



**CLEAN DEVELOPMENT MECHANISM
PROGRAMME OF ACTIVITIES DESIGN DOCUMENT FORM
(CDM-POA-DD) Version 01**

CONTENTS

- A. General description of programme of activities (POA)
- B. Duration of the programme of activities
- C. Environmental Analysis
- D. Stakeholder comments
- E. Application of a baseline and monitoring methodology to a typical CDM Programme Activity (CPA)

Annexes

Annex 1: Contact information on Coordinating/managing entity and participants of POA

Annex 2: Information regarding public funding

Annex 3: Baseline information

Annex 4: Monitoring plan

NOTE:

This form is for the submission of a CDM POA whose CPAs apply a large scale approved methodology.

At the time of requesting registration this form must be accompanied by a CDM-CPA-DD form that has been specified for the proposed POA, as well as by one completed CDM-CPA-DD (using a real case).



SECTION A. General description of programme of activities (POA)

A.1 Title of the programme of activities:

Capture and combustion of Methane in coal mines

Version: 1.00

Date 29/5/2012

A.2. Description of the programme of activities:

Capture and combustion of Methane in coal mines (hereafter referred to as “The proposed POA”) mainly aims to reduce GHG emission by destroying methane emitted from coal mines in Africa using a range of technologies from flaring to combustion for electricity, heat generation and motive power. Excess energy will be exported to the grid as may excess methane piped off site. Coal Mine Methane (CMM) and Coal Bed Methane (CBM) are the sole focus of the POA. VAM is excluded from the POA and will remain vented to the atmosphere.

For safety in coal mines the methane concentration in the exhaust air of the mine is diluted to avoid the risk of explosion. Standard operating practice in mines¹ is to vent methane gas and release it from the mine as soon as practicable. Typically there is no national or sectoral policy that requires methane to be utilised other than vented from the mine for safety purposes.

CBM is released naturally as an open cast mine progresses in its development as a result of the removal of overburden and the lowering of the water table.

For safety reasons all VAM, CMM and CBM is typically released in the atmosphere in the business as usual (BAU) activity, which is also the identified baseline scenario.

In BAU, coal mines normally import grid power to meet the electricity demand during mining process. In the baseline a coal boiler is the normal heating source in coal mines.

The proposed POA

The objective of the POA is to transform common practice in COAL mines in Africa from releasing methane into the atmosphere to one of utilizing the methane as an energy source for the mine and nearby communities. The result will be a significant reduction in GHG emitted into the atmosphere. To achieve this goal the POA will:

- reduce greenhouse gas emissions by destroying methane
- replace electricity generated from the grid thereby displacing fossil fuel generation
- provide motive power for mine vehicles again replacing fossil fuels

¹ MOOIPLAATS COLLIERY “Mandatory Code of Practice for the Prevention of Flammable Gas and Coal Dust Explosions” 5 January 2009 pp 21 Coal of Africa CONFIDENTIAL



- replace heat generated by coal-fired boilers (Emission reductions from replacement of heat will not be claimed for conservativeness)
- compress gas to be piped off site for general use providing an alternative source of natural gas.

Stated Policy/Goal of the POA is

To facilitate Coal mines that currently emit methane in large quantities directly into the atmosphere to be able to utilise the POA to register a CPA that outlines a project at that specific coal mine to reduce methane emissions utilising the various options outlined in the POA

The coordinating/managing entity for the proposed POA is Environmental Intermediaries & Trading Group Limited of New Zealand (EITG) EITG will be the focal point for the UNFCCC EB and handle all communications with the EB

The proposed POA is a voluntary action by the coordinating/managing entity. The proposed POA will include entities which agree over the philosophy and carried out voluntary activity having same targets. That is, CPAs for reducing GHG emission by oxidizing methane performed at any coalmines in Africa, which meet the eligibility criteria, will be included in the proposed POA.

The expected result for the proposed POA is a significant reduction in GHG emissions compared to the emissions that would occur in the absence of the proposed POA. Furthermore, sustainable coal production can be promoted, and environmental and social/economic benefit can also be achieved.

a. Local and global environmental benefits

The proposed POA will contribute GHG emission reduction to local environment and therefore contributing to the mitigation of adverse impacts of climate change, both locally and globally.

The proposed POA may also displace thermal energy generated by conventional coal-fired boiler operated by coal mines and electricity from the Grid. By employing clean methane in generating thermal energy, the project will reduce SO_x and particulate matter emissions from the mine's coal-fired boiler and the predominantly coal-fired power plants operated by the Grid, therefore contributing to the mitigation of air pollution in the local area. Even if the thermal energy would be released without utilization, as flaring discharges exhaust gas without SO_x, NO_x, and particulate matter, and waste water, it means that the proposed POA will reduce substantial amount of GHG gas without creating a negative environmental impact in terms of air and water pollution.

b. Social-Economic benefits



The proposed POA will utilize methane as energy source, which would otherwise be released into the atmosphere under the baseline scenario, thus contributing to the establishment of a recycling-oriented and zero-emission society, and to the amelioration of the imbalance of energy supply/demand in the area where the proposed POA would be implemented.

The proposed POA will create new employment during the construction and operation of various mitigation options, which will thus contribute to the regional development of Africa.

In summary, the proposed POA will not only benefit global GHG emission reductions but also make a significant contribution to local environment and sustainable development.

A.3. Coordinating/managing entity and participants of POA:

The coordinating entity of the proposed POA is Environmental Intermediaries & Trading Group Limited. Coordinating/managing entity and project participants of this POA are listed as follows:

Name of Party involved (* (host) indicates a host Party)	Private and/or public entity(ies) ((CME) indicates the coordinating/managing entity)project participants (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
The Republic of South Africa (host)	Environmental Intermediaries & Trading Group Limited (CME)	No
United Kingdom	Gregory Services Limited	No

Environmental Intermediaries and Trading Group Limited shall be the focal point for communications with the UNFCCC EB.

Further contact information of coordinating entity and project participants is provided in Annex 1.

A.4. Technical description of the programme of activities:

A.4.1. Location of the programme of activities:

>>The sub continent of Africa

A.4.1.1. Host Party(ies):

>>

Initially the Republic of South Africa extending to other countries in the sub continent of Africa

A.4.1.2. Physical/ Geographical boundary:



The geographical boundary for the proposed POA includes all provinces of the Republic of South Africa extending over time to the rest of the sub continent of Africa including but not limited to Mozambique, Botswana, Namibia, and Kenya.

Figure-1 characterizes the geographical boundary of the proposed POA.



Figure-1 Geographical boundary of the proposed POA

A.4.2. Description of a typical CDM programme activity (CPA):

>>



A.4.2.1. Technology or measures to be employed by the CPA:

The proposed POA activity consists of CPAs which have the same technical concept. The process is to capture coal mine methane in order to destroy methane or pipe it to a location where it will be destroyed.

Energy may be produced by combustion of methane and this will be used to generate electricity, heat and motive power.

Each CPA included in the proposed POA has following five options or their combination; that is,

- (i) to release the thermal energy,
- (ii) to use the thermal energy for heating,
- (iii) to use the combustive energy to generate electricity
- (iv) the use of methane to generate motive power
- (v) the piping of the methane to a location where it will be used for options (i)-(iv) outside of the project boundary.

Schematic view of the technology to be employed by the proposed POA is presented in Figure-2:

The regulatory framework for coal mine methane of all the coal mines in Africa is the similar in all countries, the BAU scenario is the same, which means the baseline scenario is applicable to all the coal mines that meet the eligibility criteria of this POA.

Analysis of policies governing best practice and mine methane can be found in a 2010 UN paper². This POA will result in projects that follow the practices outlined in this document.

The US EPA also provides similar guidance in its best practice guide³.

Typically for a new mine, CBM will be captured in the first instance, and when the mine is operational CMM will be captured and utilized as outlined in this POA.

² United Nations Guides Best Practice Guidelines for Effective Methane Drainage 2010
www.unece.org/energy/se/.../BestPractGuide_MethDrain_es31.pdf [accessed 11 June 2012]

³ US EPA http://www.epa.gov/cmop/docs/analysis_best_practices.pdf [accessed 11 June 2012]

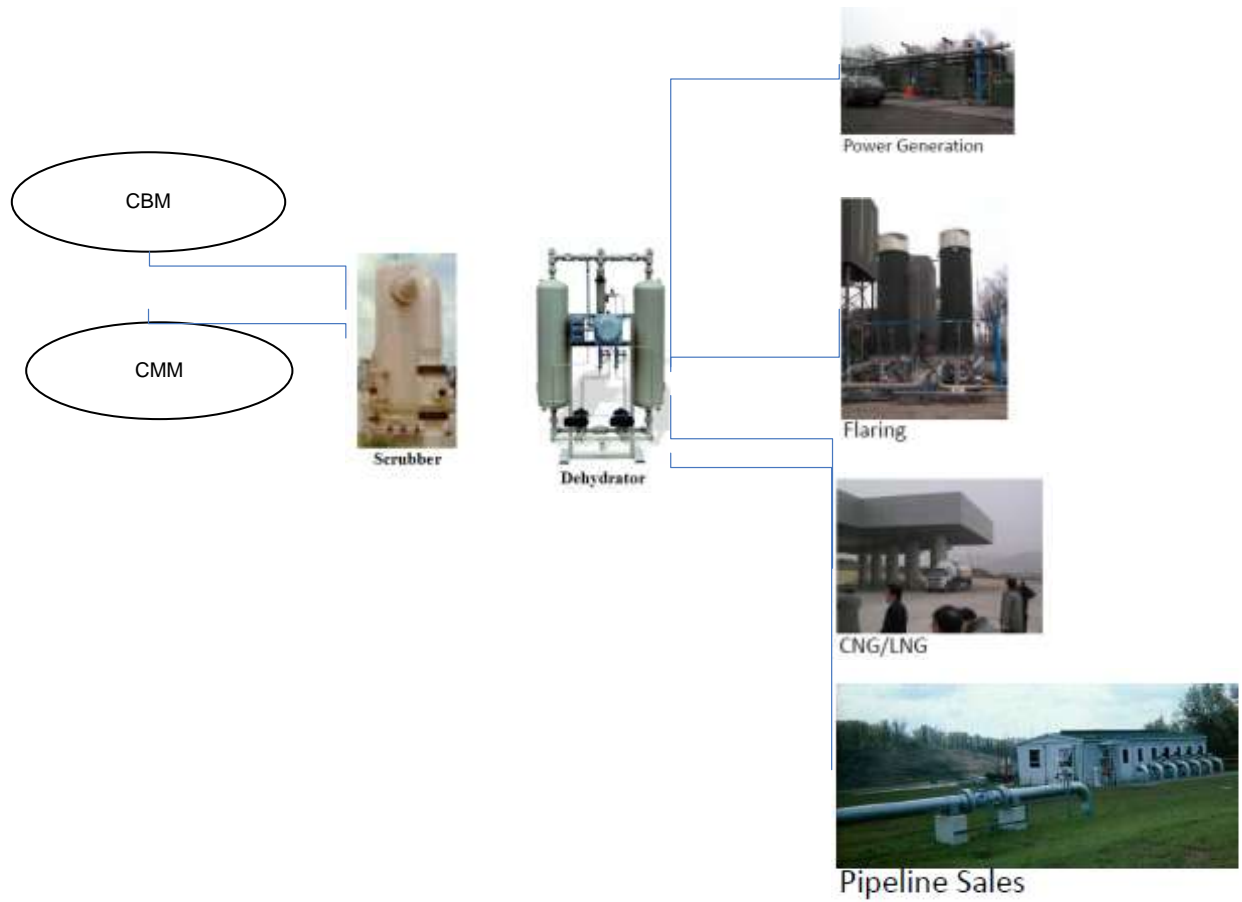


Figure-2 Schematic view of the technology to be employed by the proposed POA

Technology to be employed by each CPA in the proposed POA includes following equipment:



Scrubber



Dehydrator



>>

Medium Temperature Flare

CDM Compliant

- » Completely Enclosed Combustion
- » Low Capital and Operating Costs
- » Meets 40 CFR 60.18 regulations
- » 99% Destruction Efficiency
- » 10:1 Turndown Ratio
- » Only requires 220 btu/ft³ gas to maintain combustion



Jenbacher or similar gas engine with generator



A.4.2.2. Eligibility criteria for inclusion of a CPA in the POA:

>>

Following eligibility criteria should be applicable for inclusion of the CPA in the proposed POA:

These follow EB65 Annex 3 paragraph 14 and follow the same numbering scheme for (a)-(l)

- a) The geographic boundary of a CPA lies within Africa;
- b) A CPA will be checked by CME through dedicated management system to avoid double counting of emission reductions, including but not limited to sourcing declaration from the CPA participant, search of the relevant UN CDM⁴ databases, local DNA⁵ databases and careful recording of the CPA GPS coordinates. Each CPA shall include a statement that the project is included in this POA and not another PDD.
- c) All equipment used and specified in the CPA shall demonstrate
 - a. Compliance with CDM standards per the approved methodology used in the CPA
 - b. Have full operating and maintenance manuals
 - c. Clearly identify calibration procedures
 - d. Have a process to ensure accurate data capture
 - e. Where applicable electronically record data parameters as specified by the approved methodology
- d) The start date of the CPA must be readily able to be identified including but not limited to the following documents
 - a. Regulatory rights establishing licenses to operate the mine
 - b. Reports supporting the mine establishment process
 - c. A mine plan
 - d. Drilling plans and quotations
 - e. Quotations for the equipment supplied
 - f. Installation documents indicating the commissioning of the aforesaid equipment
- e) The CPA must describe a either an existing coal mine that currently does not capture methane, but vents such methane into the atmosphere or a coal mine that is to be established where the methane must be removed from the mine for safety reasons. The CPA must follow the methodology described by this POA in the establishment and operation of a methane capture and destruction system of any or all of the various options specified in this POA with the exception of a mine that currently captures VAM for the

⁴ <https://cdm.unfccc.int/Projects/projsearch.html> [last accessed 6 June 2012] ACM0008 no projects found

⁵ DNA data base for South Africa search

<http://www.energy.gov.za/files/esources/kyoto/2012/South%20African%20CDM%20Projects%20Portfolio%2030%20May%202012.pdf> [last accessed 6 June 2012] valid 30 May 2012



purposes of destruction of that VAM. That mine may still utilise the options from this POA

- f) The CPA must demonstrate that
 - a. The BAU activity involves the venting of methane into the atmosphere and
 - b. The activity in the absence of CDM fails to meet the threshold for financial additionality as follows:
 - i. The IRR of the CPA is calculated based on updated input parameters and assumptions and the method provided in section E.5.1 of CDM-POA-DD;
 - ii. The threshold shall be sourced by using Guidelines on the Assessment of Investment Analysis EB62 Report Annex 5 version 5.0 15/7/2011 being the IRR after taxes in the country in which the CPA is located⁶ using Group 2 subclass 8 mining/mineral production;
 - iii. The financial additionality is demonstrated by showing that the calculated IRR (without CDM) is below the applied investment benchmark in (ii) after carrying out sensitivity analysis.
 - c. Or this activity is the first of its kind in the region in which it will be established as defined in EB63 Annex 11
- g) The CPA must undertake stakeholder consultation and environmental impact assessment for the CPA following the process outlined in this POA including but not limited to
 - a. For stakeholder consultation
 - i. Advertising the project in a manner that would advise all potential stakeholders
 - ii. Holding stakeholder consultation meetings, keeping an attendance register and minutes noting comments from those stakeholders and where applicable:
 - iii. Taking action to address stakeholder concerns as part of the CPA
 - b. For environmental impact assessment
 - i. Where required by local law or regulation
 - 1. Complete an environmental impact assessment
- h) The CPA must include a statement that no official development assistance has been received to fund the CPA or any aspect of it by:
 - a. Providing letters of declaration in respect of the CPA parties
 - b. Providing 3 years financial accounts of the CPA parties to the DOE for review, such accounts shall be treated as confidential
- i) The target group for the CPA is coal mining companies and each CPA party will be an entity that in whole or part operates a coal mine.

⁶ In South Africa this IRR is 11.9%



- j) The CPA shall not use the process of statistical sampling to establish emissions reductions as each coal mine differs substantially from another based on a number of factors including geological and operational issues.
- k) This is not applicable as the POA does not use a small scale methodology
- l) This is not applicable as the POA does not use a small scale methodology
- m) The start date (defined in the Glossary of CDM terms) of the CPA is not prior to the commencement of validation of the POA;
- n) The CPA may be constructed at an opencast mine or a mine that is open cast that is then developed into an underground mine or any combination thereof. CBM option for methane gas extraction through surface well is specifically included;

A.4.3. Description of how the anthropogenic emissions of GHG by sources are reduced by a CPA below those that would have occurred in the absence of the registered POA (assessment and demonstration of additionality):

Additionality will be assessed at CPA level due to the variation between various locations, mines, local factors, such as environmental regulations, stakeholder concerns, prevailing regulations for the host country, the acceptable rate of return for investment in that location, the geology of the mine, logistics and political risks to name some of the variables that would change from CPA to CPA.

Whilst the principals remain, the derivation of those would vary from mine to mine and hence additionality tests per the tool for demonstration of additionality must be applied to each CPA in turn.

The information presented here shall constitute the demonstration of additionality of the POA as a whole.

- (i) The proposed POA is a voluntary coordinated action;

Currently in the BAU scenario, all methane emitted from coal mines in Africa is released into the atmosphere, because it is difficult and costly to utilize or destroy methane.

The proposed POA improves current practice by introducing technology to capture and utilize the methane. There are no national, province or local requirements providing for dealing with mine methane. Standard procedures and manuals call for the ventilation and dilution of methane for



safety reasons⁷. Therefore the proposed POA is a voluntary action to reduce GHG emissions implemented by the coordinating/managing entity.

- (ii) If the POA is implementing a voluntary coordinated action, it would not be implemented in the absence of the POA;

As described in E.5.1, any CPA under the proposed POA was financially not attractive, then no investment will be made into the CPAs in the absence of the POA. Major financial benefits generated by the proposed POA to the POA coordinator. This revenue from the sale of certified emissions reductions under the UNFCCC CDM. Without CER revenue, the POA coordinator has no obligation to, and cannot manage the POA and conduct coordination between all participants because it is a private entity. Thus, the voluntary coordinated action would not be implemented in the absence of the POA, and none of the CPA which would be included in the POA is likely to be implemented without CDM revenue.

- (iii) If the POA is implementing a mandatory policy/regulation, this would/is not enforced;

Not applicable.

- (iv) If mandatory a policy/regulation is enforced, the POA will lead to a greater level of enforcement of the existing mandatory policy/regulation.

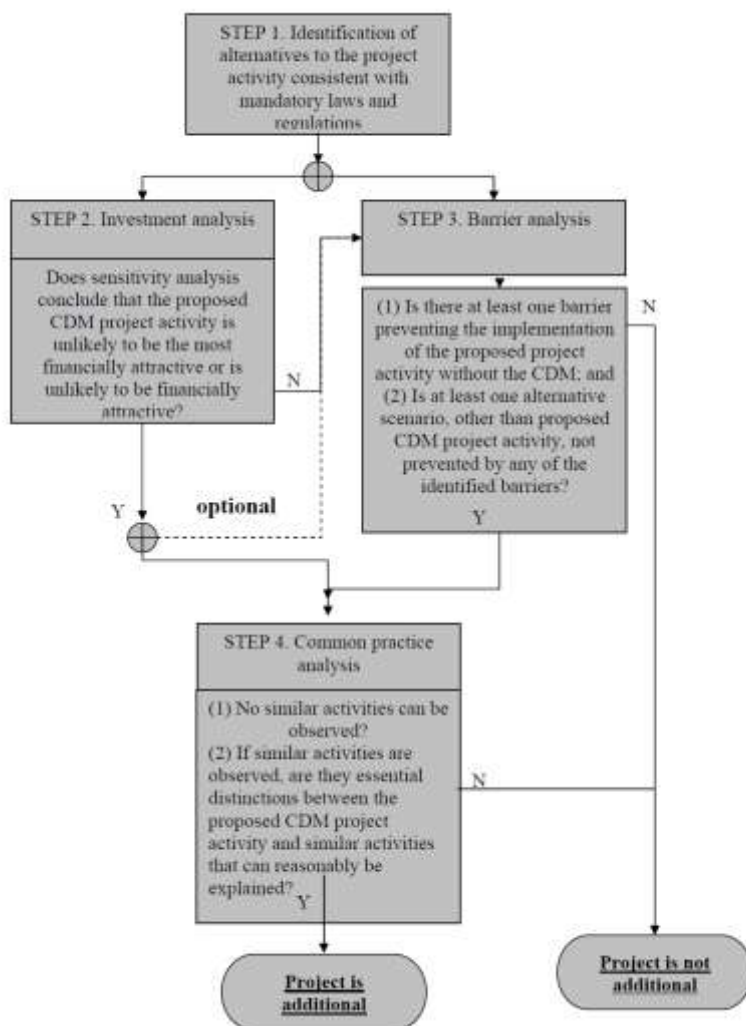
Not applicable.

Each CPA shall be subjected to analysis using the tool for the demonstration and assessment of additionality (Version 06.0), which links to:

<http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v6.pdf>

The process in flow chart form from the tool is as follows:

⁷ MOOIPLAATS COLLIERY “Mandatory Code of Practice for the Prevention of Flammable Gas and Coal Dust Explosions” 5 January 2009 pp 21 Coal of Africa CONFIDENTIAL



The steps required are as follows:

Step 1. Identification of alternatives to the project activity consistent with current laws and regulations:

Sub-Step 1a: Define alternative scenarios to the proposed CDM project activity

Alternative Scenarios for Mine Methane

Alternative Scenarios for Non-Mine Methane

Sub-Step 1b: Consistency with mandatory applicable laws and regulations:

State what options comply with the mandatory applicable laws and regulations.



National and Sectoral Policies and Regulations Relevant to Determining the Baseline Scenario

Step 2. Investment analysis:

Sub-step 2a. Determine appropriate analysis method

If the CPA generates no financial or economic benefits other than CDM related income use Option I

If the CPA creates income by saving electricity and/or coal for the coal mine self use other than CER revenue, an investment comparison (Option II) is used when the project is a new construction activity.

Benchmark analysis (Option III) is to be adopted depending on whether the CPA is a existing activity.

Sub-step 2b – Option I. Simple Cost Analysis

Document the costs associated with the CDM project activity and the alternatives identified in step 1 and demonstrate there is at least one alternative that is less costly than the project activity.

Sub-step 2b – Option II and III. Apply investment benchmark analysis

The IRR (Internal Rate of Return) is employed as the financial indicator for the benchmark analysis. The Guidelines on the Assessment of Investment Analysis EB62 Report Annex 5 version 5.0 15/7/2011 identifies the threshold IRR after taxes in respective countries for Group 2 subclass 8 mining/mineral production. Benchmark IRR chosen by the PDDs for CMM power generation projects uploaded on the UNFCCC website varies from 8% to over 15%. In order to be conservative the EB62 guidelines above are to be adopted to provide the benchmark IRR.

Sub-step 2c – Calculation and comparison of financial indicators

The IRR should be calculated based on all critical techno-economic parameters and assumptions. The key parameters and assumptions upon which the calculation is based are provided in Table-7.

Table-7 Key parameter and assumptions of investment analysis for a typical CPA

Item	Unit	Source
Total Investment	Million	FS Report
O& M Cost	Million /year	FS Report
Power Saved Amount (optional)	MWh/year	FS Report
Power Unit Price (including VAT) (optional)	/kWh	FS Report



Coal Saved Amount (optional)	t/year	FS Report
Coal Unit Price (optional)	/t	FS Report
Project Lifetime	years	FS Report
Depreciable Period	years	FS Report
Residual Value Rate	%	FS Report
Income Tax Rate	%	FS Report
VAT (for power) (optional)	%	FS Report
VAT (for heat) (optional)	%	FS Report
City Maintenance and construction tax rate	%	FS Report
Education additive charge rate	%	FS Report

The methodological tool states that: *If the CDM project activity has a less favorable indicator (e.g. lower IRR) than the benchmark, then the CDM project activity cannot be considered as financially attractive.*

Therefore, if the IRR of the CPA was falling less than the benchmark above (Project IRR after tax) requirement, the CPA could not be considered as financially attractive.

Sub-step 2d – Sensitivity analysis

A sensitivity analysis should be carried out to estimate whether the conclusion regarding the financial/economic attractiveness is robust to reasonable variation in the critical assumptions. An assessment is conducted of the impact that the parameters, total investment cost, operating cost, power price and power amount, heat price and heat amount will have the effect on the IRR (without CER revenues) when they fluctuate is in the range of -10% to +10%.

The methodological tool states that: *The investment analysis provides a valid argument in favor of additionality only if it consistently supports (for a realistic range of assumptions) the conclusion that the project activity is unlikely to be financially/economically attractive.*

If after the sensitivity analysis it is concluded that the CPA under the proposed POA is unlikely to be financially/economically attractive. Then proceed to Step 4 (Common practice analysis).

Step 3. Barrier analysis:

Sub-step 3a: Identify barriers that would prevent the implementation of alternative scenarios:

A list of the alternative scenarios and the investment, technological barriers and barriers due to prevailing practice that they face is presented below:

Alternative Scenarios for the Mine Methane

Scenario Ai: The VAM can be vented to atmosphere



Scenario Aii: The VAM can be destroyed or used in technology that can use VAM rather than venting it

Scenario Bi: The mine methane can be captured and vented above ground in a safe location

Scenario Bii: The captured mine methane can be flared above ground

Scenario Biii: The mine methane can be used for additional grid or captive power generation

Scenario Biv: The mine methane can be used for the generation of thermal heat, such as hot and/or chilled water and/or steam

Scenario Bv: The mine methane can be fed into a gas pipeline

Scenario Bvi: The mine methane can be used for electricity generation with the excess flared

Scenario Bvii: The mine methane can be used for electricity generation with the excess flared without being registered as a CDM project activity.

Scenario Ci: The electricity can be imported from the national grid

Scenario Cii: The electricity can be generated from fossil fuels other than mine methane

Scenario Ciii: The electricity can be generated from methane

Scenario Civ: The electricity can be generated from renewable energies

Sub-step 2b: Eliminate alternative scenarios which are prevented by the identified barriers:

Step 4. Common practice analysis:

Identify and discuss the existing common practice through the following Sub-steps:

Sub-step 4a. Analyze other activities similar to the proposed project activity:

Use as geographical boundary for common practice of the proposed CPA the country and therefore regulatory structure to which the mine is governed by.

Sub-step 4b. Discuss any similar options that are occurring:

If it is identified that similar activity is widely observed and commonly carried out in the sub-step 4a, essential distinctions between the project activity and similar activities should be reasonably explained in the sub-step 4b.



Therefore, if steps 2, investment analysis was satisfied, i.e., a CPA under the proposed POA was financially not attractive, then the CPA under the proposed POA is additional.

A.4.4. Operational, management and monitoring plan for the programme of activities:

A.4.4.1. Operational and management plan:

Management⁸ and operational scheme of the proposed POA is shown in Figure-5 below.

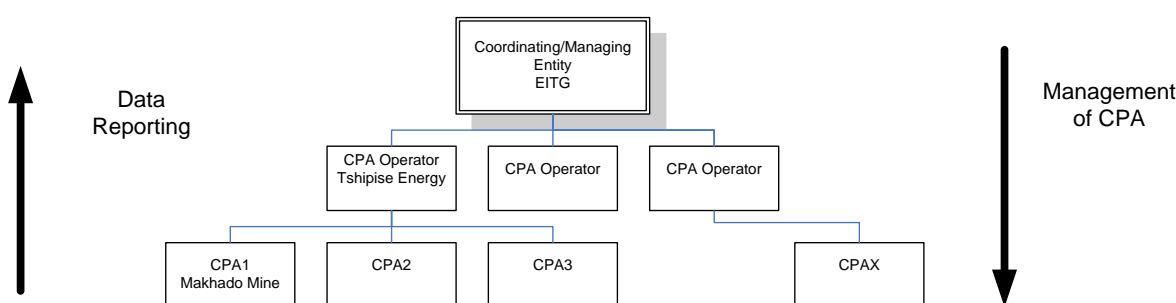


Figure-5 Management and operational scheme of the proposed POA

The coordinating/managing entity, Environmental Intermediaries & Trading Group Limited is in charge of coordinating all project participants of the proposed POA, collecting necessary data and information from each CPA for the purpose of monitoring, and also communicating with DOE and CDM Executive Board.

- (i) A record keeping system for each CPA under the POA.

Each CPA is operated by a CPA operator under the control of the coordinating/managing entity. The CPA operator reports monitored data to the managing/coordinating entity.

The record keeping system consists of the method of data monitoring, the duty and roles of each participants and the database including all necessary information/data of each CPA. The database is completed by CPA operators through *ex ante* and *ex post* survey of entire activity. The database is submitted to the coordinating entity periodically. The CME verifies the reported data with field check if necessary.

Related responsibilities and tasks of participants under the record keeping system are described in the Table-1 below.

⁸ EITG Code of Practice Manual for CPA inclusion in POA Revision 001 effective date January 2012



Table-1 Responsibilities and tasks of the participants to the POA

Activities	Entity in Charge	Task Description
Inclusion of CPA	CME will receive and approve the request for inclusion of a CPA	Receive and approve formal written request for CPA inclusion. Sign the agreement on the participation in the POA and CER revenue allocation framework
Writing Stakeholder guideline	CME will provide the guideline and be responsible for the implementation.	Writing POA guideline with instruction for all involved stakeholders to clarify responsibility and tasks.
Monitoring	Monitoring data will be collected and archived according to approved methodology.	Collection of monitoring data
Data archiving and analysis	Monitoring data are sent to CME, and then archived and analyzed by CME.	Maintaining data base and provide the data in a suitable format for calculating emission reduction.
CDM application	CME will take the full responsibility for the CDM application.	Develop and register the POA as along the CDM regulations.
CER trading and revenue allocation	CME will be in charge of trading the CERs and allocating the revenue based on the agreement with the related project participants.	Trading CERs and allocate revenue.
Communication and reporting	CME is responsible for coordinating between project participants and communicating with DOE and CDM EB.	Communication between project participants and with DOE and CDM EB, and reporting monitoring data, et al.

- (ii) A system/procedure to avoid double accounting e.g. to avoid the case of including a new CPA that has been already registered either as CDM project activity or as a CPA of another POA.

The operator of a CPA shall, in accordance with the eligibility criteria in section 4.2.2, confirm with a written statement at the time of CPA inclusion that any methane capture system under the CPA does not belong to another CPA under this POA, another registered CDM project activity or another CDM POA.



CME will check the CPA against the eligibility criteria and other information including but not limited to the Host Country DNA website and UNFCCC website to confirm no other projects CPA or PDD exist that will result in double counting of emissions reductions.

- (iii) The provisions to ensure that those operating the CPA are aware and have agreed that their activity is being subscribed to the POA;

As per the eligibility criteria for CPAs in section 4.2.2, the operator shall also confirm with a written statement that they are aware that the CPA will be subscribed to the POA.

A.4.4.2. Monitoring plan:

- (i) Description of the proposed statistically sound sampling method/procedure to be used by DOEs for verification of the amount of reductions of anthropogenic emissions by sources or removals by sinks of greenhouse gases achieved by CPAs under the POA.

The POA monitoring plan does not involve any sampling among CPAs. Each CPA of the proposed POA is to be monitored according to the approved methodology ACM0008 VERSION 7. A database will be maintained by CME for all data collected at the CPA level to ensure quality control and that no double counting occurs.

- (ii) In case the coordinating/managing entity opts for a verification method that does not use sampling but verifies each CPA (whether in groups or not, with different or identical verification periods) a transparent system is to be defined and described that ensures that no double accounting occurs and that the status of verification can be determined anytime for each CPA;

All relevant parameters included in the monitoring plan shall be monitored and recorded for each included CPAs independently. Monitoring reports will be prepared separately for each of the CPAs for the purpose of verification and request for issuance of CERs. To guarantee the uncomplicated access to the CPA data, the coordinating entity will maintain a database for all included CPAs.

A.4.5. Public funding of the programme of activities:

>>

No public funding from Parties included in Annex I countries is involved. With each CPA a declaration from the CME confirming no Annex I funding is involved will be supplied. Also each party to the CPA will supply a similar declaration along with copies of their financial accounts demonstrating the same.



SECTION B. Duration of the programme of activities

B.1. Starting date of the programme of activities:

The starting date of the POA is 31st December 2012

B.2. Length of the programme of activities:

The length of the proposed POA is 28 years.

C.1. Please indicate the level at which environmental analysis as per requirements of the CDM modalities and procedures is undertaken. Justify the choice of level at which the environmental analysis is undertaken:

>>

1. Environmental Analysis is done at POA level
2. Environmental Analysis is done at CPA level

C.2. Documentation on the analysis of the environmental impacts, including transboundary impacts:

Not applicable. Environmental Analysis is done at CPA level due to the wide range of circumstances, including location specific regulations, and potential range of environmental effects created by each project. Given the diversity of types of mines and their differing operations and local regulations environmental impacts will vary widely between CPA. Where required by the prevailing regulation in the jurisdiction they are located environmental impact assessments are to be provided at CPA level.

C.3. Please state whether in accordance with the host Party laws/regulations, an environmental impact assessment is required for a typical CPA, included in the programme of activities (POA);

In line with the national law/regulations, an Environmental Impact Assessment (EIA) should be carried out and approved by the environmental agency in charge of environmental protection before a CPA would start. The EIA should be carried out for the following Environmental impact:

- Expected Environmental impacts during construction, on such as atmosphere, noise, waste water and solid waste;
- Expected Environmental impacts during operation, on such as atmosphere, noise, waste water and solid waste.

SECTION D. Stakeholders' comments

>>



D.1. Please indicate the level at which local stakeholder comments are invited. Justify the choice:

1. Local stakeholder consultation is done at POA level
2. Local stakeholder consultation is done at CPA level

D.2. Brief description how comments by local stakeholders have been invited and compiled:

Not applicable. Local stakeholder consultation is done at CPA level due to the wide range of circumstances and effects created by each project. Given the diversity of types of mines and their differing operations and localities stakeholder impacts will vary widely between CPA. Given these facts it is considered prudent to engage stakeholders at CPA level to ensure each CPA can be specifically tailored to address stakeholder comments.

D.3. Summary of the comments received:

Not applicable. Local stakeholder consultation is done at CPA level.

D.4. Report on how due account was taken of any comments received:

Not applicable. Local stakeholder consultation is done at CPA level.

SECTION E. Application of a baseline and monitoring methodology

This section shall demonstrate the application of the baseline and monitoring methodology to a typical -CPA. The information defines the POA specific elements that shall be included in preparing the POA specific form used to define and include a CPA in this POA (POA specific CDM-CPA-DD).

E.1. Title and reference of the approved baseline and monitoring methodology applied to each CPA included in the POA:

- (a) Approved consolidated methodology ACM0008 VERSION 7; “Consolidated methodology for coal bed methane, coal mine methane and ventilation air methane capture and use for power (electrical or motive) and heat and/or destruction through flaring or flameless oxidation”, which links to:
<http://cdm.unfccc.int/UserManagement/FileStorage/FRLOKZ8HJ1PD62VAY3UW75B49CQXE>
- (b) The tool for the demonstration and assessment of additionality (Version 06.0), which links to:



<http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v6.pdf>
 The tool to calculate the emission factor for an electricity system (Version 02.2.1), which links to:
<http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.2.1.pdf>
 The tool to determine project emissions from flaring gases containing methane
<http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-06-v1.pdf>

E.2. Justification of the choice of the methodology and why it is applicable to each CPA:

ACM0008 VERSION 7 defines the applicability of this methodology. The following Table-2 and Table-3 explain the reason why the methodology applies to each CPA:

Table-2 Comparison of extraction components of each CPA with applicability of ACM0008 VERSION 7

ACM0008 VERSION 7 Applicability	Extraction Components of a CPA
Surface drainage boreholes to capture CBM associated with mining activities	The proposed CPA involves the extraction of CBM
Underground boreholes in the mine to capture pre mining CMM	Included
Surface goaf wells, underground boreholes, gas drainage galleries or other goaf gas capture techniques, including gas from sealed areas, to capture post mining CMM	Underground boreholes, gas drainage galleries or some other goaf gas capture techniques are adopted to capture the post mining CMM.
Ventilation air methane that would normally vented	Excluded and remains vented to the atmosphere

Table-3 Comparison of the utilization components of each CPA with applicability of ACM0008 VERSION 7

ACM0008 VERSION 7 Applicability	Utilization Components of a CP
The methane is captured and destroyed through flaring	Initially flaring will be involved in the project and as volume increases this gas will be captured to generate electricity. Flaring will continue where the cost of the pipeline outweighs the return on electricity generation.
The methane is captured and destroyed through oxidation with or without utilization of the thermal energy	The methane in CBM/CMM will be captured and destroyed by oxidation with or without utilization of the thermal energy.
The methane is captured and destroyed through utilization to produce electricity, motive power	The methane will be captured and destroyed through combustion to produce electricity



and/or thermal energy; emission reductions may or may not be claimed for displacing or avoiding energy from other sources	and/or heat; emission reduction for displacing heat from coal-fired boilers will not be claimed. This is conservative.
The remaining share of the methane, to be diluted for safety reason, may still be vented	VAM will still be vented in the project.
All the CBM or CMM captured by the project should either be used or destroyed, and cannot be vented	All of the CBM/CMM captured by the project will either be used or destroyed, and cannot be vented.

The project may be constructed at an opencast mine, an underground mine or a mine that is a combination of the two.

Table-4 Comparison of the utilization components of each CPA with applicability of ACM0008 VERSION 7 for open cast mines

ACM0008 VERSION 7 Applicability	Utilization Components of a CP
The mine should have been a working concession for 3 years	Only mines that have been a concession for 3 years will be included
The methane is captured and destroyed through use of flameless oxidizers	Excluded. CPA will not use flameless oxidizers to destroy methane
Only pre mine drainage from wells placed within the area to be mined are considered as eligible for crediting	Included
Such pre mine drainage well life may be credited up to but no more than ten years prior to actual mining or the date of issuance of mining concession whichever is later	Included
Avoided emission from methane extracted should only be credited in the year in which the seam is mined through the zone of influence or the de stressing zone	Included

Project participants is able to supply the necessary to data for ex ante projections of methane demand as described in sections Baseline Emissions and Leakage to use the methodology.

ACM0008 VERSION 7 also defines the types of activities that could not be applied to this methodology. Each CPA does not apply to any of those activities (Table-5):

Table-5 Comparison of each CPA with incompatibility of ACM0008 VERSION 7

ACM0008 VERSION 7 Inapplicability	CPA
--	------------



Capture methane from abandoned /decommissioned coal mines	The proposed CPA is implemented at a working coal mine
Capture/use of virgin coal-bed methane, e.g. methane of high quality extracted from coal seams independently of any mining activities	All of methane captured/used in the project is dependent with mining activity
Use CO2 or any other fluid/gas to enhance CBM drainage before mining takes place	CBM extraction will not be enhanced in any way
CBM captured outside the zone of influence of the mining activity	Each well will be assessed to establish its involvement or otherwise in the zone of influence of the mine. Methane from each well will be then treated as eligible for CER or the emissions accounted for in the project boundary

It can be concluded from the above analysis that the proposed project complies with both the baseline and the monitoring methodologies of ACM0008 VERSION 7.

E.3. Description of the sources and gases included in the CPA boundary.

Based on the conditions required in the methodology and the eligibility criteria, the project boundary for this project activity is presented in Figure-6, and the overview on emissions sources including in or excluded from the project boundary is presented in Table-5.

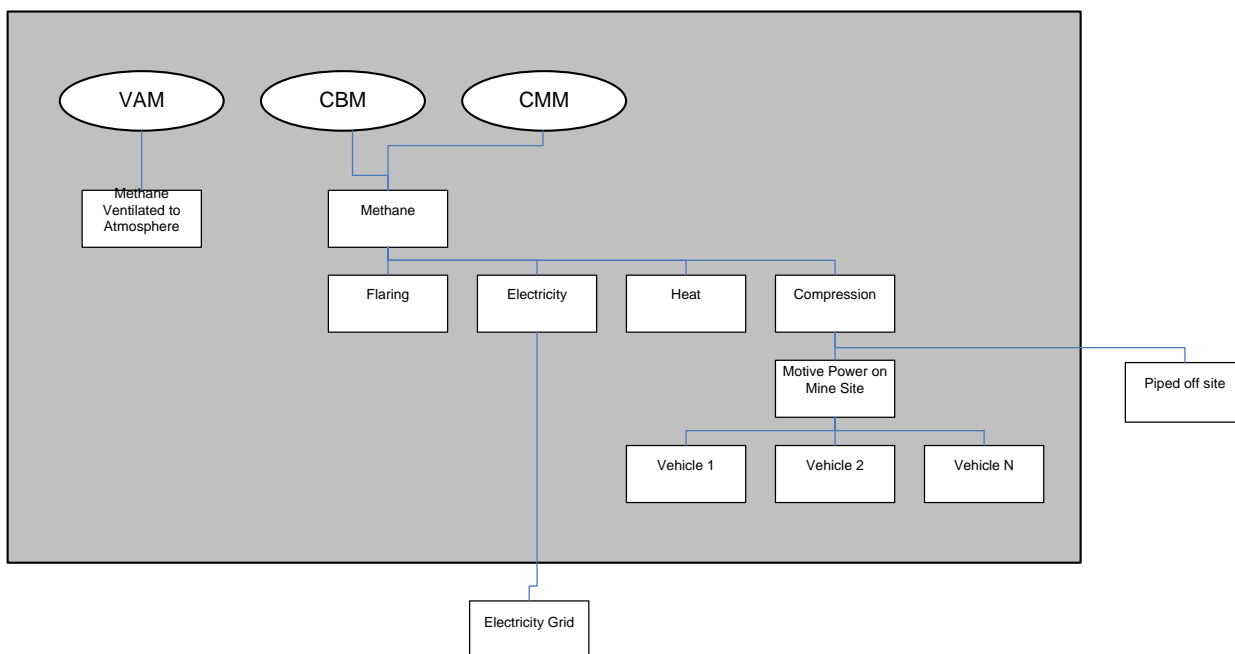


Figure-6 Typical CPA boundary under the proposed POA



Table-5 Overview on emissions sources included in or excluded from the typical CPA boundary

	Source	Gas		Justification / Explanation
Baseline Emissions	Emissions of methane as a result of venting	CH ₄	Included	<ul style="list-style-type: none"> Main emission source. However, certain sources of methane may not be included, as noted in the applicability conditions; Recovery of methane from coal seams will be taken into account only when the particular seams are mined through or disturbed by the mining activity; Recovery of methane from abandoned coalmines will not be included; The amount of methane to be released depends on the amount used (for local consumption, gas sales, etc) in the baseline
	Emissions from destruction of methane in the baseline	CO ₂	Included	Considers any flaring or use for heat and power in the baseline scenario
		CH ₄	Excluded	Excluded for simplification. This is conservative
		N ₂ O	Excluded	Excluded for simplification. This is conservative
	Grid electricity generation (electricity provided to the grid)	CO ₂	Included	<ul style="list-style-type: none"> Only CO₂ emissions associated to the same quantity of electricity than electricity generated as a result of the use of methane included as baseline emission will be counted; Use of combined margin method as described in “Tool to calculate the emission factor for an electricity system” should be made
		CH ₄	Excluded	Excluded for simplification. This is conservative
		N ₂ O	Excluded	Excluded for simplification. This is conservative
	Captive power and/or heat, and vehicle fuel use	CO ₂	Included	Only when the baseline scenario involves such usage
		CH ₄	Excluded	Excluded for simplification. This is conservative
		N ₂ O	Excluded	Excluded for simplification. This is conservative



	Source	Gas		Justification / Explanation
Project Emissions	Emissions of methane as a result of continued venting	CH ₄	Excluded	Only the change in CMM/CBM/VAM emissions release will be taken into account, by monitoring the methane used or destroyed by the project activity
	On-site fuel consumption due to the project activity, including transport of the gas	CO ₂	Included	If additional equipment such as compressors or fans are required on top of what is required for purely drainage, energy consumption from such equipment should be accounted for
		CH ₄	Excluded	Excluded for simplification. This emission source is assumed to be very small
		N ₂ O	Excluded	Excluded for simplification. This emission source is assumed to be very small
	Emissions from methane destruction	CO ₂	Included	From the combustion of methane in a flare, flameless oxidation, or heat/power generation
	Emissions from NMHC destruction	CO ₂	Included	From the combustion of NMHC in a flare or flameless oxidizer, or heat/power generation, if NMHC accounts for more than 1% by volume of extracted coal mine gas
	Fugitive emissions of unburned methane	CH ₄	Included	Small amounts of methane will remain unburned in flares, flameless oxidizers or heat/power generation
	Fugitive methane emissions from on-site equipment	CH ₄	Excluded	Excluded for simplification. This emission source is assumed to be very small
	Fugitive methane emissions from gas supply pipeline or in relation to use in vehicles	CH ₄	Excluded	Excluded for simplification. However taken into account among other potential leakage effects (see leakage section)
	Accidental methane release	CH ₄	Excluded	Excluded for simplification. This emission source is assumed to be very small

E.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:



The baseline scenario of CPAs is identified according to approved methodology ACM 0008 (version 7).

CPAs in the proposed POA only includes destruction/utilization of CBM/CMM. The VAM will still be vented to the atmosphere.

Therefore those baseline scenario alternatives concerning only extraction and treatment of CBM/CMM are included in the following discussions.

Step 1. Identify technically feasible options for capturing and/or using CBM or CMM or VAM

Step 1a. Options for CBM and CMM or VAM extraction

Following options could be included:

- A. Ventilation air methane extraction;
- B. Pre mining CBM extraction;
- C. Pre-mining CMM extraction;
- D. Post-mining CMM extraction;
- E. Possible combination of A, B,C and D with the relative gas shares specified.

Option B,C,D is the proposed project activity not implemented as a CDM project.

Typical gassy coal mine carries out a combination of CBM, and pre-mining and post-mining CMM by underground boreholes. However, pre-mining and post-mining CMM are normally both brought to the gas drainage station on the surface through the same drainage lines, and it is therefore impossible to specify the share of CMM captured by each method. CBM eligible for CDM can be established from ACM0008 VERSION 7.

Step 1b. Options for extracted CBM and CMM or VAM treatment

The possible options are as follows:

- i. Venting;
- ii. Flaring;
- iii. Use for additional grid power generation;
- iv. Use for additional captive power generation;
- v. Use for additional heat generation;
- vi. Compressed for used as a fuel for vehicles at the mine site;
- vii. Feed into gas pipeline for use in a range of activities;

Possible combinations of options i-vii with the relative shares of gas treated under each option specified is the proposed project activity not implemented as a CDM project.

The technology to handle VAM is early stage and difficult to operate often underperforming its specifications.



To summarize the above analysis, the options left for Methane treatment, those are:

- i. Venting;
- ii. Using/destroying ventilation air methane rather than venting it;
- iv. Use for additional grid power generation;
- v. Use for additional captive power generation;
- vi. Use for additional heat generation;

Possible combinations of options i, ii, iv or v, and vi with the relative shares of gas treated under each option specified is the proposed project activity not implemented as a CDM project.

Step 1c. Options for energy production

Options for energy production in a CPA involve heat generation for producing hot water and/or combustion to generate electricity with combustion/steam and/or compression for motor vehicle use and/or feeding into a pipeline for use outside the project boundary. The baseline scenario alternatives envisaged for energy production include the following options:

1. Electricity from a Grid;
2. Power generation from captive fossil fuel fired power plants;
3. Power generation using captured CMM/CBM;
4. Heat generation using captured CMM/CBM;
5. Heat generation from coal boilers;

Possible combination of option 1, 3, 4, and 5 with the relative shares of energy production under each option specified is the proposed CPA not implemented as a CDM project.

Step 2. Eliminate baseline options that do not comply with legal or regulatory requirements

It is requirement for coal mines that methane concentration in the ventilation air of the mine to be below specified levels to avoid the risk of explosion. Solely adopting ventilation in a coal mine could not satisfy the requirement to avoid an explosive volume of methane. Coalmine Safety Regulation requires methane to be extracted at gas drainage station built above ground.

Therefore, in the CPAs, gas must be extracted employing underground boreholes. It is also difficult to specify the share of gas of pre-mining CMM and post-mining CMM in the normal case, because they are brought to the surface through the same extraction system.

Based on the above considerations, options A, B, C and D in *step 1a* do not comply with regulatory requirements solely. Thus, option A, B, C and D in *step 1a* could be eliminated.



Methane concentration of VAM is limited by regulation to avoid the risk of explosion. There is no law or regulation requiring destruction or utilization of VAM, or giving any instruction on how to destruct or utilize VAM. There are no legal requirements for utilizing CMM or CBM.

Hence the above listed all options in the proposed CPA in *step 1b* are in compliance with legal and regulatory requirements.

Step 3. Formulate baseline scenario alternatives:

Based on the consideration of the baseline options that are technically feasible and comply with regulatory requirements, the following baseline options are identified.

Options in *step 1a*:

E. Possible combination of A, B, C and D.

Options in *step 1b*;

- i. Venting;
- ii. Flaring;
- iii. Use for additional grid power generation;
- iv. Use for additional captive power generation;
- v. Use for additional heat generation;
- vi. Compressed for used as a fuel for vehicles;
- vii. Feed into gas pipeline for use in a range of activities;

Possible combinations of options i-vii with the relative shares of gas treated under each option specified is the proposed project activity not implemented as a CDM project.

Options in *step 1c*:

1. Electricity from a Grid;
2. Power generation from captive fossil fuel fired power plants;
3. Power generation using captured CMM/CBM;
4. Heat generation using captured CMM/CBM;
5. Heat generation from coal boilers;

Possible combination of option 1-5 with the relative shares of energy production under each option specified is the proposed project activity not implemented as a CDM project.

Combining the above baseline options, the projected baseline scenario is as follows:



Table 6 Possible baseline scenarios

Scenario	CMM or CBM extraction	CMM or CBM Treatment	Electricity Generation	Heat Generation	Description of the Scenario
Scenario I (business as usual scenario)	D	i	1	5	Gas extraction is a combination of CMM and CBM. CMM or CBM can be combusted via flaring or used for electricity generation or heat generation, with the relative shares of each option specified. The coal mine's electricity demand is met through the grid, as well as electricity generated from methane combustion, if applicable. The coal mine's heat demand is supplied by its own coal boilers, as well as heat generated from methane combustion applicable.
Scenario II (the proposed CPA not implemented as a CDM project).	E	Possible combinations of options i-vii	Possible combinations of options 1-5	Possible combinations of 1-5	Gas extraction is a combination of CMM and CBM. Methane is either combusted by flaring or use in electricity generation. Excess can be compressed and used for motive power or piped off site. The relative shares of each option specified. The coal mine's electricity demand is met through the grid. The coal mine's heat demand is supplied by its



					own coal boilers.
--	--	--	--	--	-------------------

Step 4. Eliminate baseline scenario alternatives that face prohibitive barriers

Scenario I: This is the BAU scenario and faces no barriers.

Scenario II: This is the proposed CPA not implemented as a CDM project.

The utilisation of mine methane for flaring, electricity generation or compression for vehicle use or pipelines has only occurred once in South Africa and NOT at a coal mine.

This CDM project 4728 The Capture and Utilisation of Methane at the Gold Fields owned Beatrix Mine⁹ uses ACM00074 which was derived from ACM0008 VERSION 7 the selected methodology in this case. As a result, the technical risks to install and operate the power generation and compression equipment are considered to be significant, thus this scenario faces **barriers due to prevailing practice.**

Moreover, according to the eligibility criteria described in A.4.2.2, calculated IRR of a proposed CPA without CDM revenue should be below the applied investment benchmark¹⁰ of 11.9% for an electricity generator and well below that of a Mine operator¹¹. Flaring alone has a negative financial return unless it is operated as part of a CDM. CBM is naturally released as the water table is lowered and the overburden removed in an opencast mine.

These considerations exclude scenario II from being as a baseline scenario.

As a result of above consideration, **Scenario I** (business as usual scenario) is the only scenario that does not face prohibitive barriers.

E.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the CPA being included as registered POA (assessment and demonstration of additionality of CPA): >>

E.5.1. Assessment and demonstration of additionality for a typical CPA:

As required by methodology ACM0008 VERSION 7, the latest version of the “Tool for the demonstration and

⁹ <http://cdm.unfccc.int/Projects/Validation/DB/FZNY1KDY3FV94IE5TNALVQ8V0L1XTU/view.html>

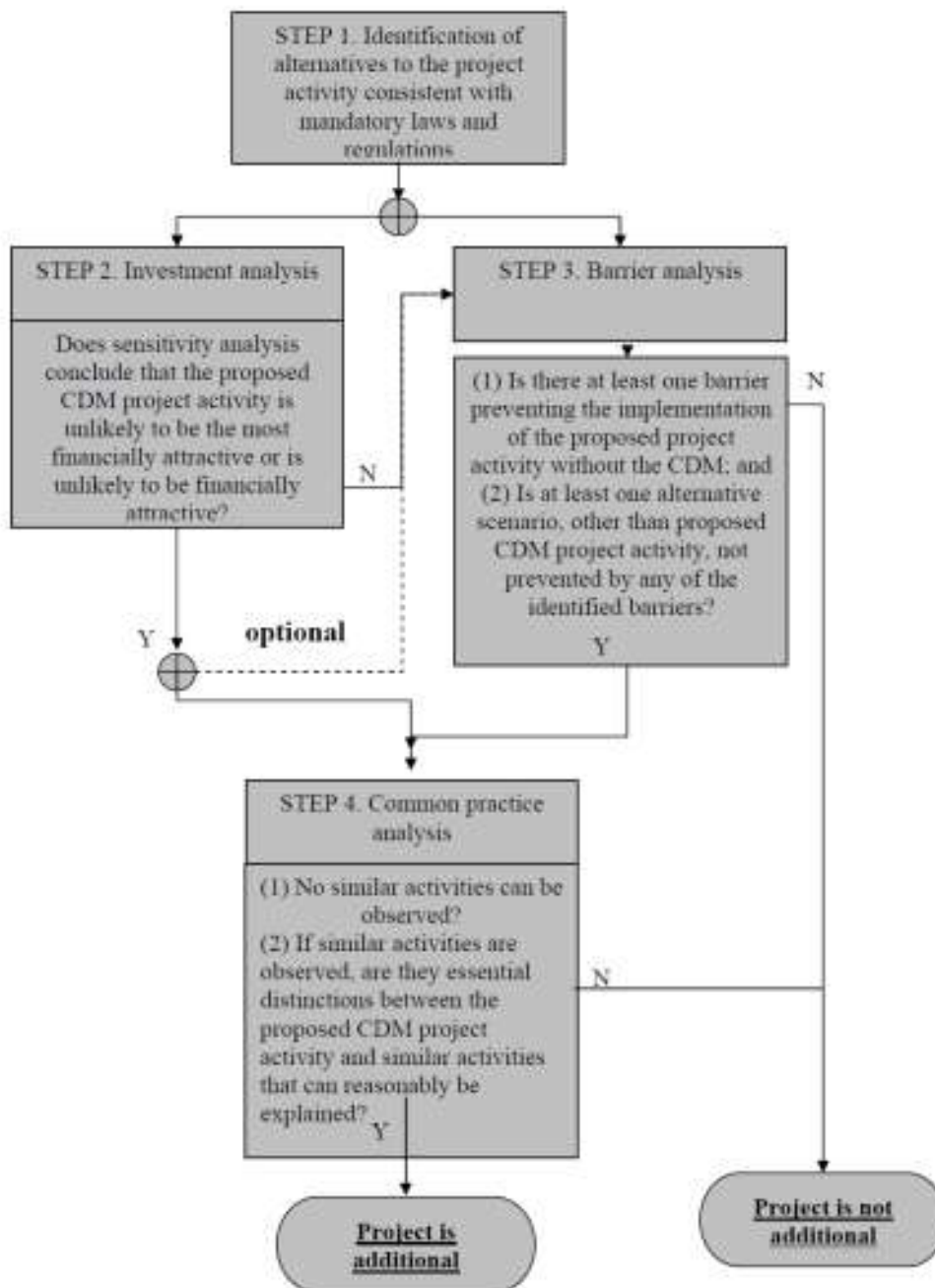
¹⁰ https://cdm.unfccc.int/Reference/Guidclarif/reg/reg_guid03.pdf Investment Analysis group 2 South Africa 11.9% IRR after tax

¹¹ Project 4728 referenced above indicates a projected IRR of 12% for a gold mine after CDM is applied and sub 8% in the absence of CDM



assessment of additionality (Version 06.0)” is applied to demonstrate additionality of a typical CPA.

The baseline scenario alternative selected in the previous section shall be used when applying Steps 2 (or 3) to 5 of the “Tool for the demonstration and assessment of additionality”.



E.5.2. Key criteria and data for assessing additionality of a CPA:



The criteria included here shall be checked upon inclusion of a CPA to the proposed POA in order to demonstrate that the additionality arguments presented in section E.5.1 fully apply to the CPA.

Key criteria and data for assessing additionality of a CPA are as follows:

Criteria related to the investment analysis

To demonstrate that a CPA under the proposed POA is financially not attractive, the following three steps should be checked upon inclusion the CPA to the proposed POA as per the Eligibility Criteria 13):

- (i) The IRR of the CPA is calculated based on updated input parameters, assumptions and the method provided in section E.5.1 of CDM-POA-DD;
- (ii) Using the Guidelines on the Assessment of Investment Analysis EB62 Report Annex 5 version 5.0 15/7/2011 the threshold IRR after taxes for Group 2 subclass 8 mining/mineral production shall be established²². This IRR should be applied to estimate the financial additionality at activity of the CPA under the proposed POA;
- (iii) The financial additionality is demonstrated by showing that the calculated IRR (without CDM) is below the applied investment benchmark after carrying out sensitivity analysis.

Criteria related to the common practice analysis

There is only one criteria related the common practice analysis. That is, a CPA under the proposed POA destroys methane using various technology, which is included in the Eligibility Criteria 3) for inclusion of a CPA in the proposed POA.

E.6. Estimation of Emission reductions of a CPA:

E.6.1. Explanation of methodological choices, provided in the approved baseline and monitoring methodology applied, selected for a typical CPA:

The equations from the approved methodology ACM0008 VERSION 7 are applied for calculating emission reduction of a CPA.

The formulae from “Tool to calculate the emission factor for an electricity system (Version 02.2.1)” are applied for calculating carbon emissions factor of electricity used by coal mine and replaced by a CPA.

E.6.2. Equations, including fixed parametric values, to be used for calculation of emission reductions of a CPA:

²² In South Africa this is 11.9%



Project Emissions

Project emissions are defined by the following equation:

$$PE_y = PE_{ME} + PE_{MD} + PE_{UM} \quad (1)$$

Where:

PE_y	=	Project emissions in year y (tCO ₂ e)
PE_{ME}	=	Project emissions from energy use to capture and use methane (tCO ₂ e)
PE_{MD}	=	Project emissions from methane destroyed (tCO ₂ e)
PE_{UM}	=	Project emissions from un-combusted methane (tCO ₂ e)

Combustion emissions from additional energy required for CBM/CMM/VAM capture and use

Additional energy may be used for the capture, transport, compression and use or destruction of CBM/CMM/VAM. Emissions from this energy use should be included as project emissions.

$$PE_{ME} = CONS_{ELEC,PJ} \cdot CEF_{ELEC} + CONS_{HEAT,PJ} \cdot CEF_{HEAT} + CONS_{FossFuel,PJ} \cdot CEF_{FossFuel} + PE_{FC,j,y} \quad (2)$$

Where:

PE_{ME}	=	Project emissions from energy use to capture and use or destroy methane (tCO ₂ e)
$CONS_{ELEC,PJ}$	=	Additional electricity consumption for capture and use or destruction of methane, if any (MWh) ²³
CEF_{ELEC}	=	Carbon emissions factor of electricity used by coal mine (tCO ₂ /MWh)
$CONS_{HEAT,PJ}$	=	Additional heat consumption for capture and use or destruction of methane, if any (GJ)
CEF_{HEAT}	=	Carbon emissions factor of heat used by coal mine (tCO ₂ e/GJ)
$CONS_{FossFuel,PJ}$	=	Additional fossil fuel consumption for capture and use or destruction of methane, if any (GJ) ²⁴
$CEF_{FossFuel}$	=	Carbon emissions factor of fossil fuel used by coal mine (tCO ₂ /GJ)
$PE_{FC,j,y}$	=	CO ₂ emissions from fossil fuel combustion in process j during the year y . Calculated using the “Tool to calculate project or leakage CO ₂ emissions from fossil fuel combustion”

²³ For instance, VAM units will consume electricity in fan motors, which are required to push the VAM through the unit without creating any back-pressure on the existing mine ventilation systems.

²⁴ Pre-heating of VAM units prior to start-up will utilize some form of heat, most likely bottled butane or propane. Emissions from this source will be counted as $CONS_{FossFuel,PJ}$



For electricity emissions factor, the same formulae are used as in the calculations of baseline emissions. In other words, if the source of power for the coalmine is the grid, then the formulae from “Tool to calculate the emission factor for an electricity system” for calculating the combined margin emissions factor are used. If the source of power for the coalmine is captive power generation, then the emissions factor is calculated based on the emission factor for the fuel used and the efficiency of the captive power plant.

To calculate carbon emission factor of electricity used, the formulae presented in “Tool to calculate the emission factor for an electricity system (Version 02.2.1)” is used.

For the heat generation emission factor, the same formulae are used as in the calculations of baseline emissions. In other words, the boiler efficiency and the emission factor for the fuel used are the basis of the emissions factor.

Combustion emissions from use of captured methane

When the captured methane is burned in a flare, heat or power plant, or oxidized in a flameless oxidation unit, combustion emissions are released. In addition, if NMHC account for more than 1% by volume of the extracted CMM/CBM or more than 0.1% by volume of the extracted VAM, combustion emission from these gases should also be included.

$$PE_{MD} = (MD_{FL} + MD_{OX} + MD_{ELEC} + MD_{HEAT} + MD_{GAS}) \times (CEF_{CH_4} + r \times CEF_{NMHC}) \quad (3)$$

Where in the POA $MD_{OX} = 0$

$$PE_{MD} = (MD_{FL} + MD_{ELEC} + MD_{HEAT} + MD_{GAS}) \times (CEF_{CH_4} + r \times CEF_{NMHC}) \quad (3)$$

with:

$$r = PC_{NMHC} / PC_{CH_4} \quad (4)$$

Where:²⁵

PE_{MD}	=	Project emissions from CMM/CBM destroyed (tCO ₂ e)
MD_{FL}	=	Methane destroyed through flaring (tCH ₄)
MD_{OX}	=	Methane destroyed through flameless oxidation (tCH ₄)
MD_{ELEC}	=	Methane destroyed through power generation (tCH ₄)
MD_{HEAT}	=	Methane destroyed through heat generation (tCH ₄)
MD_{GAS}	=	Methane destroyed after being supplied to gas grid or for vehicle use (tCH ₄)
CEF_{CH_4}	=	Carbon emission factor for combusted methane (2.75 tCO ₂ /tCH ₄)
CEF_{NMHC}	=	Carbon emission factor for combusted non methane hydrocarbons (the

²⁵ 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.



- concentration varies and, therefore, to be obtained through periodical analysis of captured methane) (tCO₂/tNMHC)
- r = Relative proportion of NMHC compared to methane
- PC_{CH_4} = Concentration (in mass) of methane in extracted gas (%), measured on wet basis
- PC_{NMHC} = NMHC concentration (in mass) in extracted gas (%)

In each end-use, the amount of gas destroyed depends on the efficiency of combustion of each end use.

$$MD_{OX} = 0$$

$$MD_{FL} = MM_{FL} - (PE_{flare}/GWP_{CH_4}) \quad (5)$$

Where:

- MD_{FL} = Methane destroyed through flaring (tCH₄)
- MM_{FL} = Methane measured sent to flare (tCH₄)
- PE_{flare} = Project emissions of non-combusted CH₄, expressed in terms of CO_{2e}, from flaring of the residual gas stream (tCO_{2e})
- GWP_{CH_4} = Global warming potential of methane (25 tCO_{2e}/tCH₄)

The project emissions of non-combusted CH₄ expressed in terms of CO_{2e} 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”. PE_{flare} can be calculated on an annual basis or for the required period of time using this tool.

$$MD_{ELEC} = MM_{ELEC} \times Eff_{ELEC} \quad (7)$$

Where:

- MD_{ELEC} = Methane destroyed through power generation (tCH₄)
- MM_{ELEC} = Methane measured sent to power plant (tCH₄)
- Eff_{ELEC} = Efficiency of methane destruction/oxidation in power plant (taken as 99.5% from IPCC)

$$MD_{HEAT} = MM_{HEAT} \times Eff_{HEAT} \quad (8)$$

Where:

- MD_{HEAT} = Methane destroyed through heat generation (tCH₄)
- MM_{HEAT} = Methane measured sent to heat plant (tCH₄)
- Eff_{HEAT} = Efficiency of methane destruction/oxidation in heat plant (taken as 99.5% from IPCC)

$$MD_{GAS} = MM_{GAS} \times Eff_{GAS} \quad (9)$$



Where:

- MD_{GAS} = Methane destroyed after being supplied to gas grid (tCH₄)
 MM_{GAS} = Methane measured supplied to gas grid for vehicle use or heat/power generation off-site (tCH₄)
 Eff_{GAS} = Overall efficiency of methane destruction/oxidation through gas grid to various combustion end uses, combining fugitive emissions from the gas grid and combustion efficiency at end user (taken as 98.5% from IPCC)²⁶

Un-combusted methane from project activity

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

$$PE_{UM} = [GWP_{CH_4} \times \sum_i MM_i \times (1 - Eff_i)] + PE_{flare} + PE_{OX} \times GWP_{CH_4} \quad (10)$$

Where:

- PE_{UM} = Project emissions from un-combusted methane (tCO₂e)
 GWP_{CH_4} = Global warming potential of methane (25 tCO₂e/tCH₄)
i = Use of methane (power generation, heat generation, supply to gas grid to various combustion end uses)
 MM_i = Methane measured sent to use *i* (tCH₄)
 Eff_i = Efficiency of methane destruction in use *i* (%)
 PE_{flare} = Project emissions of non-combusted CH₄ expressed in terms of CO₂e from flaring of the residual gas stream (tCO₂e)
 PE_{OX} = Project emissions of non oxidized CH₄ from flameless oxidation of the VAM stream (tCH₄)

$PE_{OX} = 0$ as VAM is excluded from POA

$$PE_{UM} = [GWP_{CH_4} \times \sum_i MM_i \times (1 - Eff_i)] + PE_{flare} \quad (10)$$

²⁶ The Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories gives a standard value for the fraction of carbon oxidised for gas combustion of 99.5% (Reference Manual, Table 1.6, page 1.29). It also gives a value for emissions from processing, transmission and distribution of gas which would be a very conservative estimate for losses in the grid and for leakage at the end user (Reference Manual, Table 1.58, page 1.121). These emissions are given as 118,000kgCH₄/PJ on the basis of gas consumption, which is 0.6%. Leakage in the residential and commercial sectors is given as 0 to 87,000kgCH₄/PJ, which is 0.4%, or in industrial plants and power station the losses are 0 to 175,000kg/CH₄/PJ, which is 0.8%. These leakage estimates are additive. Eff_{GAS} can now be calculated as the product of these three efficiency factors, giving a total efficiency of (99.5% * 99.4% * 99.6%) 98.5% for residential and commercial sector users, and (99.5% * 99.4% * 99.2%) 98.1% for industrial plants and power stations.



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”. PE_{flare} can be calculated on an annual basis or for the required period of time using this tool.

Baseline Emissions

Baseline emissions are given by the following equation:

$$BE_y = BE_{MD,y} + BE_{MR,y} + BE_{Use,y} \quad (11)$$

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)

Methane destruction in the baseline

Depending on the nature of the activities in the baseline scenario, CBM/CMM can be removed at five different stages –

- (1) as coal bed methane from a CBM to goaf wells prior to mining, or from underground pre-mining CMM drainage;
- (2) during the mining process using surface or underground post mining CMM drainage techniques,
- (3) during the mining process using ventilation air,
- (4) after the mining process by drainage from sealed goafs but before the mine is closed or
- (5) as coal bed methane from a CBM to open cast mine face.

Depending on the baseline scenario, part of this methane may be destroyed in the baseline scenario through flaring, flameless oxidation, power generation, heat generation, supply to gas grid to various combustion end uses. Baseline emissions should account for the CO₂ emissions resulting from the destruction of that methane.

$$BE_{MD,y} = (CEF_{CH_4} + r \times CEF_{NMHC}) \times \sum_i (CBM_{BL,i,y} + VAM_{BL,i,y} + CMM_{BL,i,y} + PMM_{BL,i,y}) \quad (12)$$



Where:

- BE_{MDy} = Baseline emissions from destruction of methane in the baseline scenario in year y (tCO₂e)
- i = Use of methane (flaring, power generation, heat generation, supply to gas grid to various combustion end uses)
- $CBM_{BL,i,y}$ = CBM that would have been captured, sent to and destroyed by use i in the baseline scenario in the year y (expressed in tCH₄)
- $VAM_{BL,i,y}$ = VAM that would have been captured, sent to and destroyed by use i in the baseline scenario in the year y (expressed in tCH₄)
- $CMM_{BL,i,y}$ = Pre-mining CMM that would have been captured, sent to and destroyed by use i in the baseline scenario in year y (expressed in tCH₄)
- $PMM_{BL,i,y}$ = Post-mining CMM that would have been captured, sent to and destroyed by use i in the baseline scenario in year y (tCH₄)
- CEF_{CH4} = Carbon emission factor for combusted methane (2.75 tCO₂e/tCH₄)
- CEF_{NMHC} = Carbon emission factor for combusted non methane hydrocarbons. This parameter should be obtained through periodical analysis of captured methane (tCO₂eq/tNMHC)
- r = Relative proportion of NMHC compared to methane

with :

$$r = PC_{NMHC} / PC_{CH4} \quad (13)$$

Where:

- PC_{CH4} = Concentration (in mass) of methane in extracted gas (%), to be measured on wet basis
- PC_{NMHC} = NMHC concentration (in mass) in extracted gas (%)

Note that to estimate conservatively methane destruction in the baseline over time, it is important to understand the characteristics of any *ex ante* thermal demand for methane in the baseline scenario. As stated in the applicability conditions of this methodology, project participants must be able to supply the necessary data for *ex ante* projections of methane demand in order to use this methodology.

Calculation of the mean annual demand (Thy) for each year of the crediting period

For thermal demand, which includes on-site heat generation and supply to the gas grid for various combustion end uses, demand can vary within the year. More importantly, this section presumes that such power generation (or other uses) projects are designed to primarily (or exclusively) use extracted VAM/CMM that would *not* be used for baseline thermal energy and would otherwise be emitted to the atmosphere.



Combustion emissions from additional energy required for CBM/CMM capture and use

All equipment to capture VAM and CMM is operated under BAU for the safe operation of the mine. There is no additional installation or fuel consumption to capture methane from underground.

However, compressors require electricity, for sending the gas to its various uses other than flaring.

Emissions from these energy uses should be included as project emissions per equation (2).

Methane released into the atmosphere

Depending on the nature of the project activity, CBM/VAM/CMM can be removed at five different stages – (1) as coal bed methane from a CBM wells prior to mining, or from underground pre-mining CMM drainage; (2) during the mining process using surface or underground post mining CMM drainage techniques; (3) during the mining process using ventilation air (4) after the mining process by drainage from sealed goafs but before the mine is closed or (5) from open cast mine pre-mining .

This methane would have been emitted to the atmosphere in the baseline scenario, unless some capture and use activities form part of the baseline:

$$BE_{MRy} = GWP_{CH_4} \times [\sum_i (CBMe_{i,y} - CBM_{BLi,y}) + \sum_i (CMM_{Pji,y} - CMM_{BLi,y}) + \sum_i (PMM_{Pji,y} - PMM_{BLi,y}) + \sum_i (VAM_{Pji,y} - VAM_{BLi,y})] \quad (16)$$

Where:

- BE_{MRy} = Baseline emissions from release of methane into the atmosphere in year y that is avoided by the project activity (tCO₂e)
- 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 tCH₄)
- $CBM_{BLi,y}$ = CBM that would have been captured, sent to and destroyed by use i in the baseline scenario in the year y (expressed in tCH₄)
- $CMM_{Pji,y}$ = Pre-mining CMM captured, sent to and destroyed by use i in the project activity in year y (expressed in tCH₄)
- $CMM_{BLi,y}$ = Pre-mining CMM that would have been captured, sent to and destroyed by use i in the baseline scenario in year y (expressed in tCH₄)
- $PMM_{Pji,y}$ = Post-mining CMM captured, sent to and destroyed by use i in the project activity in year y (tCH₄)



- $PMM_{BLi,y}$ = Post-mining CMM that would have been captured, sent to and destroyed by use i in the baseline scenario in year y (tCH₄)
- $VAM_{Pi,y}$ = VAM sent to and destroyed by use i in the project activity in year y (tCH₄). In the case of flameless oxidation, $VAM_{Pi,y}$ is equivalent to MD_{OX} defined previously
- $VAM_{BLi,y}$ = VAM that would have been captured, sent to and destroyed by use i in the baseline scenario in year y (tCH₄)
- GWP_{CH4} = Global warming potential of methane (25 tCO₂e/tCH₄)

The methane that is still vented in the project scenario is not accounted for in the project emissions or in the baseline emissions, since it is vented in both scenarios.

For CBM captured, the avoided emissions should only be credited in the year in which the seam is mined through the CBM well zone of influence, or the de-stressing zone, as explained in the next section.

Emissions from power/heat generation and vehicle fuel replaced by project

For emissions from displacing other energy forms, it is necessary to distinguish between emissions reductions derived from the use of CBM versus CMM, because CBM emissions reductions should only be credited once the mining area has intersected the zone of influence of the CBM well.

$$BE_{Use,y} = ED_{CBMw,y} + ED_{CBMz,y} + ED_{CPMM,y} \quad (24)$$

Where:

- $BE_{Use,y}$ = Total baseline emissions from the production of power or heat replaced by the project activity in year y (tCO₂)
- $ED_{CBMw,y}$ = Emissions from displacement of end uses by use of coal bed methane captured from wells where the mining area intersected the zone of influence in year y (tCO₂)
- $ED_{CBMz,y}$ = Emissions from displacement of end uses by use of coal bed methane captured from wells where the mining area intersected the zone of influence prior to year y (tCO₂)
- $ED_{CPMM,y}$ = Emissions from displacement of end uses by use of coal mine methane, VAM and post-mining methane (tCO₂)

The total methane captured during year y can be described as follows:

$$CBMM_{tot,y} = CBM_{w,y} + CBM_{z,y} + CBM_{x,y} + CMM_{Pi,y} + PMM_{Pi,y} + VAM_{Pi,y} \quad (25)$$



Where:

- $CBMM_{tot,y}$ = Total CBM, CMM and VAM captured and utilised by the project activity (tCH₄)
 $CBM_{w,y}$ = CBM captured from wells where the mining area intersected the zone of influence in year y (tCH₄)
 $CBM_{z,y}$ = CBM captured from wells where the mining area intersected the zone of influence prior to year y (tCH₄)
 $CBM_{x,y}$ = CBM captured from wells where the mining area has not yet intersected the zone of influence in year y (tCH₄)
 $CMM_{PJ,i,y}$ = Pre-mining CMM captured by the project activity in year y (tCH₄)
 $PMM_{PJ,y}$ = Post-mining CMM captured by the project activity in year y (tCH₄)
 $VAM_{PJ,y}$ = VAM captured by the project activity year y (tCH₄)

The total potential emissions reductions from displacement of power/heat generation and vehicle fuels are given by the following equation:

$$PBE_{Use,y} = GEN_y \times EF_{ELEC} + HEAT_y \times EF_{HEAT} + VFUEL_y \times EF_V \quad (26)$$

Where:

- $PBE_{Use,y}$ = Potential total baseline emissions from the production of power or heat replaced by the project activity in year y (tCO₂e)
 GEN_y = Electricity generated by project activity in year y (MWh), including through the use of CBM
 EF_{ELEC} = Emissions factor of electricity (grid, captive or a combination) replaced by project (tCO₂/MWh)
 $HEAT_y$ = Heat generation by project activity in year y (GJ), including through the use of CBM
 EF_{HEAT} = Emissions factor for heat production replaced by project activity (tCO₂/GJ)
 $VFUEL_y$ = Vehicle fuel provided by the project activity in year y (GJ), including through the use of CBM
 EF_V = Emissions factor for vehicle operation replaced by project activity (tCO₂/GJ)

To identify the CBM/CMM that should receive credits in the year during which the gas is captured and used, the following formulae are used, assuming that CMM and CBM are used for various end uses in the same proportions as the overall supply for that year of different gas sources:

$$ED_{CBMz,y} = \frac{CBM_{z,y}}{CBMM_{tot,y}} \times PBE_{Use,y} \quad (27)$$

Where:

- $ED_{CBMz,y}$ = Emissions from displacement of end uses by use of coal bed methane captured from wells where the mining area intersected the zone of influence prior to year y (tCO₂e)



- $CBM_{z,y}$ = CBM captured from wells where the mining area intersected the zone of influence prior to year y (tCH₄)
- $CBMM_{tot,y}$ = Total CBM, CMM and VAM captured and utilised by the project activity in year y (tCH₄)
- $PBE_{Use,y}$ = Potential total baseline emissions from the production of power or heat replaced by the project activity in year y (tCO₂e)

$$ED_{CPMM,y} = \frac{CMM_{PJ,y} + PMM_{PJ,y} + VAM_{PJ,y}}{CBMM_{tot,y}} \times PBE_{Use,y} \quad (28)$$

Where:

- $ED_{CPMM,y}$ = Emissions from displacement of end uses by use of coal mine methane and post-mining methane (tCO₂e)
- $CMM_{PJ,y}$ = Pre-mining CMM captured by the project activity in year y (tCH₄)
- $PMM_{PJ,y}$ = Post-mining CMM captured by the project activity in year y (tCH₄)
- $VAM_{PJ,y}$ = VAM captured by the project activity in year y (tCH₄)
- $CBMM_{tot,y}$ = Total CBM CMM and VAM captured and utilised by the project activity in year y (tCH₄)
- $PBE_{Use,y}$ = Potential total baseline emissions from the production of power or heat replaced by the project activity in year y (tCO₂e)

$$ED_{CBMw,y} = \sum_{m=0}^{y-b} \left[\frac{CBM_{w,y-m}}{CBMM_{tot,y-m}} \times PBE_{Use,y-m} \right] \quad (29)$$

Where:

- $ED_{CBMw,y}$ = Emissions from displacement of end uses by use of coal bed methane captured from wells where the mining area intersects the zone of influence in year y (tCO₂e)
- $CBM_{w,y-m}$ = CBM captured in the year $y-m$ from wells where the mining area intersected the zone of influence in year y (tCH₄)
- $CBMM_{tot,y-m}$ = Total CBM, CMM and VAM captured and utilised by the project activity in year $y-m$ (tCH₄)
- $PBE_{Use,y-m}$ = Potential total baseline emissions from the production of power or heat replaced by the project activity in year $y-m$ (tCO₂e)
- b = Initial year of crediting period

Note that no emissions reductions are associated with $CBM_{x,y}$, so the actual baseline emissions in each year will vary from the potential baseline emissions.

Eligible CBM

The approach to quantify the eligible CBM is to identify the zone of influence of CBM wells, and when these are impacted by mining activities.



Step 1: Identify relevant wells

The first step is to identify the drilling plan and the wells that will be intersected by mining or are likely to extract methane from an area that will overlap with future coal extraction.

The location of CBM wells in relation to the mine concession area and mining plan during the initial crediting period is estimated using the latest mine plan information, and a map should be included in the Project Design Document. Indicative mining maps showing relevant CBM wells and their zones of influence is shown in Figures 4a and 4b, with the area of coal to be mined shaded in blue. Figure 4a depicts an underground coal mine plan and the pre-mine drainage boreholes, while Figure 4b depicts a surface coal mine and its pre-mine drainage boreholes

Note: Wells that extract virgin coal bed methane, i.e. from areas that would not be mined and would not influence eventual CMM emissions in mined areas, are out of the boundary of both the baseline and the project. Any activity intending to extract and use such virgin coal bed methane should refer to another methodology.

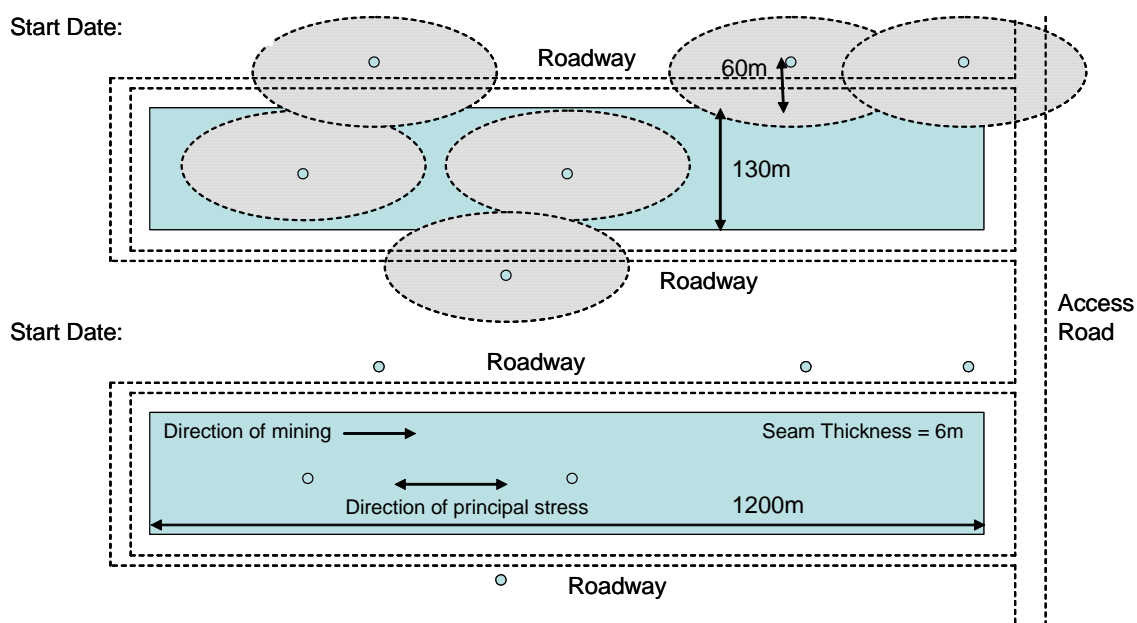


Figure 4a: Indicative Figure Showing underground Mining Plan, relevant CBM wells and their zones of influence

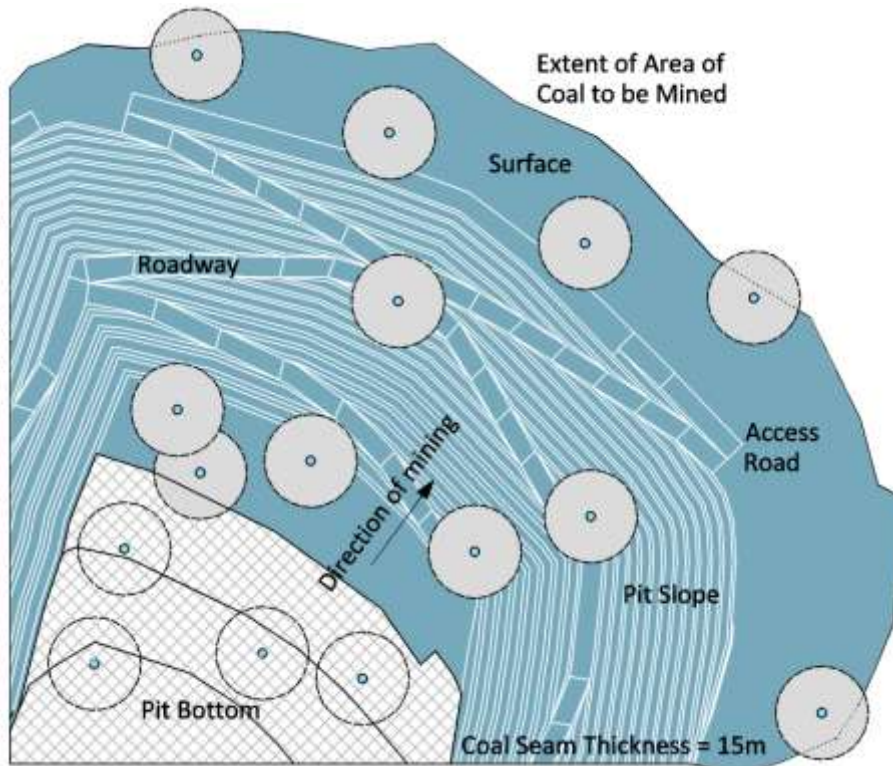


Figure 4b: Indicative Figure Showing Surface Mining Plan, relevant CBM wells and their zones of influence

Step 2: Estimation of the Zone of Influence of a CBM Well and eligible methane

This methodology estimates the overlap between a cylindrical gas drainage zone around a production well with the zone of disturbance around an area of coal to be mined, from which gas is emitted.

A generalised zone or radius of influence, R, for a particular well can be estimated at any time during the pre drainage process based on either (i) the cumulative flow measured at the well V_w or (ii) on the total cumulative gas drained from all the wells measured at the centralised monitoring station V_c . Idealised uniform degassing is assumed within a cylindrical zone centred on the borehole and a constant production flow.

(i) Using cumulative flow at an individual well:

$$R = ((V_w)/(\pi \times T \times \rho_{\text{coal}} \times g_{\text{coal}}))^{0.5} \tag{17}$$

Where:

- R = Cumulative radius of zone of influence (m)
- V_w = Cumulative flow measured at an individual well (m^3)
- T = Total thickness of coal in section accessed by well (m)
- ρ_{coal} = Density of locally mined coal (t/m^3)– default value $1.4 t/m^3$
- g_{coal} = Gas content of the coal ($m^3 CH_4/tonne \text{ coal}$)

(ii) Using cumulative flow from a number of wells:



$$R = ((n \times V_a) / (\pi \times T \times \rho_{\text{coal}} \times g_{\text{coal}}))^{0.5} \quad (18)$$

Where:

R	=	Cumulative radius of zone of influence (m)
n	=	Number of days the selected wells are operational
V _a	=	Average flow per day across all wells (m ³ /d)
T	=	Total thickness of coal in section accessed by well (m)
ρ _{coal}	=	Density of locally mined coal – default value 1.4 t/m ³
g _{coal}	=	Gas content of the coal (tCH ₄ /tonne coal)

and

$$V_a = V_c / N = \frac{\sum V_w}{N} \quad (19)$$

Where:

V _a	=	Average flow per day (m ³ /d)
V _c	=	Total cumulative gas drained from all the wells measured at the centralised monitoring station (m ³)
V _w	=	Cumulative flow measured at an individual well (m ³)
N	=	Sum of days that all wells have been operational (days)

As an example, taking the density of coal as 1.4 tonne per m³, the gas in coal to be 12 m³ per tonne, the thickness of the section to be 40 metres and the flow rate to be 2400m³/day, then the radius of zone of influence will increase by 20 m per year. Therefore, if the number pre-drainage years are ‘n’ the corresponding radius of zone of influence will be n x20 m. The Project Design Document should elaborate the project specific values for the zone of influence.

Area of Overlap

Once the zone of influence for a well in a given year overlaps the area of coal to be mined, then the gas from the well is considered to be eligible CBM. To estimate portion of CBM that would have been released from mining activities, a geometric approach in the horizontal plane and the vertical plane is used where the area of overlap between the defined zones of influence for each well and the area of coal to be mined (“*Area of Overlap*”) is used as well as the de-stressing zone above and below the seam to be mined.

Horizontal plane: The ratio of the Area of Overlap to the total area of the zones of influence of the wells considered is calculated and used to identify the appropriate share of gas counted as eligible CBM. The equations for this are:

$$ES_h = \frac{\sum_w AO_w}{\sum_w AT_w} \quad (20)$$

Where:

ES _h	=	Eligible share of CBM based on the horizontal plane overlap (%)
-----------------	---	---



- AO_w = Area of overlap of well w with the area of coal to be mined(m²)
 AT_w = Total zone of influence of well w (m²)
 w = CBM wells with zones of influence that overlap with mining activity

Note that for CBM wells which will be physically intersected by mining, ES_h is unity by definition. In other words, all of the CBM drained from this type of well is eligible, unless there is gas coming from seams beyond the de-stressing zone.

Vertical plane: The de-stressing zone typically extends upwards 140 m and downwards 40 metres. If cased boreholes are used and the seams are fractured within the de-stressing zone, then all the gas entering the CBM well is gas that would have appeared as methane in ventilation air and CMM during and after mining. If other seams outside of the de-stressed zone are fractured, then this gas must be excluded from the eligible CBM. The eligible share is defined as follows:

$$ES_v = \frac{t}{T} \quad (21)$$

Where:

- ES_v = Eligible share of CBM based on the vertical plane overlap (%)
 t = Thickness of coal which lies within the emission zone (m)
 T = Total thickness of coal that is producing gas in the production well (m)

The value for ES_v would be 1 for cased boreholes where fracking is only done in the seams of relevance. A mine cross section should be included in the PDD together and supporting documentation on the well drilling process should be supplied to the Validator to justify the ratio of t/T .

Eligible CBM: Summarising the eligible contribution of CBM in the horizontal and vertical planes gives the final ratio of eligible CBM:

$$ES_t = ES_h \cdot ES_v \quad (22)$$

Where:

- ES_t = Total eligible share of CBM (%)
 ES_h = Eligible share of CBM based on the horizontal plane overlap (%)
 ES_v = Eligible share of CBM based on the vertical plane overlap (%)

CO₂ emissions from use or destruction of CBM

Note that while only the eligible CBM should be accounted to calculate the volume of methane emissions avoided by the project, the totality of the CO₂ resulting from the use or the destruction of all the CBM extracted should be accounted as project emissions.

Note that once a CBM well has been mined through at an underground mine, then the well acts in the same manner as conventional underground post mining CMM drainage (surface goaf well) and therefore all of



the methane that is drained through this type of well is eligible, irrespective of whether the well is drilled off-centre to the longwall panel and some of the area of influence is outside the area of the longwall panel.

Also note that a CBM will no longer exist after it has been mined through at a surface mine, the well will likely be shut in and as mine-through occurs. If the area of influence of a CBM well extends outside the area of coal to be mined, only the gas produced from the mined area is eligible.

The Project Design Document should contain the relevant project specific data in order to calculate an *ex ante* estimate of the above. Furthermore this will be updated *ex-post* using mining plans and accurate measurements of the locations of the actually drilled wells, as the final location of the relevant CBM wells will be determined after proper risk assessments and taking into account local conditions for drilling.

If any CBM wells that were planned to be intersected by mining, or their zones of influence overlap with mining, are not reached by the mining activities, then corresponding methane extracted should not be taken into account in the emission reduction calculation.

Step 3: Temporal adjustments for baseline emissions within a defined crediting period

No emission reductions from CBM utilization and or destruction can be claimed until the mining activity enters the zone of influence of the well. At that time the emission reductions from the share of eligible pre-drainage and subsequent post-drainage methane can be claimed. This is calculated as follows:

$$CBM_{e,y} = \left[ES_t \cdot \sum_w \sum_{m=1}^{y-b} V_{w,y-m} \right] + \left[ES_t \cdot \sum_w V_{w,y} \right] \quad (23)$$

Where:

- $CBM_{e,y}$ = Eligible CBM captured by the project for year y (tCH₄)
- ES_t = Total eligible share of CBM (%)
- $V_{w,y-m}$ = Volume of methane captured from well w in year $y-m$ (tCH₄)
- $V_{w,y}$ = Volume of methane captured from well w in year y (tCH₄)
- W = Number of wells where mining reached the zone of influence in year y
- b = Initial year of crediting period

Note that the first term covers the sum of all the methane drained from each new well for which mining has actually entered the zone of influence during a given year y , from the start of the crediting period to the end of the previous year (i.e. end of year $y-1$). The second term covers the sum of all methane drained from each well for which mining has entered the zone of influence for the year y . For example, at a mine in which 5 CBM wells had been drilled, if mining entered the zone of influence of all five wells in year 4, then in years 1 to 3 the eligible CBM would be zero. In year 4 it would be the cumulative volume for the previous 3 years plus the volume extracted in year 4. In year 5 it would only be the volume extracted in year 5.

Heat generation emissions factor



If the baseline scenario includes heat generation (either existing or new) that is replaced by the project activity, the Emissions Factor for displaced heat generation is calculated as follows:

$$EF_{heat,y} = \frac{EF_{CO_2,j}}{Eff_{heat}} \cdot \frac{44}{12} \cdot \frac{1TJ}{1000GJ} \quad (32)$$

Where:

$EF_{heat,y}$	=	Emissions factor for heat generation (tCO ₂ /GJ)
$EF_{CO_2,i}$	=	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

To estimate boiler efficiency, project participants may choose between the following two options:

Option A:

Use the highest value among the following three values as a conservative approach:

- Measured efficiency prior to project implementation;
- Measured efficiency during monitoring;
- Manufacturer nameplate data for efficiency of the existing boilers.

Option B:

Assume a boiler efficiency of 100% based on the net calorific values as a conservative approach.

Grid Power Emission Factor

The formulae from “Tool to calculate the emission factor for an electricity system (Version 02.2.1)” are applied for calculating carbon emissions factor of electricity used by coal mine and replaced by a CPA.

Vehicle fuel use emissions factor

If the baseline scenario includes vehicle operation that will be fuelled by gas produced by the project activity, the Emissions Factor for displaced vehicle fuel use is calculated as follows:

$$EF_V = \frac{EF_{CO_2,j}}{EFF_V} \cdot \frac{44}{12} \cdot \frac{1TJ}{1000GJ} \quad (33)$$

Where:

EF_V	=	Emissions factor for vehicle operation replaced by project activity (tCO ₂ /GJ)
$EF_{CO_2,i}$	=	CO ₂ emissions factor of fuel used for vehicle operation (tC/TJ)
Eff_V	=	Vehicle engine efficiency (%)



44/12 = Carbon to Carbon Dioxide conversion factor
1/1000 = TJ to GJ conversion factor

To estimate vehicle engine efficiency, project participants should select the highest value among the following three values as a conservative approach:

- Measured fuel efficiency prior to project implementation;
- Measured fuel efficiency during monitoring;
- Manufacturer reported data for efficiency for vehicle.

3) Leakage

LEAKAGE

The formula for leakage is given as follows:

$$LE_y = LE_{d,y} + LE_{o,y} \quad (34)$$

Where:

LE_y = Leakage emissions in year y (tCO₂e)
 $LE_{d,y}$ = Leakage emissions due to displacement of other baseline thermal energy uses of methane in year y (tCO₂e)
 $LE_{o,y}$ = Leakage emissions due to other uncertainties in year y (tCO₂e)

Displacement of baseline thermal energy uses

Leakage may occur if the project activity prevents CMM/CBM from being used to meet baseline thermal energy demand, whether as a result of physical constraints on delivery, or price changes. Where regulations require that local thermal demand is met before all other uses, which is common in many jurisdictions, then this leakage can be ignored.

If displacement does occur, the project activity may cause increased emissions outside the project boundary associated with meeting thermal energy demand with other fuels. Because of likely day-to-day fluctuations in CMM extraction rates, to ensure a conservative result, CERs should not be calculated solely from annual data. Any CERs generated from methane destruction should be calculated using daily logs, or monthly logs if daily data is not available, of project-case demand for CMM for non-thermal uses compared against estimates of baseline CMM demand for thermal uses. For each day (or month) of the crediting period, this form of leakage must be calculated if:

$$ME_k - (MM_{ELEC,k} + MM_{HEAT,k}) < TH_k \quad (35)$$

with:

$$TH_k = \frac{\overline{TH}_{BL}}{365} \times d_k^{\max} \quad (36)$$



Where:

- ME_k = Methane extracted on day k (tCH₄)
- $MM_{ELEC,k}$ = Methane measured sent to power plant on day k (tCH₄)
- $MM_{HEAT,k}$ = Methane measured sent to new heat generation uses on day k in the Project Scenario that would not have been sent in the Baseline Scenario on day k (tCH₄)
- TH_k = Methane used to serve thermal energy demand in the baseline for day k (tCH₄)
- TH_{BL} = Average annual thermal demand over the past 5 years (tCH₄)
- d_k = Scalar adjustment factor for day k to reflect seasonal variations such that $\sum d_k = 365$
- d_k^{max} = Maximum scalar adjustment factor for day k over the past 5 years (i.e. $\sum d_k^{max} > 365$)

Under this condition, some portion of CMM/VAM that would have gone to meet thermal energy demand in the baseline scenario is instead used by the project. A corresponding amount of thermal energy demand in the project scenario will have to be met by an alternative fuel, leading to possible increased emissions. To calculate such emissions, the following approach should be used.

The amount of thermal energy from CMM/VAM diverted from thermal uses existing in the baseline diverted to other uses by the project should be calculated on a daily basis, and then summed up for each year y :

$$ED_{th,y} = \Sigma(ED_{th,k}) = \Sigma[\max(0, (TH_k - (ME_k - (MM_{ELEC,k} + MM_{HEAT,k}))) \times NCV_{CH_4}] \quad (37)$$

Where:

- $ED_{th,y}$ = Quantity of thermal energy displaced by the project activity in year y (GJ)
- $ED_{th,k}$ = Quantity of thermal energy displaced by the project activity on day k (GJ)
- ME_k = Total methane extracted on day k (tCH₄)
- $MM_{ELEC,k}$ = Methane measured sent to power plant on day k (tCH₄)
- $MM_{HEAT,k}$ = Methane measured sent to new heat generation uses on day k in the Project Scenario that would not have been sent in the Baseline Scenario on day k (tCH₄)
- NCV_{CH_4} = Net calorific value for methane (GJ/tCH₄)

Project participants must describe and justify what alternative fuel(s) is (are) used to provide thermal energy in the area when VAM/CMM is not available. They must then calculate the amount of alternative fuel required to provide the same heat output as the VAM/CMM.

$$Q_{AF,y} = ED_{th,y} / NCV_{AF} \quad (38)$$

Where:



$Q_{AF,y}$	=	Quantity of alternative fuels displaced by the project activity in year y (tonnes or m ³)
$ED_{th,y}$	=	Quantity of thermal energy displaced by the project activity in year y (GJ)
NCV_{AF}	=	Net calorific value for alternative fuels (GJ/tonne or m ₃)

Emissions from the use of alternative fuels are calculated as follows:

$$LE_{d,y} = Q_{AF,y} \times NCV_{AF} \times EF_{AF} \times OXID \quad (39)$$

Where:

$LE_{d,y}$	=	Leakage emissions in year y (tCO ₂ e)
$Q_{AF,y}$	=	Quantity of alternative fuels displaced by the project activity in year y (tonnes or m ³)
NCV_{AF}	=	Net calorific value for alternative fuels (GJ/tonne or m ₃)
EF_{AF}	=	Emissions factor for alternative fuel (tCO ₂ /GJ), sourced from IPCC
$OXID$	=	Oxidation efficiency of combustion (%), sourced from IPCC

The formula for leakage is given as follows

$$LE_y = LE_{d,y} + LE_{o,y} \quad (34)$$

where:

LE_y	Leakage emissions in year y (tCO ₂ e)
$LE_{d,y}$	Leakage emissions due to displacement of other baseline thermal energy uses of methane in year y (tCO ₂ e)
$LE_{o,y}$	Leakage emissions due to other uncertainties in year y (tCO ₂ e)

The leakage of CDM project activities could result from the following:

- Displacement of baseline thermal energy uses ;
- CBM extraction from outside the de-stressed zone ;
- Impact of CDM project activity on coal production ;
- Impact of CDM project activity on coal prices and market dynamics.

Methane is not employed for other baseline thermal energy uses, thus $LE_{d,y}$ is 0. CBM is not used in the project activity and the CDM project activity has no influence upon coal production and prices and market dynamics; thus, $LE_{o,y}$ is 0.

Therefore, leakage emissions can be excluded from the project.

4) Estimation of emission reductions:

EMISSION REDUCTIONS



The emission reduction ER_y by the project activity during a given year y is the difference between the baseline emissions (BE_y) and project emissions (PE_y), as follows:

$$ER_y = BE_y - PE_y - LE_y \quad (40)$$

Where:

- ER_y = Emissions reductions of the project activity during the year y (tCO₂e)
- BE_y = Baseline emissions during the year y (tCO₂e)
- PE_y = Project emissions during the year y (tCO₂e)
- LE_y = Leakage emissions in year y (tCO₂e)

Note that, because emissions reductions from CBM are only credited when the seam is mined through, there could be cases where CBM drainage commenced before the start of the crediting period.

E.6.3. Data and parameters that are to be reported in CDM-CPA-DD form:

Data and parameters monitored

In addition to the parameters listed in the tables below, the provisions on data and parameters not monitored in the tools referred to in this methodology apply.

E.6.3. Data and parameters that are to be reported in CDM-CPA-DD form:

(Copy this table for each data and parameter)

Data / Parameter:	CONS _{ELEC,PJ}
Data unit:	MWh
Description:	Additional electricity consumption for capture and use or destruction of methane, if any
Source of data used:	Project site
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	CONS _{HEAT,PJ}
Data unit:	GJ
Description:	Additional heat consumption for capture and use or destruction of methane
Source of data used:	Project site



**PROGRAMME OF ACTIVITIES DESIGN DOCUMENT FORM
(CDM-POA-DD) - Version 01**



Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	CONS _{FossilFuel,PJ}
Data unit:	GJ
Description:	Additional fossil fuel consumption for capture and use or destruction of methane
Source of data used:	Project site
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	CEF _{ELEC}
Data unit:	tCO ₂ /MWh
Description:	Carbon emissions factor of electricity used by coal mine
Source of data used:	Project site
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	CEF _{HEAT}
Data unit:	tCO ₂ /GJ
Description:	Carbon emissions factor of heat used by coal mine
Source of data used:	Project site
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually	



**PROGRAMME OF ACTIVITIES DESIGN DOCUMENT FORM
(CDM-POA-DD) - Version 01**



applied :	
Any comment:	

Data / Parameter:	CEF _{FossFuel}
Data unit:	tCO ₂ /GJ
Description:	Carbon emissions factor of fossil fuel used by coal mine
Source of data used:	IPCC 2006
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Use of IPCC default or national values would suffice

Data / Parameter:	MM _{FL}
Data unit:	tCH ₄
Description:	Methane measured sent to flare
Source of data used:	Project site
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Flow meters will record gas volumes, pressure and temperature. Density of methane under normal conditions of temperature and pressure is 0.67kg/m ³ (Revised 1996 IPCC Reference Manual p 1.24 and 1.16)

Data / Parameter:	MM _{ELEC}
Data unit:	tCH ₄
Description:	Methane sent to power plant
Source of data used:	Project site
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Flow meters will record gas volumes, pressure and temperature. Density of methane under normal conditions of temperature and pressure is 0.67kg/m ³ (Revised 1996 IPCC Reference Manual p 1.24 and 1.16)



**PROGRAMME OF ACTIVITIES DESIGN DOCUMENT FORM
(CDM-POA-DD) - Version 01**



Data / Parameter:	Eff _{ELEC}
Data unit:	-
Description:	Efficiency of methane destruction/oxidation in power plant
Source of data used:	IPCC 2006
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Set at 99.5%(IPCC)

Data / Parameter:	MM _{HEAT}
Data unit:	tCH ₄
Description:	Methane sent to boiler
Source of data used:	Project site
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Flow meters will record gas volumes, pressure and temperature. Density of methane under normal conditions of temperature and pressure is 0.67kg/m ³ (Revised 1996 IPCC Reference Manual p 1.24 and 1.16)

Data / Parameter:	Eff _{HEAT}
Data unit:	-
Description:	Efficiency of methane destruction/oxidation in heat plant
Source of data used:	IPCC
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Set at 99.5%(IPCC)

Data / Parameter:	MM _{GAS}
Data unit:	tCH ₄
Description:	Methane sent to gas grid for end users
Source of data used:	Project site



**PROGRAMME OF ACTIVITIES DESIGN DOCUMENT FORM
(CDM-POA-DD) - Version 01**



Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Flow meters will record gas volumes, pressure and temperature. Density of methane under normal conditions of temperature and pressure is 0.67kg/m ³ (Revised 1996 IPCC Reference Manual p 1.24 and 1.16)

Data / Parameter:	Eff _{GAS}
Data unit:	-
Description:	Overall efficiency of methane destruction/oxidation through gas grid
Source of data used:	IPCC
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Set at 98.5% (IPCC)

Data / Parameter:	CEF _{NMHC}
Data unit:	
Description:	Carbon emission factor for combusted non methane hydrocarbons (various)
Source of data used:	Project site
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	To be obtained through periodical analysis of the fractional composition of captured (if NMHC over 1%)

Data / Parameter:	PC _{CH4}
Data unit:	%
Description:	Concentration (in mass) of methane in extracted gas (%), measured on wet basis
Source of data used:	Project site - Concentration meters, optical and calorific
Value applied:	
Justification of the choice of data or description of measurement methods	



**PROGRAMME OF ACTIVITIES DESIGN DOCUMENT FORM
(CDM-POA-DD) - Version 01**



and procedures actually applied :	
Any comment:	To be measured on wet basis

Data / Parameter:	PC_{NMHC}
Data unit:	%
Description:	NMHC concentration (in mass) in extracted gas
Source of data used:	Concentration meters, optical and calorific
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	If over 1% then must be incorporated

Data / Parameter:	MM_i
Data unit:	tCH ₄
Description:	Methane measured sent to use <i>i</i>
Source of data used:	Project site
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Flow meters will record gas volumes, pressure and temperature

Data / Parameter:	Eff_i
Data unit:	-
Description:	Efficiency of methane destruction/oxidation through use <i>i</i> (power generation, heat generation, supply to gas grid to various combustion end uses)
Source of data used:	Project site
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	PE_{Mvent}
Data unit:	tCH ₄



**PROGRAMME OF ACTIVITIES DESIGN DOCUMENT FORM
(CDM-POA-DD) - Version 01**



Description:	Emissions of methane vented to atmosphere during the project activity
Source of data used:	Project site
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	This parameter is to include any methane vented to atmosphere through flares, in ventilation air methane as well as direct emissions through vents

Data / Parameter:	$CBMe_{i,y}$
Data unit:	tCH ₄
Description:	Eligible CBM captured, sent to and destroyed by use <i>i</i> in the project for year <i>y</i>
Source of data used:	
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	$CMM_{PJ,i,y}$
Data unit:	tCH ₄
Description:	Pre-mining CMM captured, sent to and destroyed by use <i>i</i> in the project activity in year <i>y</i>
Source of data used:	Project site
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	$CMM_{PJ,i,y}$ can be measured together with $PMM_{PJ,i,y}$ when the common extraction system is located in the underground mine

Data / Parameter:	$PMM_{PJ,i,y}$
Data unit:	tCH ₄
Description:	Post-mining CMM captured, sent to and destroyed by use <i>i</i> in the project activity in year <i>y</i>
Source of data used:	Project site
Value applied:	



Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	$PMM_{PJ, i, y}$ can be measured together with $CMM_{PJ, i, y}$ when the common extraction system is located in the underground mine

Data / Parameter:	GWP_{CH_4}
Data unit:	tCO ₂ e/ tCH ₄
Description:	Global warming potential of methane
Source of data used:	IPCC 2007
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	25 tCO ₂ e/tCH ₄

Data / Parameter:	CEF_{CH_4}
Data unit:	tCO ₂ e/tCH ₄
Description:	Carbon emission factor for combusted methane
Source of data used:	IPCC
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	$44/16 = 2.75$ tCO ₂ e/tCH ₄

Data / Parameter:	R
Data unit:	m
Description:	Cumulative radius of zone of influence for a given well
Source of data used:	Project site
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	



Data / Parameter:	V_w
Data unit:	m^3
Description:	Cumulative flow at well
Source of data used:	Project site
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Monitoring at each well should record gas flow, methane concentration, pressure, and temperature

Data / Parameter:	T
Data unit:	m coal
Description:	Thickness of all coal accessed by wells
Source of data used:	Project site
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Depth of fractures into respective seams and casing used should be recorded at time of drilling

Data / Parameter:	ρ_{coal}
Data unit:	t/m^3
Description:	Density of locally mined coal
Source of data used:	Project site
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Default value is 1.4

Data / Parameter:	g_{coal}
Data unit:	m^3CH_4/t coal
Description:	Gas content of coal
Source of data used:	Project site



**PROGRAMME OF ACTIVITIES DESIGN DOCUMENT FORM
(CDM-POA-DD) - Version 01**



Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	n
Data unit:	Days
Description:	Number of days the selected well is operational
Source of data used:	Project site
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	V_a
Data unit:	m^3/day
Description:	Average flow per day
Source of data used:	Project site
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Flow meters will record gas volumes, pressure and temperature

Data / Parameter:	V_c
Data unit:	m^3/day
Description:	Cumulative flow from all wells
Source of data used:	Project site
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	



Any comment:	Total flow from all boreholes measured at collection manifold using automatic remote monitoring of gas flow, methane concentration, pressure and temperature
--------------	--

Data / Parameter:	N
Data unit:	Days
Description:	Sum of days all wells operational
Source of data used:	Project site
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	
Data unit:	Coordinates easting and northing via GPS
Description:	Position of wells relative to mining plan
Source of data used:	Project Site
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Recorded in PDD <i>ex ante</i> . New drawing produced each year

Data / Parameter:	
Data unit:	Coordinates
Description:	Well profile
Source of data used:	
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Shows each well and zone of influence against latest mining plan

Data / Parameter:	
Data unit:	m
Description:	Well depth
Source of data used:	Project site



Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Based on actual drilling records

Data / Parameter:	t
Data unit:	m
Description:	Total thickness of coal in emission zone
Source of data used:	Project site
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	From geology report and drilling records

Data / Parameter:	AO_w
Data unit:	m^2
Description:	Area of overlap with are to be mined
Source of data used:	Project Site
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	AT_w
Data unit:	m^2
Description:	Total zone of influence
Source of data used:	Project Site
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	



Any comment:	
--------------	--

Data / Parameter:	w
Data unit:	
Description:	Wells
Source of data used:	Project Site
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Identification assigned to a well

Data / Parameter:	$CBM_{w,y}$
Data unit:	tCH ₄
Description:	CBM captured from well intersected in year y
Source of data used:	
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Monitor each well separately

Data / Parameter:	$CBM_{z,y}$
Data unit:	tCH ₄
Description:	CBM captured from well intersected before year y
Source of data used:	
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Monitor each well separately

Data / Parameter:	$CBM_{x,y}$
Data unit:	tCH ₄
Description:	CBM captured from well not yet intersected in year y
Source of data used:	
Value applied:	



**PROGRAMME OF ACTIVITIES DESIGN DOCUMENT FORM
(CDM-POA-DD) - Version 01**



Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Monitor each well separately

Data / Parameter:	GEN _y
Data unit:	MWh
Description:	Electricity generation by project
Source of data used:	Project Site
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Ammeter calibrated per manufacturers standards, cross referenced against billing to external grid operator

Data / Parameter:	HEAT _y
Data unit:	GJ
Description:	Heat generation by project
Source of data used:	Project Site
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	VFUEL _y
Data unit:	GJ
Description:	Vehicle power supplied by project
Source of data used:	Project Site
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Meter readings for delivery, odometer or hour meter readings cross referenced to



	fuel consumption data
--	-----------------------

Data / Parameter:	EF_{ELEC}
Data unit:	tCO ₂ /MWh
Description:	CO ₂ emission factor of the grid
Source of data used:	
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Calculated as per “Tool to calculate the emission factor for an electricity system”

Data / Parameter:	$EF_{OM,y}$
Data unit:	tCO ₂ /MWh
Description:	CO ₂ Operating Margin emission factor of the grid
Source of data used:	
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Calculated as per “Tool to calculate the emission factor for an electricity system”

Data / Parameter:	$EF_{BM,y}$
Data unit:	tCO ₂ /MWh
Description:	CO ₂ Build Margin emission factor of the grid
Source of data used:	
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Calculated as per “Tool to calculate the emission factor for an electricity system”

Data / Parameter:	$F_{i,j,y}$
Data unit:	t or m ₃ /yr
Description:	Amount of each fossil fuel consumed by each power source/plant
Source of data used:	
Value applied:	



**PROGRAMME OF ACTIVITIES DESIGN DOCUMENT FORM
(CDM-POA-DD) - Version 01**



Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Obtained from the power producers, dispatch centers or latest local statistics

Data / Parameter:	$COEF_{i,k}$
Data unit:	tCO ₂ /t or m ³
Description:	CO ₂ emission coefficient of each fuel type and each power source/plant
Source of data used:	
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Plant or country-specific values to calculate COEF are preferred to IPCC default values, in case of obtaining EF_{OM} <i>ex post</i>

Data / Parameter:	$GEN_{i,y}$
Data unit:	MWh/yr
Description:	Electricity generation of each power source/plant
Source of data used:	
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Obtained from the power producers, dispatch centers or latest local statistics

Data / Parameter:	$EF_{CO2,i}$
Data unit:	tC/TJ
Description:	CO ₂ emission factor of fuel used for captive power or heat
Source of data used:	
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	National sources or IPCC defaults



Data / Parameter:	Eff_{captive}
Data unit:	%
Description:	Energy efficiency of captive power plant
Source of data used:	
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Depending on option chosen in baseline, measured before or after project implementation

Data / Parameter:	Eff_{heat}
Data unit:	%
Description:	Energy efficiency of heat plant
Source of data used:	
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	Eff_v
Data unit:	%
Description:	Efficiency of vehicle engine
Source of data used:	Vehicle data
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	ME_k
Data unit:	tCH ₄
Description:	Methane extracted on day <i>k</i>
Source of data used:	Project site
Value applied:	



**PROGRAMME OF ACTIVITIES DESIGN DOCUMENT FORM
(CDM-POA-DD) - Version 01**



Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Flow meters will record gas volumes, pressure and temperature

Data / Parameter:	$MM_{ELEC,k}$
Data unit:	tCH ₄
Description:	Methane measured for power generation on day <i>k</i>
Source of data used:	
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Flow meters will record gas volumes, pressure and temperature

Data / Parameter:	$MM_{HEAT,k}$
Data unit:	tCH ₄
Description:	Methane measured for new heat generation on day <i>k</i>
Source of data used:	
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Flow meters will record gas volumes, pressure and temperature

Data / Parameter:	$MM_{FL,k}$
Data unit:	tCH ₄
Description:	Methane measured sent flare on day <i>k</i>
Source of data used:	
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Flow meters will record gas volumes, pressure and temperature



E.7. Application of the monitoring methodology and description of the monitoring plan:

D.7.1. Data and parameters to be monitored by each CPA:

(Copy this table for each data and parameter)

Data / Parameter:	
Data unit:	
Description:	
Source of data to be used:	
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	In this section the project participants shall provide description of equipment used for measurement, if applicable, and its accuracy class.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	CONS _{ELEC,PJ}
Data unit:	MWh
Description:	Additional electricity consumption for capture and use or destruction of methane, if any
Source of data to be used:	Monitoring Data from CPA Operator
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	Continuous via electricity meter sub 1% accuracy
QA/QC procedures to be applied:	Meter checked maintained and calibrated to manufacturers standards or per local regulation
Any comment:	



**PROGRAMME OF ACTIVITIES DESIGN DOCUMENT FORM
(CDM-POA-DD) - Version 01**



Data / Parameter:	CONS _{HEAT,PJ}
Data unit:	GJ
Description:	Additional heat consumption for capture and use or destruction of methane
Source of data to be used:	Monitoring Data from CPA Operator
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	Continuous
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	CONS _{FossFuel,PJ}
Data unit:	GJ
Description:	Additional fossil fuel consumption for capture and use or destruction of methane
Source of data to be used:	Project site
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	Pump metering cross referenced to delivery invoices from suppliers, sub 1% accuracy
QA/QC procedures to be applied:	Meter checked maintained and calibrated to manufacturers standards or per local regulation
Any comment:	



Data / Parameter:	CEF _{ELEC}
Data unit:	tCO ₂ /MWh
Description:	Carbon emissions factor of electricity used by coal mine
Source of data to be used:	Calculated per tool
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	<i>Ex ante</i>
QA/QC procedures to be applied:	Meters checked maintained and calibrated to manufacturers standards or per local regulation
Any comment:	

Data / Parameter:	CEF _{HEAT}
Data unit:	tCO ₂ /GJ
Description:	Carbon emissions factor of heat used by coal mine
Source of data to be used:	
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	<i>Ex ante</i>
QA/QC procedures to be applied:	
Any comment:	



Data / Parameter:	$CEF_{FossFuel}$
Data unit:	tCO ₂ /GJ
Description:	Carbon emissions factor of fossil fuel used by coal mine
Source of data to be used:	IPCC
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	<i>Ex ante</i>
QA/QC procedures to be applied:	Review IPCC defaults annually
Any comment:	Use of IPCC default or national values would suffice

Data / Parameter:	MM_{FL}
Data unit:	tCH ₄
Description:	Methane measured sent to flare
Source of data to be used:	CPA operator
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	Continuous output from flow meter to excel format file
QA/QC procedures to be applied:	Meter checked maintained and calibrated to manufacturers standards or per local regulation
Any comment:	Flow meters will record gas volumes, pressure and temperature. Density of methane under normal conditions of temperature and pressure is 0.67kg/m ³ (Revised 1996 IPCC Reference Manual p 1.24 and 1.16)

Data / Parameter:	MM_{ELEC}
Data unit:	tCH ₄
Description:	Methane sent to power plant
Source of data to be used:	M



Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	Continuous output to excel file.
QA/QC procedures to be applied:	Meter checked maintained and calibrated to manufacturers standards or per local regulation
Any comment:	Flow meters will record gas volumes, pressure and temperature. Density of methane under normal conditions of temperature and pressure is 0.67kg/m ³ (Revised 1996 IPCC Reference Manual p 1.24 and 1.16)

Data / Parameter:	Eff _{ELEC}
Data unit:	%
Description:	Efficiency of methane destruction/oxidation in power plant
Source of data to be used:	IPCC 2006
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	0.995
Description of measurement methods and procedures to be applied:	<i>Ex ante</i>
QA/QC procedures to be applied:	Annual review of IPCC factor
Any comment:	Set at 99.5%(IPCC)



Data / Parameter:	MM _{HEAT}
Data unit:	tCH ₄
Description:	Methane sent to boiler
Source of data to be used:	CPA operator
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	Continuous data output to excel file
QA/QC procedures to be applied:	Meter checked maintained and calibrated to manufacturers standards or per local regulation
Any comment:	Flow meters will record gas volumes, pressure and temperature. Density of methane under normal conditions of temperature and pressure is 0.67kg/m ³ (Revised 1996 IPCC Reference Manual p 1.24 and 1.16)

Data / Parameter:	Eff _{HEAT}
Data unit:	-
Description:	Efficiency of methane destruction/oxidation in heat plant
Source of data to be used:	IPCC
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	0.995
Description of measurement methods and procedures to be applied:	<i>Ex ante</i>
QA/QC procedures to be applied:	Annual review of IPCC standard
Any comment:	Set at 99.5% (IPCC)



Data / Parameter:	MM _{GAS}
Data unit:	tCH ₄
Description:	Methane sent to gas grid for end users
Source of data to be used:	CPA operator
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	Continuous
QA/QC procedures to be applied:	Invoices to external gas pipeline operator/end users, Meter checked maintained and calibrated to manufacturers standards or per local regulation
Any comment:	Flow meters will record gas volumes, pressure and temperature. Density of methane under normal conditions of temperature and pressure is 0.67kg/m ³ (Revised 1996 IPCC Reference Manual p 1.24 and 1.16)

Data / Parameter:	Eff _{GAS}
Data unit:	-
Description:	Overall efficiency of methane destruction/oxidation through gas grid
Source of data to be used:	IPCC
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	0.985
Description of measurement methods and procedures to be applied:	<i>Ex ante</i>
QA/QC procedures to be applied:	Annual review of IPCC standard
Any comment:	Set at 98.5% (IPCC)



Data / Parameter:	CEF _{NMHC}
Data unit:	
Description:	Carbon emission factor for combusted non methane hydrocarbons (various)
Source of data to be used:	
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	
QA/QC procedures to be applied:	Independent laboratory analysis from certified laboratory annually or as required by CME from time to time (including blind sample)
Any comment:	To be obtained through periodical analysis of the fractional composition of captured

Data / Parameter:	PC _{CH4}
Data unit:	%
Description:	Concentration (in mass) of methane in extracted gas (%), measured on wet basis
Source of data to be used:	CPA operator Concentration meters, optical and calorific
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	Hourly/Daily
QA/QC procedures to be applied:	Meter checked maintained and calibrated to manufacturers standards or per local regulation
Any comment:	To be measured on wet basis



Data / Parameter:	PC_{NMHC}
Data unit:	%
Description:	NMHC concentration (in mass) in extracted gas
Source of data to be used:	Concentration meters, optical and calorific
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	Annually
QA/QC procedures to be applied:	Independent certified laboratory to undertake the tests from samples including blind control sample
Any comment:	To be counted if above 1% of gas composition

Data / Parameter:	PE_{Mvent}
Data unit:	tCH ₄
Description:	Emissions of methane vented to atmosphere during the project activity
Source of data to be used:	CPA operator
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	Continuous
QA/QC procedures to be applied:	Meter checked maintained and calibrated to manufacturers standards or per local regulation
Any comment:	This parameter is to include any methane vented to atmosphere through flares, in ventilation air methane as well as direct emissions through vents



Data / Parameter:	GWP_{CH_4}
Data unit:	tCO_2e/tCH_4
Description:	Global warming potential of methane
Source of data to be used:	IPCC 2007
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	25
Description of measurement methods and procedures to be applied:	<i>Ex ante</i>
QA/QC procedures to be applied:	Annual review of accepted IPCC parameters noting the 25 is accepted for a limited period in 2013
Any comment:	25 tCO_2e/tCH_4

Data / Parameter:	CEF_{CH_4}
Data unit:	tCO_2e/tCH_4
Description:	Carbon emission factor for combusted methane
Source of data to be used:	ACM0008 VERSION 7 default value
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	2.75
Description of measurement methods and procedures to be applied:	<i>Ex ante</i>
QA/QC procedures to be applied:	
Any comment:	$44/16 = 2.75 tCO_2e/tCH_4$



Data / parameter:	R
Data unit:	m
Description:	Cumulative radius of zone of influence
Source of data to be used:	CPA operator
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	Annually
QA/QC procedures to be applied:	Derived from Equation (15)
Any comment:	

Data / Parameter:	V_w
Data unit:	m^3
Description:	Cumulative flow at well
Source of data to be used:	CPA operator
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	
QA/QC procedures to be applied:	Meter checked maintained and calibrated to manufacturers standards or per local regulation
Any comment:	Monitoring at each well should record gas flow, methane concentration, pressure, and temperature



Data / Parameter:	T
Data unit:	m coal
Description:	Thickness of all coal accessed by wells
Source of data to be used:	CPA operator
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	Annually
QA/QC procedures to be applied:	Drill records matched to expected data and survey data
Any comment:	Depth of fractures into respective seams and casing used should be recorded at time of drilling

Data / Parameter:	ρ_{coal}
Data unit:	t/m ³
Description:	Density of locally mined coal
Source of data to be used:	ACM0008 VERSION 7 default
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	1.4
Description of measurement methods and procedures to be applied:	At start of each crediting period
QA/QC procedures to be applied:	Assessed by independent certified laboratory
Any comment:	Default value is 1.4



**PROGRAMME OF ACTIVITIES DESIGN DOCUMENT FORM
(CDM-POA-DD) - Version 01**



Data / Parameter:	g_{coal}
Data unit:	m^3CH_4/t coal
Description:	Gas content of coal
Source of data to be used:	CPA operator
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	At start of each crediting period
QA/QC procedures to be applied:	Assessed by independent certified laboratory
Any comment:	

Data / Parameter:	n
Data unit:	Days
Description:	Number of days the selected well is operational
Source of data to be used:	CPA operator
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	Log data from well flow meters
QA/QC procedures to be applied:	Log book and records, hard copies cross referenced against flow meter and total flow rates. Meter checked maintained and calibrated to manufacturers standards or per local regulation
Any comment:	



Data / Parameter:	V_a
Data unit:	m^3/day
Description:	Average flow per day
Source of data to be used:	CPA operator
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	
QA/QC procedures to be applied:	Calculated from total volume and days operated
Any comment:	

Data / Parameter:	V_c
Data unit:	m^3/day
Description:	Cumulative flow from all wells
Source of data to be used:	CPA operator
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	
QA/QC procedures to be applied:	Sum of metered data, cross referenced to immediate prior periods and expected flow
Any comment:	Total flow from all boreholes measured at collection manifold using automatic remote monitoring of gas flow, methane concentration, pressure and temperature



**PROGRAMME OF ACTIVITIES DESIGN DOCUMENT FORM
(CDM-POA-DD) - Version 01**



Data / Parameter:	N
Data unit:	Days
Description:	Sum of days all wells operational
Source of data to be used:	CPA operator
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	
QA/QC procedures to be applied:	Sum of other well data
Any comment:	

Data / Parameter:	
Data unit:	Coordinates
Description:	Position of wells relative to mining plan
Source of data to be used:	CPA operator
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	Annually
QA/QC procedures to be applied:	GPS records from mining plan as lodged with the authorities. Spot check using hand held GPS, noting that GPS reading error
Any comment:	Recorded in PDD <i>ex ante</i> . New drawing produced each year



Data / Parameter:	
Data unit:	Coordinates
Description:	Well profile
Source of data to be used:	CPA operator
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	Annually
QA/QC procedures to be applied:	GPS records from mining plan as lodged with the authorities. Spot check using hand held GPS, noting that GPS reading error
Any comment:	Shows each well and zone of influence against latest mining plan

Data / Parameter:	
Data unit:	m
Description:	Well depth
Source of data to be used:	CPA operator
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	At time of drilling
QA/QC procedures to be applied:	
Any comment:	Based on actual drilling records



Data / Parameter:	t
Data unit:	m
Description:	Total thickness of coal in emission zone
Source of data to be used:	CPA operator
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	At start of each crediting period
QA/QC procedures to be applied:	
Any comment:	From geology report and drilling records

Data / Parameter:	AO_w
Data unit:	m^2
Description:	Area of overlap with are to be mined
Source of data to be used:	CPA operator
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	Annually
QA/QC procedures to be applied:	
Any comment:	



Data / Parameter:	AT _w
Data unit:	m ²
Description:	Total zone of influence
Source of data to be used:	CPA operator
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	Annually
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	w
Data unit:	
Description:	Wells
Source of data to be used:	CPA operator
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	
QA/QC procedures to be applied:	Recorded in a data file that is verified and stored off site
Any comment:	



Data / Parameter:	CBM _{w,y}
Data unit:	tCH ₄
Description:	CBM captured from well intersected in year y
Source of data to be used:	CPA operator
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	Continuous
QA/QC procedures to be applied:	
Any comment:	Monitor each well separately

Data / Parameter:	CBM _{z,y}
Data unit:	tCH ₄
Description:	CBM captured from well intersected before year y
Source of data to be used:	CPA operator
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	Continuous
QA/QC procedures to be applied:	Meter checked maintained and calibrated to manufacturers standards or per local regulation
Any comment:	Monitor each well separately



Data / Parameter:	CBM _{x,y}
Data unit:	tCH ₄
Description:	CBM captured from well not yet intersected in year y
Source of data to be used:	CPA operator
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	Continuous
QA/QC procedures to be applied:	Meter checked maintained and calibrated to manufacturers standards or per local regulation
Any comment:	Monitor each well separately

Data / Parameter:	GEN _y
Data unit:	MWh
Description:	Electricity generation by project
Source of data to be used:	CPA operator
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	Continuous sub 1%
QA/QC procedures to be applied:	Cross referenced to invoices raised for external supply and or use for internal equipment. Meter checked maintained and calibrated to manufacturers standards or per local regulation
Any comment:	



**PROGRAMME OF ACTIVITIES DESIGN DOCUMENT FORM
(CDM-POA-DD) - Version 01**



Data / Parameter:	HEAT _y
Data unit:	GJ
Description:	Heat generation by project
Source of data to be used:	CPA operator
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	Continuous
QA/QC procedures to be applied:	Meter checked maintained and calibrated to manufacturers standards or per local regulation
Any comment:	

Data / Parameter:	VFUEL _y
Data unit:	GJ
Description:	Vehicle power supplied by project
Source of data to be used:	CPA operator
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	Continuous
QA/QC procedures to be applied:	Meter checked maintained and calibrated to manufacturers standards or per local regulation, calculated from fuel data and IPCC fuel energy factors reviewed annually. Cross check against vehicle hour logs and external invoices for vehicle fuel
Any comment:	



Data / Parameter:	EF _{ELEC}
Data unit:	tCO ₂ /MWh
Description:	CO ₂ emission factor of the grid
Source of data to be used:	National or regional data as published
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	1.04 for South Africa
Description of measurement methods and procedures to be applied:	Annually
QA/QC procedures to be applied:	Data to be sourced from external data such as Eskom web site or the SAPP emissions factor data as publicly available on the web
Any comment:	Calculated as per “Tool to calculate the emission factor for an electricity system”

Data / Parameter:	EF _{OM,y}
Data unit:	tCO ₂ /MWh
Description:	CO ₂ Operating Margin emission factor of the grid
Source of data to be used:	National or regional data as published
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	1.01 for South Africa
Description of measurement methods and procedures to be applied:	Annually or <i>ex ante</i>
QA/QC procedures to be applied:	Data to be sourced from external data such as Eskom web site or the SAPP emissions factor data as publicly available on the web
Any comment:	Calculated as per “Tool to calculate the emission factor for an electricity system”



Data / Parameter:	$EF_{BM,y}$
Data unit:	tCO ₂ /MWh
Description:	CO ₂ Build Margin emission factor of the grid
Source of data to be used:	National or regional data as published
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	1.06 for South Africa
Description of measurement methods and procedures to be applied:	Annually or <i>ex ante</i>
QA/QC procedures to be applied:	Data to be sourced from external data such as Eskom web site or the SAPP emissions factor data as publicly available on the web
Any comment:	Calculated as per “Tool to calculate the emission factor for an electricity system”

Data / Parameter:	$F_{i,j,y}$
Data unit:	t or m ₃ /yr
Description:	Amount of each fossil fuel consumed by each power source/plant
Source of data to be used:	
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	Annually or <i>ex ante</i>
QA/QC procedures to be applied:	Data to be sourced from external data such as Eskom web site or the SAPP emissions factor data as publicly available on the web
Any comment:	Obtained from the power producers, dispatch centers or latest local statistics



Data / Parameter:	COEF _{i,k}
Data unit:	tCO ₂ /t or m ³
Description:	CO ₂ emission coefficient of each fuel type and each power source/plant
Source of data to be used:	National or regional data as published
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	Annually
QA/QC procedures to be applied:	Data to be sourced from external data such as Eskom web site or the SAPP emissions factor data as publicly available on the web
Any comment:	Plant or country-specific values to calculate COEF are preferred to IPCC default values, in case of obtaining EF _{OM} <i>ex post</i>

Data / Parameter:	GEN _{i,y}
Data unit:	MWh/yr
Description:	Electricity generation of each power source/plant
Source of data to be used:	
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	Annually or <i>ex ante</i>
QA/QC procedures to be applied:	Data to be sourced from external data such as Eskom web site or the SAPP emissions factor data as publicly available on the web
Any comment:	Obtained from the power producers, dispatch centers or latest local statistics



Data / Parameter:	$EF_{CO_2,i}$
Data unit:	tC/TJ
Description:	CO ₂ emission factor of fuel used for captive power or heat
Source of data to be used:	
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	Annually or <i>ex ante</i>
QA/QC procedures to be applied:	Annual review of source data and IPCC
Any comment:	National sources or IPCC defaults

Data / Parameter:	$Ef_{captive}$
Data unit:	%
Description:	Energy efficiency of captive power plant
Source of data to be used:	CPA operator
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	Annually
QA/QC procedures to be applied:	
Any comment:	Depending on option chosen in baseline, measured before or after project implementation



**PROGRAMME OF ACTIVITIES DESIGN DOCUMENT FORM
(CDM-POA-DD) - Version 01**



Data / Parameter:	Ef_{heat}
Data unit:	%
Description:	Energy efficiency of heat plant
Source of data to be used:	CPA operator
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	Annually
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	Ef_v
Data unit:	%
Description:	Efficiency of vehicle engine
Source of data to be used:	Manufacturers data
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	Annually
QA/QC procedures to be applied:	
Any comment:	This is fixed based on the operating manual



Data / Parameter:	ME_k
Data unit:	tCH ₄
Description:	Methane extracted on day k
Source of data to be used:	CPA operator
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	Daily/continuous
QA/QC procedures to be applied:	Meter checked maintained and calibrated to manufacturers standards or per local regulation
Any comment:	

Data / Parameter:	$MM_{ELEC,k}$
Data unit:	tCH ₄
Description:	Methane measured for power generation on day k
Source of data to be used:	CPA operator
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	Daily/continuous
QA/QC procedures to be applied:	Meter checked maintained and calibrated to manufacturers standards or per local regulation
Any comment:	



Data / Parameter:	$MM_{HEAT,k}$
Data unit:	tCH ₄
Description:	Methane measured for new heat generation on day <i>k</i>
Source of data to be used:	CPA operator
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	Daily/continuous
QA/QC procedures to be applied:	Meter checked maintained and calibrated to manufacturers standards or per local regulation
Any comment:	

Data / Parameter:	$MM_{FL,k}$
Data unit:	tCH ₄
Description:	Methane measured sent flare on day <i>k</i>
Source of data to be used:	CPA operator
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	Daily/continuous
QA/QC procedures to be applied:	Meter checked maintained and calibrated to manufacturers standards or per local regulation
Any comment:	



Data / Parameter:	$f_{V_{ih}}$
Data unit:	-
Description:	Volumetric fraction of component i in the residual gas in the hour h where $i = CH_4, CO, CO_2, O_2, H_2, N_2$
Source of data to be used:	Measurements by project participants using a continuous gas analyser
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	Ensure that the same basis (dry or wet) is considered for this measurement and the measurement of the volumetric flow rate of the residual gas (FV_{RGh}) when the residual gas temperature exceeds 60 °C
Description of measurement methods and procedures to be applied:	Continuously. Values to be averaged hourly or at a shorter time interval
QA/QC procedures to be applied:	Analysers must be periodically calibrated according to the manufacturer's recommendation or local regulation. A zero check and a typical value check should be performed by comparison with a standard certified gas.
Any comment:	As a simplified approach, project participants may only measure the methane content of the residual gas and consider the remaining part as N ₂ .

Data / Parameter:	FV_{RGh}
Data unit:	m ³ /h
Description:	Volumetric flow rate of the residual gas in dry basis at normal conditions in the hour h
Source of data to be used:	Measurements by project participants using a flow meter
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	Ensure that the same basis (dry or wet) is considered for this measurement and the measurement of volumetric fraction of all components in the residual gas ($f_{V_{ih}}$) when the residual gas temperature exceeds 60 °C
Description of measurement methods and procedures to be applied:	Continuously. Values to be averaged hourly or at shorter time interval
QA/QC procedures to be applied:	Flow meters are to be periodically calibrated according to the manufacturer's recommendation or local regulation
Any comment:	



PROGRAMME OF ACTIVITIES DESIGN DOCUMENT FORM
(CDM-POA-DD) - Version 01



Data / Parameter:	t_{O_2h}
Data unit:	-
Description:	Volumetric fraction of O ₂ in the exhaust gas of the flare in the hour <i>h</i>
Source of data to be used:	Measurements by project participants using a continuous gas analyser
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	Extractive sampling analysers with water and particulates removal devices or in situ analysers for wet basis determination. The point of measurement (sampling point) shall be in the upper section of the flare (80% of total flare height). Sampling shall be conducted with appropriate sampling probes adequate to high temperatures level (e.g. inconel probes). An excessively high temperature at the sampling point (above 700 °C) may be an indication that the flare is not being adequately operated or that its capacity is not adequate to the actual flow.
Description of measurement methods and procedures to be applied:	Continuously. Values to be averaged hourly or at a shorter time interval
QA/QC procedures to be applied:	Analysers must be periodically calibrated according to the manufacturer's recommendation or local regulation. A zero check should be performed by comparison with a standard gas.
Any comment:	Monitoring of this parameter is only applicable in case of enclosed flares and continuous monitoring of the flare efficiency.



Data / Parameter:	$f_{V_{CH_4 FGh}}$
Data unit:	mg/m^3
Description:	Concentration of methane in the exhaust gas of the flare in dry basis at normal conditions in the hour h
Source of data to be used:	Measurements by project participants using a continuous gas analyser
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	Extractive sampling analysers with water and particulates removal devices or in situ analyser for wet basis determination. The point of measurement (sampling point) shall be in the upper section of the flare (80% of total flare height). Sampling shall be conducted with appropriate sampling probes adequate to high temperatures level (e.g. inconel probes). An excessively high temperature at the sampling point (above 700 oC) may be an indication that the flare is not being adequately operated or that its capacity is not adequate to the actual flow.
Description of measurement methods and procedures to be applied:	Continuously. Values to be averaged hourly or at a shorter time interval
QA/QC procedures to be applied:	Analysers must be periodically calibrated according to manufacturer's recommendation or local regulation. A zero check and a typical value check should be performed by comparison with a standard gas.
Any comment:	Monitoring of this parameter is only applicable in case of enclosed flares and continuous monitoring of the flare efficiency. Measurement instruments may read ppmv or% values. To convert from ppmv to mg/m^3 simply multiply by 0.716. 1% equals 10 000 ppmv.



PROGRAMME OF ACTIVITIES DESIGN DOCUMENT FORM
(CDM-POA-DD) - Version 01



Data / Parameter:	T_{flare}
Data unit:	°C
Description:	Temperature in the exhaust gas of the flare
Source of data to be used:	Measurements by project participants
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	Measure the temperature of the exhaust gas stream in the flare by a Type N thermocouple. A temperature above 500 oC indicates that a significant amount of gases are still being burnt and that the flare is operating.
Description of measurement methods and procedures to be applied:	Continuously.
QA/QC procedures to be applied:	Thermocouples should be replaced or calibrated every year to manufacturer's specification or local regulation.
Any comment:	An excessively high temperature at the sampling point (above 700 °C) may be an indication that the flare is not being adequately operated or that its capacity is not adequate to the actual flow.



Data / Parameter:	NCV _{ch4}
Data unit:	GJ
Description:	Net calorific value of methane
Source of data to be used:	IPCC 2006
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	0.0359 GJ/m ³
Description of measurement methods and procedures to be applied:	fixed
QA/QC procedures to be applied:	Annual review of IPCC standard
Any comment:	

Data / Parameter:	NCV _{AF}
Data unit:	GJ
Description:	Net calorific value of alternate fuel
Source of data to be used:	IPCC 2006
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	fixed
QA/QC procedures to be applied:	Annual review of IPCC standard
Any comment:	



Data / Parameter:	OXID
Data unit:	%
Description:	Oxidation
Source of data to be used:	IPCC 2006
Value of data applied for the purpose of calculating expected emissions reductions in section B.5	
Description of measurement methods and procedures to be applied:	Daily/continuous
QA/QC procedures to be applied:	Annual review of IPCC standard
Any comment:	

E.7.2. Description of the monitoring plan for a CPA:

Organization and Monitoring Manual

Each proposed CPA involves the development of a monitoring manual, based on which accurate monitoring shall be conducted. The monitoring manual clearly states the monitoring method employed at each monitoring point and makes sure that the monitoring is accurately conducted.

The manual clarifies the management structure for a CPA. Typical monitoring structure is presented in Figure-7. A monitoring team is formed under the CDM Manager, who oversees the entire project, for the management of the monitoring of the project. Monitoring is mainly conducted at each location for the activities in the CPA.

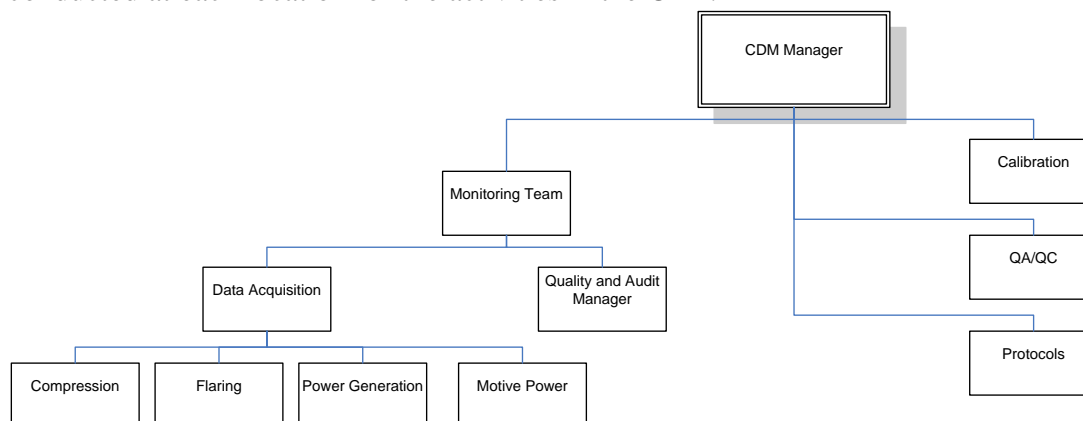


Figure 7 – Monitoring Structure

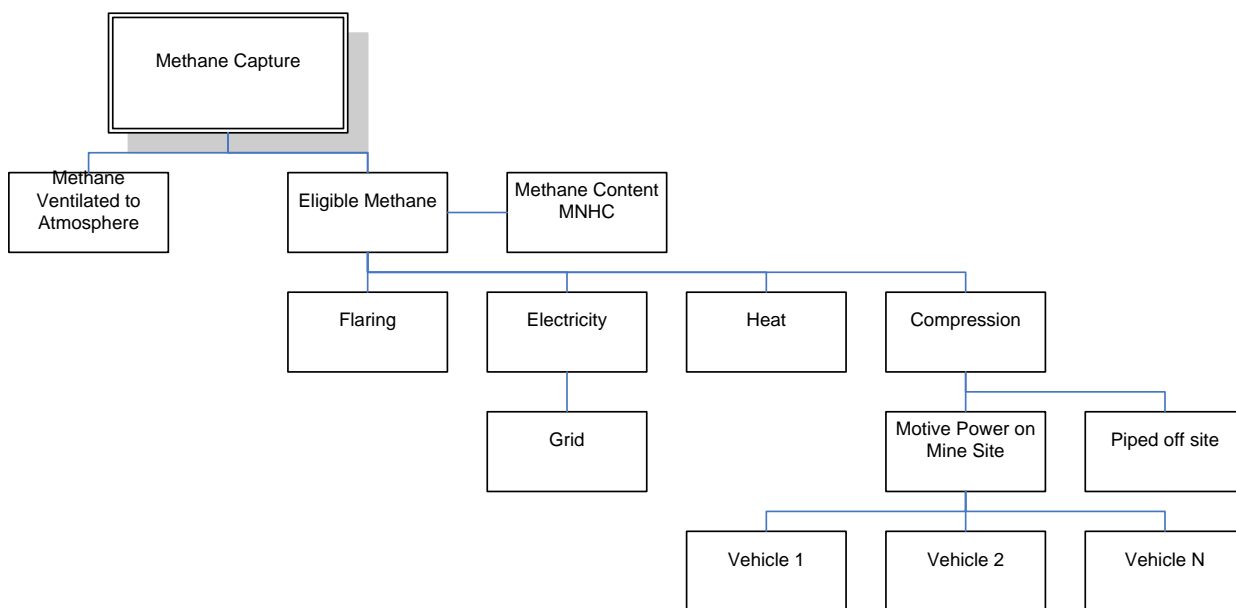


Figure-8 Monitoring & Other Function of Each Section

Monitoring points and data to be monitored

The data that will be monitored are shown in the table of Section E.7.1. Figure-9 indicates the detailed instruments installation for monitoring (depend on each CPA). All equipments will be installed, operated and calibrated corresponding to national or industry standards or manufacture's specifications. Calibration will be checked regularly by outside contractors.

The gas flow measured is corrected by pressure and temperature.

Further, annual analysis will be undertaken by third qualified party to check the NMHC concentration in the methane flow, and if it accounts for more than 1% of methane analysis of the carbon emission factor for combusted NMHC will be undertaken.

Each well will be monitored for Flow, temperature and pressure on a continuous basis. NMHC will be tested from samples of each well annually.

Each well will be classified for eligible CBM by computation equations 23-27

At each point of use the methane flow, that is, flaring, electricity generation, heat generation, compression resulting in motive power and pipelined off site, temperature and pressure shall be monitored on a continuous basis with NMHC being tested annually.

Electricity generated shall be monitored by meter and electricity exported to the grid shall be monitored by meter.

For each vehicle fuel use and hours operated or odometer readings will be recorded.



Type	Name	Parameter	Name
Well	Eligible CMM	F1	Flow rate
		T1	Temperature
		P1	Pressure
		G1	Gas Composition
Well	Eligible CBM	F1	Flow rate
		T1	Temperature
		P1	Pressure
		G1	Gas Composition
Well	Non Eligible CBM	Th1	Thickness of coal
		F1	Flow rate
		T1	Temperature
		P1	Pressure
Flare		G1	Gas Composition
		Th1	Thickness of coal
		F1	Flow rate
		T1	Temperature
Electricity		P1	Pressure
		G1	Gas Composition
		AE	Auxiliary output for internal use
Motive Power	Vehicle	E1	Electricity for Grid
		F	Gas flow
		Fd	Fuel delivered to vehicle
Pipeline	Gas piped off site	M	Distance or operating hours
		F1	Flow rate
		T1	Temperature
		P1	Pressure
		G1	Gas Composition

Figure-9 Monitoring Points for a CPA

Monitoring, recording and management of data

All data continuously measured are transmitted to the monitoring computer. All monitored data will be recorded electronically or in paper copies. The electronic records and paper copies are kept for two years after the end of the crediting period as required by approved methodology ACM0008 VERSION 7.



The chief of each section will check the data every day and report the data to the monitoring team. And the chief of each section will send the monitoring data of the previous month to the monitoring team for storage and management.

The monitoring team will summarize and check the monthly data and complete the monthly monitoring report, compile the collected data to calculate emission reductions and send it to the CDM director. The team will also be responsible for data storage and for preparing the data for verification.

Quality control and training

The following procedures will be followed to install, maintain and calibrate the equipments used in this project:

- 1) CDM monitoring team and their staff has training on every day maintenance check during the test operation by the instrument supplier to ensure that the managing site engineer and his team are familiar with the operation and maintenance of the equipment.
- 2) The measuring instruments such as for flow rate, methane concentration, pressure and temperature will be calibrated periodically in accordance with relevant national/sectoral or manufacturers' requirements;
- 3) The electricity meters will be calibrated periodically by authorized entities in accordance with relevant national/sectoral standards or manufacturers' requirements.

Emergency Procedures

In case there are errors found in calibration or during the regular checks of meters, the malfunctioning meter or component will be repaired or replaced immediately in accordance with the manufacturer's instructions.

The CDM responsible person and specialists are informed of the error and ensure that the necessary corrective actions and appropriate steps are taken to resolve the problem.

Corrective Actions

The quality assurance and quality control procedures for recording, maintaining and archiving data shall be improved as part of this CDM project activity according to EB rules and real practice. This is an on-going process which will be

E.8. Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)
--

>>

The completion date of the application of the baseline study and monitoring methodology:



30/09/2011

The name of the responsible person(s)/entity(ies):

Environmental Intermediaries & Trading Group Limited

Note: Environmental Intermediaries & Trading Group Limited is also a project participant as an Annex I domiciled entity.



Annex 1

**CONTACT INFORMATION ON COORDINATING/MANAGING ENTITY and
PARTICIPANTS IN THE PROGRAMME of ACTIVITIES**

Organization:	Environmental Intermediaries & Trading Group Limited
Street/P.O.Box:	10/114 St Georges Bay Rd
Building:	'G'
City:	Parnell
State/Region:	Auckland
Postfix/ZIP:	1051
Country:	New Zealand
Telephone:	+64 9 9201092
FAX:	+64 9 9201093
E-Mail:	richard.hayes@eitg.co.nz
URL:	www.eitg.co.nz
Represented by:	Richard Hayes
Title:	Director
Salutation:	Mr
Last Name:	Hayes
Middle Name:	Stewart
First Name:	Richard
Department:	
Mobile:	+64 21 310 301
Direct FAX:	
Direct tel:	
Personal E-Mail:	richardshayes@gmail.com



Organization:	Gregory Services Limited
Street/P.O.Box:	7 – 9 Conway street
Building:	3 rd fl Conway House
City:	St Helier
State/Region:	
Postfix/ZIP:	
Country:	Jersey JE3 3NT
Telephone:	+ 441534870670
FAX:	
E-Mail:	
URL:	
Represented by:	Baccata Trustees
Title:	Director
Salutation:	Mr
Last Name:	Nick
Middle Name:	
First Name:	Falla
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding associated with this POA.

Annex 3

BASELINE INFORMATION

Refer Section E.4. no additional information supplied here



Annex 4

MONITORING INFORMATION

Contents of the Monitoring Manual

1. Introduction
 - a. Purpose of the Operations Monitoring Plan
 - b. Use of the Operations Monitoring Plan
2. Project Information
 - a. The Monitoring Methodology
 - b. Description of the project activity
 - c. Estimated amount of emission reductions over the chosen crediting period
 - d. Duration of the project activity
 - e. The baseline scenario
 - f. Description of the sources and gases included in the project boundary
3. Management
 - a. Allocation of Responsibilities
 - b. Monitoring Organization
 - c. Operational Obligations
 - d. Job Responsibility
 - e. Performance Reports
4. Calculation of emission reductions
 - a. Project Emissions
 - b. Baseline Emissions
 - c. Leakage
 - d. Estimation of emission reductions
5. Monitoring System
 - a. Data and parameters monitored:
 - b. Recording and Archiving of Monitoring Data
 - c. Monitoring Point
 - d. Monitoring
 - e. The Project Workbook – How to use the Workbook
 - f. Quality Assurance
 - g. Training
6. Auditing and Verification
 - a. Project Commissioning
 - b. Verification Procedures
