



Monitoring report form
(Version 05.1)

Complete this form in accordance with the Attachment "Instructions for filling out the monitoring report form" at the end of this form.

MONITORING REPORT

Title of the project activity	Duerping Coal Mine Methane Utilization Project	
UNFCCC reference number of the project activity	1900	
Version number of the monitoring report	01	
Completion date of the monitoring report	20/ 08/2016	
Monitoring period number and duration of this monitoring period	11 01/06/2015 – 31/08/2016	
Project participant(s)	Shanxi Coking Coal Group Company Ltd Sindicatum Carbon Capital Ltd.	
Host Party	P. R. China	
Sectoral scope(s)	8, 10	
Selected methodology(ies)	ACM0008: 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--- version 3.0	
Selected standardized baseline(s)	Standard baseline(s) is not applicable.	
Estimated amount of GHG emission reductions or net GHG removals by sinks for this monitoring period in the registered PDD	475,251tCO ₂ e	
Total amount of GHG emission reductions or net GHG removals by sinks achieved in this monitoring period	GHG emission reductions or net GHG removals by sinks reported up to 31 December 2012	GHG emission reductions or net GHG removals by sinks reported from 1 January 2013 onwards
	Not applicable	455,820 tCO ₂ e

SECTION A. Description of project activity

A.1. Purpose and general description of 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 was 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. There is one heating season within the monitoring period, 14th October to 11th April 2016, during which emission reductions were generated by heat displacement.

The total emission reductions achieved in this monitoring period are 455,820 tCO₂e

A.2. Location of project activity

The coal mine is located 20 km west of Taiyuan, the capital of Shanxi Province of the People's Republic of China.

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



Figure A.2-1 Location of the project activity

A.3. Parties and project participant(s)

Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate whether the Party involved wishes to be considered as project participant (yes/no)
Party A (host): People's Republic of China	Public entity A: Shanxi Coking Coal Group Company Ltd.	No
Party B: United Kingdom of Great Britain and Northern Ireland	Private entity B: Sindicatum Carbon Capital Ltd.	No

A.4. Reference of applied methodology and standardized baseline

- ACM0008: 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--- version 3.0;
- 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"

The standardized baseline is not applicable to the project activity.

A.5. Crediting period of project activity

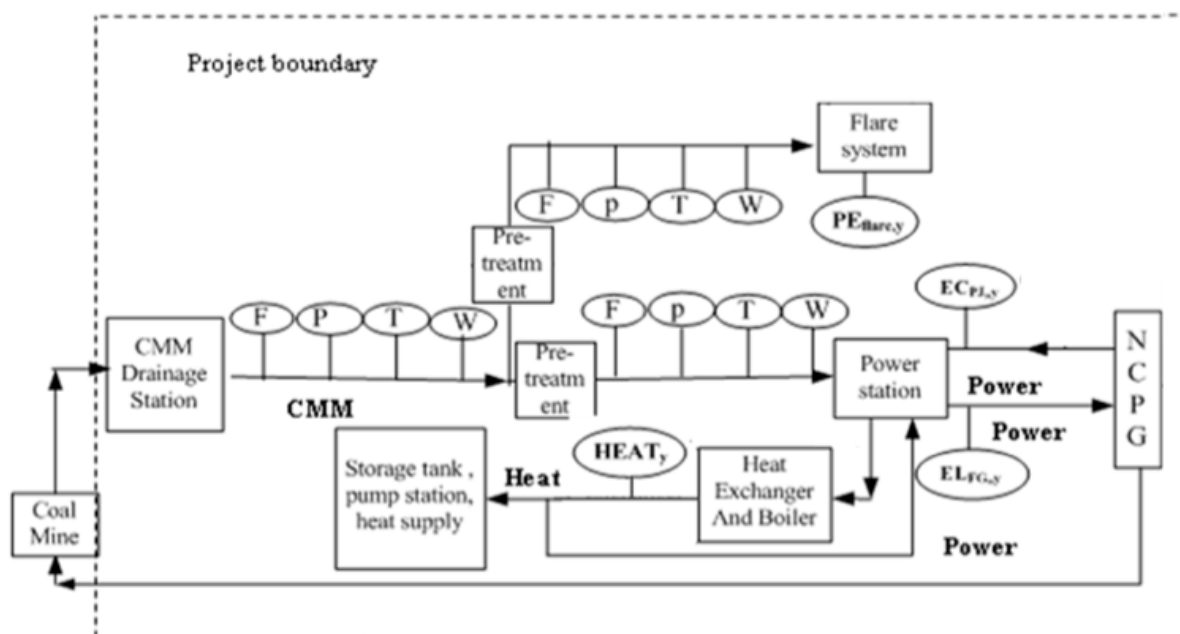
The fixed 10 years crediting period is chosen for the project activity. The starting date of the crediting period is 06/03/2009 which is the date of registration.

A.6. Contact information of responsible persons/entities

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SECTION B. Implementation of project activity**B.1. Description of implemented registered project activity**

This project involves container-type methane pre-treatment equipment, generator sets, power distribution system, an 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 B.1-1 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 B.1-1.

Table B.1-1 Technology specifications generator sets

Items	Parameter
A. Gas engine	
Sets	7
Model	TCG 2020V20
Cylinder numbers	20
Exhaust temperature	442°C
Rated rotational speed	1,500rpm
Allowed CH ₄ concentration in CMM	≥30%
Combustion air Temperature minimum/ design	20/25 °C
Exhaust Temperature at 100% load	430 °C
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. Waste 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/heating season).

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 B.1-2 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. The heat transfer calculation is detailed in the CDM Calculation Manual made available to the DOE.

Table B.1-3 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 B.1-4 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 CH₄ concentrations in the range of 25-30% will be destroyed by the enclosed flare. The methane concentration adjustment for barometric pressure according to the manufacturer's requirement is detailed in the CDM Calculation Manual and made available to the DOE. 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 B.1-5 Technical specifications for the enclosed flare

Manufacturer	Nanjing Shunfeng-Pioneer Air & Gas Purification 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 is included in the project activity. The monitoring instruments 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 are regularly calibrated in accordance with the national standards or the manufacturers' specification.

5. Implementation 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. Engines no.4, no.6 and no.7 have been operational since December 2010. Engine no.5 started commissioning on 23th of May 2011 and achieved continuous operation by 13th of June 2011. The total combined capacity of the plant is 11.9 MW. The waste heat from the installed generators will be recovered for heating the shaft air intake at the coal mine during the winter/heating season. During this monitoring period, no material changes occurred on Phases 1 and 2 of the project. An overview of special events is presented in Annex 4.

B.2. Post-registration changes

B.2.1. Temporary deviations from registered monitoring plan, applied methodology or applied standardized baseline

There have been no temporary deviations from registered monitoring plan or applied methodology in this monitoring period.

B.2.2. Corrections

There have been no corrections to project information or parameters fixed at validation have been approved during in this monitoring period or submitted with this monitoring report.

Corrections and a revised PDD (Version 4.10, completed 15/11/2012) were approved on 19 Mar 2013 prior to the submission of this monitoring report for request for issuance, with a reference number of PRC-1900-001.

B.2.3. Changes to start date of crediting period

No changes to the start date of the crediting period have been submitted or approved.

B.2.4. Inclusion of a monitoring plan to the registered PDD that was not included at registration

Not applicable

B.2.5. Permanent changes from registered monitoring plan, applied methodology or applied standardized baseline

There have been no permanent changes from the registered monitoring plan or applied methodologies have been approved during this monitoring period or submitted with this monitoring report.

Minor revisions to the initial monitoring plan included in the registered PDD were made and validated by TUV-Sued (validation report nr. 600500291). The revision was approved by the UNFCCC EB on 13/12/2009. This monitoring report has been completed by using the revised monitoring plan.

B.2.6. Changes to project design of registered project activity

No changes to project design have been applied.

B.2.7. Types of changes specific to afforestation or reforestation project activity

Not applicable to the project activity

SECTION C. Description of 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 the DOE) is based upon the requirements set out in the PDD and the 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 CH₄ mass flow against Gross power is performed every month to confirm the back-calculating CH₄ 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

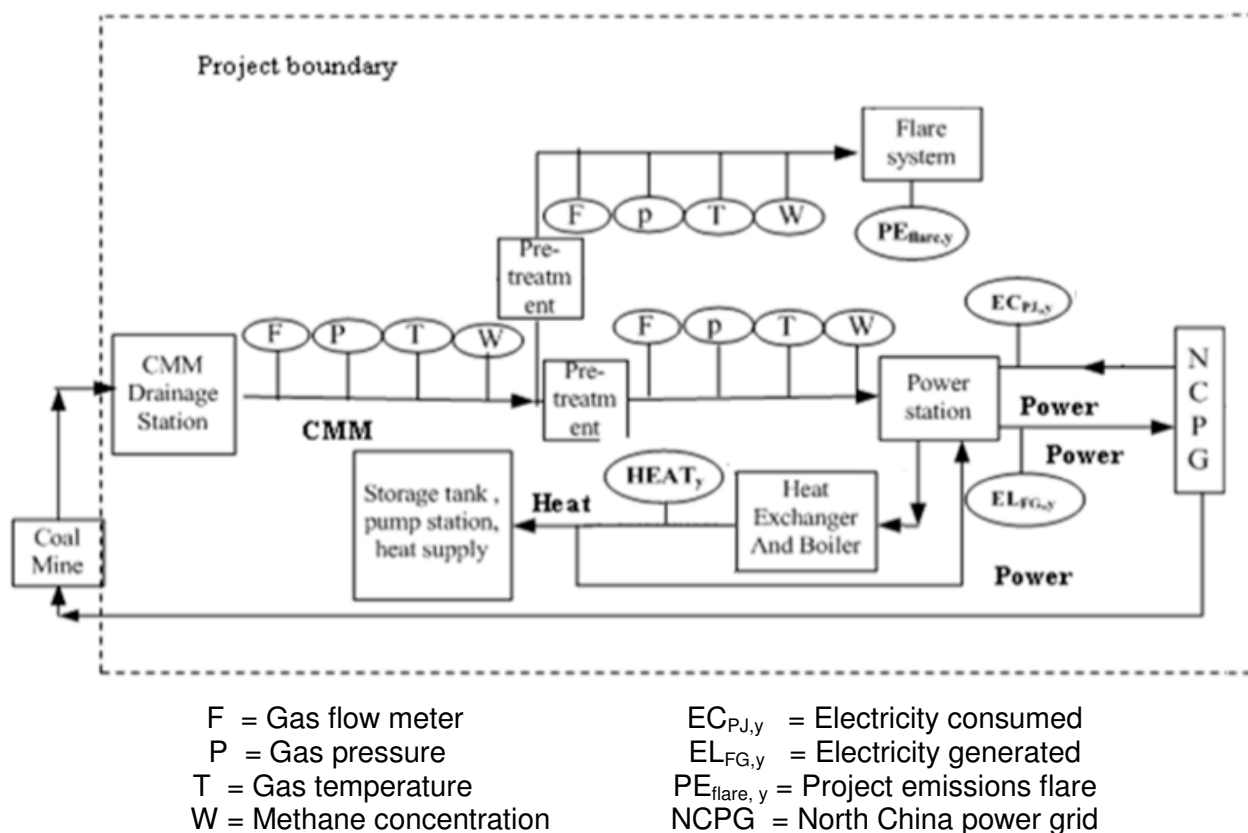


Figure C-1 Schematic line diagram showing relevant monitoring point

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

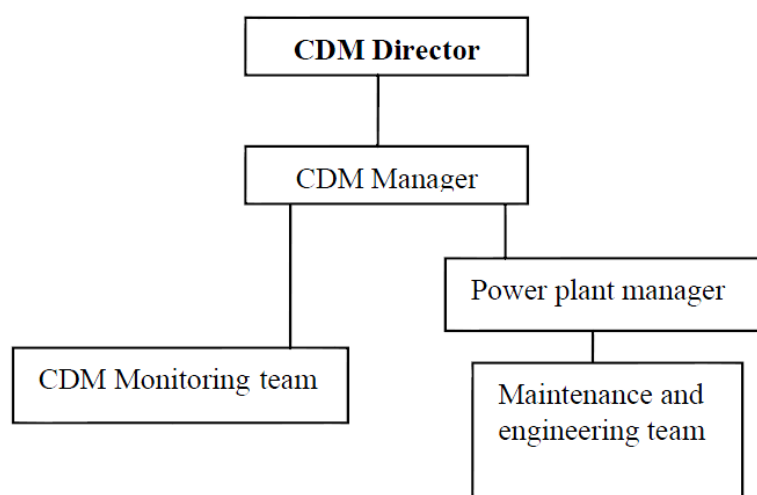


Figure C-2 Organizational structure

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

Table C-1 Data collection process

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

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 every two years) by *Institute of Metrological Supervision and Measurement of Hebei Province* (flare, oil heating circuit and engine v-cones) and by *Shanxi Provincial institute of*

Metrology (the 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 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 5 includes a list of each period during which no CDM data was recorded (all data missing). Missing of all 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. Periods during which all CDM data was missing had no ER claim associated.

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 April 2016. 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

Relevant process operators and CDM technical staff have received in-house Advance Training Course on 18th September 2015 to ensure compliance with the tasks and procedures set out in the monitoring plan. Training records are available for verification by the DOE.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante or at renewal of crediting period

Data/parameter:	Eff_{ELEC}
Unit	%
Description	Efficiency of methane destruction / oxidation in power plant
Source of data	Default value taken from ACM0008 version 03
Value(s) applied	99.5

Choice of data or measurement methods and procedures	Not applicable
Purpose of data	The data is used for project emissions calculation
Additional comments	No additional comment

Data/parameter:	EF_{ELEC}
Unit	tCO ₂ /MWh
Description	CO ₂ emission factor of the North China Power Grid
Source of data	Calculated from NDRC Values
Value(s) applied	1.03205
Choice of data or measurement methods and procedures	Calculated using ACM0002. See Section E1.
Purpose of data	The data is used for project emissions calculation
Additional comments	No additional comment

Data/parameter:	Eff_{heat}
Unit	%
Description	Efficiency of heat conversion in the baseline scenario
Source of data	Default value taken from ACM0008 version 3.0
Value(s) applied	100
Choice of data or measurement methods and procedures	Not applicable
Purpose of data	The data is used for baseline emissions calculation
Additional comments	No additional comment

Data/parameter:	GWP_{CH4}
Unit	tCO ₂ e/tCH ₄
Description	Global warming potential of methane
Source of data	IPCC and change from GWP of 21 to 25 according to decision 4/CMP7 paragraph 66, EB69
Value(s) applied	25
Choice of data or measurement methods and procedures	Not applicable
Purpose of data	This data is used for baseline and project emissions calculation
Additional comments	No additional comment

Data/parameter:	CEF_{CH4}
Unit	tCO ₂ e/tCH ₄
Description	Carbon emission factor for combusted methane
Source of data	2006 Revised IPCC Guidelines
Value(s) applied	2.75

Choice of data or measurement methods and procedures	Not applicable
Purpose of data	The data is used for project emissions calculation
Additional comments	No additional comment

Data/parameter:	Manufacturer's specification for the flare
Unit	-
Description	The flare operation in normal conditions defined by the flare manufacturer specifications provided by Nanjing Shunfen-Pioneer (flow rate 300-5,000m ³ /h and flame temp from 500 – 1,350 °C)
Source of data	Commissioning reports, certificates and approval notices provided by manufacturers or suppliers
Value(s) applied	-
Choice of data or measurement methods and procedures	Not applicable
Purpose of data	This data is not directly used but just as a reference for project emission calculations
Additional comments	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.

D.2. Data and parameters monitored

Data/parameter:	MM_{ELEC}
Unit	tCH ₄
Description	Methane sent to power plant
Measured/calculated/default	Measured/Calculated
Source of data	Measured by a flow meter on the inlet to each generator and a methanometer on the manifold pipe to the generators and summed. For the ex ante prediction on conversion for NTP (given by the methodology as 0.67 kg/m ³ at 20°C and 1 atm) is required, but for ex post, temperature and pressure will be recorded and the volume adjusted to NTP using the gas law $P_1V_1/T_1=P_2V_2/T_2$.
Value(s) of monitored parameter	Refer to ER spreadsheet
Monitoring equipment	Pressure, temperature, CH ₄ concentration and flow meters with differential pressure measurement function are used to determine the amount of methane sent to generators, see 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 CH ₄ concentration.
QA/QC procedures:	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.
Purpose of data:	This data is used for baseline and project emissions calculation
Additional comments:	No additional comment

Data/parameter:	PEy
Unit	tCO ₂ e
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.
Value(s) of monitored parameter	Refer to ER spreadsheet
Monitoring equipment	Pressure, temperature, CH ₄ concentration and flow meters with differential pressure measurement function are used to determine the amounts of methane combusted and un-combusted by the project activity. See 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:	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.
Purpose of data:	This is project emission.
Additional comments:	No additional comment

Data/parameter:	PEmd
Unit	tCO ₂ e
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 Nm ³ , 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 $P_1V_1/T_1=P_2V_2/T_2$
Value(s) of monitored parameter	Refer to ER spreadsheet
Monitoring equipment	Pressure, temperature, CH ₄ concentration and flow meters with differential pressure measurement function are used to determine the project emissions from destruction of methane by the project activity, as per Annex 2 for full 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 MD _{ELEC} and MD _{FL} below
QA/QC procedures:	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.
Purpose of data:	This is part of project emission.

Additional comments:	No additional comment
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Data/parameter:	PEum
Unit	tCO ₂ e
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	Refer to ER spreadsheet
Monitoring equipment	Pressure, temperature, CH ₄ concentration and flow meters with differential pressure measurement function are used to determine PEmd, the amount of methane combusted by engines and flare. See Annex 2 for details. Default efficiency is 99.5%, therefore un-combusted methane from generators is: (0.005 * methane sent to generator sets and the flare). Default efficiency for flares is 90%, therefore un-combusted methane from flare is (0.1* methane sent to generator sets and the flare)
Measuring/reading/recording frequency:	Measurements are taken continuously and logged at nominal 30 second intervals
Calculation method (if applicable):	
QA/QC procedures:	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
Purpose of data:	This is part of project emission.
Additional comments:	No additional comment

Data/parameter:	PEme
Unit	tCO ₂ e
Description	Project emissions from energy use to capture and use methane
Measured/calculated/default	Calculated
Source of data	Calculated from electricity consumption from the North China Power Grid (as per CONS _{ELEC,PJ})
Value(s) of monitored parameter	Refer to ER spreadsheet
Monitoring equipment	6.3kV and 35kV Power meters as per Annex 2 for further details.
Measuring/reading/recording frequency:	Continuously measured but manually recorded everyday by a site operator.
Calculation method (if applicable):	As per CONS _{ELEC,PJ}
QA/QC procedures:	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
Purpose of data:	This is part of project emission.
Additional comments:	No additional comment

Data/parameter:	MD_{ELEC}
Unit	tCH ₄
Description	Methane destroyed by power generators
Measured/calculated/default	Measured/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 MM _{ELEC} and PC _{CH4} . As per Annex 2 for details
Monitoring equipment	See MM _{ELEC} 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):	It is calculated from MM _{ELEC} and PC _{CH4}
QA/QC procedures:	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.
Purpose of data:	This data is used for project emission calculations
Additional comments:	No additional comment

Data/parameter:	MM_{FL}
Unit	tCH ₄
Description	Methane sent to flare(s)
Measured/calculated/default	Measured/Calculated
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 normalized as per Flaring tool.
Value(s) of monitored parameter	As per ER spreadsheet
Monitoring equipment	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/m ³ (revised 1996 IPCC Reference manual p.1.24 and 1.16).
QA/QC procedures:	Refer to MM _{ELEC}
Purpose of data:	This data is used for baseline and project emissions calculation
Additional comments:	No additional comment

Data/parameter:	MD_{FL}
Unit	tCH ₄
Description	Methane destroyed by flare(s)
Measured/calculated/default	Measured/Calculated

Source of data	Calculated from MMFL and $\eta_{\text{flare,h}}$
Value(s) of monitored parameter	As per ER spreadsheet
Monitoring equipment	As per MM _{FL} and $\eta_{\text{flare,h}}$
Measuring/reading/recording frequency:	N/A
Calculation method (if applicable):	See MM _{FL} and $\eta_{\text{flare,h}}$
QA/QC procedures:	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.
Purpose of data:	This data is used for project emissions calculation
Additional comments:	No additional comment

Data/parameter:	GEN_y
Unit	MWh
Description	Electricity generated by the project
Measured/calculated/default	Measured
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 ER spreadsheet
Monitoring equipment	6.3kV and 35kV Power meters as per Annex 2 for further 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:	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.
Purpose of data:	This data is used for baseline emissions calculation
Additional comments:	No additional comment

Data / Parameter:	CONS_{ELEC,PJ}
Unit	MWh
Description	Additional electricity consumption for capture and use or destruction of methane, if any
Measured/calculated/default	Measured
Source of data	Electricity meter readings, this is the negative reading of the electricity meter
Value(s) of monitored parameter	As per ER spreadhseet

Monitoring equipment	Electricity meter. See monitoring equipment items in Annex 2 for details. Instruments are calibrated on a yearly basis according to manufacturer's specifications.
Measuring/reading/recording frequency:	Continuously measured, recorded every 30 seconds.
Calculation method (if applicable):	N/A
QA/QC procedures:	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.
Purpose of data:	This data is used for project emissions calculation.
Additional comments:	N/A

Data/parameter:	HEAT_y
Unit	GJ
Description	Heat generation by project
Measured/calculated/default	Measured/Calculated
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	As per ER spreadsheet
Monitoring equipment	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 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:	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.
Purpose of data:	This data is used for baseline emissions calculation
Additional comments:	No additional comment

Data/parameter:	PC_{CH4, mass}
Unit	%
Description	Concentration (in mass) of methane in drained gas measured on wet basis ¹
Measured/calculated/default	Calculated/Measured
Source of data	Calculated by the measured concentration (in volume) of methane by the methanometer at the manifold to the generator and the flare

¹ The measurement result of volumetric fraction of methane in extracted CMM makes no difference either on wet basis or on dry basis as long as the CMM temperature is below 60°C, which is the case of this project activity, as per page 12 of "Methodological Tool to determine project emissions from flaring gases containing methane".

Value(s) of monitored parameter	Only needed to calculate the $r(r=PCNMHC/PCCH_4, mass)$ if NMHC account for more than 1% by volume of the extracted CMM, which is not the case in this monitoring period.
Monitoring equipment	Methane concentration (in volume) is measured by proprietary infrared instrumentation mounted in the gas pipe work at the gas treatment units. Accuracy of analysis $\pm 2.5\%FSD$. Gas analyzed 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:	Calculations of methane concentration in volume 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.
Purpose of data:	This data is assumed to be used for project emissions calculation, but not used in this monitoring period as NMHC accounted less than 1% by volume of the extracted CMM.
Additional comments:	No additional comment

Data/parameter:	PC_{CH₄, volume} (also fv_{CH₄, RG, h})
Unit	%
Description	Percentage of pure methane (wet basis, as per footnote 1) 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 ER spreadsheet
Monitoring equipment	Methane concentration is measured by proprietary infrared instrumentation mounted in the gas pipe work at the gas treatment units. Accuracy of analysis $\pm 2.5\%FSD$. Gas analyzed 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:	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.
Purpose of data:	This data is used for both baseline and project emissions calculation
Additional comments:	No additional comment

Data/parameter:	PC_{NMHC}
Unit	%
Description	Percentage of non-methane hydrocarbons in CMM, by mass coal mine gas
Measured/calculated/default	Measured
Source of data	Tube sample analysis

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. Gas laboratory sample results available during verification.
Monitoring equipment	N/A
Measuring/reading/recording frequency:	Annually, samples of gas were extracted into gas sampling bottles using the appropriate procedures and analyzed by qualified laboratory such as Beijing Huayuan Gas Chemical Industry in China or TES Bretby in the UK
Calculation method (if applicable):	N/A
QA/QC procedures:	A minimum of 3 samples is 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 analyzed 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.
Purpose of data:	This data is used for project emissions calculation
Additional comments:	No additional comment

Data/parameter:	CEF_{NMHC}
Unit	tCO ₂ e/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. Gas laboratory sample results available during verification.
Monitoring equipment	N/A
Measuring/reading/recording frequency:	N/A
Calculation method (if applicable):	Derived using measurements described in PC _{NMHC}
QA/QC procedures:	N/A
Purpose of data:	This data is used for project emissions calculation
Additional comments:	No additional comment

Data/parameter:	R
Unit	%
Description	Relative proportion of NMHC compared to methane
Measured/calculated/default	Calculated
Source of data	Calculated from PC _{NMHC} / PC _{CH₄mass}
Value(s) of monitored parameter	Determined from annual tests of samples of coalmine methane. Not applicable at this stage because the sum of all non-methane hydrocarbons in gas samples is less than 1%, as per tube samples SCC WS1, SCC 7 and SCC 16 taken on 04 June 2014 and analyzed on 12 June 2014 by Beijing Huayan Gas Chemical Industry Co. Ltd. Gas laboratory sample results available during verification.

Monitoring equipment	N/A
Measuring/reading/recording frequency:	Annually, samples of gas were extracted into gas sampling bottles using the appropriate procedures and analyzed by qualified laboratories such as Beijing Huayuan Gas Chemical Industry in China or TES Bretby in the UK
Calculation method (if applicable):	N/A
QA/QC procedures:	If applicable, this figure will be built into a spreadsheet for calculating emissions. Not applicable – sum of all non-methane hydrocarbons in any of the tube samples was found less than 1%. Gas laboratory sample results available during verification.
Purpose of data:	This data is used for project emissions calculation
Additional comments:	No additional comment

Data/parameter:	$FV_{RG,h}$
Unit	m^3/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 ER spreadsheet
Monitoring equipment	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):	N/A
QA/QC procedures:	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.
Purpose of data:	This data is used for both baseline and project emissions calculation
Additional comments:	No additional comment

Data/parameter:	$fv_{CH_4, RG, h}$
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	As per ER spreadsheet
Monitoring equipment	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):	N/A
QA/QC procedures:	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.

Purpose of data:	This data is used for both baseline and project emissions calculation
Additional comments:	No additional comment

Data/parameter:	T_{flare}
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	As per ER spreadsheet
Monitoring equipment	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 degrees Celsius indicates that a significant amount of gases are being burnt and that the flare is operating.
Calculation method (if applicable):	N/A
QA/QC procedures:	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.
Purpose of data:	This data is not directly used for project emissions calculation but used for the determination of the flare efficiency.
Additional comments:	No additional comment

Data/parameter:	$\eta_{\text{flare},h}$
Unit	%
Description	Flare efficiency in hour h
Measured/calculated/default	Calculated
Source of data	Flare thermocouple(s)
Value(s) of monitored parameter	<p>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.</p> <p>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.</p> <p>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.</p>
Monitoring equipment	Flare thermocouple(s) type N 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):	$\eta_{\text{flare},h}$ 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:	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.
Purpose of data:	This data is used for project emissions calculation

Additional comments:	No additional comment
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Data/parameter:	T
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 ER spreadsheet
Monitoring equipment	PT 100 temperature transmitter 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):	N/A
QA/QC procedures:	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.
Purpose of data:	This data is used for baseline emissions calculation
Additional comments:	No additional comment

D.3. Implementation of sampling plan

Not applicable to the project activity.

SECTION E. Calculation of emission reductions or GHG removals by sinks

E.1. Calculation of baseline emissions or baseline net GHG removals by sinks

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 ₂ e)
$BE_{MD,y}$	Baseline emissions from destruction of methane in the baseline scenario in year y (tCO ₂ e)
$BE_{MR,y}$	Baseline emissions from release of methane into the atmosphere in year y that is avoided by the project activity (tCO ₂ e)
$BE_{Use,y}$	Baseline emissions from the production of power, heat or supply to gas grid replaced by the project activity in year y (tCO ₂ e)

$BE_{MD,y}$ 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:

$$BE_{MR,y} = GWP_{CH_4} \times \left[\sum_i (CBMe_{i,y} - CBM_{BLi,y}) + \sum_i (CMM_{PJi,y} - CMM_{BLi,y}) + \sum_i (PMM_{PJi,y} - PMM_{BLi,y}) \right] \quad (2)$$

Where,

$BE_{MR,y}$	Baseline emissions from release of methane into the atmosphere in year y that is avoided by the project activity (tCO ₂ e)
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
$CMM_{PJi,y}$	Pre-mining CMM captured, sent to and destroyed by use i in the project activity in year y (expressed in tCH ₄)
$CMM_{BLi,y}$	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
$PMM_{PJi,y}$	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_{CH_4}	Global warming potential of methane (25 tCO ₂ e/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 report², as the gas is extracted from the mine within the project boundary of the CDM project activity, and a connection between $CMM_{PJi,y}$ (pre-mining CMM captured, sent and destroyed) and $PMM_{PJi,y}$ (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:

$$BE_{MR,y} = GWP_{CH_4} \times (MM_{ELEC} + MM_{FL}) \quad (3)$$

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

² <http://cdm.unfccc.int/UserManagement/FileStorage/JTV1YA8FCHR4W2GMEOQ53SK60P9DLX>

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 (tCO₂e) is:

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

Where:

GEN _y	Electricity generated by project activity in year y (MWh)
EF _{ELEC}	Emissions factor of grid 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

According ACM0002, the baseline grid emission factor is the simple average of BM and OM:
 $1.1208 + 0.9397 / 2 = 1.03025 \text{ tCO}_2/\text{MWh}$

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

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

Where:

EF _{heat,y}	Emissions factor for heat generation (tCO ₂ /GJ)	(5)
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%.

Here below is the sample calculation for BE_y during the period 01/01/2016 – 31/01/2016.

Sample calculation for BE_{MR,y} during the period 01/01/2016 – 31/01/2016:

Symbol	Value	Units
ρ (CH ₄) at 101.325Pa and 273 K	0.000716	t/m ³
GWP _{CH4}	25	tCO ₂ e/tCH ₄
CEF _{CH4}	2.75	tCO ₂ e/tCH ₄
V _{CMM,ELEC}	4,199,766.1	m ³
PC _{CH4,ELEC}	35.4	%
V _{CMM,FL}	0	m ³
PC _{CH4,FL}	0	%
MM _{ELEC} = V _{CMM,ELEC} × PC _{CH4,ELEC} × ρ _{CH4}	1,063.1	tCH ₄
MM _{FL} = V _{CMM,FL} × PC _{CH4,FL} × ρ _{CH4}	-	tCH ₄
BE _{MR} = GWP _{CH4} × (MM _{ELEC} + MM _{FL})	26,577.1	tCO ₂ e

Where :

V _{CMM,ELEC}	= cumulative volume of CMM measured sent to the power engines during the period 01/01/2016 – 31/01/2016 (m ³)
V _{CMM,FL}	= cumulative volume of CMM measured sent to the flare during the period

01/01/2016 – 31/01/2016 (m³)

$PC_{CH_4,ELEC}$ = Concentration of methane of CMM measured sent to the power engines during the period 01/01/2016 – 31/01/2016 (%)

$PC_{CH_4,FL}$ = Concentration of methane of CMM measured sent to the flares during the period 01/01/2016 – 31/01/2016 (%)

Sample calculation for $BE_{Use,y}$ during the period 01/01/2015 – 31/01/2015:

Symbol	Value	Units
EF_{ELEC}	1.03025	tCO ₂ /MWh
EF_{HEAT}	0.0946	tCO ₂ /GJ
GEN_y	5,345.7	MWh
$HEAT_y$	4,758.6	GJ
$BE_{Use,y} = GEN_y \times EF_{ELEC} + HEAT_y \times EF_{HEAT}$	5,955.0	tCO ₂ e

So that $BE_y = BE_{MD,y} + BE_{MR,y} + BE_{Use,y} = 0 + 26,577.1 + 5,955.0 = 32,532.1$ tCO₂e.

The baseline emissions are calculated in the ER calculation excel spreadsheets, and a summary of the results are provided in section E.4.

E.2. Calculation of project emissions or actual net GHG removals by sinks

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:

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

Where:

PE_y Project emissions in year y (tCO₂e)
 PE_{ME} Project emissions from energy use to capture and use methane (tCO₂e)
 PE_{MD} Project emissions from methane destroyed (tCO₂e)
 PE_{UM} Project emissions from un-combusted methane (tCO₂e)

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 Therefore:

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

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:

$$PE_{MD} = (MD_{FL} + MD_{ELEC}) \times (CEF_{CH_4} + r \times CEF_{NMHC}) \quad (8)$$

with:

$$r = PC_{NMHC} / PC_{CH_4}$$

Where:³

PE_{MD}	Project emissions from CMM destroyed (tCO ₂ e)
MD_{FL}	Methane destroyed through flaring (tCH ₄)
MD_{ELEC}	Methane destroyed through power generation (tCH ₄)

CEF_{CH_4}	Carbon emission factor for combusted methane (2.75 tCO ₂ e/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 ₂ e/tNMHC)
R	Relative proportion of NMHC compared to methane
PC_{CH_4}	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:

$$PE_{MD} = CEF_{CH_4} \times (MD_{FL} + MD_{ELEC}) \quad (10)$$

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:

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

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)

$$MD_{FL} = MM_{FL} - PE_{flare} / GWP_{CH_4} \quad (12)$$

Where:

MD_{FL}	Methane destroyed through flaring (tCH ₄)
MM_{FL}	Methane measured sent to flare (tCH ₄)
PE_{flare}	Project emissions of non-combusted CH ₄ , expressed in terms of CO ₂ e, from flaring of the residual gas stream (tCO ₂ e), calculated according to the “Tool to determine project emissions from flaring gases containing Methane”
GWP_{CH_4}	Global warming potential of methane (25tCO ₂ e/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”.

Project emissions from flaring ($PE_{flare,y}$) are calculated as the sum of emissions from each hour h , based on the methane flow rate in the residual gas ($TM_{RG,h}$) and the flare efficiency during each hour h ($\eta_{flare,h}$), as follows:

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.

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

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 (25tCO ₂ e/tCH ₄).

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

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

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 ³ CH ₄), density of methane under normal conditions of temperature and pressure (20°C and 1atm) is 0.67kg/m ³ (Revised 1996 IPCC Reference Manual p 1.24 and 1.16)

For the enclosed flares, option a) of the flare tool - a default value is used to determine the flare efficiency. Continuous monitoring of compliance with manufacturer's specifications of flare (temperature, flow rate) is performed, the following efficiencies will be used under different situations:

- 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 .

PE_{UM} Project emissions from un-combusted methane

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:

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

Where:

PE_{UM}	Project emissions from un-combusted methane (tCO ₂ e)
GWP_{CH4}	Global warming potential of methane (25 tCO ₂ e/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 ₂ e), calculated in accordance with formulas (13) and (14)

Here below is the sample calculation for PE_y during the period 01/01/2016 – 31/01/2016

Sample calculation for PE_{ME} during the period 01/01/2016 – 31/01/2016:

Symbol	Value	Units
EF_{ELEC}	1.03025	tCO ₂ /MWh
$CONS_{ELEC,PJ}$	0	MWh
$PE_{ME} = CONS_{ELEC,PJ} \times EF_{ELEC}$	0	tCO ₂ e

Sample calculation for PE_{MD} during the period 01/01/2016 – 31/01/2016:

Symbol	Value	Units
CEF_{CH_4}	2.75	tCO ₂ /tCH ₄
R	0 (as of $PC_{NMHC} < 1\%$ by lab tests of CMM samples)	
Eff_{ELEC}	99.5	%
MM_{ELEC}	1,063.1	tCH ₄
MM_{FL}	0	tCH ₄
$MD_{ELEC} = MM_{ELEC} \times Eff_{ELEC}$	1,057.8	tCH ₄
$MD_{FL} = \sum_h MM_{FL,h} \times \eta_{flare,h}$	0	tCH ₄
$PE_{MD} = (MD_{FL} + MD_{ELEC}) \times (CEF_{CH_4} + r \times CEF_{NMHC})$	2,908.9	tCO ₂ e

Sample calculation for PE_{UM} during the period 01/01/2016 – 31/01/2016:

Symbol	Value	Units
GWP_{CH_4}	25	tCO ₂ e/tCH ₄
Eff_{ELEC}	99.5	%
MM_{ELEC}	1,063.1	tCH ₄
MM_{FL}	0	tCH ₄
$MD_{ELEC} = MM_{ELEC} \times Eff_{ELEC}$	1,057.8	tCH ₄
$MD_{FL} = \sum_h MM_{FL,h} \times \eta_{flare,h}$	0	tCH ₄
PE_{flare}	0	tCO ₂ e
$PE_{UM} = GWP_{CH_4} \times MM_{ELEC} \times (1 - Eff_{ELEC}) + PE_{flare}$	132.9	tCO ₂ e

So that $PE_y = PE_{ME} + PE_{MD} + PE_{UM} = 0 + 2,908.9 + 132.9 = 3,041.8$ tCO₂e

The project emissions are calculated in the ER calculation excel spreadsheets, and a summary of the results are provided in section E.4.

E.3. Calculation of leakage

There is no overlap usage between methane consumption in the baseline and the methane consumption by the project activity during the monitoring period therefore there is no leakage to consider in this category.

E.4. Summary of calculation of emission reductions or net GHG removals by sinks

Item	Baseline emissions or baseline net GHG removals by sinks (t CO ₂ e)	Project emissions or actual net GHG removals by sinks (t CO ₂ e)	Leakage (t CO ₂ e)	GHG emission reductions or net GHG removals by sinks (t CO ₂ e) achieved in the monitoring period		
				Up to 31/12/2012	From 01/01/2013	Total amount
Total	504,218	48,398	0	0	455,820	455,820

E.5. Comparison of actual emission reductions or net GHG removals by sinks with estimates in registered PDD

Item	Values estimated in ex ante calculation of registered PDD	Actual values achieved during this monitoring period
Emission reductions or GHG removals by sinks (tCO ₂ e)	(214 days in 2015 + 244 days in 2016)/ 365 x 378,748 = 475,251	455,820

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

There is no increase in the reported emission reductions achieved during the current monitoring period from that stated in the registered CDM-PDD. The registered PDD estimates a total of 475,251 tCO₂e for the current monitoring period (calculation as per table in section E.5), while 455,820 tCO₂e have actually been generated during the same period because of slightly lower gas drainage.

Appendix 1. Contact information of project participants and responsible persons/entities

Project participant and/or responsible person/ entity	<input checked="" type="checkbox"/> Project participant <input type="checkbox"/> Person/entity responsible for completing the CDM-MR-FORM
Organization name	Sindicatum Carbon Capital Ltd
Street/P.O. Box	Sindicatum Sustainable Resources Group, 80 Anson Road, #28-02,
Building	Fuji Xerox Towers
City	Singapore
State/region	
Postcode	079907
Country	Singapore
Telephone	+65 6732 8897
Fax	+65 6732 9767
E-mail	jay.mariyappan@sindicatum.com
Website	http://www.sindicatum.com
Contact person	Jay Mariyappan
Title	Managing Director, Delivery
Salutation	Mr
Last name	Mariyappan
Middle name	-
First name	Jay
Department	Delivery
Mobile	-
Direct fax	-
Direct tel.	-
Personal e-mail	jmariyappan@gmail.com

Project participant and/or responsible person/ entity	<input checked="" type="checkbox"/> Project participant <input type="checkbox"/> Responsible person/ entity for completing the CDM-MR-FORM
Organization name	Shanxi Coking Coal Group Company Ltd.
Street/P.O. Box	No 1, Section 1, Xin Jin Ci Road
Building	Jiaomei Building
City	Taiyuan
State/Region	Shanxi Province
Postcode	030024
Country	P. R. China
Telephone	86 0351 8305175
Fax	86 0351 8305174
E-mail	150335164987
Website	http://www.sxcc.com.cn
Contact person	Jia Qingrong
Title	Director
Salutation	Mr.
Last name	Jia
Middle name	
First name	Qingrong
Department	Environment Protection
Mobile	15035164987
Direct fax	86 0351 8305174
Direct tel.	86 0351 8305175
Personal e-mail	15035164987@qq

Appendix 2. CDM Monitoring equipment calibration dates

No	Name	Relevant parameter	Instrument type	SN	Scale	Calibration certificate	Calibration date	Calibration validity	Accuracy class	
									Accuracy class	Reference source
1	Flare gas T	PEmd PEum MDFL MMFL	shanghai Hongda WZPK (Pt100)	070907963	0-100°C	JZRX201502859	2015-5-14	1 year	Class A (allowable deviation $\pm(0.15+0.002Itl)$)	Manufacturer Technical Specification
			Honeywell STT25M-0-ENS-000-000-000-00-3D	C3106879004036	0-60□	JZRX201502856	2015-5-14	1 year	± 0.025 % of span	Manufacturer Technical Specification
			shanghai Hongda WZPK (Pt100)	070907963	0-100°C	JZRX201603156	2016-5-6	1 year	Class A (allowable deviation $\pm(0.15+0.002Itl)$)	Manufacturer Technical Specification
2	Phase 1 engine gas T	PEmd PEum MMELEC MDELEC	WZP-240(PT100)	908273	-200-450 °C	JZRX201502861	2015-5-14	1 year	Class A (allowable deviation $\pm(0.15+0.002Itl)$)	Manufacturer Technical Specification
			Anhui Tiakang WZP-240 (Pt100)	----	-200-450 °C	JZRX201603154	2016-5-6	1 year	Class A (allowable deviation $\pm(0.15+0.002Itl)$)	Manufacturer Technical Specification
3	Phase 2 engine gas T	MDELEC	Honeywell STT830-171-TC.M1.W1.CD-WEEO-H06S-R2U6-A05TR080-2D-000	080625368	0-100°C	JZRX201502860	2015-5-14	1 year	Class A $\pm (0.15+0.002 Itl)$	Manufacturer Technical Specification
			Zhejiang Lunte N-WZPK-270	2012031768	-200-350 °C	JZRX201603152	2016-5-6	1 year	Class A $\pm (0.15+0.002 Itl)$	Manufacturer Technical Specification
4	Flare thermal couples	MMFL T_{flare}	Honeywell STT830-173-TC.M3.W1.CD-WEEO-H10S-T7G6-A05T(Y)240-2D-000	080609834	0-1300°C	JZRX201502585	2015-5-14	1 year	Class I (allowable deviation $\pm(0.0075Itl)$)	Manufacturer Technical Specification
						JZRX201603188	2016-5-10	1 year	Class I (allowable deviation $\pm(0.0075Itl)$)	Manufacturer Technical Specification
				09-3180-01-04	0-1300°C	JZRX201502584	2015-5-14	1 year	Class I (allowable deviation $\pm(0.0075Itl)$)	Manufacturer Technical Specification

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No	Name	Relevant parameter	Instrument type	SN	Scale	Calibration certificate	Calibration date	Calibration validity	Accuracy class	
									Accuracy class	Reference source
				2012031767	-40-1100 °C	JZRX201603187	2016-5-10	1 year	Class I (allowable deviation $\pm(0.0075\text{t})$)	Manufacturer Technical Specification
						JZRX201500847	2015-3-2	1 year	Class I ± 1.5 or $\pm 0.4\%$ t	Manufacturer Technical Specification
						JZRX201600905	2016-2-28	1 year	Class I ± 1.5 or $\pm 0.4\%$ t	Manufacturer Technical Specification
5	Flare gas P	MM_{FL}	Rosemount 3051 TG1A2B21AB4E5M5	4793856	0-207Kpa	JZYL201501456	2015-3-18	1 year	$\pm 0.075\%$	Manufacturer Technical Specification
						JZYL201601096	2016-3-10	1 year	$\pm 0.075\%$	Manufacturer Technical Specification
6	Phase 1 engine gas P	MD_{ELEC}	Hefei Keheng Automation Instrument KH-AFY801	114932	0-40Kpa	JZYL201501454	2015-3-18	1 year	$\pm 0.5\%$	Manufacturer Technical Specification
						JZYL201601095	2016-3-10	1 year	$\pm 0.5\%$	Manufacturer Technical Specification
7	Phase 2 engine gas P	MD_{ELEC}	Rosemount 3051 TG1A2B21AB4E5Q4	5466031	-20-20Kpa	JZYL201501455	2015-3-18	1 year	$\pm 0.075\%$	Manufacturer Technical Specification
						JZYL201601092	2016-3-10	1 year	$\pm 0.075\%$	Manufacturer Technical Specification
8	Flare CH4%	PC_{CH4, mass} MM_{FL}	Guardian plus, model:97460	26065	0-100%	JZYQ201500258	2015-5-8	1 year	$\pm 2.5\%$	Manufacturer Technical Specification
						JZYQ201600055	2016-3-14	1 year	$\pm 2.5\%$	Manufacturer Technical Specification

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No	Name	Relevant parameter	Instrument type	SN	Scale	Calibration certificate	Calibration date	Calibration validity	Accuracy class	
									Accuracy class	Reference source
9	Phase 1 engine CH4%	PC _{CH4, mass} MD _{ELEC}	Guardian plus, model:97460	32624	0-100%	JZYQ201500187	2015-3-18	1 year	±2.5%	Manufacturer Technical Specification
				32624	0-100%	JZYQ201600056	2016-3-14	1 year	±2.5%	Manufacturer Technical Specification
10	Phase 2 engine CH4%	PC _{CH4, mass} MD _{ELEC}	Guardian plus, model:97460	29782	0-100%	JZYQ201500185	2015-3-18	1 year	±2.5%	Manufacturer Technical Specification
						JZYQ201600057	2016-3-14	1 year	±2.5%	Manufacturer Technical Specification
11	Barometric pressure	MM _{FL}	Rosemount 3051 TA1A2B21JE5Q4	4980061	0-141.33Kpa	JZYL201501457	2015-3-18	1 year	±0.075%	Manufacturer Technical Specification
			Rosemount 3051 TA1A2B21AB4E5Q4	1794561	0-207Kpa	JZYL201601030	2016-3-15	1 year	±0.075%	Manufacturer Technical Specification
12	V-cone engine 1	MM _{ELEC} MD _{ELEC}	MOORE-KINGWAYS (SHANGHAI)CONTROL SYSTEM CO.,LTD KVV08IIC24FWN	7092005	237.5-1900m3/hr	LLYQ14-JZ1007	2014-4-3	2 year	±0.5%	Manufacturer Technical Specification
						LLYQ16-JZ2007	2016-3-25	2 year	±0.5%	Manufacturer Technical Specification
13	DP engine 1	MM _{ELEC} MD _{ELEC}	Rosemount 3051 CD1A22A1AM5B4K5	4870528	0-6.22KPa	JZYL201501467	2015-3-18	1 year	±0.075%	Manufacturer Technical Specification
						JZYL201601104	2016-3-10	1 year	±0.075%	Manufacturer Technical Specification
14	V-cone engine 2	MM _{ELEC} MD _{ELEC}	MOORE-KINGWAYS (SHANGHAI)CONTROL SYSTEM CO.,LTD	7092003	237.5-1900m3/hr	LLYQ14-JZ1009	2014-4-3	2 year	±0.5%	Manufacturer Technical Specification

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No	Name	Relevant parameter	Instrument type	SN	Scale	Calibration certificate	Calibration date	Calibration validity	Accuracy class	
									Accuracy class	Reference source
			KVW08IIKC24FWN			LLYQ16-JZ2009	2016-3-25	2 year	±0.5%	Manufacturer Technical Specification
15	DP engines 2	MM_{ELEC} MD_{ELEC}	Rosemount 3051 CD1A22A1AM5B4K5	4879835	0-6.22KPa	JZYL201501464	2015-3-18	1 year	±0.075%	Manufacturer Technical Specification
						JZYL201601102	2016-3-10	1 year	±0.075%	Manufacturer Technical Specification
16	V-cone engine 3	MM_{ELEC} MD_{ELEC}	MOORE-KINGWAYS (SHANGHAI)CONTROL SYSTEM CO.,LTD KVW08IIKC24FWN	7092004	237.5-1900m3/hr	LLYQ14-JZ1008	2014-4-3	2 year	±0.5%	Manufacturer Technical Specification
						LLYQ16-JZ2008	2016-3-25	2 year	±0.5%	Manufacturer Technical Specification
17	DP engines 3	MM_{ELEC} MD_{ELEC}	Rosemount 3051 CD1A22A1AM5B4K5	4870527	0-6.22KPa	JZYL201501466	2015-3-18	1 year	±0.075%	Manufacturer Technical Specification
						JZYL201601103	2016-3-10	1 year	±0.075%	Manufacturer Technical Specification
18	V-cone 1# for flare	MM_{FL}	MOORE-KINGWAYS (SHANGHAI)CONTROL SYSTEM CO.,LTD- KVW10IIAB24FWN	7102302	250-3000m3/hr	LLYQ14-JZ1005	2014-4-3	2 year	±0.5%	Manufacturer Technical Specification
						LLYQ16-JZ2005	2016-3-25	2 year	±0.5%	Manufacturer Technical Specification
19	DP 1# for flare	MM_{FL}	Rosemount 3051 CD1A22A1AM5B4K5	4870526	0-6.22KPa	JZYL201501459	2015-3-18	1 year	±0.075%	Manufacturer Technical Specification
						JZYL201601098	2016-3-10	1 year	±0.075%	Manufacturer Technical Specification

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No	Name	Relevant parameter	Instrument type	SN	Scale	Calibration certificate	Calibration date	Calibration validity	Accuracy class	
									Accuracy class	Reference source
20	V-cone 2# for flare	MM _{FL}	MOORE-KINGWAYS (SHANGHAI)CONTROL SYSTEM CO.,LTD K VW10IIB24FWN	7102301	250-3000m3/hr	LLYQ14-JZ1006	2014-4-3	2 year	±0.5%	Manufacturer Technical Specification
						LLYQ16-JZ2006	2016-3-25	2 year	±0.5%	Manufacturer Technical Specification
21	DP 2# for flare	MM _{FL}	Rosemount 3051CD2A22A1AM5I5	5489467	0-25KPa	JZYL201501458	2015-3-18	1 year	±0.075%	Manufacturer Technical Specification
						JZYL201601097	2016-3-10	1 year	±0.075%	Manufacturer Technical Specification
22	V-cone engine 4	MD _{ELEC}	Moore-Kingways (ShangHai) control system Co, Ltd. KVS06IIKC23FSN	9061201	200-2000m3/hr	LLYQ14-JZ1003	2014-4-3	2 year	±0.5%	Manufacturer Technical Specification
						LLYQ16-JZ2003	2016-3-25	2 year	±0.5%	Manufacturer Technical Specification
23	DP engines 4	MD _{ELEC}	Rosemount 3051 CD1A22A1AM5B4K5	5058739	0-6.216Kpa	JZYL201501465	2015-3-18	1 year	±0.075%	Manufacturer Technical Specification
						JZYL201601094	2016-3-10	1 year	±0.075%	Manufacturer Technical Specification
24	V-cone engine 5	MD _{ELEC}	Moore-Kingways (ShangHai) control system Co, Ltd. KVS06IIKC23FSN	9061203	200-2000m3/hr	LLYQ14-JZ1001	2014-4-3	2 year	±0.5%	Manufacturer Technical Specification
						LLYQ16-JZ2001	2016-3-25	2 year	±0.5%	Manufacturer Technical Specification
25	DP engines 5	MD _{ELEC}	Rosemount 3051 CD1A22A1AM5B4K5	5058740	0-6.216Kpa	JZYL201501463	2015-3-18	1 year	±0.075%	Manufacturer Technical Specification
						JZYL201601101	2016-3-10	1 year	±0.075%	Manufacturer Technical

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No	Name	Relevant parameter	Instrument type	SN	Scale	Calibration certificate	Calibration date	Calibration validity	Accuracy class	
									Accuracy class	Reference source
										Specification
26	V-cone engine 6	MD _{ELEC}	Moore-Kingways (ShangHai) control system Co, Ltd. KVS06IIKC23FSN	9061204	200-2000m3/hr	LLYQ14-JZ1004	2014-4-3	2 year	±0.5%	Manufacturer Technical Specification
						LLYQ16-JZ2004	2016-3-25	2 year	±0.5%	Manufacturer Technical Specification
27	DP engines 6	MD _{ELEC}	Rosemount 3051 CD1A22A1AM5B4K5	5058741	0-6.216Kpa	JZYL201501462	2015-3-18	1 year	±0.075%	Manufacturer Technical Specification
						JZYL201601100	2016-3-10	1 year	±0.075%	Manufacturer Technical Specification
28	V-cone engine 7	MD _{ELEC}	Moore-Kingways (ShangHai) control system Co, Ltd. KVS06IIKC23FSN	9061202	200-2000m3/hr	LLYQ14-JZ1002	2014-4-3	2 year	±0.5%	Manufacturer Technical Specification
						LLYQ16-JZ2002	2016-3-25	2 year	±0.5%	Manufacturer Technical Specification
29	DP engines 7	MD _{ELEC}	Rosemount 3051 CD2A22A1ADFE5Q4	5525313	0-20Kpa	JZYL201501461	2015-3-18	1 year	±0.075%	Manufacturer Technical Specification
						JZYL201601093	2016-3-10	1 year	±0.075%	Manufacturer Technical Specification
30	V-cone for oil	HEAT _y	MOORE-KINGWAYS (SHANGHAI)CONTROL SYSTEM CO.,LTD KVV06IIB24FWN	9102801	18000-180000Kg/hr	LLYQ15-JZ5001	2015-5-5	2 year	±0.5%	Manufacturer Technical Specification
31	DP for oil	HEAT _y	Rosemount: 3051CD2A22A1AM5B4K5	4870525	0-62.2KPa	JZYL201501460	2015-3-18	1 year	±0.075%	Manufacturer Technical Specification
						JZYL201601099	2016-3-10	1 year	±0.075%	Manufacturer

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No	Name	Relevant parameter	Instrument type	SN	Scale	Calibration certificate	Calibration date	Calibration validity	Accuracy class	
									Accuracy class	Reference source
										Technical Specification
32	T- Oil outlet	HEAT _y	SBWZPK-241	611052	0-300 °C	JZRX201502858	2015-5-14	1 year	Class A (allowable deviation $\pm(0.15+0.002ItI)$)	Manufacturer Technical Specification
						JZRX201603155	2016-5-6	1 year	Class A (allowable deviation $\pm(0.15+0.002ItI)$)	Manufacturer Technical Specification
33	T- Oil return	HEAT _y	福州福光百特自动化 SBWZ-2480-6-GT	1	0-200 °C	JZRX201503326	2015-5-14	1 year	Class A (allowable deviation $\pm(0.15+0.002ItI)$)	Manufacturer Technical Specification
						JZRX201603159	2016-5-6	1 year	Class A (allowable deviation $\pm(0.15+0.002ItI)$)	Manufacturer Technical Specification
34	6.3KV power meter	CONS _{ELEC}	Jiangsu linyang Electronics Co., Ltd DSSD71	0040		JZDX201502330	2015-4-23	1 year	Active power : 0.5S/1.0	Manufacturer Technical Specification
				0073		JZDX201601310	2016-3-16	1 year	Active power : 0.5S/1.0	Manufacturer Technical Specification
35	35KV power meter	CONS _{ELEC}	Weisheng Group DSSD331	11030599360019		JZDX201502331	2015-4-23	1 year	Active power : 0.2S	Manufacturer Technical Specification
				09080130690001		JZDX201601311	2016-3-16	1 year	Active power : 0.2S	Manufacturer Technical Specification

Appendix 3. CDM Instruments removal and installation dates

No.	Name	Instrument type	SN	scale	2015 Calibration date	Removal date for calibration	2016 Calibration date	Installation date after calibration
1	Flare gas T	shanghai Hongda WZPK(Pt100)	070907963	0-100□	2015-5-14	2015-6-28	-	-
		Honeywell STT25M-0-ENS-000-000-000-00-3D	C31068790 04036	0-60□	2015-5-14	-	-	2015-6-28
					2015-5-14	2016-5-6	-	-
		shanghai Hongda WZPK(Pt100)	070907963	0-100□	-	-	2016-5-6	2016-5-12
2	Phase 1 engine gas T	WZP-240(PT100)	908273	-200-450℃	2015-5-14	2016-5-12	-	-
		Anhui Tiankang WZP-240 (Pt100)	----	-200-450℃	-	-	2016-5-6	2016-5-12
3	Phase 2 engine gas T	Honeywell STT830-171-TC.M1.W1.CD-WEE0-H06S-R2U6-A05TR080-2D-000	080625368	0-100□	2015-5-14	2016-5-12	-	-
		Zhejiang Lunte WZPK-270	2012031768	-200-350℃	-	-	2016-5-6	2016-5-12
4	Flare thermal couples	Honeywell STT830-173-TC.M3.W1.CD-WEE0-H10S-T7G6-A05T(Y)240-2D-000	080609834	0-1300℃	2015-5-14	2016-5-10	2016-5-10	2016-5-12
			09-3180-01-04	0-1300℃	2015-5-14	2016-5-10	2016-5-10	2016-5-12
		Zhejiang Lunte H-WRNK-240-J	2012031767	-40-1100℃	2015-3-2	2016-2-28	2016-2-28	2016-3-1
5	Flare gas P	Rosemount 3051 TG1A2B21AB4E5M5	4793856	0-207 kPa	2015-3-18	Calibration on site	2016-3-10	Calibration on site
6	Phase 1 engine gas P	Hefei Keheng Automation Instrument KH-AFY801	114932	0-40 kPa	2015-3-18	Calibration on site	2016-3-10	Calibration on site
7	Phase 2 engine gas P	Rosemount 3051 TG1A2B21AE5Q4	5466031	-20-20Kpa	2015-3-18	Calibration on site	2016-3-10	Calibration on site

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No.	Name	Instrument type	SN	scale	2015 Calibration date	Removal date for calibration	2016 Calibration date	Installation date after calibration
8	Flare CH4%	Guardian plus, model:97460	26065	0-100%	2015-5-8	Calibration on site	2016-3-14	Calibration on site
9	Phase 1 engine CH4%	Guardian plus, model:97460	32624	0-100%	2015-3-18	Calibration on site	2016-3-14	Calibration on site
10	Phase 2 engine CH4%	Guardian plus, model:97460	29782	0-100%	2015-3-18	Calibration on site	2016-3-14	Calibration on site
11	Barometric pressure	Rosemount TA1A2B21JE5Q4	4980061	0-141.33 kPa	2015-3-18	2016-3-18	-	-
		Rosemount 3051 TA1A2B21AB4E5Q4	1794561	0-207Kpa	-	-	2016-3-15	2016-3-18
12	V-cone engine 1	MOORE-KINGWAYS (SHANGHAI)CONTROL SYSTEM CO.,LTD KVVW08IIKC24FWN	7092005	237.5-1900 m3/hr	2014-4-3	2016-3-24	2016-3-25	2016-3-28
13	DP engines 1	Rosemount 3051 CD1A22A1AM5B4K5	4870528	0-6.22 kPa	2015-3-18	Calibration on site	2016-3-10	Calibration on site
14	V-cone engine 2	MOORE-KINGWAYS (SHANGHAI)CONTROL SYSTEM CO.,LTD KVVW08IIKC24FWN	7092003	237.5-1900 m3/hr	2014-4-3	2016-3-24	2016-3-25	2016-3-28
15	DP engines 2	Rosemount 3051 CD1A22A1AM5B4K5	4879835	0-6.22 kPa	2015-3-18	Calibration on site	2016-3-10	Calibration on site
16	V-cone engine 3	MOORE-KINGWAYS (SHANGHAI)CONTROL SYSTEM CO.,LTD KVVW08IIKC24FWN	7092004	237.5-1900 m3/hr	2014-4-3	2016-3-24	2016-3-25	2016-3-28
17	DP engines 3	Rosemount 3051 CD1A22A1AM5B4K5	4870527	0-6.22 kPa	2015-3-18	Calibration on site	2016-3-10	Calibration on site
18	V-cone 1# flare	MOORE-KINGWAYS (SHANGHAI)CONTROL SYSTEM CO.,LTD KVVW10IAB24FWN	7102301	250-3000 m3/hr	2014-4-3	2016-3-24	2016-3-25	2016-3-28
19	DP 1# flare	Rosemount 3051 CD1A22A1AM5B4K5	4870526	0-6.22 kPa	2015-3-18	Calibration on site	2016-3-10	Calibration on site
20	V-cone 2# flare	MOORE-KINGWAYS (SHANGHAI)CONTROL SYSTEM CO.,LTD KVVW10IAB24FWN	7102302	250-3000 m3/hr	2014-4-3	2016-3-24	2016-3-25	2016-3-28

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No.	Name	Instrument type	SN	scale	2015 Calibration date	Removal date for calibration	2016 Calibration date	Installation date after calibration
21	DP 2# flare	Rosemount 3051CD2A22A1AM5I5	5489467	0-25 kPa	2015-3-18	Calibration on site	2016-3-10	Calibration on site
22	V-cone engine 4	Moore-Kingways (ShangHai) control system Co, Ltd. KVS06 II KC23FSN	9061201	200-2000 m3/hr	2014-4-3	2016-3-24	2016-3-25	2016-3-28
23	DP engines 4	Rosemount 3051 CD1A22A1AM5B4K5	5058739	0-6.216 kPa	2015-3-18	Calibration on site	2016-3-10	Calibration on site
24	V-cone engine 5	Moore-Kingways (ShangHai) control system Co, Ltd. KVS06 II KC23FSN	9061203	200-2000 m3/hr	2014-4-3	2016-3-24	2016-3-25	2016-3-28
25	DP engines 5	Rosemount 3051 CD1A22A1AM5B4K5	5058740	0-6.216 kPa	2015-3-18	Calibration on site	2016-3-10	Calibration on site
26	V-cone engine 6	Moore-Kingways (ShangHai) control system Co, Ltd. KVS06 II KC23FSN	9061204	200-2000 m3/hr	2014-4-3	2016-3-24	2016-3-25	2016-3-28
27	DP engines 6	Rosemount 3051 CD1A22A1AM5B4K5	5058741	0-6.216 kPa	2015-3-18	Calibration on site	2016-3-10	Calibration on site
28	V-cone engine 7	Moore-Kingways (ShangHai) control system Co, Ltd. KVS06 II KC23FSN	9061202	200-2000 m3/hr	2014-4-3	2016-3-24	2016-3-25	2016-3-28
29	DP engines 7	Rosemount 3051 CD2A22A1ADFE5Q4	5525313	0-20Kpa	2015-3-18	Calibration on site	2016-3-10	Calibration on site
30	V-cone for oil	MOORE-KINGWAYS (SHANGHAI)CONTR OL SYSTEM CO.,LTD KVV06IIAB24FWN	9102801	18000-180000 Kg/hr	2015-5-5	-	-	-
31	DP for oil	Rosemount: 3051CD2A22A1AM5B4K5	4870525	0-62.2 kPa	2015-3-18	Calibration on site	2016-3-10	Calibration on site
32	T- Oil outlet	SBWZPK-241	611052	0-300℃	2015-5-14	2016-5-6	2016-5-6	2016-5-12
33	T- Oil return	福耀石化 SBWZ-2480-6-GT	1	0-200 ℃	2015-5-14	2016-5-6	2016-5-6	2016-5-12
34	6.3KV power meter	Jiangsu linyang Electronics Co., Ltd DSSD71	0040	-	2015-4-23	2016-3-31	-	-
			0073	-	-	-	2016-3-16	2016-3-31

CDM-MR-FORM

No.	Name	Instrument type	SN	scale	2015 Calibration date	Removal date for calibration	2016 Calibration date	Installation date after calibration
35	35KV power meter	Weisheng Group DSSD331	110305993 60019	-	2015-4-23	2016-3-31	-	-
			090801306 90001	-	-	-	2016-3-16	2016-3-31

Appendix 4. Special CDM data events

Start time (GMT)	End time (GMT)	Length of event	Event / Cause	Action taken
2015-6-1	2015-6-28	28 days	Flare gas T fault – gas T was 0 while flare was running	Replace flare gas T with upper limit(100 °C)
2015-8-1 18:00:00	2015-8-2 3:00:00	10 hours	35kv fault - power generation through 6kv	No action required
2015-12-11 01:00:00	2015-12-11 06:00:00	6 hours	35kv fault - power generation through 6kv	No action required
2015-12-23 04:00:00	2015-12-23 12:00:00	9 hours	35kv fault - power generation through 6kv	No action required
2016-02-21 05:00:00	2016-02-21 10:00:00	6 hours	35kv fault - power generation through 6kv	No action required
2016-05-06 01:00:00	2016-05-06 04:00:00	4 hours	35kv fault - power generation through 6kv	No action required
2016-05-09 01:00:00	2016-05-09 04:00:00	4 hours	35kv fault - power generation through 6kv	No action required

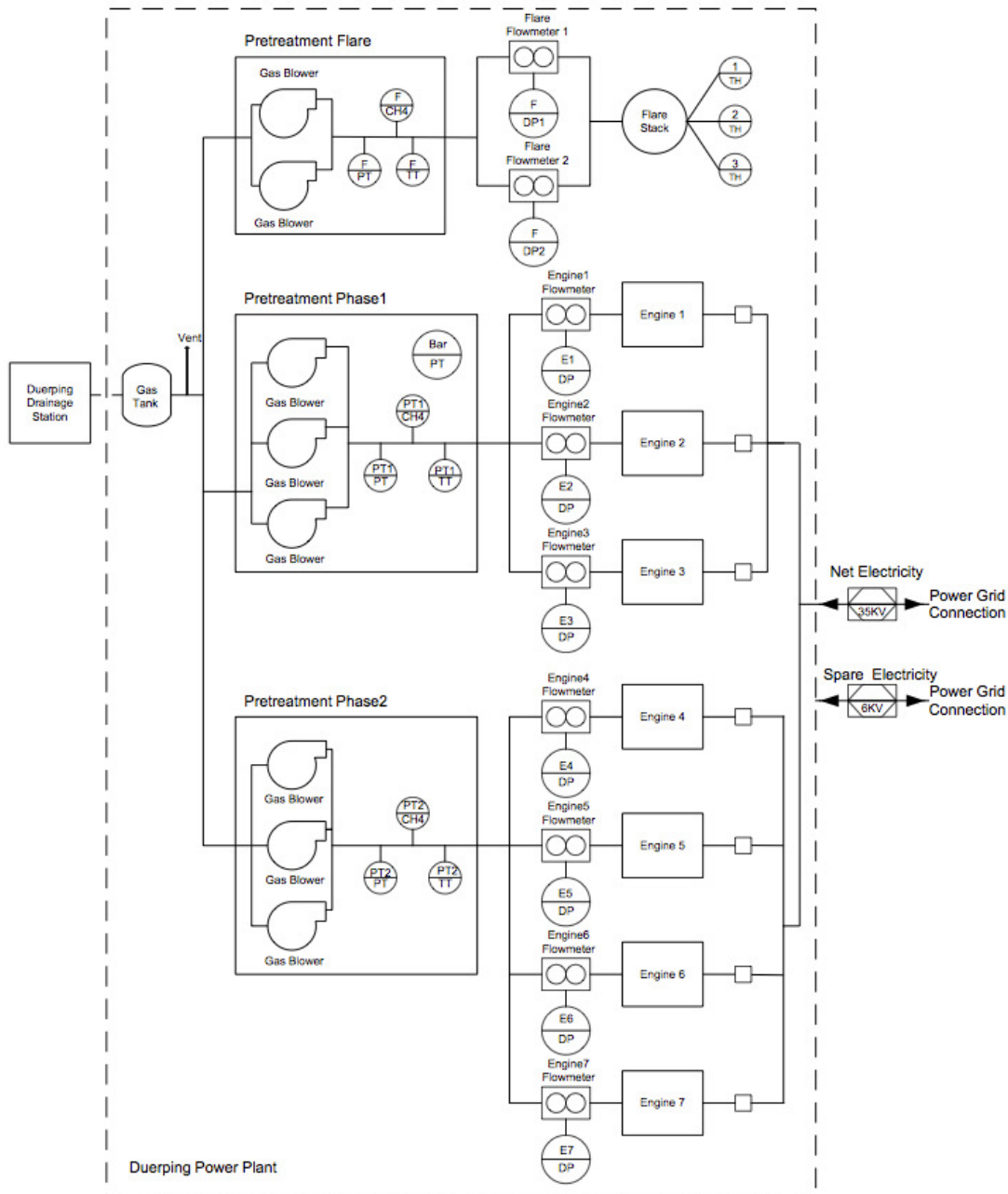
Appendix 5. Missing CDM data events

Start time (GMT)	End time (GMT)	Length of event (hh:mm:ss)
2015-08-01 16:00:00	2015-08-01 16:59:59	1:00:00
2015-08-26 06:00:00	2015-08-26 07:59:59	2:00:00
2015-10-20 00:00:00	2015-10-20 03:59:59	4:00:00
2015-10-21 00:00:00	2015-10-21 04:59:59	5:00:00
2016-05-12 03:00:00	2016-05-12 03:59:59	1:00:00
2016-05-22 00:00:00	2016-05-22 03:59:59	4:00:00

Appendix 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.

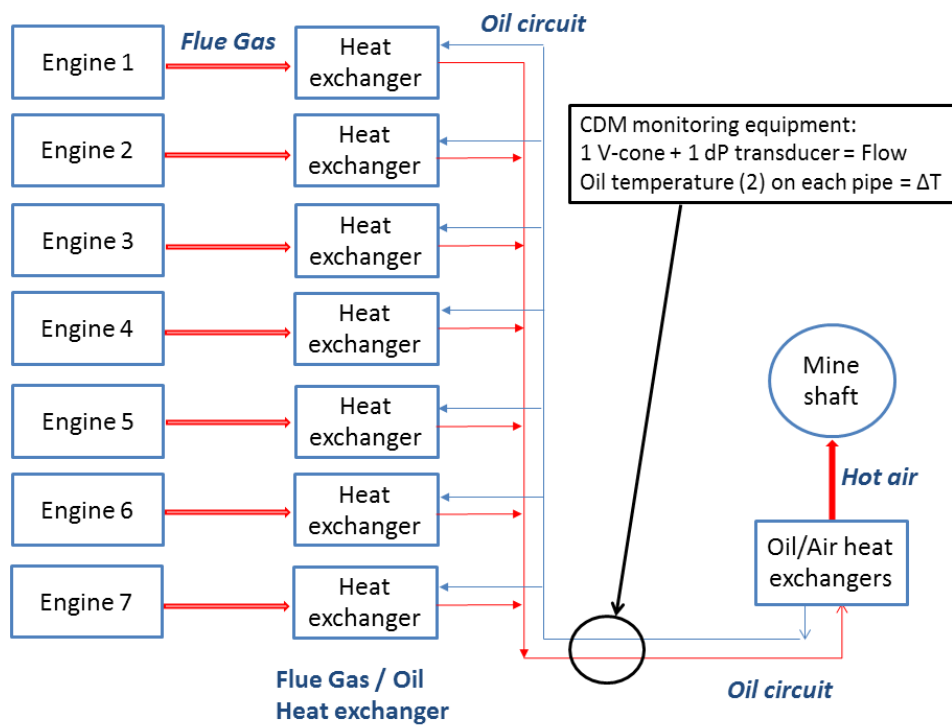
Detailed Flow Diagram showing implementation Phase 1 and 2:



Monitoring Equipment Legend

	Flowmeters		CH ₄ Infra-red Gas Analyser		Temperature Transmitters		Type N Thermocouple
	Pressure Transmitters		Differential Pressure Transmitters		Gas Blower		

Schematic flow diagram showing heat recovery system:



Appendix 7. Gas sample analysis

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检验报告

报告编号: 20160429-5

送检单位: 北京中法清洁能源技术有限公司
送检样品: 7669空气中CH₄混合气体样品
生产单位: 2016-4-14杜尔瓦克发电厂

一、检验依据: 华元公司HY-Q-W/118气相色谱法微量检测操作规范; HY-Q-W/10《静态容量法操作规范》; HY-Q-W/13《标准气管理方法》

二、检验方法:
1. 北京3420GC, TCD检测器, 2m×3mm 5A分子筛色谱柱;
2. 东西电子4008GC, FID检测器+甲烷转化器, 3m×3mm TDX-01色谱柱;
3. HP-5910GC, FID检测器, 50m×0.53mm 4L-01色谱柱。

三、参比标准: GBW(E)060574, GBW(E)060575, GBW(E)060579, GBW(E)060571, GBW(E)060579及静态容量法配制标准法(S06142)。

四、检验结果: 样品编号 746#

组分	二氯化碳 (CO ₂)	甲烷 (CH ₄)	氮气 (N ₂)	一氧化碳 (CO)	乙烷 (C ₂ H ₆)
分析检测结果 (v/v %)	1.83	53.4	8.23	0.00142	0.0070
不确定度 (k=2)	±0.02	±0.4	±0.1	±0.0001	±0.0005
检测方法	2	1	1	2	3

五、结论:
六、说明:
1. 本检验报告必须加盖“北京市华元气体化工有限公司质量检验专用章”方为有效;
2. 本检验报告只对送检样品负责

检验日期: 2016年4月29日
检验: (签字) 审核: (签字)
(质量检验专用章)

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检验报告

报告编号: 20150615-5

送检单位: 北京中法清洁能源技术有限公司
送检样品: SCC135空气中CH₄混合气体样品
生产单位: 2015-6-5杜尔瓦克发电厂

一、检验依据: 华元公司HY-Q-W/118气相色谱法微量检测操作规范; HY-Q-W/10《静态容量法操作规范》; HY-Q-W/13《标准气管理方法》

二、检验方法:
1. 北京3420GC, TCD检测器, 2m×3mm 5A分子筛色谱柱;
2. 东西电子4008GC, FID检测器+甲烷转化器, 3m×3mm TDX-01色谱柱;
3. HP-5910GC, FID检测器, 50m×0.53mm 4L-01色谱柱。

三、参比标准: GBW(E)060574, GBW(E)060575, GBW(E)060579, GBW(E)060571, GBW(E)060579及静态容量法配制标准法(S06142)。

四、检验结果: 样品编号 SCC135

组分	二氯化碳 (CO ₂)	甲烷 (CH ₄)	氮气 (N ₂)	一氧化碳 (CO)	乙烷 (C ₂ H ₆)
分析检测结果 (v/v %)	0.869	41.8	9.96	0.00136	0.0086
不确定度 (k=2)	±0.01	±0.4	±0.1	±0.0001	±0.0005
检测方法	2	1	1	2	3

五、结论:
六、说明:
1. 本检验报告必须加盖“北京市华元气体化工有限公司质量检验专用章”方为有效;
2. 本检验报告只对送检样品负责

检验日期: 2015年6月15日
检验: (签字) 审核: (签字)
(质量检验专用章)

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检验报告

报告编号: 20150615-6

送检单位: 北京中法清洁能源技术有限公司
送检样品: SCC139空气中CH₄混合气体样品
生产单位: 2015-6-5杜尔瓦克发电厂

一、检验依据: 华元公司HY-Q-W/118气相色谱法微量检测操作规范; HY-Q-W/10《静态容量法操作规范》; HY-Q-W/13《标准气管理方法》

二、检验方法:
1. 北京3420GC, TCD检测器, 2m×3mm 5A分子筛色谱柱;
2. 东西电子4008GC, FID检测器+甲烷转化器, 3m×3mm TDX-01色谱柱;
3. HP-5910GC, FID检测器, 50m×0.53mm 4L-01色谱柱。

三、参比标准: GBW(E)060574, GBW(E)060575, GBW(E)060579, GBW(E)060571, GBW(E)060579及静态容量法配制标准法(S06142)。

四、检验结果: 样品编号 SCC139

组分	二氯化碳 (CO ₂)	甲烷 (CH ₄)	氮气 (N ₂)	一氧化碳 (CO)	乙烷 (C ₂ H ₆)
分析检测结果 (v/v %)	0.869	41.4	10.2	0.00104	0.0086
不确定度 (k=2)	±0.01	±0.4	±0.1	±0.0001	±0.0005
检测方法	2	1	1	2	3

五、结论:
六、说明:
1. 本检验报告必须加盖“北京市华元气体化工有限公司质量检验专用章”方为有效;
2. 本检验报告只对送检样品负责

检验日期: 2015年6月15日
检验: (签字) 审核: (签字)
(质量检验专用章)

北京市华元气体化工有限公司
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检验报告

报告编号: 20150615-7

送检单位: 北京中法清洁能源技术有限公司
送检样品: 360空气中CH₄混合气体样品
生产单位: 2015-6-5杜尔瓦克发电厂

一、检验依据: 华元公司HY-Q-W/118气相色谱法微量检测操作规范; HY-Q-W/10《静态容量法操作规范》; HY-Q-W/13《标准气管理方法》

二、检验方法:
1. 北京3420GC, TCD检测器, 2m×3mm 5A分子筛色谱柱;
2. 东西电子4008GC, FID检测器+甲烷转化器, 3m×3mm TDX-01色谱柱;
3. HP-5910GC, FID检测器, 50m×0.53mm 4L-01色谱柱。

三、参比标准: GBW(E)060574, GBW(E)060575, GBW(E)060579, GBW(E)060571, GBW(E)060579及静态容量法配制标准法(S06142)。

四、检验结果: 样品编号 360

组分	二氯化碳 (CO ₂)	甲烷 (CH ₄)	氮气 (N ₂)	一氧化碳 (CO)	乙烷 (C ₂ H ₆)
分析检测结果 (v/v %)	0.724	38.0	10.7	0.00120	0.0071
不确定度 (k=2)	±0.01	±0.4	±0.1	±0.0001	±0.0005
检测方法	2	1	1	2	3

五、结论:
六、说明:
1. 本检验报告必须加盖“北京市华元气体化工有限公司质量检验专用章”方为有效;
2. 本检验报告只对送检样品负责

检验日期: 2015年6月15日
检验: (签字) 审核: (签字)
(质量检验专用章)

北京市华元气体化工有限公司
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检验报告

报告编号: 20160429-3

送检单位: 北京中法清洁能源技术有限公司
送检样品: SCC068空气中CH₄混合气体样品
生产单位: 2016-4-14杜尔瓦克发电厂

一、检验依据: 华元公司HY-Q-W/118气相色谱法微量检测操作规范; HY-Q-W/10《静态容量法操作规范》; HY-Q-W/13《标准气管理方法》

二、检验方法:
1. 北京3420GC, TCD检测器, 2m×3mm 5A分子筛色谱柱;
2. 东西电子4008GC, FID检测器+甲烷转化器, 3m×3mm TDX-01色谱柱;
3. HP-5910GC, FID检测器, 50m×0.53mm 4L-01色谱柱。

三、参比标准: GBW(E)060574, GBW(E)060575, GBW(E)060579, GBW(E)060571, GBW(E)060579及静态容量法配制标准法(S06142)。

四、检验结果: 样品编号 SCC068

组分	二氯化碳 (CO ₂)	甲烷 (CH ₄)	氮气 (N ₂)	一氧化碳 (CO)	乙烷 (C ₂ H ₆)
分析检测结果 (v/v %)	2.25	34.2	8.06	0.00138	0.0089
不确定度 (k=2)	±0.02	±0.4	±0.1	±0.0001	±0.0005
检测方法	2	1	1	2	3

五、结论:
六、说明:
1. 本检验报告必须加盖“北京市华元气体化工有限公司质量检验专用章”方为有效;
2. 本检验报告只对送检样品负责

检验日期: 2016年4月29日
检验: (签字) 审核: (签字)
(质量检验专用章)

北京市华元气体化工有限公司
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检验报告

报告编号: 20160429-4

送检单位: 北京中法清洁能源技术有限公司
送检样品: SCC168空气中CH₄混合气体样品
生产单位: 2016-4-14杜尔瓦克发电厂

一、检验依据: 华元公司HY-Q-W/118气相色谱法微量检测操作规范; HY-Q-W/10《静态容量法操作规范》; HY-Q-W/13《标准气管理方法》

二、检验方法:
1. 北京3420GC, TCD检测器, 2m×3mm 5A分子筛色谱柱;
2. 东西电子4008GC, FID检测器+甲烷转化器, 3m×3mm TDX-01色谱柱;
3. HP-5910GC, FID检测器, 50m×0.53mm 4L-01色谱柱。

三、参比标准: GBW(E)060574, GBW(E)060575, GBW(E)060579, GBW(E)060571, GBW(E)060579及静态容量法配制标准法(S06142)。

四、检验结果: 样品编号 SCC168

组分	二氯化碳 (CO ₂)	甲烷 (CH ₄)	氮气 (N ₂)	一氧化碳 (CO)	乙烷 (C ₂ H ₆)
分析检测结果 (v/v %)	2.27	35.0	7.81	0.00137	0.0090
不确定度 (k=2)	±0.02	±0.4	±0.1	±0.0001	±0.0005
检测方法	2	1	1	2	3

五、结论:
六、说明:
1. 本检验报告必须加盖“北京市华元气体化工有限公司质量检验专用章”方为有效;
2. 本检验报告只对送检样品负责

检验日期: 2016年4月29日
检验: (签字) 审核: (签字)
(质量检验专用章)

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Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
05.1	4 May 2015	Editorial revision to correct version numbering.
05.0	1 April 2015	Revisions to: <ul style="list-style-type: none"> • Include provisions related to delayed submission of a monitoring plan; • Provisions related to the Host Party; • Remove reference to programme of activities; • Overall editorial improvement.
04.0	25 June 2014	Revisions to: <ul style="list-style-type: none"> • Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1; • Change the reference number from <i>F-CDM-MR</i> to <i>CDM-MR-FORM</i>; • Editorial improvement.
03.2	5 November 2013	Editorial revision to correct table in page 1.
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01	28 May 2010	EB 54, Annex 34. Initial adoption.
Decision Class: Regulatory Document Type: Form Business Function: Issuance Keywords: monitoring report		