure and retrievable storage format where it will be held for the crediting period plus 2 years.

Document Control

A document control system has been introduced ensuring that the current versions of necessary documents are available at the point of use. As a part of the document control system, an internal Technical Review Process has been established to ensure the quality of all relevant documents, including the CDM Monitoring Report.

Treatment of missing or corrupted data

Where data in the on-line system are corrupted or missing whilst the plant is operating, the corrupt or missing data can be corrected and justified using installed back-up metering devices, average previous hour readings and gross power readings.

In case errors are identified, both corrective and preventive actions are taken. Annex 7 includes a list of each period during which no CDM data was recorded (all data missing). Missing CDM data records were due to connectivity failure between the Master or Local System Control and Data Acquisition (SCADA) systems and the central computer, preventing the measured CDM value to be recorded in the CDM database system.

Internal Audit

An audit of the data collection and QC/QA system is performed periodically, at least once per year. An internal audit has been carried out in July 2009, November 2009, April 2010 and December 2010. A copy of the internal audit reports is available for verification by the DOE. Furthermore, a management review is carried out on a yearly basis to assess the operational/verification status, scheduling of audits and verifications, health and safety, improvements to be made and training updates and staffing.

Internal Training

Update 2011 training - Relevant process operators and CDM technical staff have received in-house refresher training on January 14th 2010 by Sven Starckx (Senior Technical Advisor on Monitoring and Verification, SCC) to ensure compliance with the tasks and procedures set out in the monitoring plan. New SCC staff received training on 26th and 27th February 2010 by Ruben Martinez Rubio (CDM Director of CMM Verification Team, SCC). Training records are available for verification by the DOE.

SECTION D. Data and parameters

D.1. Data and parameters determined at registration and not monitored during the monitoring period, including default values and factors

Data / Parameter:	**PEme**
Data unit:	tCO_2
Description:	Project emissions from energy use to capture and use methane
Source of data used:	N/A
Value(s) :	0
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	The data is used for project emission calculations
Additional comment:	No additional energy is used. Capture and removal of methane is the business as usual scenario.

Data / Parameter:	**Eff_{ELEC}**
Data unit:	%
Description:	Efficiency of combustion of in power generators
Source of data used:	Default taken from methodology
Value(s) :	99.5% (IPCC)
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	The data is used for project emission calculations
Additional comment:	This figure is built into a spreadsheet for calculating emissions. The spreadsheet is archived periodically and stored in two locations. Access to this figure is controlled. This is a constant so no measurement uncertainty

Data / Parameter:	**$CONS_{ELEC,PJ}$**
Data unit:	MWh
Description:	Additional electricity consumption for capture and use or destruction of methane
Source of data used:	N/A, since the project activity does not use any additional power when compared to the baseline
Value(s) :	0
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	The data is used for project emission calculations
Additional comment:	No comment

Data / Parameter:	**Eff_{HEAT}**
Data unit:	Percentage
Description:	Efficiency of the heat conversion in the baseline
Source of data used:	ACM0008 ver 3

Value(s) :	100 %
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This data is used for baseline emission calculations
Additional comment:	The approved methodology provides two different options. Option B is selected whereby the boilers are assumed to convert 100% of the heat value of the coal into heat for the mine air. This is a conservative assumption because no data on efficiency of conversion is available.

Data / Parameter:	**MM_i**
Data unit:	tCH4
Description:	Methane measured sent to use i
Source of data used:	ACM0008 ver 3
Value(s) :	N/A
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	N/A
Additional comment:	No comment

Data / Parameter:	**$PMM_{pj,iy}$**
Data unit:	tCH4
Description:	Post-mining CMM captured, sent to and destroyed by use *i* in the project activity in year *y*
Source of data used:	ACM0008 ver 3
Value(s) :	N/A
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	The data would be used to calculate baseline emissions
Additional comment:	In line guidance given in the EB 55 report[1], as the gas is extracted from the mine within the project boundary of the CDM project activity, and a connection between $CMM_{PJ,i,y}$ (pre-mining CMM captured, sent and destroyed) and $PMM_{PJ,i,y}$ (post-mining CMM captured, sent to and destroyed) is in the underground mine as specified in ACM0008 version 7, the practice of combined measurement and baseline emissions are determined ex post by measuring the methane emitted from the methane drainage system at the point where it enters the equipment.

Data / Parameter:	**Manufacturer's specification for the flare**
Data unit:	**-**
Description:	The flare operation in normal conditions defined by the flare manufacturer specifications provided by Nanjing Shunfen-Pioneer (flow rate 300-5,000m3/h and flame temp from 500 – 1,350 °C).
Source of data used:	Commissioning reports, certificates and approval notices provided by manufacturers or suppliers
Value(s) :	-
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This data is not directly used but just as a reference for project emission calculations

[1] http://cdm.unfccc.int/UserManagement/FileStorage/JTV1YA8FCHR4W2GMEOQ53SK60P9DLX

Additional comment:	Implementation of maintenance and calibrations schedules, with results (e.g. calibration certificates) to be stored for the longer of two years longer than the crediting period or two years after the last issuance of CERs.

Data / Parameter:	**GWP $_{CH4}$**
Data unit:	tCO_2e/tCH_4
Description:	Global warming potential of methane
Source of data used:	2006 Revised IPCC Guidelines
Value(s) :	21
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This data is used for baseline and project emission calculations
Additional comment:	-

Data / Parameter:	**CEF_{CH4}**
Data unit:	tCO_2e/tCH_4
Description:	Carbon emission factor for combusted methane
Source of data used:	2006 Revised IPCC Guidelines
Value(s) :	2.75
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This data is used for project emission calculations
Additional comment:	-

Data / Parameter:	**CEF_{ELEC} (also EF_{ELEC})**
Data unit:	tCO_2/MWh
Description:	CO_2 emission factor of electricity used by coal mine (also CO_2 emission factor of the grid)
Source of data used:	Calculated by using ACM0002
Value(s) :	1.03025
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This data is used for baseline and project emission calculations
Additional comment:	-

D.2. Data and parameters monitored	
Data / Parameter:	**PEy**
Data unit:	tCO2eq
Description:	Project emissions in period y
Measured /Calculated /Default:	Calculated
Source of data:	Calculated from sum of emissions from combustion of methane and emissions of un-combusted methane. 2.75 t CO2 per tonne of methane combusted plus 0.005 t CO2 per tonne of methane burnt in from un-combusted methane
Value(s) of monitored parameter:	As per the spreadsheets in Annex 1
Indicate what the data are used for (Baseline/ Project/	This data is used for project emission calculations

Leakage emission calculations)	
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	As per Annex 2 for details
Measuring/ Reading/ Recording frequency:	Measurements are taken continuously and logged at nominal 30 second intervals.
Calculation method (if applicable):	
QA/QC procedures applied:	Calculations are performed by spreadsheet which are audited periodically and protected from being over-written or altered by unauthorized personnel. Data is backed up and archived in two different locations, where it will be stored for the longer of two years longer than the crediting period or two years after the last issuance of CERs. The volume of methane destroyed is correlated with gross power output from the generators.

Data / Parameter:	**PEmd**
Data unit:	tCO2eq
Description:	Project emissions from destruction of methane
Measured /Calculated /Default:	Calculated
Source of data:	Calculated from volume of methane at normal temperature and pressure combusted by generators and flares multiplied by 2.75. Ex ante volume of methane consumed is in Nm3, therefore no conversion is necessary before applying the density. For the ex ante prediction no conversion for NTP is required, but ex post, temperature and pressure will be recorded and the volume adjusted to NTP using the gas law P1V1/T1=P2V2/T2
Value(s) of monitored parameter:	As per the spreadsheets in Annex 1
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This data is used for project emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	As per Annex 2 for details
Measuring/ Reading/ Recording frequency:	Measurements are taken continuously and logged at nominal 30 second intervals
Calculation method (if applicable):	Volume of pure methane destroyed is calculated from volume and concentration measurements taken every 30 seconds at the inlet to the generators and flare. See MDelec and MDfl below
QA/QC procedures applied:	Calculations are performed by spreadsheet which are audited periodically and protected from being over-written or altered by unauthorized personnel. Data is backed up and archived in two different locations, where it will be stored for the longer of two years longer than the crediting period or two years after the last issuance of CERs. The volume of methane destroyed is correlated with gross power output from the generators.

Data / Parameter:	**PEum**

Data unit:	tCO_2e
Description:	Un-combusted methane emitted from the generators, flare
Measured /Calculated /Default:	Calculated
Source of data:	Calculated from mass of methane burnt in generators, flare
Value(s) of monitored parameter:	As per the spreadsheets in Annex 1
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This data is used for project emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Default efficiency is 99.5%, therefore un-combusted methane from generators is 0.005 * PEmd. Default efficiency for flares is 90%, therefore un-combusted methane from flare is 0,1*PEmd.
Measuring/ Reading/ Recording frequency:	Measurements are taken continuously and logged at nominal 30 second intervals
Calculation method (if applicable):	
QA/QC procedures applied:	Calculations are performed by spreadsheet which are audited periodically and protected from being over-written or altered by unauthorized personnel. Data is backed up and archived in two different locations, where it will be stored for the longer of two years longer than the crediting period or two years after the last issuance of CERs. The volume of methane destroyed is correlated with gross power output from the generators

Data / Parameter:	**MDelec**
Data unit:	tCH_4
Description:	Methane destroyed by power generators
Measured /Calculated /Default:	Calculated
Source of data:	Calculated from the flow and concentration of methane at the inlet to the generators and methane concentration at the manifold to the generators
Value(s) of monitored parameter:	See MMelec and PC CH4
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This data is used for baseline emission and project emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	See MMelec and PC CH4. As per Annex 2 for details
Measuring/ Reading/ Recording frequency:	Measurements are taken continuously and logged at nominal 30 second intervals
Calculation method (if applicable):	See MMelec and PC CH4
QA/QC procedures applied:	Calculations are performed by spreadsheet which are audited periodically and protected from being over-written or altered by unauthorized personnel. Data is backed up and archived in two different locations, where it will be stored for the longer of two years longer than the crediting period or two years after the last issuance of

	CERs. The volume of methane destroyed is correlated with gross power output from the generators.

Data / Parameter:	**MM_{ELEC}**
Data unit:	tCH_4
Description:	Methane sent to power plant
Measured /Calculated /Default:	Measured
Source of data:	Measured by a flow meter on the inlet to each generator and summed. For the ex ante prediction on conversion for NTP (given by the methodology as 0.67 kg/m3) is required, but ex post, temperature and pressure will be recorded and the volume adjusted to NTP using the gas law P1V/T1=P2V2/T2
Value(s) of monitored parameter:	As per the spreadsheets in Annex 1
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This data is used for both baseline emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	V-cone with differential pressure flow meters As per Annex 2 for details
Measuring/ Reading/ Recording frequency:	Measurements are taken continuously and logged at nominal 30 second intervals
Calculation method (if applicable):	The V-cone records gas volumes and the pressure gauge and temperature meter record the gas pressure and temperature. Methane concentration meter records the volumetric CH4 concentration.
QA/QC procedures applied:	Calculations are performed by spreadsheet which are audited periodically and protected from being over-written or altered by unauthorized personnel. Data is backed up and archived in two different locations, where it will be stored for the longer of two years longer than the crediting period or two years after the last issuance of CERs. The volume of methane destroyed is correlated with gross power output from the generators.

Data / Parameter:	**CEF-nmhc**
Data unit:	$tC0_2$ / tNMHC
Description:	Carbon emission factor for combusted non-methane hydrocarbons
Measured /Calculated /Default:	Calculated
Source of data:	If necessary, the value for specific non-methane hydrocarbons will be determined by stoichiometric calculation.
Value(s) of monitored parameter:	Not applicable at this stage because the sum of all non-methane hydrocarbons in gas samples is less than 1% and therefore can be ignored. (See results of gas analysis in Appendix 2)
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This data is used for project emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	n/a

Measuring/ Reading/ Recording frequency:	n/a
Calculation method (if applicable):	Derived using measurements described in PCnmhc
QA/QC procedures applied:	n/a

Data / Parameter:	**PC CH4**
Data unit:	%
Description:	Percentage of pure methane (wet basis) in drained gas (by volume)
Measured /Calculated /Default:	Measured
Source of data:	Methanometer at the manifold to the generator
Value(s) of monitored parameter:	As per the spreadsheets in Annex 1
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This data is used for both baseline and project emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Methane concentration is measured by proprietary infra red instrumentation mounted in the gas pipework at the gas treatment units. Accuracy of analysis +/-2.5%FSD. Gas analysed as sample (gas dried by pretreatment). Measurements are taken continuously and logged at nominal 30 second intervals. Annex 2 for details
Measuring/ Reading/ Recording frequency:	Continuously, recorded every 30 seconds
Calculation method (if applicable):	Not applicable
QA/QC procedures applied:	Calculations are performed by spreadsheet which are audited periodically and protected from being over-written or altered by unauthorized personnel. Data is backed up and archived in two different locations, where it will be stored for the longer of two years longer than the crediting period or two years after the last issuance of CERs.

Data / Parameter:	**PCnmhc**
Data unit:	%
Description:	Percentage of non-methane hydrocarbons in CCM, by mass coal mine gas
Measured /Calculated /Default:	Measured
Source of data:	Tube sample analysis as per Annex 4
Value(s) of monitored parameter:	Not applicable at this stage because the sum of all non-methane hydrocarbons in gas samples is less than 1% and therefore can be ignored.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This data is used for project emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	n/a
Measuring/ Reading/ Recording frequency:	Annually, samples of gas are extracted into gas sampling bottles using the appropriate procedures and analyzed by an qualified laboratory, for

	example, TES Bretby in the UK or an equivalent qualified laboratory in China.
Calculation method (if applicable):	n/a
QA/QC procedures applied:	A minimum of 3 samples are collected in secure gas sample vessels, suitable for storage and transport to the selected laboratory. Samples are taken in accordance with protocol procedures in the CDM monitoring manual and analysed in a qualified laboratory. If one or more samples are found to be faulty (i.e. leaked) replacement samples will be taken. Scanned copies of the analyses are backed up and archived in two different locations, where they will be stored for the longer of two years longer than the crediting period or two years after the last issuance of CERs.

Data / Parameter:	**r**
Data unit:	%
Description:	Relative proportion of NMHC compared to methane
Measured /Calculated /Default:	Calculated
Source of data:	Calculated from PC nmhc / PC CH4
Value(s) of monitored parameter:	Determined from annual tests of samples of coal mine methane. Not applicable at this stage because the sum of all non-methane hydrocarbons in gas samples is less than 1% and therefore can be ignored.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This data are used for project emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	n/a
Measuring/ Reading/ Recording frequency:	Annually, samples of gas are extracted into gas sampling bottles using the appropriate procedures and analyzed by an qualified laboratory, for example, TES Bretby in the UK or an equivalent qualified laboratory in China.
Calculation method (if applicable):	n/a
QA/QC procedures applied:	If applicable, this figure will be built into a spreadsheet for calculating emissions. The spreadsheet is archived periodically and stored in two locations. Access to this figure will be controlled.

Data / Parameter:	**GEN_y**
Data unit:	MWh
Description:	Electricity generated by the project
Measured /Calculated /Default:	Calculated
Source of data:	Net power is calculated from the difference between gross power from all the generators (positive active power) and the power consumption by the project (negative active power).
Value(s) of monitored parameter:	As per the spreadsheets in Annex 1
Indicate what the data are used for (Baseline/ Project/ Leakage emission	This data is used for baseline emission calculations.

calculations)	
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Power meter as per Annex 2 for details
Measuring/ Reading/ Recording frequency:	Continuously measured but manually recorded everyday by a site operator.
Calculation method (if applicable):	Positive active power (gross power) and negative active power (power consumed by the project) are both measured continuously with a single power meter located at the link from the generators to the power grid. Net power is calculated from the difference of these two readings.
QA/QC procedures applied:	Calculations are performed by spreadsheet which are audited periodically and protected from being over-written or altered by unauthorized personnel. Data is backed up and archived in two different locations, where it will be stored for the longer of two years longer than the crediting period or two years after the last issuance of CERs. The net export meter power meter has been approved by the local power company and calibrated and monitored in accordance with their instructions.

Data / Parameter:	**BEy**
Data unit:	tCO2
Description:	Baseline emissions in year y
Measured /Calculated /Default:	Calculated
Source of data:	Equals to BEmr,y+ BEuse,y
Value(s) of monitored parameter:	Equals to BEmr,y+ BEuse,y
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This data is used for baseline emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Same as BEmr,y. See below
Measuring/ Reading/ Recording frequency:	
Calculation method (if applicable):	Equals BEmr,y. See below
QA/QC procedures applied:	Equals BEmr,y. See below

Data / Parameter:	**BEmr,y**
Data unit:	tCO2
Description:	Baseline emissions from the release of methane to the atmosphere in year y that is avoided by the project activity.
Measured /Calculated /Default:	Calculated
Source of data:	MDelec, MMelec and MMflare
Value(s) of monitored parameter:	As per Annex 1
Indicate what the data are	This data is used for baseline emission calculations

used for (Baseline/ Project/ Leakage emission calculations)	
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	See MDelec above
Measuring/ Reading/ Recording frequency:	
Calculation method (if applicable):	See MDelec above
QA/QC procedures applied:	See MDelec above

Data / Parameter:	**$HEAT_y$**
Data unit:	GJ
Description:	Heat generation by project
Measured /Calculated /Default:	Measured
Source of data:	Measurement of flow rate on the oil heating circuit and the oil temperatures on the outward and returning heating Pipes
Value(s) of monitored parameter:	No heat generation and utilisation during the monitoring period.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This data is used for baseline emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	V-cone flow meter and Temperature meter As per Annex 2 for details
Measuring/ Reading/ Recording frequency:	Continuously, recorded every 30 seconds
Calculation method (if applicable):	During heating season (not applicable to current monitoring period) waste heat is transferred from the generators to the mines ventilation, heater and building by way of closed circuit heat transfer system. The circuits are fitted with constant flow pumps, thermocouples in the flow and return pipes and flow meter. Actual heat transferred is determined by measuring the flow, inlet and return temperatures and logging the data.
QA/QC procedures applied:	Temperature and flow rate data is used to calculate heat supplied and this is fed into a data logger for determination of heat supply. Heat will be supplied to meet demand (in winter months) which is determined by need for compliance with mine air temperature regulations and hence on ambient temperature which will also be recorded. Measurement equipment is calibrated and monitored in accordance with manufacturer instructions.

Data / Parameter:	**T**
Data unit:	Kelvin
Description:	Temperature of CMM
Measured /Calculated /Default:	Measured

Source of data:	Temperature sensor on gas pipework between the treatment unit and the generators
Value(s) of monitored parameter:	As per the spreadsheets
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This data is used for baseline emission and project emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Temperature sensor as per Annex 2 for details
Measuring/ Reading/ Recording frequency:	Continuously, recorded every 30 seconds
Calculation method (if applicable):	N/A
QA/QC procedures applied:	Calibrated and monitored as per manufacturers' instructions. Logging of data and storage for 2 years after crediting lifetime.

Data / Parameter:	**MM_{FL}**
Data unit:	tCH_4
Description:	Methane sent to flare
Measured /Calculated /Default:	Measured
Source of data:	Measured continuously using flow meters and CH_4 levels on the inlet to the flares. Flow, temperature and absolute pressure will be recorded and the volume normalised as per Flaring tool.
Value(s) of monitored parameter:	As per the spreadsheets in Annex 1
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This data is used for baseline emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	V-cone with differential pressure flow meters as per Annex 2 for details
Measuring/ Reading/ Recording frequency:	Continuously, recorded every 30 seconds
Calculation method (if applicable):	Pressure, temperature, CH_4 concentration and flow meters with differential pressure measurement function are used to determine the amount of methane sent to the flares. Mass of methane sent to the flares is determined taking into account the density of methane under normal conditions of temperature and pressure. Density of methane under normal conditions of temperature and pressure is 0.67 kg/m3 (revised 1996 IPCC Reference manual p.1.24 and 1.16).
QA/QC procedures applied:	Refer to MMelec.

Data / Parameter:	**MD_{FL}**
Data unit:	tCH_4
Description:	Methane destroyed by flare(s)
Measured /Calculated	Calculated

/Default:	
Source of data:	Calculated from MM_{FL} and $\eta_{flare,h}$
Value(s) of monitored parameter:	As per the spreadsheets in Annex 1
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This data is used for project emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	As per MM_{FL} and $\eta_{flare,h}$
Measuring/ Reading/ Recording frequency:	n/a
Calculation method (if applicable):	See MM_{FL} and $\eta_{flare,h}$
QA/QC procedures applied:	Calculations are performed by spreadsheet (at least monthly) which are audited periodically and protected from being over-written or altered by unauthorized personnel. Data is backed up and archived in two different locations, where it will be stored for a period of two years after the crediting period or two years after the last issuance of CERs.

Data / Parameter:	$FV_{RG,h}$
Data unit:	m3/h
Description:	volumetric flow rate of the residual gas at normal conditions in the hour h (residual gas to flare)
Measured /Calculated /Default:	Measured
Source of data:	Measured using a flow meter.
Value(s) of monitored parameter:	As per the spreadsheets in Annex 1
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This data is used for both baseline and project emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Flow meter instrument as per Annex 2
Measuring/ Reading/ Recording frequency:	Measurements are taken continuously and logged at nominal 30 second intervals.
Calculation method (if applicable):	Not applicable
QA/QC procedures applied:	Flow meters are periodically calibrated according to the manufacturer's recommendation. Ensure that the same basis is considered for this measurement and the measurement of the volumetric fraction of all components in the residual gas when the residual gas temperature exceeds 60 °C.

Data / Parameter:	$fv_{i,h}$
Data unit:	-

Description:	Volumetric fraction of component *i* in the residual gas in the hour *h* where *i* = CH_4, CO, CO_2, O_2, H_2, N_2 (simplified approach will be applied).
Measured /Calculated /Default:	Measured
Source of data:	Measurements by project participants using a continuous gas analyzer
Value(s) of monitored parameter:	As per the spreadsheets in Annex 1
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This data is used for both baseline and project emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Gas monitoring instrument as per Annex 2
Measuring/ Reading/ Recording frequency:	As a simplified approach, project participants may only measure the Methane content of the residual gas and consider the remaining part as N_2. Ensure that the same basis is considered for this measurement and the measurement of the volumetric fraction of all components in the residual gas when the residual gas temperature exceeds 60 °C. Measurements are taken continuously and logged at nominal 30 second intervals.
Calculation method (if applicable):	Not applicable
QA/QC procedures applied:	Analyzers are periodically calibrated according to the manufacturer's recommendation. A zero check and a typical value check are performed by comparison with a standard certified gas.

Data / Parameter:	$fv_{CH4,RG,h}$
Data unit:	-
Description:	volumetric fraction of methane in the residual gas on dry basis in the hour *h*
Measured /Calculated /Default:	Measured
Source of data:	Measured by project participants using a continuous gas analyzer
Value(s) of monitored parameter:	
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This data is used for both baseline and project emission calculation
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Gas monitoring instrument as per Annex 2
Measuring/ Reading/ Recording frequency:	Ensure that the same basis is considered for this measurement and the measurement of the volumetric fraction of all components in the residual gas when the residual gas temperature exceeds 60 °C.
Calculation method (if applicable):	Not applicable
QA/QC procedures applied:	Analyzers are periodically calibrated according to the manufacturer's recommendation. A zero check and a typical value check is performed

	by comparison with a standard certified gas.

Data / Parameter:	**T_{flare}**
Data unit:	°C
Description:	Temperature of the flue gas of the flare
Measured /Calculated /Default:	Measured
Source of data:	Flare thermocouple(s)
Value(s) of monitored parameter:	
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This data is used for project emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Flare thermocouple(s) type N as per Annex 2 for details
Measuring/ Reading/ Recording frequency:	Continuously, recorded every 30 seconds. Monitored continuously by a Type N thermocouple. A temperature above 500 Degree indicates that a significant amount of gases are being burnt and that the flares is operating.
Calculation method (if applicable):	Not applicable
QA/QC procedures applied:	Data is backed up and archived where it will be stored for the longer of two years longer than the crediting period or two years after the last issuance of CERs. Thermocouples are calibrated according to the manufacturer's specifications.

Data / Parameter:	$\eta_{flare,h}$
Data unit:	%
Description:	Flare efficiency in hour *h*
Measured /Calculated /Default:	Calculated
Source of data:	T_{flare}
Value(s) of monitored parameter:	0, if the temperature in the exhaust gas of the flare (T_{flare}) is below 500 °C for more than 20 minutes during the hour h. 50, if the temperature in the exhaust gas of the flare (T_{flare}) is above 500 °C for more than 40 minutes during the hour h, but the manufacturer's specifications on proper operation of the flare are not met at any point in time during the hour h. 90, if the temperature in the exhaust gas of the flare (T_{flare}) is above 500 °C for more than 40 minutes during the hour h and the manufacturer's specifications on proper operation of the flare are met continuously during the hour h.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This data is used for project emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration	Flare thermocouple(s) type N as per Annex 2 for details

frequency, date of last calibration, validity)	
Measuring/ Reading/ Recording frequency:	Measurements are taken continuously and logged at nominal 30 second intervals.
Calculation method (if applicable):	$\eta_{flare,h}$ cannot be directly monitored. Therefore, the parameter T_{flare} is instead monitored in order to measure the flare combustion efficiency (refer to the "Tool to determine project emissions from flaring gases containing methane").
QA/QC procedures applied:	Data is backed up and archived in two different locations, where it will be stored for a period of two years after the crediting period or two years after the last issuance of CERs.

SECTION E. Emission reductions calculation

E.1. Baseline emissions calculation

The formulae used for determination of the baseline emissions are described in section B.6.1 of the registered PDD for the project activity. It is available on the UNFCCC website.
http://cdm.unfccc.int/UserManagement/FileStorage/Q3PBR459OM8KI0Y6FATGX1SJW27HNC

Baseline emissions are calculated as follows:

$$BE_y = BE_{MD,y} + BE_{MR,y} + BE_{Use,y} \quad (1)$$

Where

BE_y Baseline emissions in year y (tCO_2e)
$BE_{MD,y}$ Baseline emissions from destruction of methane in the baseline scenario in year y (tCO_2e)
$BE_{MR,y}$ Baseline emissions from release of methane into the atmosphere in year y that is avoided by the project activity (tCO_2e)
$BE_{Use,y}$ Baseline emissions from the production of power, heat or supply to gas grid replaced by the project activity in year y (tCO_2e)

$BE_{MD,y}$ Baseline emissions from destruction of methane in the baseline scenario in year y

No methane is destroyed in the baseline scenario therefore $BE_{MD,y}$ are zero.

$BE_{MR,y}$ Baseline emissions from release of methane into the atmosphere in year y that is avoided by the project activity

The original formula used for $BE_{MR,y}$ calculation in ACM0008/version 03 is as the following:

$$BE_{MRy} = GWP_{CH4} \times [\sum_i (CBMe_{i,y} - CBM_{BLi,y}) + \sum_i (CMM_{PJi,y} - CMM_{BLi,y}) + \sum_i (PMM_{PJi,y} - PMM_{BLi,y})] \quad (2)$$

Where,

$BE_{MR,y}$ Baseline emissions from release of methane into the atmosphere in year y that is avoided by the project activity (tCO_2e)
I Use of methane (flaring, power generation, heat generation, supply to gas grid to various combustion end uses)

$CBMe_{i,.y}$ Eligible CBM captured, sent to and destroyed by use *i* in the project for year y (expressed in tCH_4) = 0

$CBM_{BLi,y}$ CBM that would have been captured, sent to and destroyed by use *i* in the baseline scenario in the year y (expressed in tCH_4) = 0

$CMM_{PJ,i,y}$ Pre-mining CMM captured, sent to and destroyed by use *i* in the project activity in year y (expressed in tCH_4)

$CMM_{BL,i,y}$ Pre-mining CMM that would have been captured, sent to and destroyed by use *i* in the baseline scenario in year y (expressed in tCH_4) = 0

$PMM_{PJ,i,y}$ post-mining CMM captured, sent to and destroyed by use *i* in the project activity in year y (tCH_4)

$PMM_{BLi,,y}$ post-mining CMM that would have been captured, sent to and destroyed by use *i* in the baseline scenario in year y (tCH_4) = 0

GWP_{CH4} Global warming potential of methane (21 tCO_2e/tCH_4)

In practice, the pre-mining and post-mining methane are indistinguishable, being extracted through the same pumping system in proportions that vary depending on mining activities, atmospheric pressure changes and day to day management of the ventilation systems. In line guidance given in the EB 55 report[2], as the gas is extracted from the mine within the project boundary of the CDM project activity, and a connection between $CMM_{PJ,i,y}$ (pre-mining CMM captured, sent and destroyed) and $PMM_{PJ,i,y}$ (post-mining CMM captured, sent to and destroyed) is in the underground mine as specified in ACM0008 version 7, the practice of combined measurement and baseline emissions are determined ex post by measuring the methane emitted from the methane drainage system at the point where it enters the equipment.

The release of methane into the atmosphere is avoided by the project activity through power generation and destruction in the enclosed flare. Therefore formula (2) can be simplified to:

$$BE_{MR,y} = GWP_{CH4} \times (MM_{ELEC} + MM_{FL}) \quad \textbf{(3)}$$

Where:

MM_{ELEC} Methane measured sent to power plant (tCH_4)

MM_{FL} Methane measured sent to the flare (tCH_4)

$BE_{Use,y}$ Baseline emissions from the production of power, heat or supply to gas grid replaced by the project activity in year y

Electricity and heat will be generated by the project activity, therefore baseline emissions from the production of power and heat replaced by the project activity in year y (tCO_2e) is:

$$BE_{use,y} = GEN_y \times EF_{ELEC} + HEAT_y \times EF_{HEAT} \quad \textbf{(4)}$$

Where:

GEN_y Electricity generated by project activity in year y (MWh)

EF_{ELEC} Emissions factor of gird electricity replaced by the project activity (tCO_2/MWh)

$HEAT_y$ Heat generation by project activity in year y (GJ)

EF_{HEAT} Emissions factor for heat production replaced by project activity (tCO_2/GJ)

The EF_{ELEC} is calculated as per ACM0002 version 6, from the average of the operating margin and build margin in the North China Power Grid.

EF_{OM}	1.1208
EF_{BM}	0.9397

[2] http://cdm.unfccc.int/UserManagement/FileStorage/JTV1YA8FCHR4W2GMEOQ53SK60P9DLX

According ACM0002, the baseline grid emission factor is the simple average of BM and OM:
1.1208+0.9397/ 2 = 1.03025 tCO_2/MWh

The emissions factor for displaced heat generation is calculated as follows:

$$EF_{heat,y} = \frac{EF_{CO2,i}}{Eff_{heat}} \times \frac{44}{12} \times \frac{1TJ}{1000GJ} \quad \textbf{(5)}$$

Where:

$EF_{heat,y}$	Emissions factor for heat generation (tCO_2/GJ)
$EF_{CO2,i}$	CO_2 emissions factor of fuel used in heat generation (tC/TJ)
Eff_{heat}	Boiler efficiency of the heat generation (%)
44/12	Carbon to Carbon Dioxide conversion factor
1/1000	TJ to GJ conversion factor

Boiler efficiency is taken as 100%.

E.2. Project emissions calculation

The formulae used for determination of the project emissions are described in section B.6.1 of the registered PDD for the project activity. It is available on the UNFCCC website.
http://cdm.unfccc.int/UserManagement/FileStorage/Q3PBR459OM8KI0Y6FATGX1SJW27HNC

Project emissions are calculated as follows:

$$PE_y = PE_{ME} + PE_{MD} + PE_{UM} \quad \textbf{(6)}$$

Where:

PE_y	Project emissions in year y (tCO_2e)
PE_{ME}	Project emissions from energy use to capture and use methane (tCO_2e)
PE_{MD}	Project emissions from methane destroyed (tCO_2e)
PE_{UM}	Project emissions from un-combusted methane (tCO_2e)

PE_{ME} Project emissions from energy use to capture and use methane

The project activity will consume some electricity during operation. No additional heat or fossil fuel will be consumed. CHECK WITH ZHANG MIN TO DELETE EXPLANATION AND MAKE IT ZERO Therefore:

$$PE_{ME} = CONS_{ELEC,PJ} \times EF_{ELEC} \quad \textbf{(7)}$$

But in practice only the readings of the net electricity output (GEN_y-$CONS_{ELEC,PJ}$) is recorded
So:

$$BE_{use,y} - PE_{ME} = GEN_y \times EF_{ELEC} + HEAT_y \times EF_{HEAT} - CONS_{ELEC,PJ} \times EF_{ELEC}$$
$$= (GEN_y - CONS_{ELEC,PJ}) \times EF_{ELEC} + HEAT_y \times EF_{HEAT}$$

Hence in the emission reduction calculations, the PE_{ME} can be treated as zero.

PE_{MD} Project emissions from methane destroyed

Only gensets and flare is installed for the project activity, CMM is not used directly in CMM boilers or distributed into the gas pipelines. Therefore:

$PE_{MD} = (MD_{FL} + MD_{ELEC}) \times (CEF_{CH4} + r \times CEF_{NMHC})$ **(8)**

with:

$r = PC_{NMHC} / PC_{CH4}$ **(9)**

Where:[3]

PE_{MD}	Project emissions from CMM destroyed (tCO_2e)
MD_{FL}	Methane destroyed through flaring (tCH_4)
MD_{ELEC}	Methane destroyed through power generation (tCH_4)
CEF_{CH4}	Carbon emission factor for combusted methane (2.75 tCO_2e/tCH_4)
CEF_{NMHC}	Carbon emission factor for combusted non methane hydrocarbons (the concentration varies and, therefore, to be obtained through periodical analysis of captured methane) ($tCO_2e/tNMHC$)
R	Relative proportion of NMHC compared to methane
PC_{CH4}	Concentration (in mass) of methane in extracted gas (%)
PC_{NMHC}	NMHC concentration (in mass) in extracted gas (%)

As the volumetric fraction of NMHC measured in the external lab is lower than 1% in this monitoring period, it can be ignored. Hence formula can be simplified as:

$PE_{MD} = CEF_{CH4} \times (MD_{FL} + MD_{ELEC})$ **(10)**

Not all of the methane sent to power plant and flare will be combusted, so a small amount will escape to the atmosphere. The combusted methane is calculated using the following formulas:

$MD_{ELEC} = MM_{ELEC} \times Eff_{ELEC}$ **(11)**

Where:

MD_{ELEC}	Methane destroyed through power generation (tCH_4)
MM_{ELEC}	Methane measured sent to power plant (tCH_4)
Eff_{ELEC}	Efficiency of methane destruction/oxidation in power plant (taken as 99.5% from IPCC)

$MD_{FL} = MM_{FL} - PE_{flare}/GWP_{CH4}$ **(12)**

Where:

MD_{FL}	Methane destroyed through flaring (tCH_4)
MM_{FL}	Methane measured sent to flare (tCH_4)
PE_{flare}	Project emissions from flaring of the residual gas stream (tCO_2e)
GWP_{CH4}	Global warming potential of methane (21tCO_2e/tCH_4)

The project emissions from flaring of the residual gas stream (PE_{flare}) shall be calculated following the procedures described in the "Tool to determine project emissions from flaring gases containing Methane".

To determine project emissions from flaring gases containing methane

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[3] Note that throughout this baseline methodology, it is assumed that measured quantities of coal mine gas are converted to tonnes of methane using the measured methane concentration of the coal mine gas and the density of methane.

For the enclosed flares: Option (a) in the flaring tool of a 90% efficiency default value is used to determine the flare efficiency. Continuous monitoring of compliance with manufacturer's specification of flare (temperature, flow rate of residual gas at the inlet of the flare) must be performed. If in a specific hour any of the parameters are out of the limit of manufacturer's specifications, a 50% default value for the flare efficiency is used for the calculations for the specific hour.

Applicable steps are:
STEP 1: Determination of the mass flow rate of the residual gas that is flared
STEP 2: Determination of the mass fraction of carbon, hydrogen, oxygen and nitrogen in the residual gas
STEP 5: Determination of methane mass flow rate of the residual gas on a dry basis
STEP 6: Determination of the hourly flare efficiency
STEP 7: Calculation of annual project emissions from flaring based on measured hourly values or based on default flare efficiencies.

Option (b) Continuous monitoring of the methane destruction efficiency of the flare (flare efficiency).

The project activity follows the approach described as Option (a) using of 90% default flare efficiency. The manufacturer's specifications for the operation of the flare and the required data and procedures to monitor the flare operation are documented in the EB approved revised monitoring plan. .

STEP 1. Determination of the mass flow rate of the residual gas that is flared
This step calculates the residual gas mass flow rate in each hour *h*, based on the volumetric flow rate and the density of the residual gas. The density of the residual gas is determined using the simplified approach as described in the methodology where only the volumetric fraction of methane is measured and the difference to 100% is considered as nitrogen.

$$FM_{RG,h} = \rho_{RG,n,h} \times FV_{RG,h} \quad (1)$$

Where:

Variable	SI Unit	Description
$FM_{RG,h}$	kg/h	Mass flow rate of the residual gas in hour *h*
$\rho_{RG,n,h}$	kg/m^3	Density of the residual gas at normal conditions in hour *h*
$FV_{RG,h}$	m^3/h	Volumetric flow rate of the residual gas in dry basis at normal conditions in the hour *h*

and:

and:

$$\rho_{RG,n,h} = \frac{P_n}{\frac{R_u}{MM_{RG,h}} \times T_n} \quad (2)$$

Where:

Variable	SI Unit	Description
$\rho_{RG,n,h}$	kg/m³	Density of the residual gas at normal conditions in hour *h*
P_n	Pa	Atmospheric pressure at normal conditions (101 325)
R_u	Pa.m³/kmol.K	Universal ideal gas constant (8 314)
$MM_{RG,h}$	kg/kmol	Molecular mass of the residual gas in hour *h*
T_n	K	Temperature at normal conditions (273.15)

and:

$$MM_{RG,h} = \sum_i (fv_{i,h} * MM_i) \quad (3)$$

Where:

Variable	SI Unit	Description
$MM_{RG,h}$	kg/kmol	Molecular mass of the residual gas in hour *h*
$fv_{i,h}$	-	Volumetric fraction of component *i* in the residual gas in the hour *h*
MM_i	kg/kmol	Molecular mass of residual gas component *i*
I		The components CH_4, CO, CO_2, O_2,H_2, N_2

STEP 2. Determination of the mass fraction of carbon, hydrogen, oxygen and nitrogen in the residual gas

Determine the mass fractions of carbon, hydrogen, oxygen and nitrogen in the residual gas, calculated from the volumetric fraction of each component *i* in the residual gas (taken as only methane and nitrogen in accordance with the simplification in the methodology), as follows:

$$fm_{j,h} = \frac{\sum_i fv_{i,h} \cdot AM_j \cdot NA_{j,i}}{MM_{RG,h}} \quad (4)$$

Where:

Variable	SI Unit	Description
$fm_{j,h}$	-	Mass fraction of element *j* in the residual gas in hour *h*
$fv_{i,h}$	-	Volumetric fraction of component *i* in the residual gas in the hour *h*
AM_j	kg/kmol	Atomic mass of element *j*
$NA_{j,i}$	-	Number of atoms of element *j* in component *i*
$MM_{RG,h}$	kg/kmol	Molecular mass of the residual gas in hour *h*
j		The elements carbon, hydrogen, oxygen and nitrogen
i		The components CH_4, CO, CO_2, O_2,H_2, N_2

STEP 5. Determination of methane mass flow rate in the residual gas

The quantity of methane in the residual gas flowing into the flare is the product of the volumetric flow rate of the residual gas (*FVRG,h*), the volumetric fraction of methane in the residual gas (*fvCH4,RG,h*) and the density of methane (ρ*CH4,n,h*) in the same reference conditions (normal conditions and dry or wet basis). If the residual gas moisture is significant (temperature greater than 60ºC), the measured flow rate of the residual gas that is usually referred to wet basis should be corrected to dry basis due to the fact that the measurement of methane is usually undertaken on a dry basis (i.e. water is removed before

sample analysis). In this case the gas temperature throughout the monitoring period is always less than 60ºC and measurements are made as received, i.e. wet.

$$TM_{RG,h} - FV_{RG,h} \times fv_{CH4,RG,h} \times \rho_{CH4,n} \quad \textbf{(13)}$$

Where:

Variable	SI Unit	Description
$TM_{RG,h}$	kg/h	Mass flow rate of methane in the residual gas in the hour *h*
$FV_{RG,h}$	m^3/h	Volumetric flow rate of the residual gas in dry basis at normal conditions in hour *h*
$fv_{CH4,RG,h}$	-	Volumetric fraction of methane in the residual gas on dry basis in hour *h* (NB: this corresponds to $fv_{i,RG,h}$ where *i* refers to methane).
$\rho_{CH4,n}$	kg/m^3	Density of methane at normal conditions (0.716)

STEP 6. Determination of the hourly flare efficiency

The project has an enclosed flare and the flare efficiency in the hour *h* (*flare,h*) REPLACE SYMBOL has been calculated after applying the following conditions:

- 0% if the temperature in the exhaust gas of the flare (Tflare) is below 500 °C for more than 20 minutes during the hour *h*.
- 50%, if the temperature in the exhaust gas of the flare (Tflare) is above 500 °C for more than 40 minutes during the hour *h,* but the manufacturer's specifications on proper operation of the flare are not met at any point in time during the hour *h*.
- 90%, if the temperature in the exhaust gas of the flare (Tflare) is above 500 °C for more than 40 minutes during the hour *h* and the manufacturer's specifications on proper operation of the flare are met continuously during the hour *h*.

STEP 7. Calculation of annual project emissions from flaring

Project emissions from flaring are calculated as the sum of emissions from each hour *h*, based on the methane flow rate in the residual gas (*TMRG,h*) and the flare efficiency during each hour *h* (h*flare,h*)REPLACE SYMBOL, as follows:

$$PE_{flare,y} = \sum_{h=1}^{8760} TM_{RG,h} \times (1 - \eta_{flare,h}) \times GWP_{CH4} / 1000 \quad \textbf{(13)}$$

Where:

$TM_{RG,h}$	Mass flow rate of methane in the residual gas in the hour h（$kgCH_4/h$）
$\eta_{flare,h}$	Flare efficiency in hour h（%）
GWP_{CH4}	Global warming potential of methane valid for the first commitment period （$21tCO_2e/tCH_4$）.

The calculation for $TM_{RG,h}$ is shown below:

$$TM_{RG,h} = FV_{RG,h} \times \omega_{CH4,y} \times D_{CH4} \quad \textbf{(14)}$$

Where:

$FV_{RG,h}$	Volumetric flow rate of the residual gas in dry basis at normal conditions in hour h （m^3/h）
$\omega_{CH4,y}$	*(also PC_{CH4})* Volumetric fraction of methane in the residual gas on dry basis in hour h（%）
D_{CH4}	Methane density (tCH_4/m^3CH_4), density of methane under normal conditions of temperature and pressure (20oC and 1atm) is $0.67 kg/m^3$ (Revised 1996 IPCC Reference Manual p 1.24 and 1.16)

PE_{UM} Project emissions from un-combusted methane

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Not all of the methane sent to power plant and flare will be combusted, so a small amount will escape to the atmosphere. These emissions are calculated using the following:

$$PE_{UM} = GWP_{CH4} \times MM_{ELEC} \times (1 - Eff_{ELEC}) + PE_{flare} \quad \textbf{(15)}$$

Where:

PE_{UM}	Project emissions from un-combusted methane (tCO_2e)
GWP_{CH4}	Global warming potential of methane (21 tCO_2e/tCH_4)
MM_{ELEC}	Methane measured sent to power plant (tCH_4)
Eff_{ELEC}	Efficiency of methane destruction in power plant (%) (taken as 99.5% from IPCC)
PE_{flare}	Project emissions from flaring of the residual gas stream (tCO_2e), calculated in accordance with formulas (13) and (14)

E.3. Leakage calculation

There is no baseline thermal energy use therefore there is no leakage to consider in this category

E.4. Emission reductions calculation / table

The formula used for determination of the emission reductions is described in section B.6.1 of the registered PDD. Duerping Project Design Document is available on the UNFCCC website.
http://cdm.unfccc.int/UserManagement/FileStorage/Q3PBR459OM8KI0Y6FATGX1SJW27HNC

Emission reductions are calculated as the difference between baseline and project emissions for the same period y:

$$ER_y = BE_y - PE_y - LE_y \quad \textbf{(16)}$$

Where:

ER_y	Emissions reductions of the project activity during the year *y* (tCO_2e)
$BE_{,y}$	Baseline emissions during the year *y* (tCO_2e)
PE_y	Project emissions during the year *y* (tCO_2e)
LE_y	Leakage emissions in year y (tCO_2e) = 0

The total of the emission reductions achieved during this monitoring period is shown as the following:

Total baseline emissions:	119,688 tCO_2e
Total project emissions:	14,144 tCO_2e
Total leakage:	0 tCO_2e
Total emission reductions:	105,541 tCO_2

E.5. Comparison of actual emission reductions with estimates in the CDM-PDD

Item	Values applied in ex-ante calculation of the registered CDM-PDD	Actual values reached during the monitoring period
Emission reductions (tCO_2e)	= 378,748 × 5/12 = 157,812	105,541

E.6. Remarks on difference from estimated value in the PDD

There is no **increase** in the actual emission reductions achieved during the current monitoring period from that stated in the registered CDM-PDD. The ex-ante emission reduction calculation of the registered PDD estimates a total of 157,812 tCO2e for the current monitoring period (calculation as per table in section E.5), however only ER have actually been generated during the current monitoring period due to commissioning delays of Phase 2 of the project.

History of the document

Version	Date	Nature of revision
01	EB 54, Annex 34 28 May 2010	Initial adoption.
Decision Class: Regulatory **Document Type**: Guideline, Form **Business Function**: Issuance		

Annex 1 **Monitoring and Calculation Details**

GENERATOR

Period		Volumetric Flow Rate	Volumetric fraction CH4	Volumetric Flow Rate CH4	MM ELEC	MDelec	BE (MRy)	PE(MD)	PE(UM)	PEy	GENy	GENy x EFelec	HEATy	HEATy x Eff heat	BE (USE,y)	BE(y)	ER (period)
Unit		m3	%	m3	(tCH4)	(tCH4)	(tCO2e)	(tCO2e)	(tCO2e)	(tCO2e)	MWh				(tCO2e)	tCO2e	tCO2e
Index		A1	A2	A	B	C	D	E	F	G	H	I	J1	J2	K	L	M
from	to	A1 = A / A2	A2	A	B = A x ρ	C = B x EFF (ELEC)	D = B x GWP (CH4)	E = B x CEF(CH4) x EFF (ELEC)	F = B x GWP(CH4) x (1 –EFF (ELEC))	G = E + F	MANUAL INPUT	I = H x EF (ELEC)		J2 = J1x EF (HEAT)	K = I + J2	L = D +K	LL = Int (L - G)
27Oct10	26Nov10	1883720	38	709727	508	506	10671	1390	53	1444	2927	3016	3242	305	3321	13992	12548
27Nov10	26Dec10	2440248	37	897105	642	639	13489	1758	67	1825	3282	3381	4827	454	3835	17324	15499
27Dec10	26Jan11	3093550	39	1194289	855	851	17957	2340	90	2430	4589	4728	7681	722	5450	23408	20978
27Jan11	26Feb11	3108500	42	1304916	934	930	19621	2557	98	2655	5415	5579	7633	718	6297	25917	23262
27Feb11	26Mar11	3386419	39	1333815	955	950	20055	2613	100	2713	5504	5670	6303	593	6263	26318	23604

Constants:

Density Methane at normal conditions (ρ_{CH4} = 0.716 kg/m3 at 101,325Pa and 273K as per Flaring tool)
GWP_{CH4} is the Global Warming Potential (GWP) for methane = 21 tCO_2e/tCH_4
CEF_{CH4} is the carbon emission factor of coal mine methane = 2.75tCO_2e/tCH_4
EFF_{ELEC} is efficiency of the methane destruction in the power plant = 99.5% (IPCC)
EF_{ELE} is the emissions factor of electricity (grid, captive or a combination) replaced by project = 1.03025 tCO_2/MWh
EF_{HEAT} is the emissions factor for heat production replaced by project activity = 0.09405 tCO2/GJ
PC CH4 is the methane concentration of CMM gas delivered to the engines
The percentage of non-methane hydrocarbons in the coal mine gas NMHC have been below 1% during the whole monitoring period and, in accordance with the methodology, can be ignored for the emission reduction calculations. See gas analysis laboratory results in Annex 4 (originals will be provided during verification)

Data Collection Process Gensets

The continuous CDM monitoring system at site records data every 30 seconds.

- V-cone differential pressure (dP) to engines (7 V-cones)
- Methane concentration (CH4%) gas delivered to engines (at the manifold pipes on pre-treatment systems for Phase 1 and Phase 2)
- Gauge pressure (P) gas to engines (at the manifold pipes on pre-treatment systems for Phase 1 and Phase 2)
- Barometric pressure
- Gas temperature (T) gas delivered to engines (at the manifold pipes on pre-treatment systems for Phase 1 and Phase 2)

30 seconds input data are used for calculation and outcome is aggregated into hourly, daily etc.

The only CDM parameter that is not recorded with the 30s frequency is the net power output which although is measured continuously it is manually recorded everyday by a site operator.

Back up data (generators running hours and generators gross power) is continuously recorded from the site PLCs in case CDM monitoring instruments fail to record the gas delivery to the power plant or flare.

Spreadsheets containing 30' readings and calculations are available for verification by the DOE.

FLARE

Period		Volumetric Flow Rate	fv CH4	Volumetric Flow Rate CH4	MM (Flare)	BE (MRy)	BE(y)	MD (FLARE)	PE(MD)	MM (Flare) x (1-Eff)	PE (UM)	PEy	ER
Unit		m3	%	m3	(tCH4)	(tCO2e)	(tCO2e)	(tCH4)	(tCO2e)	(tCH4)	(tCO2)	(tCO2e)	(tCO2e)
Index		M1	M2	M	N	O	P	Q	R	S	T	U	V
from	to	M1 =M / M2	M2	M	N = M x ρ_{CH4}	= N x GWP_{CH4}	= O	$= \sum \{N((hourly)\ x\ \eta\ flare,h)\}$	= Q x CEF_{CH4}	$= \sum \{N((hourly)\ x\ (1-\eta\ flare,h)\}$	= S x GWP_{CH4}	= R + T	= P - U
27-Oct-10	26-Nov-10	1505005	37	563098	403	8467	8467	350	964	53	1108	2071	6395
27-Nov-10	26-Dec-10	805360	35	283427	203	4262	4262	178	491	25	516	1006	3255
27-Dec-10	26-Jan-11	0	0	0	0	0	0	0	0	0	0	0	0
27-Jan-11	26-Feb-11	0	0	0	0	0	0	0	0	0	0	0	0
27-Feb-11	26-Mar-11	0	0	0	0	0	0	0	0	0	0	0	0

Constants:

Density Methane at normal conditions (ρ_{CH4} = 0.716 kg/m3 at 101,325Pa and 273K as per Flaring tool)
fv CH_4 volumetric fraction of methane in the residual gas delivered to the flare
GWP_{CH4} is the Global Warming Potential (GWP) for methane = 21 tCO2e/tCH_4
$CEFCH_4$ is the carbon emission factor of coal mine methane = 2.75tCO2e/tCH_4

Data Collection Process Flare

The continuous CDM monitoring system at site records data every 30 seconds.

- V-cone differential pressure (DP) to flare (2 V-cones)
- Methane concentration (CH4%) gas delivered to flare (one at the manifold pipe)
- Gauge pressure (P) gas to flare (one at the manifold)
- Barometric pressure
- Gas temperature (T) gas delivered to flare (one at the manifold pipe)

The methane destruction efficiency of the flare in the hour h is defined (Flaring Tool, Annex 13 of EB28) as the ratio between the mass flow rate of methane delivered to the flare and the mass flow rate of methane in residual gas stream that is flared (both on dry basis and normal conditions).

In the case of enclosed flares there is a set of default values for the flare efficiency according to the performance of the flare. These sets values are:

Eff_{flare} = 0% if the temperature in the exhaust gas of the flare (Tflare) is below 500 °C for more than 20 minutes during the hour h.

Eff_{flare} = 50%, if the temperature in the exhaust gas of the flare (Tflare) is above 500 °C for more than 40 minutes during the hour h, but the manufacturer's specifications on proper operation of the flare are not met at any point in time during the hour h.

Eff_{flare} = 90%, if the temperature in the exhaust gas of the flare (Tflare) is above 500 °C for more than 40 minutes during the hour h and the manufacturer's specifications on proper operation of the flare are met continuously during the hour h.

Spreadsheets containing 30' readings and calculations are available for verification by the DOE.

Annex 2 CDM Monitoring equipment calibration dates

Item	Name	Instrument type	SN	scale	calibration certificate	Calibration date	Next date for calibration	Accuracy class	
								accuracy class	Reference source
1	flare gas T	SBWZPK-241(PT100)	611056	0-300 ℃	JZRX 20104517	2010-8-3	2011-8-2	Class A (allowable deviation ±(0.15+0.002ltl))	Manufacturer Technical Specification
2	phase 1 engine gas T	WZP-240(PT100)	-	-200-450 ℃	JZRX 20104695	2010-7-23	2011-7-22	Class A (allowable deviation ±(0.15+0.002ltl))	Manufacturer Technical Specification
3	phase 2 engine gas T	Honeywell STT830-171-TC.M1.W1.CD-WEEO-H06S-R2U6-A05TR080-2D-000	080625368	0-100℃	JZRX20104765	2010-8-6	2011-8-5	0.3℃ or ±0.1% of span	Manufacturer Technical Specification
4	Flare thermal couples	Honeywell STT830-173-TC.M3.W1.CD-WEEO-H10S-T7G6-A05T(Y)240-2D-000	070668960	0-1300 ℃	JZRX20105479	2010-8-18	2011-8-17	Class I (allowable deviation ±(0.0075ltl))	Manufacturer Technical Specification
			080609834	0-1300 ℃	H2010-0002564	2010-6-12	2011-6-11		
			080104620	0-1300 ℃	JZRX20105480	2010-8-18	2011-8-17		
5	flare gas P	3051 TG1A2B21AB4E5M5	4793856	0-207Kpa	JZYL20100150	2010-7-26	2011-7-25	±0.075%	Manufacturer Technical Specification
6	phase 1 engine gas P	KH-AFY801	72848	0-40KPa	JZYL20100149	2010-7-26	2011-7-25	±0.5%	Manufacturer Technical Specification
7	phase 2 engine gas P	罗斯蒙特绝压 3051 TA1A2B21AB4E5Q4 (1Sep10 to 24Dec10)	5466012	0-150Kpa Absolute pressure	TE10-JZ0009	2010-4-20	2011-4-19	±0.075%	Manufacturer Technical Specification
		Rosemont 3051 TG1A2B21AE5Q4 (24Dec10 onwards)	5659587	-20-20Kpa Relative Pressure	JZYL20100311	2010-12-13	2011-12-12	±0.075%	Manufacturer Technical Specification
8	Flare CH4%	Guardian plus, model:97460	26063	0-100%	JZYL20100147	2010-7-26	2011-7-25	±2.5%	Manufacturer Technical Specification

9	phase 1 engine CH4%	Guardian plus, model:97460	26062	0-100%	JZYL 20100148	2010-7-26	2011-7-25	±2.5%	Manufacturer Technical Specification
10	phase 2 engine CH4%	Guardian plus, model:97460	29782	0-100%	JZYL20100114	2010-6-15	2011-6-14	±2.5%	Manufacturer Technical Specification
11	barometric pressure	Rosemount TA1A2B21JE5Q4	4980063	0-141.33KPa	JZYL 20100145	2010-7-22	2011-7-21	±0.075%	Manufacturer Technical Specification
12	V-cone engine 1	MOORE-KINGWAYS (SHANGHAI)CONTROL SYSTEM CO.,LTD KVW08IIKC24FWN	7092005	0-1900m3/hr	TE10-JZ0013	2010-7-27	2012-7-26	±0.5%	Manufacturer Technical Specification
13	DP engine 1	Rosemount 3051 CD1A22A1AM5B4K5	4879836	0-6.22KPa	TE10-JZ0020	2010-7-27	2011-7-26	±0.075%	Manufacturer Technical Specification
14	V-cone engine 2	MOORE-KINGWAYS (SHANGHAI)CONTROL SYSTEM CO.,LTD KVW08IIKC24FWN	7092003	0-1900m3/hr	TE10-JZ0015	2010-7-27	2012-7-26	±0.5%	Manufacturer Technical Specification
15	DP engine 2	Rosemount 3051 CD1A22A1AM5B4K5	4879835	0-6.22KPa	TE10-JZ0016	2010-7-27	2011-7-26	±0.075%	Manufacturer Technical Specification
16	V-cone engine 3	MOORE-KINGWAYS (SHANGHAI)CONTROL SYSTEM CO.,LTD KVW08IIKC24FWN	7092004	0-1900m3/hr	TE10-JZ0014	2010-7-27	2012-7-26	±0.5%	Manufacturer Technical Specification
17	DP engine 3	Rosemount 3051 CD1A22A1AM5B4K5	4870527	0-6.22KPa	TE10-JZ0018	2010-7-27	2011-7-26	±0.075%	Manufacturer Technical Specification
18	V-cone 1# for flare	MOORE-KINGWAYS (SHANGHAI)CONTROL SYSTEM CO.,LTD KVW10IIAB24FWN	7102301	0-3000m3/hr	TE10-JZ0012	2010-7-27	2012-7-26	±0.5%	Manufacturer Technical Specification
19	DP 1# for flare	Rosemount 3051 CD1A22A1AM5B4K5	4870526	0-6.22KPa	TE10-JZ0017	2010-7-27	2011-7-26	±0.075%	Manufacturer Technical Specification

20	V-cone 2# for flare	MOORE-KINGWAYS (SHANGHAI)CONTROL SYSTEM CO.,LTD KVW10IIAB24FWN	7102302	0-3000m3/hr	TE10-JZ0011	2010-7-27	2012-7-26	±0.5%	Manufacturer Technical Specification
21	DP 2# for flare	Rosemount 3051 CD1A22A1AM5B4K5	4870528	0-6.22KPa	TE10-JZ0019	2010-7-27	2011-7-26	±0.075%	Manufacturer Technical Specification
22	V-cone engine 4	Moore-Kingways (ShangHai) control system Co, Ltd. KVS06ⅡKC23FSN	9061201	200-2000m3/hr	TE10-JZ0003	2010-4-20	2012-4-19	±0.5%	Manufacturer Technical Specification
23	DP engine 4	Rosemount 3051 CD1A22A1AM5B4K5	5058739	0-6.216Kpa	TE10-JZ0007	2010-4-20	2011-4-19	±0.075%	Manufacturer Technical Specification
24	V-cone engine 5	Moore-Kingways (ShangHai) control system Co, Ltd. KVS06ⅡKC23FSN	9061203	200-2000m3/hr	TE10-JZ0001	2010-4-20	2012-4-19	±0.5%	Manufacturer Technical Specification
25	DP engine 5	Rosemount 3051 CD1A22A1AM5B4K5	5058740	0-6.216Kpa	TE10-JZ0006	2010-4-20	2011-4-19	±0.075%	Manufacturer Technical Specification
26	V-cone engine 6	Moore-Kingways (ShangHai) control system Co, Ltd. KVS06ⅡKC23FSN	9061204	200-2000m3/hr	TE10-JZ0004	2010-4-20	2012-4-19	±0.5%	Manufacturer Technical Specification
27	DP engine 6	Rosemont 3051 CD1A22A1AM5B4K5	5058741	0-6.216Kpa	TE10-JZ0005	2010-4-20	2011-4-19	±0.075%	Manufacturer Technical Specification
28	V-cone engine 7	Moore-Kingways (ShangHai) control system Co, Ltd. KVS06ⅡKC23FSN	9061202	200-2000m3/hr	TE10-JZ0002	2010-4-20	2012-4-19	±0.5%	Manufacturer Technical Specification
29	DP engine 7	Rosemont CD1A22A1AM5B4K5 (10May10 to 8Dec10)	5058742	0-6.216Kpa	TE10-JZ0008	2010-4-20	2011-4-19	±0.075%	Manufacturer Technical Specification
		Rosemont 3051 CD1A22A1AM5B4K5 (8Dec10 onwards)	5525313	0-6.216Kpa	JZYL20100288	2010-11-30	2011-11-29	±0.075%	Manufacturer Technical Specification

30	V-cone for oil	MOORE-KINGWAYS (SHANGHAI)CONTROL SYSTEM CO.,LTD KVW06IIAB24FWN	9102801	0-180000Kg/hr	TE09-JZ0015	2009-12-02	2011-12-01	±0.5%	Manufacturer Technical Specification
31	DP heat recovery	Rosemount: 3051CD2A22A1AM5B4K5	4870525	0-62.2KPa	JZYL20100165	2010-7-26	2011-7-25	±0.075%	Manufacturer Technical Specification
32	T- Oil outlet	SBWZPK-241	611052	0-300 ℃	JZRX20104763	2010-8-6	2011-8-5	Class A (allowable deviation ±(0.15+0.002ltl))	Manufacturer Technical Specification
33	T- Oil return	Shanghai Hongda WZPK（Pt100）	070907964	0-200 ℃	JZRX20104762	2010-8-6	2011-8-5	Class A (allowable deviation ±(0.15+0.002ltl))	Manufacturer Technical Specification
34	6KV power meter	Jiangsu linyang Electronics Co., Ltd DSSD71	0073		JZDN 20101030	2010-7-21	2011-7-20	Active power：0.5S/1.0	Manufacturer Technical Specification
35	35KV power meter	威胜集团有限公司 DSSD331	09080130690001		JZDN 20101057	2010-8-18	2011-8-17	Active power：0.2S	Manufacturer Technical Specification

Annex 3 CDM instruments removal and installation dates

Table 3.1 CDM instruments removal and installation dates for Phase 1 Instrumentation

No	Location	Type	SN	Scale	Installation Date 1	Removal Date for calibration	Installation Date after calibration
1	V-cone engine 1	KVW08IIKC24FWN	7092005	0-1900m3/hr	2008-08-15	2010-07-24	2010-07-29
2	DP engines 1	Rosemount 3051 CD1A22A1AM5B4K5	4879836	0-6.22KPa	2009-08-04	2010-07-24	2010-07-29
3	V-cone engine 2	KVW08IIKC24FWN	7092003	0-1900m3/h	2008-08-15	2010-07-24	2010-07-29
4	DP engines 2	Rosemount 3051 CD1A22A1AM5B4K5	4879835	0-6.22KPa	2009-08-04	2010-07-24	2010-07-29
5	V-cone engine 3	KVW08IIKC24FWN	7092004	0-1900m3/h	2008-08-15	2010-07-24	2010-07-29
6	DP engines 3	Rosemount 3051 CD1A22A1AM5B4K5	4870527	0-6.22KPa	2009-08-04	2010-07-24	2010-07-29
7	V-cone 1# for flare	KVW10IIAB24FWN	7102301	0-3000m3/hr	2008-08-15	2010-07-24	2010-07-29
8	DP 1# for flare	Rosemount 3051 CD1A22A1AM5B4K5	4870526	0-6.22KPa	2009-08-04	2010-07-24	2010-07-29
9	V-cone 2# for flare	KVW10IIAB24FWN	7102302	0-3000m3/hr	2008-08-15	2010-07-24	2010-07-29
10	DP 2# for flare	Rosemount 3051 CD1A22A1AM5B4K5	4870528	0-6.22KPa	2009-08-04	2010-07-24	2010-07-29
11	Power meter	DSSD71	0040	NA	2008-08-05	2010-07-26	Replaced
12			0073	NA	-	-	2010-07-26
13	Engine CH4%	Guardian plus 97460	26062	0-100%	2009-08-05	Calibrated on site	
14	Flare CH4%	Guardian plus 97460	26063	0-100%	2010-04-23	Calibrated on site	
15	P gas engine	KH-AFY801	72848	0-40KPa	2009-08-11	Calibrated on site	
16	P gas flare	3051 TG1A2B21AB4E5M5	4793856	0-207Kpa	2009-08-11	Calibrated on site	

17	T gas flare	SBWZPK-241(PT100)	908174	0-100 ℃	2009-08-11	2010-08-04	Replaced
18			611056	0-300 ℃	-	-	2010-08-04
19	T gas engine	WZP-240(PT100)	908273	-200-450 ℃	2009-08-11	2010-08-04	Replaced
20			NA	-200-450 ℃	-	-	2010-08-04
21	Barometric pressure	Rosemount TA1A2B21JE5Q4	4980061	0-141.33KPa	2009-08-04	2010-08-04	Replaced
22			4980063	0-141.33KPa	-	-	2010-08-04
23	Flare thermal couples	STT830-173-TC.M3.W1.CD-WEEO-H10S-T7G6-A05T(Y)240-2D-000	070668959	0-1300 ℃	2009-09-23	2010-06-26	Replaced
24			080609834	0-1300 ℃	-	-	2010-06-26
25			070668960	0-1300 ℃	2009-09-23	2010-07-29	2010-09-01
26			080104620	0-1300 ℃	2009-10-05	2010-07-29	2010-09-01

Table 3.2 CDM instruments removal and installation dates for Phase 2 Instrumentation

No	Location	Type	SN	Scale	Installation Date	Removal Date for calibration	Calibration date	Installation Date after calibration	Removal / replacing
1	V-cone engine 4	Moore-Kingways (ShangHai) control system Co, Ltd. KVS06 II KC23FSN	9061201	200-2000m3/hr	-	-	2010-4-20	2010-5-10	-
2	DP engines 4	Rosemount 3051 CD1A22A1AM5B4K5	5058739	0-6.216Kpa	-	-	2010-4-20	2010-5-10	-
3	V-cone engine 5	Moore-Kingways (ShangHai) control system Co, Ltd. KVS06 II KC23FSN	9061203	200-2000m3/hr	-	-	2010-4-20	2010-5-10	-
4	DP engines 5	Rosemount 3051 CD1A22A1AM5B4K5	5058740	0-6.216Kpa	-	-	2010-4-20	2010-5-10	-

5	V-cone engine 6	Moore-Kingways (ShangHai) control system Co, Ltd. KVS06ⅡKC23FSN	9061204	200-2000m3/hr	-	-	2010-4-20	2010-5-10	-
No	**Location**	**Type**	**SN**	**Scale**	**Installation Date**	**Removal Date for calibration**	**Calibration date**	**Installation Date after calibration**	**Removal / replacing**
6	DP engines 6	Rosemont 3051 CD1A22A1AM5B4K5	5058741	0-6.216Kpa	-	-	2010-4-20	2010-5-10	-
7	V-cone engine 7	Moore-Kingways (ShangHai) control system Co, Ltd. KVS06ⅡKC23FSN	9061202	200-2000m3/hr	-	-	2010-4-20	2010-5-10	-
8	DP engines 7	Rosemont CD1A22A1AM5B4K5	5058742	0-6.216Kpa	-	-	2010-4-20	2010-5-10	2010-12-8
		Rosemont 3051 CD1A22A1AM5B4K5	5525313	0-6.216Kpa	-	-	2010-11-30	2010-12-8	-
9	DP for oil	Rosemount: 3051CD2A22A1AM5B4K5	4870525	0-62.2KPa	-	2010-7-26	2010-7-26	2010-10-11	-
10	T- Oil outlet	SBWZPK-241	611052	0-300 ℃	-	2010-7-21	2010-8-6	2010-10-11	-
11	T- Oil return	Shanghai Hongda WZPK（Pt100）	070907964	0-200 ℃	-	2010-7-29	2010-8-6	2010-10-11	-
12	phase 2 engine gas T	Honeywell STT830-171-TC.M1.W1.CD-WEEO-H06S-R2U6-A05TR080-2D-000	080625368	0-100℃	-	-	2010-8-6	2010-9-1	-
13	phase 2 engine gas P	Absolute pressure Rosemont 3051 TA1A2B21AB4E5Q4	5466012	0-150Kpa	-	-	2010-4-20	2010-9-1	2010-12-24
		Relative pressure Rosemont 3051 TG1A2B21AE5Q4	5659587	-20-20Kpa	-	-	2010-12-13	2010-12-24	-
14	phase 2 engine CH4%	Guardian plus, model:97460	29782	0-100%	2010-6-5	-	2010-6-15	Calibrated on site	
15	35KV power meter	威胜集团有限公司 DSSD331	09080130690001	NA	-	-	2010-8-18	2010-9-10	-

Annex 4.1 Gas analysis Duerping drainage station results by TES Bretby

TES Bretby

TEST REPORT

UKAS TESTING 1513

Customer: Sindicatum Carbon Capital, 34 Highland Road, Mansfield, Nottinghamshire NG18 4PT

Date analysed:	24 March 2010	Date received:	22 March 2010	
Date sampled:	12 March 2010	Site:	Duerping Power Plant	**Report №** 40585

TUBE NO	SAMPLE REF	Analysis % v/v							
		CO_2	CH_4	O_2	CO	C_2H_6	C_3H_8	n-C_4H_{10}	n-C_5H_{12}
746	Inlet @ 1035	1.07	35.0	10.19	0.0015	0.04	<0.02	<0.02	<0.02
135	Inlet @ 1037	1.08	36.0	10.14	0.0016	0.04	<0.02	<0.02	<0.02
109	Inlet @ 1041	1.10	36.0	10.12	0.0015	0.04	<0.02	<0.02	<0.02
Accuracy of Analytical Method		±0.02	±1.0	±0.05	±0.0001	±0.02	±0.02	±0.02	±0.02
Method of Analysis		1	1	2	1	3	3	3	3

Method of Analysis:	1	Infra Red	3	G.C. – F.I.D.
	2	Paramagnetic		

Analyst: I Thornewill

Customer Analytical Requirements CO_2, CH_4, O_2, CO, C_2H_6, C_3H_8, C_4H_{10}, C_5H_{12}	By Letter	Authorised by: I Thornewill

Authorised by:

I Thornewill, Senior Analyst
Direct Dial: 01 283 554461

Issue Date: 25 March 2010

Page: 2 of 2
End of Report

TES Bretby accepts no responsibility for the collection of any of the samples referred to in this report.

Annex 4.2 Gas analysis Duerping drainage station results by Beijing Huayuan Gas Chemical Industry

检验报告20110324-3

表1 分析检测结果

样品编号	采样日期、地点	分析检测结果（v/v %）									
		二氧化碳 (CO_2)	甲烷 (CH_4)	氧气 (O_2)	一氧化碳 (CO)	乙烷 (C_2H_6)	丙烷 (C_3H_8)	异丁烷 ($i\text{-}C_4H_{10}$)	正丁烷 ($n\text{-}C_4H_{10}$)	异戊烷 ($i\text{-}C_5H_{12}$)	正戊烷 ($n\text{-}C_5H_{12}$)
SCC 3	2011-3-18 杜儿坪瓦斯发电厂	1.21	41.7	9.77	0.0168	0.0584	0.00030	0.00003	0.00002	<0.00001	<0.00001
SCC 163		1.18	42.0	9.72	0.0185	0.0559	0.00027	0.00002	<0.00001	<0.00001	<0.00001
SCC 1		1.15	40.0	10.2	0.0238	0.0543	0.00026	0.00002	0.00001	<0.00001	<0.00001
不确定度 (k=2)		±0.02	±0.5	±0.1	±0.0005	±0.0005	±0.00005	±0.00002	±0.00002	±0.00002	±0.00002
检测方法		2	1	1	2	3	3	3	3	3	3

Annex 5 Special data events

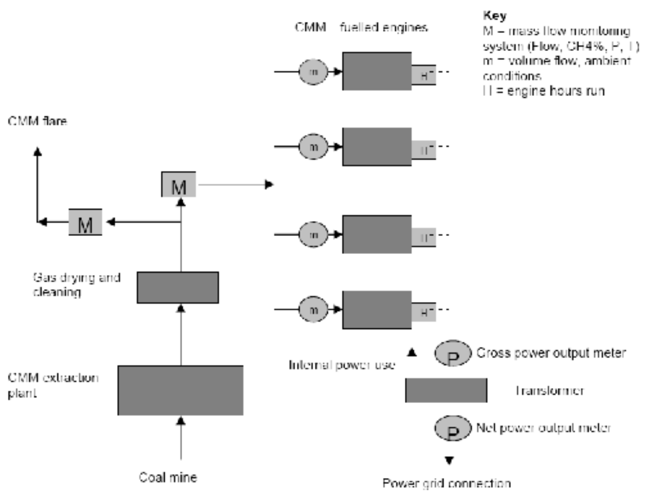
Table 5.1 Special CDM data events

Start Time (GMT)	End time (GMT)	Event / Cause	Action taken
2010-11-15 14:11:30	2010-11-16 2:29:30	Communication disconnect between Flare PLC and central PLC, flare CH4% and flame temperature signal are lost	No ER calculation
2010-11-16 2:56:00	2010-11-16 6:58:00	Communication disconnect between Flare PLC and central PLC, flare CH4% and flame temperature signal are lost	No ER calculation
2010-11-17 2:40:30	2010-11-17 3:19:00	Communication disconnect between Flare PLC and central PLC, flare CH4% and flame temperature signal are lost	No ER calculation
2010-12-4 3:19	2010-12-4 6:42	No.1 engine is running but gross power and DP data both are missing.	No ER calculation
2010-12-4 3:07	2010-12-4 6:45	No.3 engine is running but gross power and DP data both are missing.	No ER calculation
2010-12-24 4:29:00	2010-12-24 4:48:00	Replacement of relative pressure trans from absolute pressure at the outlet of phase 2 pre-treatment	Change ER algorithm
2011-1-4 3:10:30	2011-1-4 4:37:00	No.2 engine keep running but DP=0Kpa because of DP trans sample pipe frozen.	Back calculation from GP
2011-1-4 17:08:00	2011-1-6 3:56:00	No.2 engine keep running but DP=0Kpa because of DP trans sample pipe frozen.	Back calculation from GP
2011-3-17 14:31:00	2011-3-18 4:12:00	35KV system communication was lost and power meter reading displayed Zero.	No action because power meter reading back to normal display while 35KV communication reconnection.

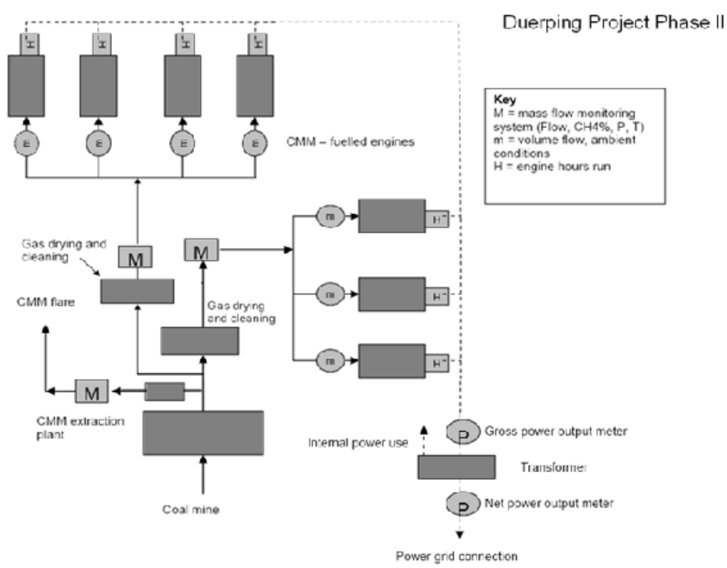
Annex 6 Process flow diagrams

The locations of methane flow monitoring to the CMM utilization plant are shown in the schematic below. Monitoring of the waste heat supply from the engines to the shaft heater has been excluded from the diagram for clarity.

Schematic Flow Diagram showing completed project:



Detailed flow diagram showing completed project:



Annex 7 Missing CDM data

Table Annex 7 CDM Missing data within MR5 monitoring period	
Start Time	**End Time**
2010-11-05 11:46:30	2010-11-05 11:48:00
2010-11-07 23:44:30	2010-11-07 23:48:00
2010-11-08 10:02:30	2010-11-08 10:03:00
2010-11-08 11:38:30	2010-11-08 11:39:30
2010-11-08 13:36:30	2010-11-08 13:36:30
2010-11-08 14:16:30	2010-11-08 14:17:30
2010-11-09 01:02:30	2010-11-09 01:03:30
2010-11-09 05:34:30	2010-11-09 05:34:30
2010-11-09 11:10:30	2010-11-09 11:12:30
2010-11-11 07:32:30	2010-11-11 07:33:30
2010-11-12 13:06:30	2010-11-12 13:07:30
2010-11-12 14:12:30	2010-11-12 14:13:00
2010-11-15 10:28:30	2010-11-15 10:30:30
2010-11-15 11:04:30	2010-11-15 11:05:30
2010-11-19 09:26:30	2010-11-19 09:28:00
2010-11-19 09:32:30	2010-11-19 09:34:00
2010-11-19 09:36:30	2010-11-19 09:36:30
2010-11-19 11:06:30	2010-11-19 11:08:00
2010-11-20 09:24:30	2010-11-20 10:23:30
2010-11-22 06:48:30	2010-11-22 07:04:00
2010-11-22 07:30:30	2010-11-22 07:44:30
2010-11-22 13:54:30	2010-11-22 14:16:00
2010-11-22 14:34:30	2010-11-22 14:37:30
2010-11-22 15:38:30	2010-11-22 15:47:00
2010-11-23 01:30:30	2010-11-23 01:31:30
2010-11-25 09:32:30	2010-11-25 09:56:00
2010-11-25 10:00:30	2010-11-25 10:01:30
2010-11-26 04:10:30	2010-11-26 05:24:00
2010-11-26 06:16:30	2010-11-26 06:35:30
2010-11-26 06:36:30	2010-11-26 06:38:00
2010-11-26 06:48:30	2010-11-26 06:49:00
2010-11-26 08:30:30	2010-11-26 10:30:00
2010-11-27 00:42:30	2010-11-27 01:18:30
2010-11-28 01:58:30	2010-11-28 02:05:30
2010-11-30 07:00:30	2010-11-30 07:32:30
2010-11-30 08:12:30	2010-11-30 08:28:00
2010-12-01 09:56:30	2010-12-01 09:58:00
2010-12-01 11:02:30	2010-12-01 11:03:00
2010-12-01 11:04:30	2010-12-01 11:04:30
2010-12-02 04:30:30	2010-12-02 07:37:30
2010-12-04 06:24:30	2010-12-04 06:31:00
2010-12-06 11:04:30	2010-12-06 11:05:00

2010-12-06 11:06:30	2010-12-06 11:06:30
2010-12-06 20:20:30	2010-12-06 21:05:30
2010-12-07 01:10:30	2010-12-07 01:11:00
2010-12-07 03:34:30	2010-12-07 03:46:30
2010-12-07 07:02:30	2010-12-07 07:12:00
2010-12-08 05:28:30	2010-12-08 06:37:00
2010-12-10 12:18:30	2010-12-10 12:18:30
2010-12-10 12:22:30	2010-12-10 12:25:00
2010-12-22 09:58:30	2010-12-22 09:58:30
2010-12-22 15:14:30	2010-12-22 15:14:30
2010-12-22 15:16:30	2010-12-22 15:16:30
2011-01-06 13:14:30	2011-01-06 13:20:30
2011-02-06 04:25:00	2011-02-06 04:25:00
2011-02-09 01:38:30	2011-02-09 03:29:00
2011-02-23 09:26:30	2011-02-23 09:28:30
2011-02-23 09:50:30	2011-02-23 09:51:30
2011-02-23 11:00:30	2011-02-23 11:01:30
2011-02-24 09:48:30	2011-02-24 09:49:00
2011-02-24 09:52:30	2011-02-24 09:53:00
2011-02-24 10:04:30	2011-02-24 10:05:30
2011-02-24 10:52:30	2011-02-24 10:53:30
2011-03-01 13:06:30	2011-03-01 13:07:00
2011-03-01 14:10:30	2011-03-01 14:11:30
2011-03-03 11:30:30	2011-03-03 11:32:00
2011-03-04 09:28:30	2011-03-04 09:30:30
2011-03-08 09:32:30	2011-03-08 09:33:30
2011-03-08 15:50:30	2011-03-08 15:56:30
2011-03-10 09:42:30	2011-03-10 09:42:30
2011-03-10 09:52:30	2011-03-10 09:52:30
2011-03-15 05:56:30	2011-03-15 06:33:30
2011-03-15 06:42:30	2011-03-15 09:46:00
2011-03-16 11:28:30	2011-03-16 11:30:30
2011-03-17 05:30:30	2011-03-17 14:31:00
2011-03-17 15:18:30	2011-03-17 15:19:00
2011-03-19 03:20:30	2011-03-19 04:08:00
2011-03-21 06:50:30	2011-03-21 06:51:30
2011-03-21 06:56:30	2011-03-21 06:57:30
2011-03-21 07:00:30	2011-03-21 07:00:30
2011-03-21 07:40:30	2011-03-21 07:40:30
2011-03-21 07:42:30	2011-03-21 07:43:30
2011-03-21 07:58:30	2011-03-21 07:59:30
2011-03-22 07:28:30	2011-03-22 07:29:00
2011-03-22 08:44:30	2011-03-22 08:44:30
2011-03-24 10:10:30	2011-03-24 11:08:00