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

CONTENTS

Annexes

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 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:

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Coal Mine Methane Utilisation and Destruction Programme in DPR Korea
Version: 01
Date: 10 October 2011

A.2. Description of the programme of activities:

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The coal industry is a major contributor of methane emissions to the atmosphere. Degassing of Coal Mine Methane gas (CMM) is an unavoidable occurrence of coal mining. CMM mainly consists of the harmful greenhouse gas methane. The Democratic People's Republic of Korea (DPR Korea) has in excess of one hundred active coal mines. All of them currently emit methane directly into the atmosphere. The DPR Korea mines around 25m tons of coal annually, thereby releasing a substantial amount of methane into the atmosphere. The DPR Korea has current plans to substantially increase coal production from existing mines.

The DPR Korea currently lacks financial resources in order to implement emission reduction projects on a wide scale. The Coal Mine Methane Utilisation and Destruction Programme in DPR Korea (herein after referred to as the "PoA") aims to support the DPR Korea's efforts to move to a low-carbon future. The managing/coordinating entity is required to finance the investment of the PoA and individual CDM Project Activities (CPAs) included in the PoA from its own funds. The DPR Korea has confirmed that it will not provide finance for the development or implementation of the CPAs.

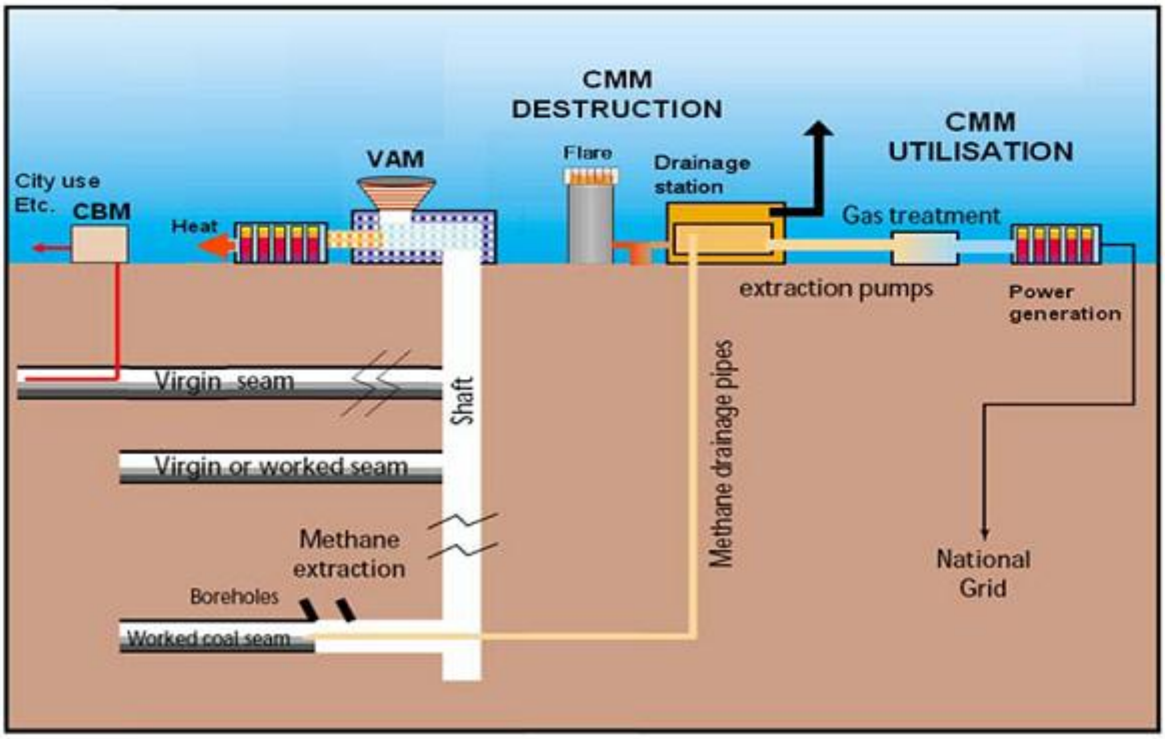
The government of the DPR Korea currently has no policy measures in place to capture and utilise or destroy methane from coal mines. The DPR Korea also does not offer any financial incentives for the implementation of the PoA and requires the coordinating/managing entity to provide finance for the entire investment of the PoA.

The PoA aims to reduce GHG emissions by capturing methane from coal mines in the territory of the DPR Korea and to either utilise the methane for electricity and/or heat generation and/or destroy the methane through flaring. The combustion of methane in a boiler and/or electricity generator and/or flare results in a significant emission reduction as the potent greenhouse gas methane (CH_4) with the Global Warming Potential (GWP) of 21 is converted into less harmful carbon dioxide (CO_2) with a GWP of 1.

In case of utilisation of the methane for electricity and/or heat generation, a further displacement of conventionally generated heat or electricity from coal adds further CO_2 reductions.

The only revenue stream arising from the PoA to the coordinating/managing entity will be CER revenue as electricity and/or heat supplied from the CPA will not be remunerated by the CPA operator or other entity in the DPR Korea.

Figure-1 shows the outline of a CPA included in the PoA:



(Source: United Nations Economic Commission for Europe Methane to Markets Partnership, February 2010)

Similar projects have already been successfully implemented in other countries and have been registered as CDM projects.

The PoA aims to identify sites where methane capture and utilisation or destruction can be implemented economically. The goal of the PoA is to identify as many sites as possible and to implement methane capture and utilisation and/or destruction to reduce the maximum amount of GHGs subject to economic viability by employing technology that has a proven track record.

The expected result of the PoA is a significant reduction of GHG emissions compared to the emissions that would occur in the absence of the PoA. The PoA also contributes to sustainable economic development in the DPR Korea and generates various social benefits.

The benefits of the PoA are as follows:

A. **Environmental benefits:**
The PoA will contribute to GHG emission reductions in the DPR Korea and therefore will also contribute to the mitigation of adverse impacts of climate change, both locally and globally. If a CPA demonstrates its feasibility for electricity and/or heat generation, then an additional environmental benefit will be the displacement of coal as source for electricity and/or heat generation.

B. **Social and economic benefits:**
The PoA will contribute to increase the safety conditions in coal mines due to an increased level

of degassing. The PoA will utilize CMM as an energy source, which would otherwise be wasted by being released into the atmosphere under the baseline scenario. The propose PoA raises awareness of unutilized sources of energy and contributes to an increase in the efficiency of the utilisation of resources. As the PoA will establish the first CMM utilisation and destruction project in the DPR Korea, it will also demonstrate progress towards reducing emissions in the DPR Korea in order to mitigate the adverse impacts of climate change globally. The PoA brings new technology to the DPR Korea. Additionally, the PoA will create employment as the monitoring process will require data collection, preparation and dissemination.

C. **Other benefits:**
The PoA allows individual CPAs to apply a unified CDM registration framework, thereby lowering the costs for CPA implementation. As a result of the reduced transaction costs, more CPAs can be implemented that would otherwise not be economically viable.

These benefits demonstrate that the PoA contributes to global GHG emission reductions as well as to sustainable development in the DPR Korea.

The coordinating/managing entity for the PoA is Carbon Development and Trading Ltd.

The PoA is a voluntary action undertaken by Carbon Development and Trading Ltd.

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

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Project participants being registered in relation to the PoA.

The coordinating/managing entity of the PoA is Carbon Development and Trading Ltd.

Project participants may or may not be involved in one of the CPAs related to the PoA.

Party involved (*) ((host) indicates a host Party)	Legal entity project participant (as applicable)	Please indicate if the Party involved wishes to be considered as project participant (Yes/No)
Democratic People’s Republic of Korea (host)	General Bureau for Cooperation with International Organizations (GBCIO), Ministry of Foreign Trade (MFT), DPR Korea	No
United Kingdom of Great Britain and Northern Ireland	Carbon Development and Trading Ltd.	No

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

A.4.1. Location of the programme of activities:

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The PoA is located within the political boundary of the Democratic People’s Republic of Korea.

A.4.1.1. Host Party(ies):

Democratic People's Republic of Korea

A.4.1.2. Physical/ Geographical boundary:

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The geographical boundary for the PoA includes all areas of the Democratic People's Republic of Korea.

Figure-2 shows the geographical boundary of the PoA.

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

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

The PoA consists of CPAs with the same technical concept. Currently CMM is vented into the atmosphere through the mine ventilation systems. The mine ventilation systems are designed for operational safety for underground mining activities and not for CMM capture. There are no CMM capture and/or suction systems in place at the coal mines of the DPR Korea.

A CPA will capture methane from an active coal mine within the territory of the DPR Korea and to perform one or a combination of the following:

1. Utilisation of the methane for the production of electricity; and/or
2. Utilisation of the methane for the production of heat; and/or
3. Destruction of the methane through a flare.

There is currently no legal requirement in the DPR Korea to utilise or destroy CMM in the territory of the DPR Korea.

The PoA will utilise flares and/or heat generation and/or electricity generation equipment that captures and destroys and/or utilises coal mine methane.

Technology will be employed CPA specific and will vary according to the CPA requirements. For all CPAs, CMM will be used.

Each CPA may include one or more flares and/or one or more boilers for heat generation and/or one or more power generation units.

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

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The following eligibility criteria are applicable for the inclusion of a CPA in the PoA:

1. The geographic boundary of the CPA lies within the DPR Korea;
2. A CPA reduces GHG emissions by utilising CMM for electricity and or power generation and/or destroying CMM through flaring;
3. The existing Approved CDM Methodology ACM0008 (Version 07) is applicable to the CPA.
4. For the purpose of determining baseline emissions, a CPA, in the baseline scenario, released all CMM into the atmosphere without destruction or utilisation;
5. A CPA operator confirms in a written statement that it is aware and agrees with the inclusion of the CPA in the PoA;
6. A CPA operator confirms in a written statement that it does not belong to any other PoA or CDM Project;
7. A CPA operator confirms in a written statement that they are not required by law or other policies to capture CMM at the CPA site ;
8. A CPA meets the following criteria for assessing additionality:
   - (i) The CPA is not required by law or other statutes or measures to capture and utilise or destroy CMM ;
   - (ii) The CPA confirms that it does not have the financial resources to implement the project.

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):

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The current business as usual activity is the release of CMM into the atmosphere without capture and utilisation or destruction. There are no laws in the DPR Korea requiring the operators of coal mines to utilise or capture CMM. Given the lack of investment capital available in the DPR Korea, the CPAs would not happen in the absence of CDM revenue. The DPR Korea currently has no plans to implement legislation for the capture and utilisation of CMM.

The PoA improves the current practise and introduces efficiency measures to the DPR Korea that also support global climate change mitigation action.

The DPR Korea has mined in excess of 25 million tons of coal in 2010. Therefore, it is estimated that several million tons of CO2 emissions will be abated when the PoA includes all active coal mines in the DPR Korea.

The only financial or economic benefit resulting from the PoA to the PoA coordinator is revenue arising from CERs. Without this CER revenue, the PoA coordinator cannot economically implement the PoA. As the managing/coordinating entity is not required by law to do so, it would not implement individual CPAs in the PoA.

The PoA does not implement any mandatory policies or regulations.

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

A.4.4.1. Operational and management plan:

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The coordinating/managing entity is responsible for the coordination of all project participants of the PoA, collecting necessary data and information from each CPA for the purpose of establishing the economic and technical feasibility of each CPA and to ensure that monitoring at each CPA site can be performed. The coordinating/managing entity is also responsible for all communications with the DOE and CDM Executive Board.

Each CPA is operated by a CPA operator that regularly reports monitored data to the coordinating/managing entity. The CPA operator will appoint a person dedicated to ensure that monitoring equipment is maintained and operational in accordance with manufacturer specifications. This person will also be tasked to ensure that data is collected in accordance to the monitoring procedures required to ensure accurate and timely data collection for all required parameters in accordance with the monitoring methodology.

The record keeping system includes, but is not limited to, a database that lists all CPAs, the CPA’s unique identification number, name and location of the CPA, size of each CPA, installed equipment, name of the company responsible for the CPA and all necessary data relating to the coal mines at each CPA site. The database will be maintained by the coordinating/managing entity with information provided by each CPA operator. The coordinating/managing entity verifies the reported data with field checks if necessary.

Each CPA operator, in accordance with the eligibility criteria set out in section 4.2.2, confirms in writing at the time of CPA inclusion that it does not belong to any other PoA or other registered CDM Project to ensure the avoidance of double counting.

Each CPA operator, in accordance with the eligibility criteria set out in section 4.2.2, confirms in writing at the time of CPA inclusion that it is aware and has agreed to be included in the PoA.

A.4.4.2. Monitoring plan:

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The CPAs will not use a statistically sound sampling method or procedure to be used by DOEs. All data required for verification of the amount of anthropogenic emissions by source is provided by the CPAs in the PoA through the coordinating/managing entity to the DOE.

According to the Procedures for Registration of a Programme of Activities as a Single CDM Project Activity and issuance of Certified Emission Reductions for a Programme of Activities (version 04.1), all CPAs in the PoA will be monitored according to the applicable methodology, procedures and guidelines.

All relevant parameters included in the monitoring plan for each CPA shall be monitored and recorded for each CPA independently. Monitoring reports for each CPA will be drawn up for verification purposes and for the request for issuance of CERs. The coordinating/managing entity will act as a central point for data collection and archiving to ensure accessibility of the data.

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

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No public funding is provided for the PoA or any of the CPAs included in the PoA.

SECTION B. Duration of the programme of activities

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

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The starting date of the PoA shall be the registration date of the PoA with the CDM Executive Board.

B.2. Length of the programme of activities:

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The length of the 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:

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1. Environmental Analysis is done at PoA level ☒
2. Environmental Analysis is done at CPA level ☐

Although, the PoA allows for large scale project activities including flaring, heat and/or power generation, the Environmental Laws of the DPR Korea do not require an established coal mine to perform an environmental impact assessment as long as the large scale CDM project activity is within the boundary of the current coal mining site. The CPA operator is empowered to implement projects at the CPA site.

The technology employed for flaring CMM and for boilers and power generation units utilising CMM is well understood. The size of the equipment is not substantial compared to the size of a coal mine, with containerized units available.

The equipment installed at the CPA site can be removed without substantial impact after the end of the project lifetime. Groundwork required for the installation of a flare, boiler and/or power generation unit is comparatively small and only requires a concrete platform on which to base the equipment.

Because no substantial impact on the ground and landscape results from the installation of a power generation unit, boiler or flare, no impairment on nature or landscape is given. After the end of the project life-cycle, the original natural state of the site can be restored in an uncomplicated way.

The facilities do not use natural resources. The equipment causes no harmful environmental impact and CMM utilisation and/or destruction will actually help reduce environmental impacts on the site compared to current operations. The facilities do not produce any waste, sewage or condensate. Due to the high operational safety standards of the equipment, a very low accident hazard is given.

The facilities cause no harmful environmental impacts. In fact the utilisation of otherwise unused CMM reduces in an active manner the amount of CMM which is released into the atmosphere and provides significant benefits for global climate protection by converting the harmful GHG methane into the less harmful GHG carbon dioxide.

Furthermore the operation of the plants reduces the uncontrolled release of CMM to the surface in the surrounding area and consequently reduces the accident hazard by fire and explosions caused through methane.

Beside the positive effects on global climate protection, no transboundary impacts occur.

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

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The following environmental impacts were analysed:

<u>During the construction period:</u>

Atmosphere
The CPA mainly causes air pollution in the form of dust caused by the installation of the equipment on site and associated construction activity. If required, water will be sprayed to control the dust.

Noise
Mechanical noise will result from the installation of equipment including flares, boilers and power generation units. The location of the equipment will be within the boundary of the existing coal mine and thereby the mechanical noise will not add substantial noise pollution to the ongoing mechanical noise resulting from coal mining operations.

Water
There is no impact on the local water environment resulting from the installation of equipment at the coal mine.

Solid waste

Solid waste is primarily from workers when doing construction work. As the number of workers compared to the amount of people working at the coal mine is insignificant, no significant impact is resulting from the construction activity.

During the operation period:

Atmosphere
The major air pollution source during the operation period is waste gas originating from CMM combustion. The pollution levels of the combustion installations are in compliance with local and national requirements. The CPA will utilize and/or destroy CMM, which is currently vented directly into the atmosphere. Therefore, air pollution resulting from the CMM release is reduced substantially. Additionally, power generation units and boilers, if installed at the site, will displace coal-fired power units and coal-fired boilers, which results in a decrease of SO2, CO2, dust and ash caused by coal-fired boilers and/or coal-fired power stations.

Noise
During the operation period, noise mainly comes from the operation of facilities such as the CMM compressor, power generation units and steam turbine. The installation of the equipment will be done at a place at the coal mining site where noise is being minimized for workers and local residents.

Water
The equipment does not require any water supply nor does it produce wastewater. Therefore, there is no impact on the local water environment.

Solid waste
As the equipment is designed to operate with minimal supervision and labour requirement, no substantial sold waste impact results from the facilities.

No transboundary impacts have been identified.

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),:

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According to the Environmental Laws of the DPR Korea, an established coal mine does not require an Environmental Impact Assessment for the implementation of a CMM capture and utilisation or destruction project. The Host Party does not consider the environmental impact of such projects as significant.

SECTION D. Stakeholders' comments

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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 ☒

Note: If local stakeholder comments are invited at the PoA level, include information on how comments by local stakeholders were invited, a summary of the comments received and how due account was taken of any comments received, as applicable.

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

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Not applicable. The stakeholder consultation is done on the CPA level.

D.3. Summary of the comments received:

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Not applicable. The stakeholder consultation is done on the CPA level.

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

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Not applicable. The stakeholder consultation is done on the 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:

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The PoA will use the Approved Methodology ACM0008 (Version 7.0): 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;

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

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The Approved Methodology ACM0008 states the applicability criteria to the methodology. Below is a comparison between the applicability criteria set out by the Approved Methodology ACM0008 and the CPAs:

Table 1: Applicability of Approved Methodology ACM0008 to each CPA

Applicability to extraction activities:	
Surface drainage boreholes to capture CBM associated with mining activities	Included.
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	Included

Ventilation air methane that would normally be vented	Excluded. VAM will not be captured and destroyed or utilised.

Applicability to CMM capture, utilisation and destruction:	
The methane is captured and destroyed through flaring	Included
The methane is captured and destroyed through flameless oxidation	Excluded. CPAs will not use flameless oxidizers to destroy methane from VAM.
The methane is captured and destroyed through utilisation to produce electricity, motive power and/or thermal energy; emission reductions may or may not be claimed for displacing or avoiding energy from other sources	Included
The remaining share of the methane, to be diluted for safety reason, may still be vented	Included
All the CBM or CMM captured by the project should either be used or destroyed, and cannot be vented.	Included

Applicability for opencast mines:	
The mines should have had a working mining concession for at least three years prior to the start of project	Excluded. No CPAs will be implemented at open cast mines.
Only pre-mine drainage from wells placed within the area to be mined are considered as eligible for crediting	Excluded. No CPAs will be implemented at open cast mines.
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	Excluded. No CPAs will be implemented at open cast mines.
For open cast mines, avoided emissions from methane extracted should only be credited in the year in which the seam is mined through the well zone of influence or the de-stressing zone	Excluded. No CPAs will be implemented at open cast mines.

Inapplicability due to incompatibility:	
Capture methane from abandoned/decommissioned coalmines	Excluded. The CPAs will not be implemented at abandoned/decommissioned coalmines
Capture/use of virgin coal bed methane, e.g. methane of high quality extracted from coal seams independently of any mining activities	Excluded in accordance with Methodology ACM0008.
Use CO_2 or any other fluid/gas to enhance CBM drainage before mining takes place	Excluded in accordance with Methodology ACM0008.

Each CPA will supply the necessary data for ex-ante projections of methane demand as described in sections Baseline Emissions and Leakage of Approved Methodology ACM0008.

Therefore, each CPA will be in compliance with the baseline and monitoring methodologies as set by Approved Methodology ACM0008 to comply with both.

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

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In compliance with Approved Methodology ACM0008, the project boundary for each CPA is determined as set out below:

A) For the purpose of determining project activity emissions, each CPA will include:

- CO_2 emissions from the combustion of methane in a flare, engine, power plant or heat generation plant;
- CO_2 emissions from the combustion of non methane hydrocarbons (NMHCs), if they represent more than 1% by volume of the extracted coal mine gas;
- CO_2 emissions from on-site fuel consumption due to the project activity, including transport of the fuel;
- Fugitive emissions from unburned methane.

B) For the purpose of determining baseline emissions, each CPA will include the following emissions sources:

- CH_4 emissions as a result of venting gas that would be captured in the project scenario;
- CO_2 emissions from the destruction of methane in the baseline scenario;
- CO_2 emissions from the production of heat and power (motive and electrical) that is replaced by the project activity.

C) The special extent of each CPA comprises:

- All equipment installed and used as part of the project activity for the extraction, compression, and storage of CMM at the project site, and transport to an off-site user;
- Flaring, captive power and heat generation facilities installed and used as part of the project activity;
- Power plants connected to the electricity grid, where the project activity exports power to the grid, as per the definition of project electricity system and connected electricity system given in "Tool to calculate the emission factor for an electricity system".

Table 2: Overview on emissions sources included in or excluded from the project boundary

	Source	Gas		Justification / Explanation
Baseline Emissio	Emissions of methane as a result of venting	CH_4	Included	. All of the capture CMM at each CPA is vented into the atmosphere in the baseline scenario. This is the main emission source.

	Source	Gas		Justification / Explanation
	Emissions from destruction of methane in the baseline	CO_2	Excluded	. There is no flaring or use for heat and/or electricity in the baseline scenario
		CH_4	Excluded	. Excluded for simplification in accordance with Approved Methodology ACM0008.
		N_2O	Excluded	. Excluded for simplification in accordance with Approved Methodology ACM0008.
	Grid electricity generation (electricity provided to the grid)	CO_2	Included	. Only emissions from the Grid equivalent for the same quantity of electricity as generated by the CPA.
		CH_4	Excluded	. Excluded for simplification in accordance with Approved Methodology ACM0008.
		N_2O	Excluded	. Excluded for simplification in accordance with Approved Methodology ACM0008.
	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 in accordance with Approved Methodology ACM0008.
		N_2O	Excluded	. Excluded for simplification in accordance with Approved Methodology ACM0008.
Project Emissions	Emissions of methane as a result of continued venting	CH_4	Excluded	. Only the change in CMM 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 is 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 in accordance with Approved Methodology ACM0008.
		N_2O	Excluded	. Excluded for simplification in accordance with Approved Methodology ACM0008.
	Emissions from methane destruction	CO_2	Included	. From the combustion of methane in a flare, or heat/power generation
	Emissions from NMHC destruction	CO_2	Included	. From the combustion of NMHC in a flare 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 or heat/power generation
	Fugitive methane emissions from on-site equipment	CH_4	Excluded	. Excluded for simplification in accordance with Approved Methodology ACM0008.

	Source	Gas		Justification / Explanation
	Fugitive methane emissions from gas supply pipeline or in relation to use in vehicles	CH_4	Excluded	. Excluded for simplification in accordance with Approved Methodology ACM0008.
	Accidental methane release	CH_4	Excluded	. Excluded for simplification in accordance with Approved Methodology ACM0008.

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

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The baseline scenario of each CPA is identified according to Approved Methodology ACM0008.

CPAs in the proposed PoA include the destruction and/or utilisation of CMM. The CMM would otherwise be vented into the atmosphere. Therefore the baseline scenario alternatives include the following:

Sep 1: Identify technically feasible options for capturing and/or using CMM

Step 1a. Steps for CMM extraction

According to Approved Methodology ACM0008, all technically feasible options to extract CMM should be listed. These include:

A. Ventilation air methane;
B. Pre-mining CMM extraction
C. Post-mining CMM extraction
D. Possible combination of A, B, C

A typical coal mine releases methane through Ventilation Air Methane (VAM). Currently coal mines do not have systems in place to capture CMM and technology is not available within the DPR Korea to install CMM capturing systems. Due to the lack of infrastructure, technology and investment capital in the DPR Korea, CMM is not used for alternative uses but simply vented into the atmosphere through the current air ventilation systems.

Step 1b: Options for extracted CMM

(i) Venting;

(ii) Using/destroying ventilation air methane rather than venting it;

(iii) Flaring of CMM;

(iv) Use for additional grid power generation;

(v) Use for additional captive power generation;

(vi) Use for additional heat generation;

(vii) Feed into gas pipeline (to be used as fuel for vehicles or heat/power generation);

(viii) Possible combinations of options i to vii with the relative shares of gas treated under each option specified.

All of the above options are being considered as possible alternatives to the baseline scenario. In Step 3 of this section, some of these options will be further developed into baseline scenario alternatives.

Step 1c: Options for energy production

The options for energy production are included in options (iv) to (viii) of Step 1b: Options for extracted CMM of this Section.

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

According to national safety regulations, the CMM has to be extracted from the coal mine through the ventilation system at the mine. There are, however, no regulations in place that require the capture and utilisation or destruction of CMM. Consequently, all alternatives listed in Step 1b: Options for extracted CMM are in full compliance with all applicable rules and regulations.

Step 3: Formulate baseline scenario alternatives

Alternative i. - Venting of CMM
As there are no legal requirements to capture and use or destroy CMM, it is common practise to release the CMM into the atmosphere. This alternative demonstrates the current situation before implementation of a CPA. All CMM vented from the coal mine is currently released into the atmosphere.

In this scenario, electricity, if available at the site, would be supplied through the applicable electricity grid that supplies the CPA site. On-site heat demand is satisfied through coal-fired boilers, which is primarily used to heat water for bathing requirements of the workers at the mine.

Alternative ii. Using/destroying ventilation air methane rather than venting it
The use and/or destruction of ventilation air methane (VAM) has been successfully implemented in countries including the UK, Australia and China. As VAM generally has a concentration in a mine's ventilation shaft of below 1% for safety reasons, it can generally not be flared under normal conditions. VAM can be destroyed through a flameless oxidation process. The infrastructure does not currently exist at any coal mine in the DPR Korea and therefore new investment would be required. This alternative would not generate any revenues in the absence of CDM revenue. In this scenario, the energy needs of the coal mine would be supplied in the say way as outlined in Alternative i.

Alternative iii. Flaring of CMM
A flare could be purchased and installed at a coal mine, which would capture the vented air and channel it to a flare. The flaring of captured methane would be a voluntary activity as it's not required by laws and regulations. The infrastructure does not currently exist at any coal mine in the DPR Korea and therefore new investment would be required. This alternative would not generate any revenues in the absence of CDM revenue. In this scenario, the energy needs of the coal mine would be supplied in the same way as outlined in Alternative i.

Alternative iv. Use for additional grid power generation
The captured methane could be utilised in a power plant for power generation. Possible power plant alternatives include conventional steam, combined gas-steam, gas turbine or fuel cell power plant

technology that is supplied with CMM. In this scenario, the energy needs of the coal mine would be supplied in the same way as outlined in Alternative i. The infrastructure does not currently exist at any coal mine in the DPR Korea and therefore new investment would be required.

Alternative v: Use for additional captive power generation
The captured methane could be utilised in a power plant for power generation. Possible power plant alternatives include conventional steam, combined gas-steam, gas turbine or fuel cell power plant technology that is supplied with CMM. In this scenario, the energy needs of the coal mine would be satisfied by the power plant. The infrastructure does not currently exist at any coal mine in the DPR Korea and therefore new investment would be required.

Alternative vi: Use for additional heat generation
The captured methane could be utilised for heat generation. Possible technologies include conventional steam boiler, or conventional hot water boiler which would be fired by CMM. The heat so generated could be used outside the coal mining facility subject to the installation of infrastructure currently lacking. It could also supply the heating needs of the coal mine, which would displace coal-fired conventional boilers. The infrastructure does not currently exist at any coal mine in the DPR Korea and therefore new investment would be required.

Alternative vii: Feed into gas pipeline (to be used as fuel for vehicles or heat/power generation)
The captured methane could be fed into a gas pipeline for the use as fuel for vehicles or heat and/or power generation. Currently there are no gas pipelines in the DPR Korea and all pipelines would have to be constructed to enable the supply of CMM into such pipelines. The infrastructure does not currently exist at any coal mine in the DPR Korea and therefore new investment would be required.

Alternative viii: Possible combinations of options i to vii with the relative shares of gas treated under each option specified
There are numerous possible combinations of the alternatives i. to vii. Given that a CPA has to take site-specific conditions into account, it is not possible to outline every possible combination.

Step 4: Eliminate baseline scenario alternatives that face prohibitive barriers

In this section the possible alternatives formulated above will be checked against the existing economic and other barriers for their implementation. Non-realistic alternatives will be eliminated.

Alternative i. - Venting of CMM
Current national regulations require that CMM has to be extracted from the coal mines for operational safety reasons. There are no legal requirements that prevent the venting of the CMM. As this is the current business practise in DPR Korea and there are no barriers or other factors that prevent this business practise to continue, this scenario can be considered a realistic alternative.

Alternative ii. Using/destroying ventilation air methane rather than venting it
In order to use or destroy ventilation air methane, additional investment is required that is currently not available in the DPR Korea. There is no capital market in the DPR Korea and the government has not made any resources available to enable the investment. Additionally, no skilled labour to implement and maintain the project is available in the DPR Korea.

Alternative iii. Flaring of CMM

Flaring is not required by existing laws and regulations. In order to install a flare, the CPA operator would have to secure investment, which is currently not available in the DPR Korea. Without CDM revenue, no income would result from this scenario and a CPA would therefore not be implemented. Additionally, no skilled labour to implement and maintain the project is available in the DPR Korea.

Alternative iv. Use for additional grid power generation
Although CMM could be used for electricity generation that is delivered to the grid, this would require substantial investments in both pipelines to bring the CMM to a power station, refurbishment of a power station and upgrade of the national electricity grid. There is no capital market in the DPR Korea and the government has not made any resources available to enable the investment.

Alternative v: Use for additional captive power generation
Although CMM could be used for electricity generation that is delivered to the grid, this would require substantial investments in the currently lacking infrastructure, including pipelines to bring the CMM to a power station, refurbishment of a power station and upgrade of the national electricity grid. There is no capital market in the DPR Korea and the government has not made any resources available to enable the investment.

Alternative vi: Use for additional heat generation
Although CMM could be used for heat generation, this would require substantial investments in infrastructure that is currently not available. There is no capital market in the DPR Korea and the government has not made any resources available to enable the investment.

Alternative vii: Feed into gas pipeline (to be used as fuel for vehicles or heat/power generation)
Although CMM could be fed into a gas pipeline for use as fuel for vehicles or heat and/or power generation, this would require substantial investments in infrastructure that is currently not available. There is no capital market in the DPR Korea and the government has not made any resources available to enable the investment.

Alternative viii: Possible combinations of options i to vii with the relative shares of gas treated under each option specified
As demonstrated above, only Alternative (i) presents a viable scenario and as such a combination with other alternatives is not a realistic scenario.

Conclusion
There is only one realistic option for the baseline scenario, which is the continuation of the current situation of venting of the CMM into the atmosphere, heat generation with the existing coal fired boilers, and the full purchase of electricity from the grid. Without additional income from emissions trading, the project is economically not viable and faces prohibitive barriers.

St**ep 5: Identify most economically attractive baseline scenario alternative (optional)**

All scenarios except for Scenario (i) face barriers as detailed in Step 4. Therefore, Scenario (i) is considered to be the baseline scenario of the PoA.

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:

>>
>> Here the PPs shall demonstrate, using the procedure provided in the baseline and monitoring methodology applied, additionality of a typical CPA.

Step 1:
In compliance with Approved Methodology ACM0008 Section "Additionality" Step 1 of "Tool for the demonstration and assessment of additionality" applicable to Approved Methodology ACM0008 can be ignored.

Step 2:
In accordance with the policy operated by the General Bureau for Cooperation with International Organisations (GBCIO), foreign companies investing in CDM projects in the DPR Korea are only allowed to take a proportion of the CER Revenue stream as compensation for their investment in the CDM project. In accordance with the GBCIO's policy on CDM project development, no other benefits may accrue to a foreign company in such CDM project. Accordingly, no revenues other than CER revenue can be considered for CPAs implemented in the DPR Korea. Therefore, a simple cost analysis has been used.

A flare that destroys CMM is estimated to cost more than €50,000 per unit. Installation, training and operating costs have to be considered in addition to this capital expenditure. Additionally, CMM capture and extraction systems need to be installed at the coal mines. If no CDM revenue results from the CPA, then the capital expenditure plus installation, training and operating costs would translate into a loss equivalent to the investment cost for each CPA.

The inclusion/upgrade of flares to include heat and/or power generation will incur additional costs. Therefore, the installation of a flare is the most conservative cost estimate for each CPA.

Step 3:
There are numerous barriers for implementing projects in the DPR Korea including lack of investment capital, lack of technology and trained operators to maintain the equipment. The primary barrier for the implementation of the PoA is the lack of financial resources by the DPR Korea to implement the PoA. The lack of financial resources is also an eligibility criterion for each CPA to ensure that this barrier exists for every CPA included in this PoA.

As there is no CMM utilisation or destruction technology currently operating in the territory of the DPR Korea, this PoA is also a "first of its kind".

Step 4:
The common practise in the DPR Korea in relation to CMM is to vent the CMM into the atmosphere without destruction or utilisation. The DPR Korea currently has no policies in place to change this practise and given the lack of investment capital, it is unlikely for this practise to change in the foreseeable future.

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

>>

To demonstrate that a CPA under the PoA is financially not attractive, the following four steps should be checked upon inclusion of the CPA in the PoA:

1. The investment cost for the CPA is greater than €50,000;
2. There is no revenue stream from power and or heat resulting from the implementation of the project activity;
3. Investment capital from the managing/coordinating entity is required in order to implement the CPA;
4. There are no rules or regulations that prohibit the release of CMM into the atmosphere.

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 outlined in the Approved Methodology ACM0008 are applied for calculating the emission reductions of each CPA.

The formulae from "Tool to calculate the emission factor for an electricity system" are applied for calculating carbon emissions factor of electricity used by a 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:

>>

PROJECT EMISSIONS

Project emissions are defined by the following equation:

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

Where:

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

<u>Combustion emissions from additional energy required for CMM capture and use</u>

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

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

Where:

PE_{ME}	=	Project emissions from energy use to capture and use or destroy methane (tCO_2e)
$CONS_{ELEC,PJ}$	=	Additional electricity consumption for capture and use or destruction of methane, if any (MWh)
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_2e/GJ)
$CONS_{FossFuel,PJ}$	=	Additional fossil fuel consumption for capture and use or destruction of methane, if any (GJ)
$CEF_{FossFuel}$	=	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"

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.

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, 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.

$$PE_{MD} = (MD_{FL} + MD_{ELEC} + MD_{HEAT} + MD_{GAS}) \times (CEF_{CH4} + r \times CEF_{NMHC}) \quad \textbf{(3)}$$

with:

$$r = PC_{NMHC} / PC_{CH4} \quad \textbf{(4)}$$

Where:

PE_{MD}	=	Project emissions from CMM/CBM destroyed (tCO_2e)
MD_{FL}	=	Methane destroyed through flaring (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_{CH4}	=	Carbon emission factor for combusted methane (2.75 tCO_2/tCH_4)
CEF_{NMHC}	=	Carbon emission factor for combusted non methane hydrocarbons (the concentration varies and, therefore, to be obtained through periodical analysis of captured methane) (tCO_2/tNMHC)
R	=	Relative proportion of NMHC compared to methane

PC_{CH4}	=	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.

$$MD_{FL} = MM_{FL} - (PE_{flare}/GWP_{CH4}) \quad \textbf{(5)}$$

Where:

MD_{FL}	=	Methane destroyed through flaring (tCH_4)
MM_{FL}	=	Methane measured sent to flare (tCH_4)
PE_{flare}	=	Project emissions of non-combusted CH_4, expressed in terms of CO_{2e}, from flaring of the residual gas stream (tCO_2e)
GWP_{CH4}	=	Global warming potential of methane (21 tCO_2e/tCH_4)

The project emissions of non-combusted CH_4 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.

$$MD_{ELEC} = MM_{ELEC} \times Eff_{ELEC} \quad \textbf{(6)}$$

Where:

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

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

Where:

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

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

Where:

MD_{GAS}	=	Methane destroyed after being supplied to gas grid (tCH_4)
MM_{GAS}	=	Methane measured supplied to gas grid for vehicle use or heat/power generation off-site (tCH_4)
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)

Un-combusted methane from project activity

Not all of the methane sent to the flare 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:

$$PE_{UM} = [GWP_{CH4} \times \sum_i MM_i \times (1 - Eff_i)] + PE_{flare} \quad \textbf{(9)}$$

Where:

PE_{UM}	=	Project emissions from un-combusted methane (tCO_2e)
GWP_{CH4}	=	Global warming potential of methane (21 tCO_2e/tCH_4)
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* (tCH_4)
Eff_i	=	Efficiency of methane destruction in use *i* (%)
PE_{flare}	=	Project emissions of non-combusted CH_4 expressed in terms of CO_2e from flaring of the residual gas stream (tCO_2e)

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:

$$BE_y = BE_{MR,y} + BE_{Use,y} \quad \textbf{(10)}$$

Where:

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

<u>Methane destruction in the baseline</u>

As per Section E4, the current baseline is the venting of all CMM into the atmosphere as there are no CMM capture systems installed at coal mines in the DPR Korea. Consequently, there is no destruction of CMM in the baseline.

<u>Methane released into the atmosphere</u>

Depending on the nature of the project activity, CBM/CMM can be removed at 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 or (4) after the mining process by drainage from sealed goafs but before the mine is closed.

This methane would have been emitted to the atmosphere in the baseline scenario:

$$BE_{MRy} = GWP_{CH4} \times [CBMe_{i,y} + CMM_{PJi,y} + PMM_{PJi,y}] \quad \textbf{(11)}$$

Where:

BE_{MRy}	=	Baseline emissions from release of methane into the atmosphere in year *y* that is avoided by the project activity (tCO_2e)
i	=	Use of methane (flaring, power generation, heat generation, supply to gas grid to various combustion end uses)
$CBMe_{i,y}$	=	Eligible CBM captured, sent to and destroyed by use i in the project for year *y* (expressed in tCH_4)
$CMM_{PJi,y}$	=	Pre-mining CMM captured, sent to and destroyed by use *i* in the project activity in year *y* (expressed in tCH_4)
$PMM_{PJi,y}$	=	Post-mining CMM captured, sent to and destroyed by use *i* in the project activity in year *y* (tCH_4)
GWP_{CH4}	=	Global warming potential of methane (21 tCO_2e/tCH_4)

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.

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.

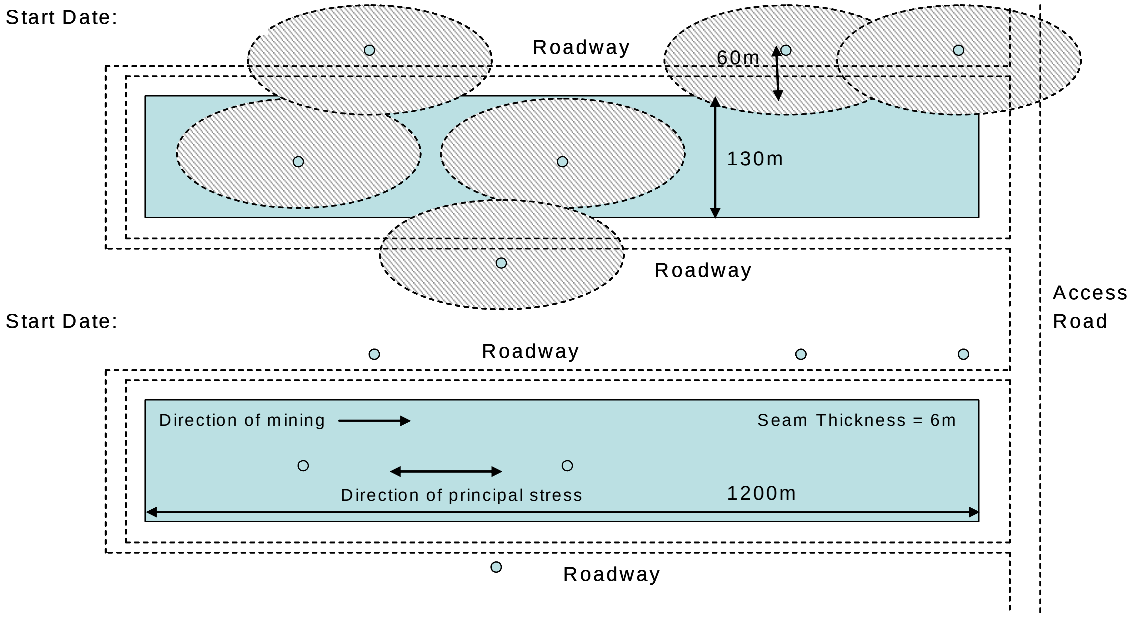
Step 1: Identify relevant wells

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. An indicative mining map showing relevant CBM wells and their zones of influence is shown in Figure 3, with the area of coal to be mined shaded in blue. Figure 3 depicts an underground coal mine plan and the 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 3: Indicative Figure Showing underground 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:

$$R = ((V_w)/(\pi \times T \times \rho_{coal} \times g_{coal}))^{0.5} \quad \textbf{(12)}$$

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 coal)

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

$$R = ((n \times V_a)/(\pi \times T \times \rho_{coal} \times g_{coal}))^{0.5} \quad \textbf{(13)}$$

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

$$V_a = V_c \ / \ N = \frac{\sum V_w}{N} \quad \textbf{(14)}$$

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)

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:

$$ES_h = \frac{\sum_w AO_w}{\sum_w AT_w} \quad \textbf{(15)}$$

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(m^2)
AT_w = Total zone of influence of well w (m^2)
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:

$$ES_v = \frac{t}{T} \quad \textbf{(16)}$$

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 fraccing is only done in the seams of relevance. A mine cross section should be included in the specific CPA-DD together and supporting documentation on the well drilling process should be supplied to the Validator to justify the ratio of *t/T*.

<u>*Eligible CBM*</u>: Summarising the eligible contribution of CBM in the horizontal and vertical planes gives the final ratio of eligible CBM:

$$ES_t = ES_h \cdot ES_v \quad \textbf{(17)}$$

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 (%)

CO_2 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 CO_2 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.

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:

$$CBM_{e,y} = \left[ES_t \cdot \sum_{w} \sum_{m=1}^{y-b} V_{w,y-m} \right] + \left[ES_t \cdot \sum_{w} V_{w,y} \right] \quad \textbf{(18)}$$

Where:

$CBM_{e,y}$	=	Eligible CBM captured by the project for year *y* (tCH_4)
ES_t	=	Total eligible share of CBM (%)
$V_{w,y-m}$	=	Volume of methane captured from well *w* in year *y-m* (tCH_4)
$V_{w,y}$	=	Volume of methane captured from well *w* in year *y* (tCH_4)
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.

Pre-mining and post-mining CMM extraction

Both $CMM_{PJ,y}$, $PMM_{PJ,y}$ are directly monitored as part of the project activity, $CMM_{PJ,y}$, $PMM_{PJ,y.}$

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.

$$BE_{Use,y} = ED_{CBMw,y} + ED_{CBMz,y} + ED_{CPMM,y} \quad \textbf{(19)}$$

Where:

$BE_{Use,y}$	=	Total baseline emissions from the production of power or heat replaced by the project activity in year *y* (tCO_2)
$ED_{CBMw,y}$	=	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* (tCO_2)
$ED_{CBMz,y}$	=	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* (tCO_2)
$ED_{CPMM,y}$	=	Emissions from displacement of end uses by use of coal mine methane, and post-mining methane (tCO_2)

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

$CBMM_{tot,y} = CBM_{w,y} + CBM_{z,y} + CBM_{x,y} + CMM_{PJ,y} + PMM_{PJ,y}$ **(20)**

Where:

$CBMM_{tot,y}$	=	Total CBM and CMM captured and utilised by the project activity (tCH_4)
$CBM_{w,.y}$	=	CBM captured from wells where the mining area intersected the zone of influence in year *y* (tCH_4)
$CBM_{z,.y}$	=	CBM captured from wells where the mining area intersected the zone of influence prior to year *y* (tCH_4)
$CBM_{x,.y}$	=	CBM captured from wells where the mining area has not yet intersected the zone of influence in year *y* (tCH_4)
$CMM_{PJ,i,y}$	=	Pre-mining CMM captured by the project activity in year *y* (tCH_4)
$PMM_{PJ,y}$	=	Post-mining CMM captured by the project activity in year *y* (tCH_4)

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

$PBE_{Use,y} = GEN_{,y} \text{ x } EF_{ELEC} + HEAT_y \text{ x } EF_{HEAT} + VFUEL_y \text{ x } EF_V$ **(21)**

Where:

$PBE_{Use,y}$	=	Potential total baseline emissions from the production of power or heat replaced by the project activity in year *y* (tCO_2e)
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 (tCO_2/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 (tCO_2/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 (tCO_2/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:

$$ED_{CBMz,y} = \frac{CBM_{z,y}}{CBMM_{tot,y}} \times PBE_{Use,y} \qquad \textbf{(22)}$$

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* (tCO_2e)
$CBM_{z,y}$	=	CBM captured from wells where the mining area intersected the zone of influence prior to year *y* (tCH_4)

$CBMM_{tot,y}$	=	Total CBM and CMM captured and utilised by the project activity in year *y* (tCH_4)
$PBE_{Use,y}$	=	Potential total baseline emissions from the production of power or heat replaced by the project activity in year *y* (tCO_2e)

$$ED_{CPMM,y} = \frac{CMM_{PJ,y} + PMM_{PJ,y}}{CBMM_{tot,y}} \times PBE_{Use,y} \quad \textbf{(23)}$$

Where:

$ED_{CPMM,y}$	=	Emissions from displacement of end uses by use of coal mine methane and post-mining methane (tCO_2e)
$CMM_{PJ,y}$	=	Pre-mining CMM captured by the project activity in year *y* (tCH_4)
$PMM_{PJ,y}$	=	Post-mining CMM captured by the project activity in year *y* (tCH_4)
$CBMM_{tot,y}$	=	Total CBM and CMM captured and utilised by the project activity in year *y* (tCH_4)
$PBE_{Use,y}$	=	Potential total baseline emissions from the production of power or heat replaced by the project activity in year *y* (tCO_2e)

$$ED_{CBMw,y} = \sum_{m=0}^{y-b} \left[\frac{CBM_{w,y-m}}{CBMM_{tot,y-m}} \times PBE_{Use,y-m} \right] \quad \textbf{(24)}$$

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* (tCO_2e)
$CBM_{w,y-m}$	=	CBM captured in the year y-m from wells where the mining area intersected the zone of influence in year *y* (tCH_4)
$CBMM_{tot,y-m}$	=	Total CBM and CMM captured and utilised by the project activity in year y-m (tCH_4)
$PBE_{Use,y-m}$	=	Potential total baseline emissions from the production of power or heat replaced by the project activity in year y-m (tCO_2e)
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.

Grid power emission factor

If the baseline scenario includes grid power supply that would be replaced by the project activity, the Emissions Factor for displaced electricity is calculated as per “Tool to calculate the emission factor for an electricity system”.

Captive power emissions factor

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

$$EF_{captive,y} = \frac{EF_{CO2,i}}{Eff_{captive}} \cdot \frac{44}{12} \cdot \frac{3.6TJ}{1000\ MWH} \quad \textbf{(25)}$$

Where:

$EF_{captive,y}$	=	Emissions factor for captive power generation (tCO_2/MWh)
$EF_{CO2,i}$	=	CO_2 emissions factor of fuel used in captive power generation (tC/TJ)
$Eff_{captive}$	=	Efficiency of the captive power generation (%)
44/12	=	Carbon to Carbon Dioxide conversion factor
3.6/1000	=	TJ to MWh conversion factor

Combination of grid power and captive power emissions factor

If the baseline scenario selection determines that both captive and grid power would be used, then the emissions factor for the baseline is the weighted average of the emissions factor for grid power and captive power.

$$EF_{ELEC,y} = s_{grid} \cdot EF_{grid,y} + s_{captive} \cdot EF_{captive,y} \quad \textbf{(26)}$$

Where:

$EF_{ELEC.,y}$	=	CO_2 baseline emission factor for the electricity displaced due to the project activity during the year *y* (tCO_2/MWh).
$EF_{grid,y}$	=	CO_2 baseline emission factor for the grid electricity displaced due to the project activity during the year *y* (tCO_2/MWh).
$EF_{captive,y}$	=	CO_2 baseline emission factor for the captive electricity displaced due to the project activity during the year *y* (tCO_2/MWh)
s_{grid}	=	Share of facility electricity demand supplied by grid imports over the last 3 years (%)
$s_{captive}$	=	Share of facility electricity demand supplied by captive power over the last 3 years (%)[2]

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:

$$EF_{heat,y} = \frac{EF_{CO2,j}}{Eff_{heat}} \cdot \frac{44}{12} \cdot \frac{1TJ}{1000\ GJ} \quad \textbf{(27)}$$

Where:

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

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.
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:

$$EF_V = \frac{EF_{CO2,j}}{EFF_V} \cdot \frac{44}{12} \cdot \frac{1TJ}{1000\ GJ} \quad \textbf{(28)}$$

Where:

EF_V	=	Emissions factor for vehicle operation replaced by project activity (tCO_2/GJ)
$EF_{CO2,i}$	=	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.

LEAKAGE

The formula for leakage is given as follows:

$$LE_y = LE_{d,y} + LE_{o,y} \quad \textbf{(29)}$$

Where:

LE_y	=	Leakage emissions in year *y* (tCO_2e)
$LE_{d,y}$	=	Leakage emissions due to displacement of other baseline thermal energy uses of methane in year *y* (tCO_2e)
$LE_{o,y}$	=	Leakage emissions due to other uncertainties in year *y* (tCO_2e)

<u>Displacement of baseline thermal energy uses</u>

As per Section E4, the current baseline is the venting of all CMM into the atmosphere as there are no CMM capture systems installed at coal mines in the DPR Korea. Consequently, there is no leakage resulting from the displacement of baseline thermal energy uses.

CBM drainage from outside the de-stressed zone

Surface CBM drainage wells can in some cases drain gas from seams that are outside the de-stressed zone for 140m specified in this methodology, or could extract from an area larger than the circular zone of influence used in this methodology. The vertical leakage would only occur if the surface wells were not cased. Similarly, if there is surface CBM extraction in the baseline, then the gas drawn from other seams would be the same in the baseline and project scenario. Therefore, in cases where:

(1) Surface boreholes drilled in the project activity are not cased;

(2) There are no surface boreholes for CBM draining present in the baseline scenario.

Project participants should discount the total emissions reductions achieved. The amount of discount should be based on:

Option 1: A comparison of *ex ante* engineering estimates of CBM production from surface boreholes versus actual project activity CBM production;

Option 2: A standard discount factor of 10%.

Impact of CDM project activity on coal production

The additional CBM/CMM extraction from the CDM project activity could in some cases release certain constraints that currently limit mining operations. In cases of gassy mines where production is constrained by gas drainage capacity (i.e. too high concentration requires temporary interruption of mining operation), CER value can cover both the cost of CMM/CBM destruction and increase of extraction capacity to release the concentration constraint, then allowing increased coal production. This will only be the case, however, when no CBM/CMM extraction is present in the baseline scenario (i.e. the baseline scenario is ventilation of mine gas only).

If the project activity is CBM/CMM extraction and the baseline scenario is ventilation only, project participants should:

Option 1: Calculate the extra coal production likely by the relaxing of the production constraint. The emission reductions claimed by the project should then be discounted so that CBM/CMM capture from the additional coal production is not included;

Option 2: Apply a standard discount factor of 10%. Note that for projects using CBM this leakage is to be calculated in addition to leakage described in section “CBM drainage from outside the de-stressed zone” above.

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:

$$ER_y = BE_y - PE_y - LE_y \quad \textbf{(30)}$$

Where:

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

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 / Parameter:	GWP_{CH4}
Data unit:	tCO_2e/ tCH_4
Description:	Global warming potential of methane
Source of data:	ACM0008 / Version 7
Measurement procedures (if any):	Default value
Monitoring frequency:	*Ex ante*
QA/QC procedures:	
Any comment:	21 tCO_2e/tCH_4

Data / Parameter:	CEF_{CH4}
Data unit:	tCO_2e/tCH_4
Description:	Carbon emission factor for combusted methane
Source of data:	ACM0008 / Version 7
Measurement procedures (if any):	Calculated
Monitoring frequency:	*Ex ante*
QA/QC procedures:	
Any comment:	44/16 = 2.75 tCO_2e/tCH_4

Data / Parameter:	CEF_{ELEC}
Data unit:	tCO_2/MWh
Description:	CO_2 emission factor of the grid
Source of data:	Central Bureau of Statistics, DPR Korea
Measurement procedures (if any):	Calculated in Accordance with “Tool to calculate the emission factor for an electricity system”
Monitoring frequency:	*Ex ante*
QA/QC procedures:	
Any comment:	CPA specific

Data / Parameter:	$EF_{OM,y}$
Data unit:	tCO_2/MWh
Description:	CO_2 Operating Margin emission factor of the grid
Source of data:	Central Bureau of Statistics, DPR Korea
Measurement procedures (if any):	Calculated in Accordance with “Tool to calculate the emission factor for an electricity system”
Monitoring frequency:	*Ex ante*
QA/QC procedures:	
Any comment:	CPA specific information

Data / Parameter:	$EF_{BM,y}$
Data unit:	tCO_2/MWh
Description:	CO_2 Build Margin emission factor of the grid
Source of data:	Central Bureau of Statistics, DPR Korea
Measurement procedures (if any):	Calculated in Accordance with “Tool to calculate the emission factor for an electricity system”
Monitoring frequency:	*Ex ante*
QA/QC procedures:	
Any comment:	CPA specific information

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:	Central Bureau of Statistics, DPR Korea
Measurement procedures (if any):	Calculated in Accordance with “Tool to calculate the emission factor for an electricity system”
Monitoring frequency:	*Ex ante*
QA/QC procedures:	
Any comment:	CPA specific information

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:	Central Bureau of Statistics, DPR Korea
Measurement procedures (if any):	Calculated in Accordance with "Tool to calculate the emission factor for an electricity system"
Monitoring frequency:	Annually
QA/QC procedures:	
Any comment:	CPA specific information

Data / Parameter:	$GEN_{j,y}$
Data unit:	MWh/yr
Description:	Electricity generation of each power source/plant
Source of data:	Central Bureau of Statistics, DPR Korea
Measurement procedures (if any):	Calculated in Accordance with "Tool to calculate the emission factor for an electricity system"
Monitoring frequency:	*Ex ante*
QA/QC procedures:	
Any comment:	CPA specific information

Data / Parameter:	CEF_{HEAT}
Data unit:	tCO_2/GJ
Description:	Carbon emissions factor of heat used by coal mine
Source of data:	CPA operator
Measurement procedures (if any):	Calculated based on historical values
Monitoring frequency:	*Ex ante*
QA/QC procedures:	
Any comment:	CPA specific information

Data / Parameter:	$CEF_{FossFuel}$
Data unit:	tCO_2/GJ
Description:	Carbon emissions factor of fossil fuel used by coal mine
Source of data:	CPA operator
Measurement procedures (if any):	IPCC default values
Monitoring frequency:	*Ex ante*
QA/QC procedures:	
Any comment:	CPA specific information

Data / Parameter:	Eff_{ELEC}
Data unit:	-
Description:	Efficiency of methane destruction in power plant
Source of data:	IPCC
Measurement procedures (if any):	99.5% (in accordance with IPCC)
Monitoring frequency:	*Ex ante*
QA/QC procedures:	
Any comment:	

Data / Parameter:	Eff_{HEAT}
Data unit:	-
Description:	Efficiency of methane destruction/oxidation in heat plant
Source of data:	IPCC
Measurement procedures (if any):	99.5% (in accordance with IPCC)
Monitoring frequency:	*Ex ante*
QA/QC procedures:	
Any comment:	

Data / Parameter:	Eff_{GAS}
Data unit:	-
Description:	Overall efficiency of methane destruction through gas grid
Source of data:	IPCC
Measurement procedures (if any):	98.5% (in accordance with IPCC)
Monitoring frequency:	*Ex ante*
QA/QC procedures:	
Any comment:	

Data / Parameter:	g_{coal}
Data unit:	m^3CH_4/t coal
Description:	Gas content of coal
Source of data:	CPA operator
Measurement procedures (if any):	Calculated based on coal analysis
Monitoring frequency:	At start of each crediting period
QA/QC procedures:	
Any comment:	CPA specific

Data / Parameter:	ρ_{coal}
Data unit:	t/m^3
Description:	Density of locally mined coal
Source of data:	ACM0008 / Version 7
Measurement procedures (if any):	Default value
Monitoring frequency:	At start of each crediting period
QA/QC procedures:	
Any comment:	1.4

Data / Parameter:	Eff_i
Data unit:	-
Description:	Efficiency of methane destruction through use *i* (power generation, heat generation, supply to gas grid to various combustion end uses)
Source of data:	
Measurement procedures (if any):	
Monitoring frequency:	*Ex ante*
QA/QC procedures:	
Any comment:	CPA and technology specific information

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:	IPCC default values
Measurement procedures (if any):	
Monitoring frequency:	*Ex ante*
QA/QC procedures:	
Any comment:	CPA specific information

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:

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:	CPA operator
Measurement procedures (if any):	
Monitoring frequency:	Continuous
QA/QC procedures:	
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:	CPA operator
Measurement procedures (if any):	
Monitoring frequency:	Continuous
QA/QC procedures:	
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:	CPA operator
Measurement procedures (if any):	
Monitoring frequency:	Continuous
QA/QC procedures:	
Any comment:	

Data / Parameter:	MM_{FL}
Data unit:	tCH_4
Description:	Methane measured sent to flare
Source of data:	CPA operator
Measurement procedures (if any):	
Monitoring frequency:	Continuous
QA/QC procedures:	
Any comment:	Flow meters will record gas volumes, pressure and temperature. Density of methane under normal conditions of temperature and pressure is 0.67kg/m3 (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:	M
Measurement procedures (if any):	
Monitoring frequency:	Continuous
QA/QC procedures:	
Any comment:	Flow meters will record gas volumes, pressure and temperature. Density of methane under normal conditions of temperature and pressure is 0.67kg/m3 (Revised 1996 IPCC Reference Manual p 1.24 and 1.16)

Data / Parameter:	MM_{HEAT}
Data unit:	tCH_4
Description:	Methane sent to boiler
Source of data:	
Measurement procedures (if any):	
Monitoring frequency:	Continuous
QA/QC procedures:	
Any comment:	Flow meters will record gas volumes, pressure and temperature. Density of methane under normal conditions of temperature and pressure is 0.67kg/m3 (Revised 1996 IPCC Reference Manual p 1.24 and 1.16)

Data / Parameter:	MM_{GAS}
Data unit:	tCH_4
Description:	Methane sent to gas grid for end users
Source of data:	M
Measurement procedures (if any):	
Monitoring frequency:	Continuous
QA/QC procedures:	
Any comment:	Flow meters will record gas volumes, pressure and temperature. Density of methane under normal conditions of temperature and pressure is 0.67kg/m3 (Revised 1996 IPCC Reference Manual p 1.24 and 1.16)

Data / Parameter:	CEF_{NMHC}
Data unit:	
Description:	Carbon emission factor for combusted non methane hydrocarbons (various)
Source of data:	
Measurement procedures (if any):	
Monitoring frequency:	
QA/QC procedures:	
Any comment:	To be obtained through periodical analysis of the fractional composition of captured gas

Data / Parameter:	PC_{CH4}
Data unit:	%
Description:	Concentration (in mass) of methane in extracted gas (%), measured on wet basis
Source of data:	Concentration meters, optical and calorific
Measurement procedures (if any):	
Monitoring frequency:	Hourly/Daily
QA/QC procedures:	
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:	Concentration meters, optical and calorific
Measurement procedures (if any):	
Monitoring frequency:	Annually
QA/QC procedures:	
Any comment:	

Data / Parameter:	MM_i
Data unit:	tCH_4
Description:	Methane measured sent to use *i*
Source of data:	
Measurement procedures (if any):	
Monitoring frequency:	Continuous
QA/QC procedures:	
Any comment:	Flow meters will record gas volumes, pressure and temperature

Data / Parameter:	PE_{Mvent}
Data unit:	tCH_4
Description:	Emissions of methane vented to atmosphere during the project activity
Source of data:	
Measurement procedures (if any):	
Monitoring frequency:	Continuous
QA/QC procedures:	
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* in the project for year *y*
Source of data:	
Measurement procedures (if any):	
Monitoring frequency:	Yearly
QA/QC procedures:	
Any comment:	

Data / Parameter:	$CMM_{PJ, i,y}$
Data unit:	tCH_4
Description:	Pre-mining CMM captured, sent to and destroyed by use *i* in the project activity in year *y*
Source of data:	
Measurement procedures (if any):	
Monitoring frequency:	Continuous
QA/QC procedures:	
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* in the project activity in year *y*
Source of data:	
Measurement procedures (if any):	
Monitoring frequency:	Continuous
QA/QC procedures:	
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:	R
Data unit:	M
Description:	Cumulative radius of zone of influence
Source of data:	C
Measurement procedures (if any):	
Monitoring frequency:	Annually
QA/QC procedures:	
Any comment:	

Data / Parameter:	V_w
Data unit:	m^3
Description:	Cumulative flow at well
Source of data:	
Measurement procedures (if any):	
Monitoring frequency:	
QA/QC procedures:	
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:	
Measurement procedures (if any):	
Monitoring frequency:	Annually
QA/QC procedures:	
Any comment:	Depth of fractures into respective seams and casing used should be recorded at time of drilling

Data / Parameter:	N
Data unit:	Days
Description:	Number of days the selected well is operational
Source of data:	
Measurement procedures (if any):	
Monitoring frequency:	
QA/QC procedures:	
Any comment:	

Data / Parameter:	V_a
Data unit:	m^3/day
Description:	Average flow per day
Source of data:	
Measurement procedures (if any):	
Monitoring frequency:	
QA/QC procedures:	
Any comment:	

Data / Parameter:	V_c
Data unit:	m^3/day
Description:	Cumulative flow from all wells
Source of data:	
Measurement procedures (if any):	
Monitoring frequency:	
QA/QC procedures:	
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:	
Measurement procedures (if any):	
Monitoring frequency:	
QA/QC procedures:	
Any comment:	

Data / Parameter:	
Data unit:	Coordinates
Description:	Position of wells relative to mining plan
Source of data:	
Measurement procedures (if any):	
Monitoring frequency:	Annually
QA/QC procedures:	
Any comment:	Recorded in PDD *ex ante*. New drawing produced each year

Data / Parameter:	
Data unit:	Coordinates
Description:	Well profile
Source of data:	
Measurement procedures (if any):	
Monitoring frequency:	Annually
QA/QC procedures:	
Any comment:	Shows each well and zone of influence against latest mining plan

Data / Parameter:	
Data unit:	M
Description:	Well depth
Source of data:	
Measurement procedures (if any):	
Monitoring frequency:	At time of drilling
QA/QC procedures:	
Any comment:	Based on actual drilling records

Data / Parameter:	T
Data unit:	M
Description:	Total thickness of coal in emission zone
Source of data:	
Measurement procedures (if any):	
Monitoring frequency:	At start of each crediting period
QA/QC procedures:	
Any comment:	From geology report and drilling records

Data / Parameter:	ES_t
Data unit:	%
Description:	Total eligible share of CBM
Source of data:	
Measurement procedures (if any):	
Monitoring frequency:	Annually
QA/QC procedures:	
Any comment:	

Data / Parameter:	ES_h
Data unit:	%
Description:	Eligible share of CBM based on the horizontal plane overlap
Source of data:	
Measurement procedures (if any):	
Monitoring frequency:	Annually
QA/QC procedures:	
Any comment:	

Data / Parameter:	ES_v
Data unit:	%
Description:	Eligible share of CBM based on the vertical plane overlap
Source of data:	
Measurement procedures (if any):	
Monitoring frequency:	
QA/QC procedures:	
Any comment:	

Data / Parameter:	AO_w
Data unit:	m^2
Description:	Area of overlap with are to be mined
Source of data:	
Measurement procedures (if any):	
Monitoring frequency:	Annually
QA/QC procedures:	
Any comment:	

Data / Parameter:	AT_w
Data unit:	m^2
Description:	Total zone of influence
Source of data:	
Measurement procedures (if any):	
Monitoring frequency:	Annually
QA/QC procedures:	
Any comment:	

Data / Parameter:	W
Data unit:	
Description:	Wells
Source of data:	
Measurement procedures (if any):	
Monitoring frequency:	
QA/QC procedures:	
Any comment:	

Data / Parameter:	$ED_{CBMw,y}$
Data unit:	tCO_2
Description:	Avoided emissions related to CBM wells intersected by mine in year *y*
Source of data:	
Measurement procedures (if any):	
Monitoring frequency:	Annually
QA/QC procedures:	
Any comment:	

Data / Parameter:	$ED_{CBMz,y}$
Data unit:	tCO_2
Description:	Avoided emissions related to CBM wells intersected before year *y*
Source of data:	
Measurement procedures (if any):	
Monitoring frequency:	Annually
QA/QC procedures:	
Any comment:	

Data / Parameter:	$ED_{CPMM,y}$
Data unit:	tCO_2
Description:	Avoided emissions related to CMM and PMM
Source of data:	
Measurement procedures (if any):	
Monitoring frequency:	Annually
QA/QC procedures:	
Any comment:	

Data / Parameter:	$CBM_{w,y}$
Data unit:	tCH_4
Description:	CBM captured from well intersected in year *y*
Source of data:	
Measurement procedures (if any):	
Monitoring frequency:	Continuous
QA/QC procedures:	
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:	
Measurement procedures (if any):	
Monitoring frequency:	Continuous
QA/QC procedures:	
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:	
Measurement procedures (if any):	
Monitoring frequency:	Continuous
QA/QC procedures:	
Any comment:	Monitor each well separately

Data / Parameter:	$PBE_{Use,y}$
Data unit:	tCO_2e
Description:	Potential baseline emissions from displacement fuels
Source of data:	
Measurement procedures (if any):	
Monitoring frequency:	Annually
QA/QC procedures:	
Any comment:	

Data / Parameter:	GEN_y
Data unit:	MWh
Description:	Electricity generation by project
Source of data:	
Measurement procedures (if any):	
Monitoring frequency:	Continuous
QA/QC procedures:	
Any comment:	

Data / Parameter:	$HEAT_y$
Data unit:	GJ
Description:	Heat generation by project
Source of data:	
Measurement procedures (if any):	
Monitoring frequency:	Continuous
QA/QC procedures:	
Any comment:	

Data / Parameter:	$VFUEL_y$
Data unit:	GJ
Description:	Vehicle power supplied by project
Source of data:	
Measurement procedures (if any):	
Monitoring frequency:	Continuous
QA/QC procedures:	
Any comment:	

Data / Parameter:	$Eff_{captive}$
Data unit:	%
Description:	Energy efficiency of captive power plant
Source of data:	
Measurement procedures (if any):	
Monitoring frequency:	Annually
QA/QC procedures:	
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:	
Measurement procedures (if any):	
Monitoring frequency:	Annually
QA/QC procedures:	
Any comment:	

Data / Parameter:	Eff_V
Data unit:	%
Description:	Efficiency of vehicle engine
Source of data:	
Measurement procedures (if any):	
Monitoring frequency:	Annually
QA/QC procedures:	
Any comment:	

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

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The CPA adopts the approved ACM0008 (Version 07) “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” , to establish the monitoring plan.

This monitoring plan is designed to ensure that the Designated Operational Entity (DOE) is able to verify the data from the CPA.

1. Management Structure and responsibilities
Each CPA operator appoints a person who is responsible for ensuring that monitoring equipment is maintained and operated in accordance with manufacturer specifications. This person will also receive training from the manufacturer on how to operate the monitoring equipment and perform maintenance on the monitoring equipment before the commissioning of the CPA.

2. Data Collection
The CPA will use continuous flow meters and equipment to monitor the temperature and pressure of the CMM/CMB gas collected at the CPA. The equipment will be serviced, calibrated and maintained in accordance with manufacturer’s instructions and complete records of such service, calibration and maintenance will be kept. Measurement data will be recorded electronically at hourly intervals and converted to average hourly flows adjusted to normal temperature and pressure. This data will subsequently be used to calculate daily average flows, amount of CMM/CBM gas collected, using a continuous flow meter and monitoring of temperature and pressure.

The CPA will use continuous analyser in order to determine the percentage of methane in the CMM/CBM gas.

The CPA will determine the project emissions from flaring of the residual gas stream (PE_{flare}) in accordance with the “Tool to determine project emissions from flaring gases containing methane”.

The CPA will use continuous analyser in order to determine the Temperature (T) and pressure (P) of the CMM/CBM gas to determine the density of methane in the CMM/CBM gas.

100% of the data should be monitored if not indicated otherwise.

3. Data calibration
All measurements are taken utilising calibrated measurement equipment according to international industry standards.

4. Data handling
The CPA operator, with the help of the managing/coordinating entity will develop and implement a protocol for adequate record keeping and data monitoring systems. The data recorded by the CPA operator will be transmitted to the managing/coordinating entity within ten business days after the end of each calendar month.

5. Data quality control
All data transmitted by the CPA operator to the managing/coordinating entity will be checked by the managing/coordinating entity to ensure the accuracy and completeness of the data. In case of mistakes, corrective action will be taken to avoid similar mistakes in the future.

6. Reporting
The CPA operator transmits copies of completed worksheets on a regular basis while maintaining originals on file. The CPA operator should prepare a brief annual report which should include: information on overall project performance, emission reductions generated and verified and comparison with targets, etc. The report can be combined with the periodic verification report.

The coordinating/managing entity will use the collected data to calculate emission reductions. The coordinating/managing entity will also be responsible for the preparation of the data for verification.

7. Data archiving
All data collected as part of monitoring will be archived electronically and be kept at least for 2 years after the end of the last crediting period. Data will be kept electronically by the managing/coordinating entity, which ensures that data can centrally be made available to a Designated Operational Entity (DOE) upon request.

8. Training
At least five (5) technicians will be trained for each CPA on the operation and maintenance of the monitoring equipment by the manufacturer before the commissioning of the project. This training will ensure that trained technicians are able to operate the equipment properly and perform routine maintenance procedures on the monitoring equipment in order to ensure that the parameters listed in this section can be monitored accurately and in accordance with individual parameter requirements.

The managing/coordinating entity will liaise with the CPA operator to ensure that ongoing training will be provided by the manufacturer of the monitoring equipment to ensure that a sufficient number of technicians are adequately trained to operate and maintain the monitoring equipment in accordance with manufacturer requirements and this monitoring plan. The initial training of technicians has to be performed before the start of the first monitoring period of the CPA.

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)

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The completion date of the application of the baseline study and monitoring methodology is the 05/10/2011

The baseline study and monitoring methodology was prepared by:
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Annex 1

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding from Parties is provided for the PoA as stated in section A.4.5.

Annex 3

BASELINE INFORMATION

Please refer to section E.4. No additional information provided here.

Annex 4

MONITORING INFORMATION

Please refer to section E.7. No additional information provided here.

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