Programme design document form for CDM programmes of activities (Version 03.0)

PART I. Programme of activities (PoA)

SECTION A. General description of PoA

A.1. Title of the PoA

Title: Coal Mine Methane Utilisation and Destruction Programme in DPR Korea
Version: 10
Date: 16/04/2013

A.2. Purpose and general description of the PoA

1. General operating and implementing framework of PoA

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 consist of the harmful greenhouse gas methane. The Democratic People's Republic of Korea (DPR Korea) has in excess of one hundred working 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 working coal 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/measure 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.

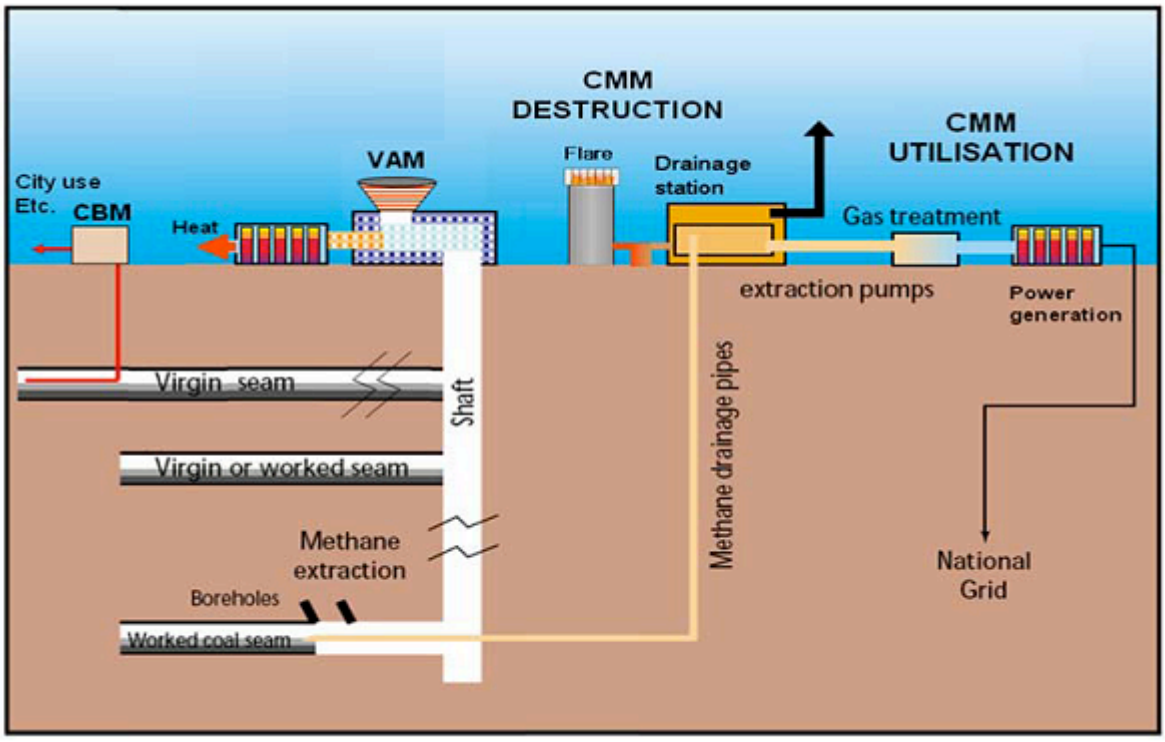
2. Policy/measure or stated goal of the PoA

The PoA aims to reduce GHG emissions by capturing methane from working 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 significant emission reductions. The PoA only considers working underground coal mines in the territory of the DPR Korea and newly built mines or open cast mines will not be eligible to be included in this PoA.

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.

Figure-1 shows the outline of a CMM drainage system::



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

The PoA aims to identify sites where methane capture and utilisation or destruction projects can be implemented economically from working underground coal mines. 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 GHG emissions subject to economic viability of the projects 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 proposed 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.

3. Confirmation that the proposed PoA is a voluntary action by the coordinating/managing entity.

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

The PoA is a voluntary action undertaken by Carbon Development and Trading Ltd. Currently the DPR Korea does not have any laws or policies that require the capture of methane from working coal mines in the DPR Korea. The Ministry of Land and Environment Protection in its letter dated 13/10/2011 confirmed that there is currently no requirement to capture and utilise or destroy coal mine methane gas in the DPR Korea. As there are no laws that enforce the capture of methane from coal mines in the DPR Korea, the CME is not by law obliged to implement the PoA.

A.3. CMEs and participants of PoA

1. Coordinating or managing entity of PoA as the entity which communicates with the Board:
Carbon Development and Trading Ltd is the coordinating/managing entity (CME) for this PoA.

2. Project participants being registered in relation to the PoA

a. General Bureau for Cooperation with International Organizations: The General Bureau for Cooperation with International Organizations (GBCIO) has been tasked by the government of the DPR Korea to promote the implementation of CDM projects in the DPR Korea. In this PoA, the GBCIO supports the CME on an ongoing basis with the implementation of the CPAs.
b. Carbon Development and Trading Ltd: Carbon Development and Trading Ltd is the CME of the POA and is responsible for the financing and implementation of all CPAs.

A.4. Party(ies)

Name of Party involved (host) indicates a host Party	Private and/or public entity(ies) project participants (as applicable)	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	No
Democratic People's Republic of Korea (host)	Carbon Development and Trading Ltd	No

A.5. Physical/ Geographical boundary of the PoA

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

The geographical boundary for the PoA includes all areas of the Democratic People's Republic of Korea (DPR Korea). Geographic references in the DPRK include latitudes 37° and 43°N, and longitudes 124° and 131°E.

Figure-2 shows the geographical boundary of the PoA.

A.6. Technologies/measures

The PoA is a Large Scale PoA with Sectoral Scopes 08 and 10. 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.

Each CPA will adopt one or a combination of the following technologies or measures at working underground coal mines in the DPR Korea:

a) Underground boreholes in the mine to capture pre mining CMM;

b) Surface goaf wells, underground boreholes, gas drainage galleries or other goaf gas capture techniques, including gas from sealed areas, to capture post mining CMM.

A CPA will capture methane from a working 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.

The technologies or measures listed above are in accordance with approved CDM Methodology ACM0008 (Version 07). Both technologies/measures capture CMM from working underground

coal mines and destroy or utilise the captured methane rather than venting it in to the atmosphere.

There is currently no legal requirement in the DPR Korea to utilise or destroy CMM in the territory of the DPR Korea. The Ministry of Land and Environment Protection has been requested by the CME to clarify the applicable national and/or sectoral policies and regulations relevant to methane emitted from coal mines in the DPR Korea. The Ministry of Land and Environment Protection in its letter dated 13/10/2011 confirmed that there is currently no requirement to capture and utilise or destroy coal mine methane gas in 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.

As the DPR Korea currently does not have any CMM capture systems in place, the CME anticipates that all technology, equipment and expertise will initially be provided to the DPR Korea through foreign experts and manufacturers. Such transfer would occur through the import of appropriate equipment to the DPR Korea, such as drilling equipment, piping, pumps and flaring technology, and employing foreign experts in the engineering and implementation of the individual CPAs. As the technology for capturing and destroying/utilising CMM is already available in non Annex-I countries, it is not compulsory for technology transfer from an Annex I country and it is more likely that technology will be imported from other Asian countries that are non-Annex I countries.

The CME envisages that training will be provided to the workforce in the DPR Korea in order to ensure that the equipment can be maintained in accordance with manufacturer specifications. Training will be provided to people on a CPA-specific basis and will be performed by the relevant equipment manufacturers as appropriate. Additionally, people at each CPA-site will be trained to perform monitoring.

A.7 Public funding of PoA

No public funding is provided for the PoA or any of the CPAs included in the PoA from an Annex I Party.

SECTION B. Demonstration of additionality and development of eligibility criteria

B.1. Demonstration of additionality for PoA

As confirmed by the letters issued by the General Bureau for Cooperation with International Organizations (GBCIO) dated 06/10/2011 and 05/04/2013, the coordinating/managing entity (CME) is only entitled to a share of the CDM Revenue from the successful implementation of CPAs in return for developing and implementing the PoA and CPAs, the PoA and CPAs would not be undertaken by the CME in case that CDM Revenue was not forthcoming.

In order to demonstrate the additionality for a CPA, the CME shall establish whether a CPA is

additional by following the “Tool for the demonstration and assessment of additionality” (Version 06.1.0). Thereby each CPA will demonstrate how the CPA would not have occurred in the absence of CDM.

In order to demonstrate such additionality, each CPA shall demonstrate that the CPA is additional by performing an investment analysis as per the “Tool for the demonstration and assessment for additionality” (Version 06.1.0). As the CME is only entitled to a share of CDM Revenue without entitlement to compensation/revenue from any other source, the simple cost analysis is applicable when performing the investment analysis for a CPA. CPAs included in this PoA would not have occurred in case of CDM Revenue lacking as this is the only revenue source arising from the implementation of a CPA.

As per Approved Methodology ACM0008 (Version 07), the baseline scenario alternative selected in Section B.4. of Part II of this PoA-DD shall be used when applying Steps 2 to 5 of the “Tool for the demonstration and assessment of additionality” (Version 06.1.0). The investment analysis approach should identify whether the baseline scenario selected above is economically and/or financially more attractive than the CDM project activity if not registered as a CDM project.

The steps outlined in Approved Methodology ACM0008 (Version 07) are followed to determine the additionality of each CPA.

Step 1: Identification of alternatives to the project activity consistent with current laws and regulations
In compliance with Approved Methodology ACM0008 (Version 07) Section “Additionality” Step 1 of “Tool for the demonstration and assessment of additionality” (Version 06.1.0) applicable to Approved Methodology ACM0008 (Version 07) can be ignored.

Step 2: Investment analysis
In compliance with Approved Methodology ACM0008 (Version 07) Section “Additionality” Step 2 of the “Tool for the demonstration and assessment of additionality” (Version 06.1.0) will be followed to assess additionality of each CPA. In order to determine the appropriate analysis method in Sub-step 2A of the "Tool for the demonstration and assessment of additionality” (Version 06.1.0), each CPA shall perform investment analysis that demonstrates the additionality for the specific CPA.

Sub-step 2a. Determine appropriate analysis method
As the coordinating/managing entity (CME) is only entitled to a share of the CDM Revenue from the successful implementation of CPAs in return for developing and implementing the PoA and CPAs, the only revenue arising to the CME for the implementation and financing of a CPA is limited to CDM Revenue. There will be no other revenue from a CPA for the CME. Therefore, Sub-step 2b: Option I Simple Cost Analysis is applicable to each CPA.

Sub-step 2b. Option I. Apply simple cost analysis
The total costs for a typical Coal Mine Methane project will include: capital investment costs and operation & maintenance costs, both of which will be additional compared with the baseline scenario. Furthermore, there will be no revenue from this proposed project activity, under this selected method of analysis.

Step 3: Barrier Analysis
Since additionality is demonstrated by using Step 2 of the "Tool for the demonstration and assessment of additionality” (Version 06.1.0),barrier analysis is not undertaken.

Step 4: Common Practice Analysis
The CPA shall perform a common practise analysis to complement the investment analysis (Step 2). Each CPA shall describe the common practise of CMM destruction and/or utilisation at coal mines in the DPR Korea in accordance with Step 4 of the “Tool for the demonstration and

assessment of additionality" (Version 06.1.0). This shall serve as a credibility check. As all CPAs under this PoA are recognized as relevant measures i.e., methane destruction under § 6 (c) of the "Tool for the demonstration and assessment of additionality" (Version 06.1.0), the common practice analysis will be performed in accordance with § 47 of the "Tool for the demonstration and assessment of additionality" (Version 06.1.0).

The steps are outlined as follows:

Step 1: Calculate applicable output range as +/-50% of the design output or capacity of the proposed project activity;

Step 2: In the applicable geographical area (DPR Korea), identify all plants that deliver the same output or capacity, within the applicable output range calculated in Step 1, as the proposed project activity and have started commercial operation before the start date of the project.13 Note their number Nall. Registered CDM project activities and projects activities undergoing validation shall not be included in this step;

Step 3: Within plants identified in Step 2, identify those that apply technologies different that the technology applied in the proposed project activity. Note their number Ndiff;

Step 4: Calculate factor F=1-Ndiff/Nall representing the share of plants using technology similar to the technology used in the proposed project activity in all plants that deliver the same output or capacity as the proposed project activity.

The proposed project activity is a "common practice" within a sector in the applicable geographical area if both the following conditions are fulfilled:

(a) The factor F is greater than 0.2; and
(b) Nall-Ndiff is greater than 3.

In conclusion, the typical CPA included in the PoA will demonstrate that it is not the common practice in the country and therefore additional because it would not be implemented without the CDM.

The "Tool for the demonstration and assessment of additionality" (Version 06.1.0) in Step 2 requires each CPA to perform an investment analysis. Each CPA shall demonstrate that the following criteria are met:

Criteria	Analysis/Evidence
The common practice analysis in accordance with § 47 of Tool for the demonstration and assessment of additionality (version 06.1.0)	Documented in the CPA and substantiated by letters from relevant authorities like Ministry of Environment and Land Protection and The ministry of coal industry.
The CPA is identified as additional following step 2 of the Additionality tool: Investment Analysis i.e., sub-step 2b: Option I. Simple Cost Analysis	The simple cost analysis along with its documented evidences has determined that the CPA has no other source of revenue except from CDM related income and therefore would not happen without CDM revenues.

In the absence of the CDM, none of the CPAs would occur. Indeed, barriers prevent the project to occur and no policies/regulations of any kind mandate capture and/or utilization or destruction of coalmine methane gas in territory of DPR Korea. The proposed PoA has no other source of revenue except for the CDM related revenues. Therefore the PoA is deemed additional.

B.2. Eligibility criteria for inclusion of a CPA in the PoA

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

1. Criterion: The geographic boundary of the CPA lies within the DPR Korea.
   Evidence: The CPA shall demonstrate this in the CPA-DD for each CPA by listing the GPS coordinates of the CPA site or by obtaining a letter from a competent authority in the DPR Korea confirming that the CPA is located within the political boundary of the DPR Korea. GPS coordinates, if used, shall be validated through on-site visit and/or through photographic evidence and/or by comparing the GPS coordinates with official maps.

2. Criterion: A CPA reduces GHG emissions by utilising CMM for electricity and/or heat generation and/or destroying CMM through flaring by adopting one or a combination of the following technologies or measures at a working coal mine in the DPR Korea:

   (a) Underground boreholes in the mine to capture pre mining CMM;

   (b) Surface goaf wells, underground boreholes, gas drainage galleries or other goaf gas capture techniques, including gas from sealed areas, to capture post mining CMM.

   Evidence: The CME shall review each CPA and its project plan when preparing the CPA-DD, The CME shall clearly demonstrate in the CPA-DD that the CPA fulfils this criterion by providing a project description sufficiently detailed to ensure compliance with this criterion. Additionally, evidence shall be provided that the CPA is implemented at a working coal mine.

3. Criterion: The existing Approved CDM Methodology ACM0008 (Version 07) is applicable to the CPA.
   Evidence: The CME shall ensure that each CPA fulfils the applicability criteria of the Approved Methodology ACM0008 (Version 07) and detail in the CPA-DD how the CPA fully complies with these applicability criteria.

4. Criterion: For the purpose of determining baseline emissions, a CPA, in the pre-project scenario, released all CMM into the atmosphere without destruction or utilisation.
   Evidence: The pre-project scenario shall be clearly described in the CPA-DD and evidenced by documentary evidence that can include but is not limited to site visits performed or photographic evidence taken or confirmation by a competent authority of the DPR Korea such as the Ministry of Land and Environment Protection or the Ministry of Coal.

5. Criterion: A CPA owner confirms in a written statement that it is aware and agrees with the inclusion of the CPA in the PoA on a voluntary basis.
   Evidence: A letter issued by the CPA owner.

6. Criterion: A CPA owner confirms in a written statement that it does not belong to any other PoA or CDM project.
   Evidence: A letter issued by the CPA owner. Additionally, the CME will consult the CDM Project Database to ensure that the CPA is not already registered or seeking to be registered in another PoA or CDM Project and provide a declaration confirming that the CPA is not already registered or seeking to be registered in another PoA or CDM Project.

7. Criterion: A CPA owner confirms in a written statement that it is not required by law or other policies to capture CMM at the CPA site.
   Evidence: A letter issued by the CPA owner. Additionally, this information shall be confirmed by a competent authority in the DPR Korea, such as the Ministry of Land and

Environment Protection or Ministry of Coal.

8. Criterion: The CME confirms in a written statement that the CPA is not currently included in the PoA and that it has consulted the CDM Project Database to ensure that the CPA is not already a registered CDM project or included in another PoA and that it has assigned a unique identification number to the CPA.
   Evidence: The CME shall confirm that the CPA is not included in the PoA including the date when the CME has consulted the CDM Project Database to ensure that the CPA is not already a registered CDM project or included in another PoA. The CME shall also confirm details regarding the unique identification number (CMM-DPRK-X) that the CME has assigned to the CPA.

9. Criterion: A CPA has to perform a local stakeholder consultation before it may be included in the PoA.
   Evidence: The stakeholder consultation shall be described in the CPA-DD and documentary evidence provided, including but not limited to, stakeholder questionnaires distributed and meeting minutes recorded during the stakeholder consultation process. Any issues identified during the stakeholder consultation shall be resolved to the satisfaction of the stakeholders before the inclusion of the CPA in the PoA.

10. Criterion: A CPA has to ensure that environmental analysis has been performed.
    Evidence: The environmental analysis shall be performed by the CME and described in the CPA-DD for each CPA. Any issues identified during the environmental analysis shall be resolved to the satisfaction of the stakeholders before the inclusion of the CPA in the PoA.

11. Criterion: The CME confirms in a written statement that no funding from an Annex 1 party is provided for the CPA.
    Evidence: The CME shall issue a letter and provide supporting documentation such as bank statements.

12. Criterion: The start date (defined in the Glossary of CDM terms) of the CPA is not prior to the commencement of validation of the PoA, which is the 22/10/2011.
    Evidence: The start date of the CPA shall be clearly described in the CPA-DD. The CME shall ensure that the CPA has not started before the validation of the PoA by including documentary evidence that can include but is not limited to site visits performed and/or photographic evidence taken (with time stamps) and/or contractual agreements entered into by the CPA owner or CME and/or a letter from a competent authority confirming the CPA start date.

13. Criterion: The Additionality of a CPA will be demonstrated as follows:
    (i) The CME provides all financing for the implementation of the future CPAs under this PoA; and
    (ii) Using Step 2 of the methodological tool "Tool for the demonstration and assessment of additionality" (Version 06.1.0): Investment Analysis i.e., sub-step 2b: Option I. Simple Cost Analysis; and
    (iii)Common practise analysis in accordance with §47 of the methodological tool "Tool for the demonstration and assessment of additionality" (Version 06.1.0).
    Evidence: The fulfilment of the criterion shall be evidenced by providing documentary evidence that can include but is not limited to quotations from suppliers, and confirmation by a competent authority of the DPR Korea.

B.3. Application of methodologies

As detailed in section A.6, In this PoA each CPA will adopt one or a combination of the following technologies or measures at working underground coal mines in the DPR Korea:

a) Underground boreholes in the mine to capture pre mining CMM;

b) Surface goaf wells, underground boreholes, gas drainage galleries or other goaf gas capture techniques, including gas from sealed areas, to capture post mining CMM.

A CPA will capture methane from a working 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.

The technologies or measures listed above are in accordance with approved CDM Methodology ACM0008 (Version 07).

The PoA uses the Approved Methodology 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.

In accordance with Approved Methodology ACM0008 (Version 07), the following tools are also used:
1. "Tool for the demonstration and assessment of additionality" (Version 06.1.0)
2. "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" (Version 02)
3. "Project emissions from flaring" (Version 02.0.0)
4. "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 02.0.0)
5. "Tool to calculate the emission factor for an electricity system" (Version 02.2.1)

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.

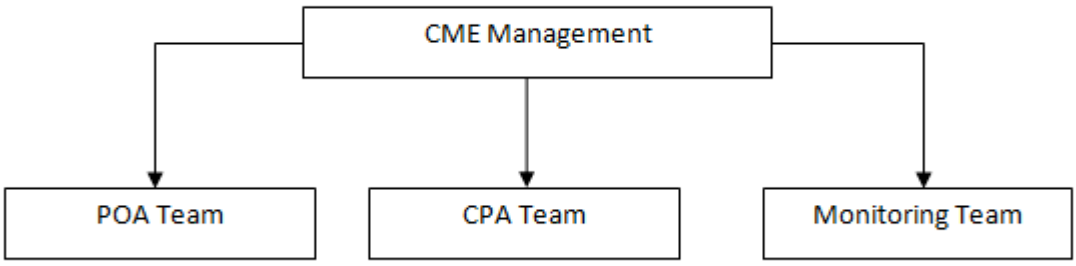
According to the "Procedures for Registration of a Programme of Activities as a Single CDM Project Activity and issuance of Certified Emission Reductions for a Programme of Activities" (Version 04.1), all CPAs in the PoA will be monitored according to the applicable methodology, procedures and guidelines.

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.

SECTION C. Management system

The coordinating/managing entity (CME) 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, to prepare the CPA-DD, and to ensure that monitoring at each CPA site can be performed. The CME is also responsible for all communications with the DOE and CDM Executive Board.

The CME will operate several teams as outlined below:



CME shall perform the following tasks:

- Identifying new potential CPAs;
- Checking whether potential CPAs fulfil the eligibility criteria;
- Liaising with the GBCIO and CPA owners to obtain necessary information and documentation in order to include a CPA in the PoA;
- Maintaining the PoA database to ensure that no double-counting exists;
- Implementing the CPAs in order to achieve emission reductions;
- Liaising with the DOE to include CPAs in the PoA;
- Preparing monitoring reports;
- Liaising with the DOE for verification of the monitored data.

Responsibilities of CME:

- CME shall work in accordance with the relevant rules and decisions of the CDM Executive Board;
- CME shall work in a transparent way and provide accurate information;
- CME shall instruct a DOE that has appropriate skill and knowledge to validate the PoA and individual CPAs;
- CME shall instruct a DOE that has appropriate skill and knowledge to verify emission reductions resulting from the implementation of CPAs.

The CME's PoA Team is responsible for the PoA overall, including the identification of new CPAs and to establish the financial and technical feasibility of a CPA. This team will also maintain the PoA database.

The CME's CPA Team is responsible for the preparation of the CPA-DD and to assess each CPA's eligibility against the criteria outlined in the PoA-DD. Before seeking to include a CPA into the PoA, the team shall check that the CPA fulfils all eligibility criteria as set out in Section B.2. of Part I of this PoA-DD and shall only seek to include such CPA if all criteria are met by the CPA. The team will also ensure that the CPA seeking to be included is not already included in the PoA.

The CME's Monitoring Team is responsible for the collection of the monitoring data from the CPA owner and for the calculation of emissions reductions for each CPA, as well as the preparation of monitoring reports. The CME's Monitoring Team shall liaise with a DOE for the verification for the achieved emission reductions from each CPA.

Each CPA is operated by a CPA owner that regularly reports monitored data to the CME's Monitoring Team. The CPA owner 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.

(i) A record keeping system for each CPA under the PoA:

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 mine at each CPA site. The database will be maintained by the CME with information provided by each CPA owner. The CME verifies the reported data with field checks if necessary.

The CME's Monitoring Team collects all monitoring data from the CPA owner and keeps those records in accordance with the monitoring methodology. All data is archived in accordance with the requirements set out in the monitoring methodology.

(ii) A system/procedure to avoid double counting e.g. to avoid the case of including a new CPA that has been already registered either as CDM project activity or as a CPA of another PoA:
Before seeking to include a CPA in the PoA, the CME's CPA Team shall obtain a letter from the CPA owner confirming that the CPA is not already registered as a CDM project activity or a CPA of another PoA. Additionally, the CME's CPA Team will consult the CDM Project Database to ensure that the CPA is not already a registered CDM project or included in another PoA. Each CPA shall have a unique identification number and unique geographical reference.

(iii) The provisions to ensure that those operating the CPA are aware and have agreed that their activity is being subscribed to the PoA:
Each CPA owner, in accordance with the eligibility criteria set out in Section B.2. of Part I of this PoA-DD, confirms in writing at the time of CPA inclusion that it is aware and has agreed to be included in the PoA on a voluntary basis.

(iv) Roles and responsibilities of personnel involved in the process of inclusion of CPAs:
The CPA inclusion tasks rests with the CME's CPA Team. The CME's management shall appoint a person to be the team leader. The team leader at his/her discretion may request additional people to join his/her team in order to ensure that sufficient resources are available to the team leader to perform his/her duties on behalf of the CME.

The CPA Team leader shall demonstrate the following competencies:

- Clear understanding of CDM modalities and protocol;
- Clear understanding of the eligibility criteria of the PoA;
- Ability to scrutinise all project related documents;
- At least one year work experience in the carbon market and/or emission reduction project development;
- Education to university degree level;
- Demonstrate fluency in English.

The team leader shall assign individual members of his/her teams to particular tasks while retaining responsibility for the performance of the tasks under his/her leadership. The team leader shall make a recommendation to the CME's management as to whether to include a CPA in the PoA

The management of the CME shall ensure that the team leader meets the competency criteria set out above.

(v) Records of arrangements for training and capacity development for personnel:
The CME will provide training to its employees as required to perform the assigned tasks with appropriate skill and care. The extent of the training to be provided is going to be dependent on the individual employee. If consultants are engaged in order to perform a particular task, the consultant shall be able to demonstrate that it has the required competencies.

(vi) Procedure for technical review of inclusion of CPAs:
Before seeking to include a CPA in the POA, the CME's CPA Team will review the eligibility criteria as set out in the PoA-DD for inclusion of a CPA in the PoA and establish that all eligibility criteria are fulfilled by the CPA seeking to be included in the PoA. The person assigned for this task shall produce documentary evidence in order to ensure that the eligibility criteria have been

fulfilled and can be verified by a DOE.

During the technical review, the CPA Team will ensure that the fulfilment of all eligibility criteria is evidenced as outlined in the PoA-DD and ensure that the CPA-DD conforms with latest CDM Executive Board guidelines.

Once the CME's CPA Team is satisfied that the eligibility criteria are met by the CPA, it should recommend inclusion of the CPA to the CME Management. Subject to approval from the CME Management, the CME's Management shall instruct a DOE to include the CPA in the PoA. In the process of inclusion, the DOE will again check that all eligibility criteria are satisfied and that the CPA can be included in the PoA.

(vii) Measures for continuous improvements of the PoA management system;

The CME strives to continuously improve the PoA management system. The CME will assess the PoA management process periodically for improvements and follow guidance issued by the CDM Executive Board and other entities involved in the carbon market in order to adhere to the latest standards for PoA management systems.

SECTION D. Duration of PoA

D.1. Start date of PoA

The starting date of the PoA shall be 01/01/2014 or the date of registration, whichever is later.

D.2. Duration of the PoA

The length of the PoA is 28 years.

SECTION E. Environmental impacts

E.1. Level at which environmental analysis is undertaken

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

As each CPAs has a choice of technology to be implemented in line with individual CPA feasibility, it is appropriate for each CPA to perform its own environmental analysis to take account of the unique features of each CPA.

E.2. Analysis of the environmental impacts

The analysis of environmental impacts will be performed and documented on the CPA level in order to ensure that proper account of environmental impacts associated with each CPA can be taken.

E.3. Environmental impact assessment

In accordance with host Party laws and regulations, it is unlikely that an environmental impact assessment will be required for a typical CPA. The requirement of an environmental impact assessment will be evaluated for each CPA. The CME will commission an environmental impact assessment if required by the host Party.

SECTION F. Local stakeholder comments

F.1. Solicitation of comments from local stakeholders

1. Local stakeholder consultation is done at PoA level ☐
2. Local stakeholder consultation is done at CPA level ☒

As the PoA covers the entire territory of the DPR Korea, the stakeholder consultation is performed on CPA level in order to ensure that comments from locally affected people can be taken into consideration.

F.2. Summary of comments received

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

F.3. Report on consideration of comments received

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

SECTION G. Approval and authorization

A letter of approval from the Democratic People's Republic of Korea is available for both project participants at the time of submitting the PoA-DD to the validating DOE and has been provided to the validating DOE.

A letter of approval from the Democratic People's Republic of Korea is available for the CME confirming the CME's authorisation of its coordination of the PoA at the time of submitting the PoA-DD to the validating DOE and has been provided to the validating DOE.

PART II. Generic component project activity (CPA)

SECTION A. General description of a generic CPA

A.1. Purpose and general description of generic CPAs

A typical CPA includes the introduction of a CMM capture and destruction and/or utilisation system compared with the current practise of venting methane into the atmosphere from coal mines.

Each CPA will either destroy the captured methane through combustion in a flare or utilise the captured methane for further use as outlined in this PoA.

Each CPA will adopt one or a combination of the following technologies or measures at working underground coal mines in the DPR Korea:

(a) Underground boreholes in the mine to capture pre mining CMM;

(b) Surface goaf wells, underground boreholes, gas drainage galleries or other goaf gas capture techniques, including gas from sealed areas, to capture post mining CMM.

A CPA will capture methane from a working 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.

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.

The aim of a CPA is to capture as much CMM from the coalmine as possible in order to reduce the maximum amount of methane currently released into the atmosphere.

SECTION B. Application of a baseline and monitoring methodology

B.1. Reference of the approved baseline and monitoring methodology(ies) selected

The PoA uses the Approved Methodology 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.

In accordance with Approved Methodology ACM0008 (Version 07), the following tools are also used:
1. "Tool for the demonstration and assessment of additionality" (Version 06.1.0)
2. "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" (Version 02)

3. "Project emissions from flaring" (Version 02.0.0)
4. "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 02.0.0)
5. "Tool to calculate the emission factor for an electricity system" (Version 02.2.1)

B.2. Application of methodology(ies)

The Approved Methodology ACM0008 (Version 07) states the applicability criteria to the methodology. Below is a comparison between the applicability criteria set out by the Approved Methodology ACM0008 (Version 07) and the CPAs:

Table 1: Applicability of Approved Methodology ACM0008 (Version 07) to each CPA

Applicability to extraction activities:	
Surface drainage boreholes to capture CBM associated with mining activities.	Excluded. CBM is not eligible in this PoA.
Underground boreholes in the mine to capture pre mining CMM.	Included. CPAs shall drain and capture methane by means of working underground boreholes in coalmines in the DPR Korea.
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. Different goaf gas capture techniques shall be used in order to extract methane from the coal mines. The exact gas capture technique depends on the circumstances at the CPA site and is individually adjusted to each CPA.
Ventilation air methane that would normally be vented.	Excluded. VAM is not captured and destroyed or utilised by CPAs.

Applicability to CMM capture, utilisation and destruction:	
The methane is captured and destroyed through flaring.	Included. Flares shall be used at CPAs in order to destroy methane rather than vent the methane into the atmosphere as currently the case.
The methane is captured and destroyed through flameless oxidation.	Excluded. CPAs shall 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. Electricity and heat production at suitable CPA sites shall be implemented to provide some respite for power shortages and shall use the methane to satisfy heat-demand and replace coal-fired boilers.
The remaining share of the methane, to be diluted for safety reason, may still be vented.	Included. If methane needs to be diluted for safety reason and therefore cannot be destroyed or utilised, then the remaining part shall be vented. Each CPA aims to use and/or destroy the maximum amount of methane possible.
All the CMM captured by the project should either be used or destroyed, and cannot be vented.	Included. Each CPA shall capture the methane available from the coal mine and either destroy it in a flare or use it for electricity and/or heat generation.

Applicability for opencast mines:	
The mines should have had a working mining	Excluded. No CPAs shall be implemented

concession for at least three years prior to the start of project.	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 shall 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 shall 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 shall be implemented at open cast mines.

Inapplicability due to incompatibility:	
Capture methane from abandoned/decommissioned coalmines.	Excluded. The CPAs shall 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 (Version 07).
Use CO_2 or any other fluid/gas to enhance CBM drainage before mining takes place.	Excluded in accordance with Methodology ACM0008 (Version 07).

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 (Version 07).

Therefore, each CPA will be in compliance with the baseline and monitoring methodologies as set by Approved Methodology ACM0008 (Version 07).

B.3. Sources and GHGs

In compliance with Approved Methodology ACM0008 (Version 07), 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 spatial 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	Included	Justification/Explanation
Baseline	Emissions of methane as a result of venting	CH_4	Included	All of the captured CMM at each CPA is vented into the atmosphere in the baseline scenario. This is the main emission source.
	Emissions from destruction of methane in the baseline	CO2	Excluded	Currently, methane is not captured and utilised or destroyed at working coal mines in the DPR Korea.
		CH_4	Excluded	Excluded for simplification in accordance with Approved Methodology ACM0008 (Version 07).
		N_2O	Excluded	Excluded for simplification in accordance with Approved Methodology ACM0008 (Version 07).
	Grid electricity generation (electricity provided to the grid)	CO_2	[CPA specific]	[CPA specific]
		CH_4	Excluded	Excluded for simplification in accordance with Approved Methodology ACM0008 (Version 07).
		N_2O	Excluded	Excluded for simplification in accordance with Approved Methodology ACM0008 (Version 07).
	Captive power and/or heat	CO_2	[CPA specific]	[CPA specific]

		CH_4	Excluded	Excluded for simplification in accordance with Approved Methodology ACM0008 (Version 07).
		N_2O	Excluded	Excluded for simplification in accordance with Approved Methodology ACM0008 (Version 07).
Project activity	Emissions of methane as a result of continued venting	CH_4	Excluded	The CPA will account for only the change in CMM emissions release 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 (Version 07).
		N_2O	Excluded	Excluded for simplification in accordance with Approved Methodology ACM0008 (Version 07).
	Emissions from methane destruction	CO_2	[CPA specific]	[CPA specific]
	Emissions from NMHC destruction	CH_4	[CPA specific]	[CPA specific]
	Fugitive emissions of unburned methane	CH_4	[CPA specific]	[CPA specific]
	Fugitive methane emissions from on-site equipment	CH_4	Excluded	Excluded for simplification in accordance with Approved Methodology ACM0008 (Version 07).
	Accidental methane release	CO_2	Excluded	Excluded for simplification in accordance with Approved Methodology ACM0008 (Version 07).

B.4. Description of baseline scenario

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

(Version 07).

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:

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

Step 1a. Steps for CMM extraction

According to Approved Methodology ACM0008 (Version 07), 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

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 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 iii, iv, v, and vi. This is the proposed PoA not implemented as a CDM project.

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 alternatives for power generation include:

1. Electricity generation by the relevant grid of DPR Korea, ie East Grid;
2. Electricity supply from captive coal-fired power generation of same scale;
3. CMM power generation. This is the project activity not undertaken as a CDM project.

The alternatives for heat generation include:

4. Continuation of current heat supply by coal-fired boilers;
5. Heat supply by heat generation technologies, including conventional steam boiler, or conventional hot water boiler, which would be fired by CMM. This is the proposed project activity not undertaken as a CDM project.

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

There are 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

Step 3a: Alternatives for CMM extraction

Alternative A
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. Hence option A is the current practice of CMM extraction in DPR Korea.

Step 3b: Alternatives for extracted CMM

Alternative (i)
Venting of CMM. As there are no legal requirements to capture and use or destroy CMM, coal mines in the DPR Korea simply release the CMM into the atmosphere. This alternative demonstrates the current pre-project situation before implementation of a CPA. All CMM vented from a coal mine is currently released into the atmosphere.

In this scenario, electricity is supplied through the applicable electricity grid that supplies the CPA site or through a captive power generation unit. 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 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. In this scenario, the energy needs of the coal mine would be supplied in the same 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 is not required by laws and/or regulations. 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).

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.

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.

Alternative (vii)
Feed into gas pipeline (to be used as fuel for vehicles or heat/power generation). CMM could be fed into a gas pipeline for use as fuel for vehicles or heat and/or power generation.

Alternative (viii)
Possible combinations of options iii, iv, v, and vi. This is the proposed PoA not implemented as a CDM project.

Step 3c: Alternatives for energy generation

Alternative 1:
Electricity generation by the relevant grid of DPR Korea, ie East Grid.

Alternative 2:
Electricity supply from captive coal-fired power generation of same scale.

Alternative 3:
CMM power generation. This is the project activity not undertaken as a CDM project.

Alternative 4:
Continuation of current heat supply by coal-fired boilers.

Alternative 5:
Heat supply by heat generation technologies, including conventional steam boiler, or conventional hot water boiler, which would be fired by CMM. This is the proposed project activity not undertaken as a CDM project.

Step 4: Eliminate baseline scenario alternatives that face prohibitive barriers

In this section possible alternatives formulated under Step 3 above will be checked against the existing economic and other barriers for their implementation. Non-realistic alternatives will be eliminated.

Step 4a: Barrier analysis of the alternatives for CMM extraction

Alternative A
This alternative represents a continuation of CMM extraction practise at the project site, thus it has not barriers.

Step 4b: Barrier analysis of the alternatives for extracted CMM

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 the 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. The CPA owner would have to secure finance for the project, that is not available from the government of the DPR Korea. To implement this alternative, a foreign investor would have to provide the required capital for implementation. In accordance with the letter from the GBCIO dated 06/11/2011, foreign investors are only entitled to a share of CDM revenue. As there are no registered projects in the DPRK using the Approved Methodology ACM0008 (Version 07), this alternative can be eliminated due to a financial barrier.

Alternative (iii)
Flaring of CMM. Flaring is not required by existing laws and/or regulations. In order to install a flare, additional investment is required. The CPA owner would have to secure finance for the project, which is currently not available from the government of the DPR Korea. To implement this alternative, a foreign investor would have to provide the required capital for implementation. In accordance with the letter from the GBCIO dated 06/11/2011, foreign investors are only entitled to a share of CDM revenue. As there are no registered projects in the DPRK using the Approved Methodology ACM0008 (Version 07), this alternative can be eliminated.

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, construction and/or refurbishment of a power station and upgrade of the national electricity grid. The CPA owner would have to secure finance for the project, which is currently not available from the government of the DPR Korea. To implement this alternative, a foreign investor would have to provide the required capital for implementation. In accordance with the letter from the GBCIO dated 06/11/2011, foreign investors are only entitled to a share of CDM revenue. As there are no registered projects in the DPRK using the Approved Methodology ACM0008 (Version 07), this alternative can be eliminated due to a financial barrier.

Alternative (v)
Use for additional captive power generation. Although CMM could be used for electricity generation that is delivered to the CPA site, this would require substantial investments in the currently lacking infrastructure, including pipelines to bring the CMM to a power station, construction and/or refurbishment of a power station at the CPA site. The CPA owner would have to secure finance for the project, which is currently not available from the government of the DPR Korea. To implement this alternative, a foreign investor would have to provide the required capital for implementation. In accordance with the letter from the GBCIO dated 06/11/2011, foreign investors are only entitled to a share of CDM revenue. As there are no registered projects in the DPRK using the Approved Methodology ACM0008 (Version 07), this alternative can be eliminated due to a financial barrier.

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. The CPA owner would have to secure finance for the project, which is currently not available from the government of the DPR Korea. To implement this alternative, a foreign investor would have to provide the required capital for implementation. In accordance with the letter from the GBCIO dated 06/11/2011, foreign investors are only entitled to a share of CDM revenue. As there are no registered projects in the DPRK using the Approved Methodology ACM0008 (Version 07), this alternative can be eliminated due to a financial barrier.

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. The CPA owner would have to secure finance for the project, which is currently not available from the government of the DPR Korea. To implement this alternative, a foreign investor would have to provide the required capital for implementation. In accordance with the letter from the GBCIO dated 06/11/2011, foreign investors are only entitled to a share of CDM revenue. As there are no registered projects in the DPRK using the Approved Methodology ACM0008 (Version 07), this alternative can be eliminated due to a financial barrier.

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 at present and as such a combination with other alternatives is not a realistic scenario.

Step 4c: Barrier analysis of the alternatives for energy production

Alternative 1:
Electricity generation by the relevant grid of DPR Korea, ie East Grid. No barrier exists.

Alternative 2:
Electricity supply from captive coal-fired power generation of same scale. No barriers exist.

Alternative 3:
CMM power generation. This is the project activity not undertaken as a CDM project. The CPA owner would have to secure finance for the project, which is currently not available from the government of the DPR Korea. To implement this alternative, a foreign investor would have to provide the required capital for implementation. In accordance with the letter from the GBCIO dated 06/11/2011, foreign investors are only entitled to a share of CDM revenue. As there are no registered projects in the DPRK using the Approved Methodology ACM0008 (Version 07), this alternative can be eliminated due to a financial barrier.

Alternative 4:
Continuation of current heat supply by coal-fired boilers. No barriers exist.

Alternative 5:
Heat supply by heat generation technologies, including conventional steam boiler, or conventional hot water boiler, which would be fired by CMM. This is the proposed project activity not undertaken as a CDM project. The CPA owner would have to secure finance for the project, which is currently not available from the government of the DPR Korea. To implement this alternative, a foreign investor would have to provide the required capital for implementation. In accordance with the letter from the GBCIO dated 06/11/2011, foreign investors are only entitled to a share of CDM revenue. As there are no registered projects in the DPRK using the Approved Methodology ACM0008 (Version 07), this alternative can be eliminated due to a financial barrier.

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 CDM Revenue, the project is economically not viable and faces prohibitive barriers.

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

The most economically attractive baseline scenario is Alternative (i) as this alternative does not require any capital outlays.

B.5. Demonstration of eligibility for a generic CPA

The PoA-DD titled Coal Mine Methane Utilisation and Destruction Programme in DPR Korea sets out the eligibility criteria for a CPA as follows:

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 heat generation and/or destroying CMM through flaring by adopting one or a combination of the following technologies or measures at a working coal mine in the DPR Korea:

    (a) Underground boreholes in the mine to capture pre mining CMM;

    (b) Surface goaf wells, underground boreholes, gas drainage galleries or other goaf gas capture techniques, including gas from sealed areas, to capture post mining CMM.

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 pre-project scenario, released all CMM into the atmosphere without destruction or utilisation.

5. A CPA owner confirms in a written statement that it is aware and agrees with the inclusion of the CPA in the PoA on a voluntary basis.

6. A CPA owner confirms in a written statement that it does not belong to any other PoA or CDM project.

7. A CPA owner confirms in a written statement that it is not required by law or other policies to capture CMM at the CPA site.

8. The CME confirms in a written statement that the CPA is not currently included in the PoA and that it has consulted the CDM Project Database to ensure that the CPA is not already a registered CDM project or included in another PoA and that it has assigned a unique identification number to the CPA.

9. A CPA has to perform a local stakeholder consultation before it may be included in the PoA.

10. A CPA has to ensure that environmental analysis has been performed.

11. The CME confirms in a written statement that no funding from an Annex 1 party is provided for the CPA.

12. The start date (defined in the Glossary of CDM terms) of the CPA is not prior to the commencement of validation of the PoA, which is the 22/10/2011.

13. The Additionality of a CPA will be demonstrated as follows:
    i. The CME provides all financing for the implementation of the future CPAs under this PoA; and
    ii. Using Step 2 of the methodological tool "Tool for the demonstration and assessment of additionality" (Version 06.1.0): Investment Analysis i.e., sub-step 2b: Option I. Simple Cost Analysis; and
    iii. Common practise analysis in accordance with §47 of the methodological tool "Tool for the demonstration and assessment of additionality" (Version 06.1.0).

The CPA complies with all eligibility criteria as follows:

[provide description how the CPA fulfils all eligibility criteria]

The steps outlined in Approved Methodology ACM0008 (Version 07) are followed to determine the additionality of this CPA.

Step 1: Identification of alternatives to the project activity consistent with current laws and regulations
In compliance with Approved Methodology ACM0008 (Version 07) Section “Additionality” Step 1 of “Tool for the demonstration and assessment of additionality” (Version 06.1.0) applicable to Approved Methodology ACM0008 (Version 07) can be ignored as the alternatives have been identified and assessed at PoA level in the PoA-DD.

Step 2: Investment analysis
In compliance with Approved Methodology ACM0008 (Version 07) Section “Additionality” Step 2 of the “Tool for the demonstration and assessment of additionality” (Version 06.1.0) will be followed to assess additionality of this CPA. In accordance with the eligibility criteria of the PoA titled " Coal Mine Methane Utilisation and Destruction Programme in DPR Korea" (Version 10), each CPA shall perform investment analysis, i.e., sub-step 2b: Option I. Simple Cost Analysis, that demonstrates the additionality for the specific CPA.

Sub-step 2a. Determine appropriate analysis method
For this CPA, the following has been established:
[provide description how the CPA fulfils the eligibility criteria for Step 2 of the methodological tool "Tool for the demonstration and assessment of additionality" (Version 06.1.0)]

The only revenue arising to the CME for the implementation and financing of this CPA is limited to CDM Revenue. There will be no other revenue from this CPA for the CME. Therefore, Sub-step 2b: Option I Simple Cost Analysis is applicable to this CPA.

Sub-step 2b. Option I. Apply simple cost analysis
As per Approved Methodology ACM0008 (Version 07), the baseline scenario alternative selected in Section B.2. of this CPA-DD shall be used when applying Steps 2 to 5 of the “Tool for the demonstration and assessment of additionality” (Version 06.1.0). The investment analysis approach should identify whether the baseline scenario selected above is economically and/or financially more attractive than the CDM project activity if not registered as a CDM project.

The total costs for this CPA will include: capital investment costs and operation & maintenance costs, both of which will be additional compared with the baseline scenario. If the CPA was not registered as a CDM project, then no revenue would be generated by the CPA.

The total investment and operating costs of the project activity during the first crediting period (excluding the CDM related costs, such as monitoring, validation or verification) are estimated to be XXX. The estimated annual operating and maintenance costs are XXX per annum.

Investment costs (in XXX)		Reference
XXX	XXX	XXX
XXX	XXX	XXX
XXX	XXX	XXX
XXX	XXX	XXX
XXX	XXX	XXX
XXX	XXX	XXX
Total investment cost	XXX	

O&M (in XXX)		Reference
Operating & Maintenance/year	XXX	XXX
O&M during crediting period	XXX	XXX

[add/delete rows as required]

This clearly demonstrates that the implementation of the project is more costly than a continuation of venting the CMM.

Step 3: Barrier Analysis
Since additionality is demonstrated by using Step 2 of the "Tool for the demonstration and assessment of additionality" (Version 06.1.0),barrier analysis is not undertaken.

Step 4: Common Practice Analysis
[provide description about common practise analysis in accordance with §47 of the methodological tool "Tool for the demonstration and assessment of additionality" (Version 06.1.0)]

B.6. Estimation of emission reductions of a generic CPA

B.6.1, Explanation of methodological choices

The equations outlined in the Approved Methodology ACM0008 (Version 07) are applied for calculating the emission reductions of each CPA.

In Equation 32 of the Approved Methodology ACM0008 (Version 07), Option A is chosen.

To calculate the impact of CDM project activity on coal production, Option 2 is chosen and the standard discount factor of 10% will be applied.

Each CPA shall choose Option A of the methodological tool "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" (Version 02) for the calculation of the parameter $PE_{FC,i,y}$.

Flares installed at CPA sites will be enclosed flares. In order to determine the flare efficiency, the flare efficiency will be measured in accordance with Option B.1 of the Methodological tool "Project emissions from flaring" (Version 02.0.0). The flare efficiency will be measured bi-annually. In accordance with the above named tool, the following steps will be performed:

STEP 1: Determination of the methane mass flow in the residual gas;
STEP 2: Determination of the flare efficiency;
STEP 3: Calculation of project emissions from flaring.

Mass flow of methane in the residual gas in minute *m* ($F_{CH4,RG,m}$) is calculated using the methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 02.0.0). According to the methodological tool "Project emissions from flaring" (Version

02.0.0), the parameter $F_{CH4,RG,m}$ shall be determined as the mass flow during minute m and shall be measured on a dry basis. This represents Option D of Table 1 of the methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 02.0.0). Under this option, each CPA shall demonstrate that the temperature of the gaseous stream (T_m) is less than 60ºC (333.15 K) at the flow measurement point.

The formulae from "Tool to calculate the emission factor for an electricity system" (Version 02.2.1) are applied for calculating carbon emissions factor of electricity used by a coal mine and replaced by a CPA. Following this tool, the following steps are performed:

STEP 1. Identify the relevant electricity systems;
STEP 2. Choose whether to include off-grid power plants in the project electricity system (optional);
STEP 3. Select a method to determine the operating margin (OM);
STEP 4. Calculate the operating margin emission factor according to the selected method;
STEP 5. Calculate the build margin (BM) emission factor;
STEP 6. Calculate the combined margin (CM) emission factor.

In Step 1, for the purpose of determining the relevant electricity system the appropriate grid within the DPR Korea is chosen for which power plants are physically connected through transmission and distribution lines to the project activity.
In Step 2, only grid power plants are included in the calculation.
In Step 3, the Average OM method, choice "D" is used. The ex-ante option is used to determine the emissions factor at validation stage. As the ex-ante option is used, this calculation should be performed upon seeking renewal of the crediting period.
In Step 4, the average OM in section (d) is calculated. To determine the average OM, Option B of the simple OM of the tool is used basing the calculation on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.
In Step 5, it was determined, that the data requirement could not be met.
In Step 6, the simplified CM calculation is chosen as the DPR Korea currently has fewer than 10 registered CDM project and the data requirement of Step 5 cannot be met.

Provisions regarding the revisions of the CPA in case the methodology is put on hold or withdrawn:

- If the approved methodology is put on hold or withdrawn for any reason other than for the purpose of inclusion in a consolidated methodology, no new CPAs shall be included in the PoA.
- If the methodology is subsequently revised or replace by inclusion in a consolidated methodology, the PoA shall be revised accordingly and the changes shall be validated by a DOE and approved by the CDM Executive Board (CDM EB) if a new CPA is to be included. The CDM EB's approval defines a new version of the PoA-DD and the PoA specific CDM-CPA-DD
- Once changes have been approved by the CDM EB, each new CPA shall use the latest version of the PoA.
- CPAs that were included before the methodology was put on hold, shall apply the latest version of the PoA specific CDM-CPA-DD at the time of the renewal of each crediting period.

Provisions regarding the methodology implementation in the 2nd and 3rd crediting periods:

- The baseline scenario shall be re-assed during the renewal of each crediting period. If changes in regulation regarding the destruction of methane from coal mines in the DPR Korea have occurred, then the baseline emissions shall be re-estimated.
- The grid emissions factor shall be revised during the renewal of the crediting period to use the grid emissions factor applicable at the time of renewing the crediting period.

EQUATIONS TO BE USED FOR CALCULATION OF EMISSION REDUCTIONS OF A CPA:

[delete as appropriate]

PROJECT EMISSIONS

Project emissions are defined by the following equation:

$PE_y = PE_{ME} + PE_{MD} + PE_{UM}$ **(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)

Combustion emissions from additional energy required for CMM capture and use

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

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

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 (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"

To determine the 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" (Version 02.2.1) for calculating the combined margin emissions factor are used. If the source of power for the coalmine is captive power generation, then the emissions factor is calculated based on the emission factor for the fuel used and the efficiency of the captive power plant.

To determine 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.

$$\mathrm{PE}_{\mathrm{FC,j,y}} = \sum_i FC_{i,j,y} * COEF_{i,y} \quad \textbf{(3)}$$

Where:

$PE_{FC,j,y}$	=	CO_2 emissions from fossil fuel combustion in process *j* during the year *y*

(tCO_2e/y)

$FC_{i,j,y}$	=	Quantity of fuel type *i* combusted in process *j* during the year *y* (mass or volume unit/y)
$COEF_{i,y}$	=	CO_2 emissions coefficient of fuel type *i* during the year *y* (tCO_2/mass or volume unit)
i	=	Are the fuel types combusted in process *j* during the year *y*

The CO_2 emission coefficient $COEF_{i,y}$ is calculated based on the chemical composition of the fossil fuel type i, using the following approach:

If $FC_{i,j,y}$ is measured in a mass unit: $COEF_{i,y} = w_{C,i,y} * 44/12$ **(4)**

If $FC_{i,j,y}$ is measured in a volume unit: $COEF_{i,y} = w_{C,i,y} * \rho_{i,y} * 44/12$ **(5)**

Where:

$COEF_{i,y}$	=	CO_2 emissions coefficient of fuel type *i* (tCO_2/mass or volume unit)
$w_{C,i,y}$	=	Weighted average mass fraction of carbon in fuel type i in year y (tC/mass unit of the fuel)
$\rho_{i,y}$	=	Weighted average density of fuel type i in year y (mass unit/volume unit of the fuel)
i	=	Fuel types combusted in process *j* during the year *y*

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 or more than 0.1% by volume of the extracted VAM, combustion emission from these gases should also be included.

$PE_{MD} = (MD_{FL} + MD_{ELEC} + MD_{HEAT}) \times (CEF_{CH4} + r \times CEF_{NMHC})$ **(6)**

with:

$r = PC_{NMHC} / PC_{CH4}$ **(7)**

Where:

PE_{MD}	=	Project emissions from CMM destroyed (tCO_2e)
MD_{FL}	=	Methane destroyed through flaring (tCH_4)
MD_{ELEC}	=	Methane destroyed through power generation (tCH_4)
MD_{HEAT}	=	Methane destroyed through heat generation (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.

$MD_{FL} = MM_{FL} - (PE_{flare,y} / GWP_{CH4})$ **(8)**

Where:

MD_{FL}	=	Methane destroyed through flaring (tCH_4)
MM_{FL}	=	Methane measured sent to flare (tCH_4)

$PE_{flare,y}$	=	Project emissions from flaring of the residual gas in year *y* (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 ($PE_{flare,y}$) shall be calculated following the procedures described in the "Project emissions from flaring" (Version 02.0.0). $PE_{flare,y}$ shall be calculated on an annual basis or for the required period of time using this tool.

$MD_{ELEC} = MM_{ELEC} \times Eff_{ELEC}$ **(9)**

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)

$MD_{HEAT} = MM_{HEAT} \times Eff_{HEAT}$ **(10)**

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)

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:

$$PE_{UM} = [GWP_{CH4} \times \sum_i MM_i \times (1 - Eff_i)] + PE_{flare,y} \quad \textbf{(11)}$$

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* (%)
$PE_{flare,y}$	=	Project emissions from flaring of the residual gas in year *y* (tCO_2e)

Project emissions from flaring

Project emissions from flaring ($PE_{flare,y}$) are calculated in accordance with the methodological tool "Project emissions from flaring" (Version 02.0.0).

$$PE_{flare,y} = GWP_{CH4} \times \sum_{m=1}^{525600} F_{CH4,RG,m} \times (1 - \eta_{flare,m}) \times 10^{-3} \quad \textbf{(12)}$$

Where:

$PE_{flare,y}$	=	Project emissions from flaring of the residual gas in year *y* (tCO_2e)

GWP_{CH4}	=	Global warming potential of methane valid for the commitment period (tCO_2e/tCH_4)
$F_{CH4,RG,m}$	=	Mass flow of methane in the residual gas in the minute m (kg)
$\eta_{flare,m}$	=	Flare efficiency in minute m

The flare efficiency in minute *m* ($\eta_{flare,m}$) is determined as the average of two measurements of the flare efficiency made in year y ($\eta_{flare,y}$) as follows:

$$\eta_{flare,y} = 1 - \frac{1}{2}\sum_{t=1}^{2}\left(\frac{F_{CH4,EG,t}}{F_{CH4,RG,t}}\right) \quad \textbf{(13)}$$

Where:

$\eta_{flare,y}$	=	Flare efficiency in year *y*
$F_{CH4,EG,t}$	=	Mass flow of methane in the exhaust gas of the flare on a dry basis at reference conditions in the time period *t* (kg)
$F_{CH4,RG,t}$	=	Mass flow of methane in the residual gas in the time period *t* (kg)
t	=	The two time periods in year *y* during which the flare efficiency is measured, each a minimum of one hour and separated by at least six months

Mass flow of methane in the residual gas in minute *m* ($F_{CH4,RG,m}$) is calculated using the methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 02.0.0). According to the methodological tool "Project emissions from flaring" (Version 02.0.0), the parameter $F_{CH4,RG,m}$ shall be determined as the mass flow during minute m and shall be measured on a dry basis. This represents Option D of Table 1 of the methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 02.0.0).

$$F_{CH4,RG,m} = V_{m,db} * v_{CH4,m,db} * \rho_{CH4,m} \quad \textbf{(14)}[1]$$

Where:

$F_{CH4,RG,m}$	=	Mass flow of methane in the residual gas in minute *m* (kg)
$V_{m,db}$	=	Volumetric flow of the residual gas in minute *m* on a dry basis (m^3 dry gas/h)m^3 of dry gas)
$v_{CH4,m,db}$	=	Volumetric fraction of CH4 in the residual gas in minute *m* on a dry basis (m^3 CH4/m^3 of dry gas)
$\rho_{CH4,m}$	=	Density of CH4 in the residual gas in minute *m* (kg CH4/m^3 CH4)

$$\rho_{CH4,m} = \frac{P_m * MM_{CH4}}{R_u * T_m} \quad \textbf{(15)}[2]$$

Where:

$\rho_{CH4,m}$	=	Density of CH4 in the residual gas in minute *m* (kg gas *i* / m^3 gas *i*)
P_m	=	Pressure of the residual gas in minute *m* (Pa)
MM_{CH4}	=	Molecular mass of CH4 (kg / kmol)
R_u	=	Universal ideal gases constant (Pa.m^3 / kmol.K)
T_m	=	Temperature of the residual gas in minute *m* (K)

[1] The equation 5 from the "Tool to determine mass flow" (Version 02.0.0) has been updated to reflect that the mass flow relates to the greenhouse gas CH4 in time interval m as required by the methodological tool "Project emissions from flaring" (Version 02.0.0).

[2] The equation 6 from the "Tool to determine mass flow" (Version 02.0.0) has been updated to reflect that the mass flow relates to the greenhouse gas CH4 in time interval m as required by the methodological tool "Project emissions from flaring" (Version 02.0.0).

$V_{m,db} = M_{m,db} / \rho_{m,db}$ **(16)**[3]

Where:

$V_{m,db}$	=	Volumetric flow of the residual gas in minute *m* on a dry basis (m^3 dry gas/h)
$M_{m,db}$	=	Mass flow of the residual gas in minute *m* on a dry basis (kg/h)
$\rho_{m,db}$	=	Density of the residual gas in minute *m* on a dry basis (kg dry gas / m^3 dry gas)

$$\rho_{m,db} = \frac{P_m * MM_{m,db}}{R_u * T_m} \quad \textbf{(17)}^4$$

Where:

$\rho_{m,db}$	=	Density of the residual gas in minute *m* on a dry basis (kg dry gas / m^3 dry gas)
P_m	=	Pressure of residual gas in minute *m* (Pa)
$MM_{m,db}$	=	Molecular mass of the residual gas in minute *m* on a dry basis (kg dry gas / kmol dry gas)
R_u	=	Universal ideal gases constant (Pa.m^3 / kmol.K)
T_m	=	Temperature of the residual gas in minute *m* (K)

$$MM_{m,db} = \sum_k (v_{k,m,db} * MM_k) \quad \textbf{(18)}^5$$

Where:

$MM_{m,db}$	=	Molecular mass of the residual gas in minute *m* on a dry basis (kg dry gas / kmol dry gas
$v_{k,m,db}$	=	Volumetric fraction of gas k in the residual gas in minute m on a dry basis (m^3 gas k / m^3 dry gas)
MM_k	=	Molecular mass of gas *k* (kg / kmol)
k	=	N_2, CH_4 (in accordance with the simplification outlined in Option 1 of the methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 02.0.0).

The value for $F_{CH4,RG,t}$ is calculated using the formulae for $F_{CH4,RG,m}$ and consists of the sum of methane flow in the minutes *m* that make up the time period *t*.

BASELINE EMISSIONS

Baseline emissions are given by the following equation:

$BE_y = BE_{MR,y} + BE_{Use,y}$ **(19)**

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)

[3] The equation 12 from the "Tool to determine mass flow" (Version 02.0.0) has been updated to reflect the time interval m as required by the methodological tool "Project emissions from flaring" (Version 02.0.0).

[4] The equation 13 from the "Tool to determine mass flow" (Version 02.0.0) has been updated to reflect the time interval m as required by the methodological tool "Project emissions from flaring" (Version 02.0.0).

[5] The equation 3 from the "Tool to determine mass flow" (Version 02.0.0) has been updated to reflect the time interval m as required by the methodological tool "Project emissions from flaring" (Version 02.0.0).

Methane destruction in the baseline

As per Section B.4 of Part II of this PoA-DD, 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 and consequently this term has been ignored in Equation 19 above.

Methane released into the atmosphere

Depending on the nature of the project activity, CMM can be removed at different stages – (1) 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.

$$BE_{MR,y} = GWP_{CH4} \times [\sum_{i} CMM_{PJi,y} + \sum_{i} PMM_{PJi,y}] \quad \textbf{(20)}$$

Where:

$BE_{MR,y}$	=	Baseline emissions from release of methane into the atmosphere in year *y* that is avoided by the project activity (tCO_2e)
i	=	Use of methane (flaring, power generation, heat generation, supply to gas grid to various combustion end uses)
$CMM_{PJi,y}$	=	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 (PE_{Mvent}) is not accounted for in the project emissions or in the baseline emissions, since it is vented in both scenarios.

Pre-mining and post-mining CMM extraction

Both $CMM_{PJ,y}$, $PMM_{PJ,y}$ are directly monitored as part of the project activity. $CMM_{PJ,y}$, $PMM_{PJ,y.}$ shall be measured separately as the extraction system will not always be located in the underground mine.

Emissions from power/heat generation replaced by project

$$BE_{Use,y} = ED_{CPMM,y} \quad \textbf{(21)}$$

Where:

$BE_{Use,y}$	=	Total baseline emissions from the production of power or heat replaced by the project activity in year *y* (tCO_2)
$ED_{CPMM,y}$	=	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:

$CMM_{tot,y} = CMM_{PJ,y} + PMM_{PJ,y}$ **(22)**

Where:

$CMM_{tot,y}$	=	Total CMM captured and utilised by the project activity (tCH_4)
$CMM_{PJ,y}$	=	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)

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

$PBE_{Use,y} = GEN_y \times EF_{ELEC} + HEAT_y \times EF_{HEAT}$ **(23)**

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

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

$$ED_{CPMM,y} = \frac{CMM_{PJ,y} + PMM_{PJ,y}}{CMM_{tot,y}} \times PBE_{Use,y} \quad \textbf{(24)}$$

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)
$CMM_{tot,y}$	=	Total 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)

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” (Version 02.2.1). The same formulae are used to calculate the electricity emissions factor for project emissions.

The following steps are followed in accordance with the "Tool to calculate the emission factor for an electricity system" (Version 02.2.1) are used:

STEP 1. Identify the relevant electricity systems;
STEP 2. Choose whether to include off-grid power plants in the project electricity system (optional);
STEP 3. Select a method to determine the operating margin (OM);
STEP 4. Calculate the operating margin emission factor according to the selected method;
STEP 5. Calculate the build margin (BM) emission factor;
STEP 6. Calculate the combined margin (CM) emission factor.

Step 1: Identify the relevant electricity systems

A project electricity system is defined by the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity and that can be dispatched without significant transmission constraints.

If the DNA of the host country has published a delineation of the project electricity system and the connected electricity systems, these delineations should be used. The DNA has published a delineation of the electricity systems in the DPR Korea. Electricity generated by all CPAs will displace power production in the relevant grid of DPR Korea, ie East Grid.

STEP 2. Choose whether to include off-grid power plants in the project electricity system (optional)

The project participant may choose between the following two options to calculate the operating margin and build margin emission factors:

Option I: Only grid power plants are included in the calculation; or

Option II: Both grid power plants and off-grid power plants are included in the calculation.

Option I was chosen to calculate the operating margin and build margin emission factors.

STEP 3. Select a method to determine the operating margin (OM)

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods:

(a) Simple OM; or

(b) Simple adjusted OM; or

(c) Dispatch data analysis OM; or

(d) Average OM.

According to the "Tool to calculate the emission factor for an electricity system" (Version 02.2.1), the simplified CM method can only be used if:

- The project activity is located in a Least Developed Country(LDC) or in a country with less than 10 registered projects at the starting date of validation; and
- The data requirements for the application of step 5 cannot be met.

Under the simplified CM, OM emission factor must be calculated using the average OM.

For CPAs in this POA, the simplified CM method can be applied because the Project is located in DPR Korea with less than 10 registered projects and the data requirements for the application of step 5 cannot be met.

Consequently, to determine the operating margin emission factor, the average OM method shall be used by CPAs in this POA.

According to the "Tool to calculate the emission factor for an electricity system" (Version 02.2.1), the average OM can be calculated using either of the two following data vintages:

- Ex ante option: If the ex ante option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required. For grid power plants, use a 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation. For off-grid power plants, use a single calendar year within the five most recent calendar years prior to the time of submission of the CDM-PDD for

validation.

- Ex post option: If the ex post option is chosen, the emission factor is determined for the year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring. If the data required to calculate the emission factor for year y is usually only available later than six months after the end of year y, alternatively the emission factor of the previous year y-1 may be used. If the data is usually only available 18 months after the end of year y, the emission factor of the year proceeding the previous year y-2 may be used. The same data vintage (y, y-1 or y-2) should be used throughout all crediting periods.

CPAs in this POA shall use the ex-ante option for calculating the average OM.

STEP 4. Calculate the operating margin emission factor according to the selected method

The average OM emission factor ($EF_{grid,OM\text{-}ave,y}$) is calculated as the average emission rate of all power plants serving the grid, using the methodological guidance as described under (a)Simple OM in Step 4 of the "Tool to calculate the emission factor for an electricity system" (Version 02.2.1)), but including in all equations also low-cost/must-run power plants.

The simple OM may be calculated by one of the following two options:

Option A: Based on the net electricity generation and a CO2 emission factor of each power unit; or

Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

Option B should only be used if the necessary data for Option A is not available. As the data required for Option A is not available, Option B shall be used.

Option B - Calculation based on total fuel consumption and electricity generation of the system

Under this option, the average OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, including low-cost/must-run power plants/units, and based on the fuel type(s) and total fuel consumption of the project electricity system, as follows:

$$EF_{grid,OM-ave,y} = \frac{\sum_i (FC_{i,y} * NCV_{i,y} * EF_{CO2,i,y})}{EG_y} \quad \textbf{(25)}$$

Where:

$EF_{grid,OM\text{-}ave,y}$ = Average operating margin CO2 emission factor in year y (tCO2/MWh)
$FC_{i,y}$ = Amount of fossil fuel type i consumed in the project electricity system in year y (mass or volume unit)
$NCV_{i,y}$ = Net calorific value (energy content) of fossil fuel type i in year y (kJ/kg)
$EF_{CO2,i,y}$ = CO2 emission factor of fossil fuel type i in year y (tCO2/GJ)
EG_y = Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost/must-run power plants/units, in year y (MWh)
i = All fossil fuel types combusted in power sources in the project electricity system in year y
y = The relevant year as per the data vintage chosen in Step 3

STEP 5. Calculate the build margin (BM) emission factor;

Plants in the relevant power grids of the DPR Korea have units that are different in the launched date, generation output and consumption of fuel. The information of each power unit in the relevant power grids of the DPR Korea is very difficult to acquire in DPR Korea. So, the sample group of power units used to calculate BM could not be determined as per the procedure in the methodology. Thus, BM emission factor is zero.

STEP 6. Calculate the combined margin (CM) emission factor.

According to the "Tool to calculate the emission factor for an electricity system" (Version 02.2.1), the calculation of the combined margin (CM) emission factor (EFgrid,CM,y) is based on one of the following methods:

(a) Weighted average CM; or
(b) Simplified CM.

CPAs in this POA shall use the simplified CM method because:

- The project activity is located in a country with less than 10 registered projects at the starting date of validation; and
- The data requirements for the application of step 5 cannot be met.

According to the "Tool to calculate the emission factor for an electricity system" (Version 02.2.1), the formula for the Simplified CM is used to calculated the combined margin CO2 emission factor for the project electricity system in year y:

$$EF_{grid,y} = EF_{grid,OM-ave,y} * w_{OM-ave} + EF_{grid,BM,y} * w_{BM} \quad \textbf{(26)}^{6}$$

Where:

EF_{grid} = Combined margin CO2 emission factor for the project electricity system in year y
$EF_{grid,OM-ave,y}$ = Operating margin CO2 emission factor in year y (tCO2/MWh)
$EF_{grid,BM,y}$ = Build margin CO2 emission factor in year y (tCO2/MWh)
w_{OM-ave} = 1
w_{BM} = 0

Under the simplified CM, the operating margin emission factor ($EF_{grid,OM-ave,y}$) must be calculated using the average OM (option (d) in step 3).

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:

$$EF_{captive,y} = \frac{EF_{CO2,j}}{Eff_{captive}} \cdot \frac{44}{12} \cdot \frac{3.6TJ}{1000MWH} \quad \textbf{(27)}^{7}$$

Where:

$EF_{captive,y}$ = Emissions factor for captive power generation (tCO_2/MWh)
$EF_{CO2,j}$ = 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

[6] Equation 13 of the "Tool to calculate the emission factor for an electricity system" (Version 02.2.1) has been updated to reflect that calculations were done using the average operating margin and for consistency with Approved Methodology ACM0008 (Version 07).
[7] Equation 30 of the Approved Methodology ACM0008 (Version 07) was updated to use index j instead of i.

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.

$$EF_{ELEC,y} = s_{grid} \cdot EF_{grid,y} + s_{captive} \cdot EF_{captive,y} \quad \textbf{(28)}$$

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 (%)

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:

$$EF_{heat,y} = \frac{EF_{CO2,k}}{Eff_{heat}} \cdot \frac{44}{12} \cdot \frac{1TJ}{1000GJ} \quad \textbf{(29)}[8]$$

Where:

$EF_{heat,y}$	=	Emissions factor for heat generation (tCO_2/GJ)
$EF_{CO2,k}$	=	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 shall 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.

Leakage

The formula for leakage is given as follows:

$LE_y = LE_{o,y}$ **(30)**

[8] Equation 32 of the Approved Methodology ACM0008 (Version 07) was updated to use index k instead of j.

Where:

LE_y	=	Leakage emissions in year *y* (tCO_2e)
$LE_{o,y}$	=	Leakage emissions due to other uncertainties in year *y* (tCO_2e)

Displacement of baseline thermal energy uses

According to approved methodology ACM0008 (Version 07), leakage may occur if the project activity prevents CMM from being used to meet baseline thermal energy demand, whether as a result of physical constraints on delivery, or price changes. No displacement of baseline thermal energy uses can occur for CPAs eligible to be included in this PoA as each CPA has a baseline of venting of the CMM into the atmosphere only as outlined in Section B.4 of Part II of this PoA-DD. A CPA that shows thermal energy use of CMM in the baseline is accordingly not eligible to be included in this PoA. As there will be no displacement of baseline thermal energy uses, this term has been ignored in Equation 19 above.

Impact of CDM project activity on coal production

The additional 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 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 CMM extraction is present in the baseline scenario (i.e. the baseline scenario is ventilation of mine gas only).

As the project activity is CMM extraction and the baseline scenario is ventilation only as outlined in Section E.4, project participants should apply a standard discount factor of 10% for all CPAs.

$$LE_{o,y} = BE_y * 10\% \quad \textbf{(31)}$$

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:

$$ER_y = BE_y - PE_y - LE_y \quad \textbf{(32)}$$

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)

B.6.2. Data and parameters that are to be reported ex-ante

[delete as appropriate]

Data / Parameter:	CEF_{ELEC}

Data unit:	tCO_2e/MWh
Description:	Carbon emissions factor of electricity used by coal mine
Source of data:	Central Bureau of Statistics, DPR Korea/IPCC
Value(s) applied:	-
Choice of data or Measurement methods and procedures:	In accordance with baseline and monitoring methodology.
Purpose of data	Calculation of project emissions.
Additional comment:	The value used varies based on the specific circumstance of each CPA. The value applied will re reported ex-ante for the CPA in the specific CPA-DD.

Data / Parameter:	CEF_{HEAT}
Data unit:	tCO_2e/GJ
Description:	Carbon emissions factor of heat used by coal mine
Source of data:	Central Bureau of Statistics, DPR Korea/IPCC
Value(s) applied:	-
Choice of data or Measurement methods and procedures:	In accordance with baseline and monitoring methodology.
Purpose of data	Calculation of project emissions.
Additional comment:	The value used varies based on the specific circumstance of each CPA. The value applied will re reported ex-ante for the CPA in the specific CPA-DD.

Data / Parameter:	$CEF_{FossFuel}$
Data unit:	tCO_2e/GJ
Description:	Carbon emissions factor of fossil fuel used by coal mine
Source of data:	Central Bureau of Statistics, DPR Korea/IPCC
Value(s) applied:	-
Choice of data or Measurement methods and procedures:	In accordance with baseline and monitoring methodology.
Purpose of data	Calculation of project emissions.
Additional comment:	Use of IPCC default or national values would suffice. The value used varies based on the specific circumstance of each CPA. The value applied will re reported ex-ante for the CPA in the specific CPA-DD.

Data / Parameter:	GWP_{CH4}
Data unit:	tCO_2/tCH_4

Description:	Global warming potential of methane
Source of data:	IPCC
Value(s) applied:	21
Choice of data or Measurement methods and procedures:	In accordance with baseline and monitoring methodology and IPCC default values.
Purpose of data	Calculation of project emissions and baseline emissions
Additional comment:	-

Data / Parameter:	Eff_{ELEC}
Data unit:	%
Description:	Efficiency of methane destruction in power plant
Source of data:	IPCC
Value(s) applied:	99.5%
Choice of data or Measurement methods and procedures:	In accordance with baseline and monitoring methodology and IPCC default values.
Purpose of data	Calculation of project emissions.
Additional comment:	-

Data / Parameter:	Eff_{HEAT}
Data unit:	%
Description:	Efficiency of methane destruction/oxidation in heat plant
Source of data:	IPCC
Value(s) applied:	99.5%
Choice of data or Measurement methods and procedures:	In accordance with baseline and monitoring methodology and IPCC default values.
Purpose of data	Calculation of project emissions.
Additional comment:	-

Data / Parameter:	CEF_{CH4}
Data unit:	tCO_2e/tCH_4
Description:	Carbon emission factor for combusted methane
Source of data:	ACM0008 (Version 07)
Value(s) applied:	44/16 = 2.75

Choice of data or Measurement methods and procedures:	In accordance with baseline and monitoring methodology.
Purpose of data	Calculation of project emissions.
Additional comment:	-

Data / Parameter:	Eff_i
Data unit:	%
Description:	Efficiency of methane destruction in use i
Source of data:	Project design data / IPCC
Value(s) applied:	-
Choice of data or Measurement methods and procedures:	In accordance with baseline and monitoring methodology.
Purpose of data	Calculation of project emissions.
Additional comment:	The value used varies based on the specific circumstance of each CPA. The value applied will re reported ex-ante for the CPA in the specific CPA-DD.

Data / Parameter:	MM_{CH4}
Data unit:	kg/kmol
Description:	Molecular mass of methane
Source of data:	Methodological tool “Project emissions from flaring" (Version 02.0.0)
Value(s) applied:	16.04
Choice of data or Measurement methods and procedures:	In accordance with baseline and monitoring methodology.
Purpose of data	Calculation of project emissions.
Additional comment:	-

Data / Parameter:	MM_{N2}
Data unit:	kg/kmol
Description:	Molecular mass of nitrogen
Source of data:	Methodological tool “Project emissions from flaring" (Version 02.0.0)
Value(s) applied:	28.01

Choice of data or Measurement methods and procedures:	In accordance with baseline and monitoring methodology.
Purpose of data	Calculation of project emissions.
Additional comment:	-

Data / Parameter:	R_u
Data unit:	$Pa.m^3/kmol.K$
Description:	Universal ideal gas constant
Source of data:	Methodological tool “Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 02.0.0)
Value(s) applied:	8,314
Choice of data or Measurement methods and procedures:	In accordance with baseline and monitoring methodology.
Purpose of data	Calculation of project emissions.
Additional comment:	-

Data / Parameter:	$FC_{i,y}$
Data unit:	mass or volume unit
Description:	Amount of fossil fuel type *i* consumed in the project electricity system in year *y*
Source of data:	Central Bureau of Statistics, DPR Korea
Value(s) applied:	-
Choice of data or Measurement methods and procedures:	In accordance with baseline and monitoring methodology and “Tool to calculate the emission factor for an electricity system”.
Purpose of data	Calculation of baseline emissions.
Additional comment:	The value used varies based on the specific circumstance of each CPA. The value applied will re reported ex-ante for the CPA in the specific CPA-DD.

Data / Parameter:	$NCV_{i,y}$
Data unit:	kJ/kg
Description:	Net calorific value (energy content) of fossil fuel type *i* in year *y*
Source of data:	Central Bureau of Statistics, DPR Korea
Value(s) applied:	-

Choice of data or Measurement methods and procedures:	In accordance with baseline and monitoring methodology and "Tool to calculate the emission factor for an electricity system".
Purpose of data	Calculation of baseline emissions.
Additional comment:	The value used varies based on the specific circumstance of each CPA. The value applied will re reported ex-ante for the CPA in the specific CPA-DD.

Data / Parameter:	$EF_{CO2,i,y}$
Data unit:	tCO2/GJ
Description:	CO2 emission factor of fossil fuel type *i* in year *y*
Source of data:	IPCC default values
Value(s) applied:	-
Choice of data or Measurement methods and procedures:	In accordance with baseline and monitoring methodology and "Tool to calculate the emission factor for an electricity system".
Purpose of data	Calculation of baseline emissions.
Additional comment:	The value used varies based on the specific circumstance of each CPA. The value applied will re reported ex-ante for the CPA in the specific CPA-DD.

Data / Parameter:	EG_y
Data unit:	MWh
Description:	Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units, in year *y*
Source of data:	Central Bureau of Statistics, DPR Korea
Value(s) applied:	-
Choice of data or Measurement methods and procedures:	In accordance with baseline and monitoring methodology and "Tool to calculate the emission factor for an electricity system".
Purpose of data	Calculation of baseline emissions.
Additional comment:	The value used varies based on the specific circumstance of each CPA. The value applied will re reported ex-ante for the CPA in the specific CPA-DD.

Data / Parameter:	$EF_{grid, BM,y}$
Data unit:	tCO2/MWh
Description:	Build margin CO2 emission factor in year y
Source of data:	Central Bureau of Statistics, DPR Korea
Value(s) applied:	-

Choice of data or Measurement methods and procedures:	In accordance with baseline and monitoring methodology.
Purpose of data	Calculation of baseline emissions.
Additional comment:	The value used varies based on the specific circumstance of each CPA. The value applied will re reported ex-ante for the CPA in the specific CPA-DD.

Data / Parameter:	$EF_{CO2,j}$
Data unit:	tC/TJ
Description:	CO_2 emissions factor of fuel used in captive power generation
Source of data:	IPCC default values
Value(s) applied:	-
Choice of data or Measurement methods and procedures:	In accordance with baseline and monitoring methodology.
Purpose of data	Calculation of baseline emissions.
Additional comment:	The value used varies based on the specific circumstance of each CPA. The value applied will re reported ex-ante for the CPA in the specific CPA-DD.

Data / Parameter:	s_{grid}
Data unit:	%
Description:	Share of facility electricity demand supplied by grid imports over the last 3 years
Source of data:	CPA owner
Value(s) applied:	-
Choice of data or Measurement methods and procedures:	In accordance with baseline and monitoring methodology.
Purpose of data	Calculation of baseline emissions.
Additional comment:	The value used varies based on the specific circumstance of each CPA. The value applied will re reported ex-ante for the CPA in the specific CPA-DD.

Data / Parameter:	$s_{captive}$
Data unit:	%
Description:	Share of facility electricity demand supplied by captive power over the last 3 years
Source of data:	CPA owner
Value(s) applied:	-

Choice of data or Measurement methods and procedures:	In accordance with baseline and monitoring methodology.
Purpose of data	Calculation of baseline emissions.
Additional comment:	The value used varies based on the specific circumstance of each CPA. The value applied will re reported ex-ante for the CPA in the specific CPA-DD.

Data / Parameter:	$EF_{CO2,k}$
Data unit:	tC/TJ
Description:	CO_2 emissions factor of fuel used in heat generation
Source of data:	IPCC default values
Value(s) applied:	-
Choice of data or Measurement methods and procedures:	In accordance with baseline and monitoring methodology.
Purpose of data	Calculation of baseline emissions.
Additional comment:	The value used varies based on the specific circumstance of each CPA. The value applied will re reported ex-ante for the CPA in the specific CPA-DD.

B.6.3. Ex-ante calculations of emission reductions

EQUATIONS TO BE USED FOR CALCULATION OF EMISSION REDUCTIONS OF A CPA:
[delete as appropriate]

PROJECT EMISSIONS

Project emissions are defined by the following equation:

$PE_y = PE_{ME} + PE_{MD} + PE_{UM}$ **(2)**

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)

Combustion emissions from additional energy required for CMM capture and use

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

$$PE_{ME} = CONS_{ELEC,PJ} \cdot CEF_{ELEC} + CONS_{HEAT,PJ} \cdot CEF_{HEAT} + CONS_{FossFuel,PJ} \cdot CEF_{FossFuel} + \mathrm{PE}_{\mathrm{FC,j,y}}$$

(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 (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"

To determine the 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" (Version 02.2.1) for calculating the combined margin emissions factor are used. If the source of power for the coalmine is captive power generation, then the emissions factor is calculated based on the emission factor for the fuel used and the efficiency of the captive power plant.

To determine 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.

$$\mathrm{PE}_{\mathrm{FC,j,y}} = \sum_{i} FC_{i,j,y} * COEF_{i,y} \quad \textbf{(3)}$$

Where:

$PE_{FC,j,y}$	=	CO_2 emissions from fossil fuel combustion in process *j* during the year *y* (tCO_2e/y)
$FC_{i,j,y}$	=	Quantity of fuel type *i* combusted in process *j* during the year *y* (mass or volume unit/y)
$COEF_{i,y}$	=	CO_2 emissions coefficient of fuel type *i* during the year *y* (tCO_2/mass or volume unit)
i	=	Are the fuel types combusted in process *j* during the year *y*

The CO_2 emission coefficient $COEF_{i,y}$ is calculated based on the chemical composition of the fossil fuel type i, using the following approach:

If $FC_{i,j,y}$ is measured in a mass unit: $COEF_{\mathrm{i,y}} = w_{C,i,y} * 44/12$ **(4)**

If $FC_{i,j,y}$ is measured in a volume unit: $COEF_{\mathrm{i,y}} = w_{C,i,y} * \rho_{i,y} * 44/12$ **(5)**

Where:

$COEF_{i,y}$	=	CO_2 emissions coefficient of fuel type *i* (tCO_2/mass or volume unit)
$w_{C,i,y}$	=	Weighted average mass fraction of carbon in fuel type i in year y (tC/mass unit of the fuel)
$\rho_{i,y}$	=	Weighted average density of fuel type i in year y (mass unit/volume unit of the fuel)
i	=	Fuel types combusted in process *j* during the year *y*

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 or more than 0.1% by volume of the extracted VAM, combustion emission from these gases should also be included.

$$PE_{MD} = (MD_{FL} + MD_{ELEC} + MD_{HEAT}) \times (CEF_{CH4} + r \times CEF_{NMHC}) \quad \textbf{(6)}$$

with:

$$r = PC_{NMHC} / PC_{CH4} \quad \textbf{(7)}$$

Where:

PE_{MD}	=	Project emissions from CMM destroyed (tCO_2e)
MD_{FL}	=	Methane destroyed through flaring (tCH_4)
MD_{ELEC}	=	Methane destroyed through power generation (tCH_4)
MD_{HEAT}	=	Methane destroyed through heat generation (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.

$$MD_{FL} = MM_{FL} - (PE_{flare,y} / GWP_{CH4}) \quad \textbf{(8)}$$

Where:

MD_{FL}	=	Methane destroyed through flaring (tCH_4)
MM_{FL}	=	Methane measured sent to flare (tCH_4)
$PE_{flare,y}$	=	Project emissions from flaring of the residual gas in year *y* (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 ($PE_{flare,y}$) shall be calculated following the procedures described in the "Project emissions from flaring" (Version 02.0.0). $PE_{flare,y}$ shall be calculated on an annual basis or for the required period of time using this tool.

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

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)

$$MD_{HEAT} = MM_{HEAT} \times Eff_{HEAT} \quad \textbf{(30)}$$

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)

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:

$$PE_{UM} = [GWP_{CH4} \times \sum_{i} MM_i \times (1 - Eff_i)] + PE_{flare,y} \quad \textbf{(41)}$$

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* (%)
$PE_{flare,y}$	=	Project emissions from flaring of the residual gas in year *y* (tCO_2e)

Project emissions from flaring

Project emissions from flaring ($PE_{flare,y}$) are calculated in accordance with the methodological tool "Project emissions from flaring" (Version 02.0.0).

$$PE_{flare,y} = GWP_{CH4} \times \sum_{m=1}^{525600} F_{CH4,RG,m} \times (1 - \eta_{flare,m}) \times 10^{-3} \quad \textbf{(12)}$$

Where:

$PE_{flare,y}$	=	Project emissions from flaring of the residual gas in year *y* (tCO_2e)
GWP_{CH4}	=	Global warming potential of methane valid for the commitment period (tCO_2e/tCH_4)
$F_{CH4,RG,m}$	=	Mass flow of methane in the residual gas in the minute m (kg)
$\eta_{flare,m}$	=	Flare efficiency in minute m

The flare efficiency in minute *m* ($\eta_{flare,m}$) is determined as the average of two measurements of the flare efficiency made in year y ($\eta_{flare,y}$) as follows:

$$\eta_{flare,y} = 1 - \frac{1}{2} \sum_{t=1}^{2} \left(\frac{F_{CH4,EG,t}}{F_{CH4,RG,t}} \right) \quad \textbf{(53)}$$

Where:

$\eta_{flare,y}$	=	Flare efficiency in year *y*
$F_{CH4,EG,t}$	=	Mass flow of methane in the exhaust gas of the flare on a dry basis at reference conditions in the time period *t* (kg)
$F_{CH4,RG,t}$	=	Mass flow of methane in the residual gas in the time period *t* (kg)
t	=	The two time periods in year *y* during which the flare efficiency is measured, each a minimum of one hour and separated by at least six months

Mass flow of methane in the residual gas in minute *m* ($F_{CH4,RG,m}$) is calculated using the methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 02.0.0). According to the methodological tool "Project emissions from flaring" (Version 02.0.0), the parameter $F_{CH4,RG,m}$ shall be determined as the mass flow during minute m and shall be measured on a dry basis. This represents Option D of Table 1 of the methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 02.0.0).

$$F_{CH4,RG,m} = V_{m,db} * v_{CH4,m,db} * \rho_{CH4,m} \quad \textbf{(14)}^{9}$$

Where:

$F_{CH4,RG,m}$	=	Mass flow of methane in the residual gas in minute *m* (kg)
$V_{m,db}$	=	Volumetric flow of the residual gas in minute *m* on a dry basis (m^3 dry gas/h)m^3 of dry gas)
$v_{CH4,m,db}$	=	Volumetric fraction of CH4 in the residual gas in minute *m* on a dry basis (m^3 CH4/m^3 of dry gas)
$\rho_{CH4,m}$	=	Density of CH4 in the residual gas in minute *m* (kg CH4/m^3 CH4)

$$\rho_{CH4,m} = \frac{P_m * MM_{CH4}}{R_u * T_m} \quad \textbf{(15)}^{10}$$

Where:

$\rho_{CH4,m}$	=	Density of CH4 in the residual gas in minute *m* (kg gas *i* / m^3 gas *i*)
P_m	=	Pressure of the residual gas in minute *m* (Pa)
MM_{CH4}	=	Molecular mass of CH4 (kg / kmol)
R_u	=	Universal ideal gases constant (Pa.m^3 / kmol.K)
T_m	=	Temperature of the residual gas in minute *m* (K)

$$V_{m,db} = M_{m,db} / \rho_{m,db} \quad \textbf{(16)}^{11}$$

Where:

$V_{m,db}$	=	Volumetric flow of the residual gas in minute *m* on a dry basis (m^3 dry gas/h)
$M_{m,db}$	=	Mass flow of the residual gas in minute *m* on a dry basis (kg/h)
$\rho_{m,db}$	=	Density of the residual gas in minute *m* on a dry basis (kg dry gas / m^3 dry gas)

$$\rho_{m,db} = \frac{P_m * MM_{m,db}}{R_u * T_m} \quad \textbf{(17)}^{12}$$

Where:

$\rho_{m,db}$	=	Density of the residual gas in minute *m* on a dry basis (kg dry gas / m^3 dry gas)
P_m	=	Pressure of residual gas in minute *m* (Pa)
$MM_{m,db}$	=	Molecular mass of the residual gas in minute *m* on a dry basis (kg dry gas / kmol dry gas)
R_u	=	Universal ideal gases constant (Pa.m^3 / kmol.K)

[9] The equation 5 from the "Tool to determine mass flow" (Version 02.0.0) has been updated to reflect that the mass flow relates to the greenhouse gas CH4 in time interval m as required by the methodological tool "Project emissions from flaring" (Version 02.0.0).

[10] The equation 6 from the "Tool to determine mass flow" (Version 02.0.0) has been updated to reflect that the mass flow relates to the greenhouse gas CH4 in time interval m as required by the methodological tool "Project emissions from flaring" (Version 02.0.0).

[11] The equation 12 from the "Tool to determine mass flow" (Version 02.0.0) has been updated to reflect the time interval m as required by the methodological tool "Project emissions from flaring" (Version 02.0.0).

[12] The equation 13 from the "Tool to determine mass flow" (Version 02.0.0) has been updated to reflect the time interval m as required by the methodological tool "Project emissions from flaring" (Version 02.0.0).

T_m = Temperature of the residual gas in minute *m* (K)

$$MM_{m,db} = \sum_k (v_{k,m,db} * MM_k) \quad \textbf{(18)}^{13}$$

Where:

$MM_{m,db}$ = Molecular mass of the residual gas in minute *m* on a dry basis (kg dry gas / kmol dry gas

$v_{k,m,db}$ = Volumetric fraction of gas k in the residual gas in minute m on a dry basis (m^3 gas k / m^3 dry gas)

MM_k = Molecular mass of gas *k* (kg / kmol)

k = N_2, CH_4 (in accordance with the simplification outlined in Option 1 of the methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 02.0.0).

The value for $F_{CH4,RG,t}$ is calculated using the formulae for $F_{CH4,RG,m}$ and consists of the sum of methane flow in the minutes *m* that make up the time period *t*.

BASELINE EMISSIONS

Baseline emissions are given by the following equation:

$$BE_y = BE_{MR,y} + BE_{Use,y} \quad \textbf{(19)}$$

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)

Methane destruction in the baseline

As per Section B.4 of Part II of this PoA-DD, 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 and consequently this term has been ignored in Equation 19 above.

Methane released into the atmosphere

Depending on the nature of the project activity, CMM can be removed at different stages – (1) 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.

$$BE_{MR,y} = GWP_{CH4} \times [\sum_i CMM_{PJi,y} + \sum_i PMM_{PJi,y}] \quad \textbf{(20)}$$

[13] The equation 3 from the "Tool to determine mass flow" (Version 02.0.0) has been updated to reflect the time interval m as required by the methodological tool "Project emissions from flaring" (Version 02.0.0).

Where:

$BE_{MR,y}$	=	Baseline emissions from release of methane into the atmosphere in year *y* that is avoided by the project activity (tCO_2e)
i	=	Use of methane (flaring, power generation, heat generation, supply to gas grid to various combustion end uses)
$CMM_{PJi,y}$	=	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 (PE_{Mvent}) is not accounted for in the project emissions or in the baseline emissions, since it is vented in both scenarios.

Pre-mining and post-mining CMM extraction

Both $CMM_{PJ,y}$, $PMM_{PJ,y}$ are directly monitored as part of the project activity. $CMM_{PJ,y}$, $PMM_{PJ,y.}$ shall be measured separately as the extraction system will not always be located in the underground mine.

Emissions from power/heat generation replaced by project

$$BE_{Use,y} = ED_{CPMM,y} \quad \textbf{(21)}$$

Where:

$BE_{Use,y}$	=	Total baseline emissions from the production of power or heat replaced by the project activity in year *y* (tCO_2)
$ED_{CPMM,y}$	=	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:

$$CMM_{tot,y} = CMM_{PJ,y} + PMM_{PJ,y} \quad \textbf{(22)}$$

Where:

$CMM_{tot,y}$	=	Total CMM captured and utilised by the project activity (tCH_4)
$CMM_{PJ,y}$	=	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)

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

$$PBE_{Use,y} = GEN_y \times EF_{ELEC} + HEAT_y \times EF_{HEAT} \quad \textbf{(23)}$$

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

To identify the CMM that should receive credits in the year during which the gas is captured and

used, the following formulae are used, assuming that CMM is used for various end uses in the same proportions as the overall supply for that year of different gas sources:

$$ED_{CPMM,y} = \frac{CMM_{PJ,y} + PMM_{PJ,y}}{CMM_{tot,y}} \times PBE_{Use,y} \quad \textbf{(24)}$$

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)
$CMM_{tot,y}$	=	Total 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)

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” (Version 02.2.1). The same formulae are used to calculate the electricity emissions factor for project emissions.

The following steps are followed in accordance with the "Tool to calculate the emission factor for an electricity system" (Version 02.2.1) are used:

STEP 1. Identify the relevant electricity systems;
STEP 2. Choose whether to include off-grid power plants in the project electricity system (optional);
STEP 3. Select a method to determine the operating margin (OM);
STEP 4. Calculate the operating margin emission factor according to the selected method;
STEP 5. Calculate the build margin (BM) emission factor;
STEP 6. Calculate the combined margin (CM) emission factor.

Step 1: Identify the relevant electricity systems

A project electricity system is defined by the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity and that can be dispatched without significant transmission constraints.

If the DNA of the host country has published a delineation of the project electricity system and the connected electricity systems, these delineations should be used. The DNA has published a delineation of the electricity systems in the DPR Korea. Electricity generated by all CPAs will displace power production in the relevant grid of DPR Korea, ie East Grid.

STEP 2. Choose whether to include off-grid power plants in the project electricity system (optional)

The project participant may choose between the following two options to calculate the operating margin and build margin emission factors:

Option I: Only grid power plants are included in the calculation; or

Option II: Both grid power plants and off-grid power plants are included in the calculation.

Option I was chosen to calculate the operating margin and build margin emission factors.

STEP 3. Select a method to determine the operating margin (OM)

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods:

(a) Simple OM; or

(b) Simple adjusted OM; or

(c) Dispatch data analysis OM; or

(d) Average OM.

According to the "Tool to calculate the emission factor for an electricity system" (Version 02.2.1), the simplified CM method can only be used if:
The project activity is located in a Least Developed Country(LDC) or in a country with less than 10 registered projects at the starting date of validation; and
The data requirements for the application of step 5 cannot be met.

Under the simplified CM, OM emission factor must be calculated using the average OM.

For CPAs in this POA, the simplified CM method can be applied because the Project is located in DPR Korea with less than 10 registered projects and the data requirements for the application of step 5 cannot be met.

Consequently, to determine the operating margin emission factor, the average OM method shall be used by CPAs in this POA.

According to the "Tool to calculate the emission factor for an electricity system" (Version 02.2.1), the average OM can be calculated using either of the two following data vintages:

Ex ante option: If the ex ante option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required. For grid power plants, use a 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation. For off-grid power plants, use a single calendar year within the five most recent calendar years prior to the time of submission of the CDM-PDD for validation.

Ex post option: If the ex post option is chosen, the emission factor is determined for the year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring. If the data required to calculate the emission factor for year y is usually only available later than six months after the end of year y, alternatively the emission factor of the previous year y-1 may be used. If the data is usually only available 18 months after the end of year y, the emission factor of the year proceeding the previous year y-2 may be used. The same data vintage (y, y-1 or y-2) should be used throughout all crediting periods.

CPAs in this POA shall use the ex-ante option for calculating the average OM.

STEP 4. Calculate the operating margin emission factor according to the selected method

The average OM emission factor ($EF_{grid,OM\text{-}ave,y}$) is calculated as the average emission rate of all power plants serving the grid, using the methodological guidance as described under (a)Simple OM in Step 4 of the "Tool to calculate the emission factor for an electricity system" (Version 02.2.1)), but including in all equations also low-cost/must-run power plants.

The simple OM may be calculated by one of the following two options:

Option A: Based on the net electricity generation and a CO2 emission factor of each power unit; or

Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

Option B should only be used if the necessary data for Option A is not available. As the data required for Option A is not available, Option B shall be used.

Option B - Calculation based on total fuel consumption and electricity generation of the system

Under this option, the average OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, including low-cost/must-run power plants/units, and based on the fuel type(s) and total fuel consumption of the project electricity system, as follows:

$$EF_{grid,OM-ave,y} = \frac{\sum_i (FC_{i,y} * NCV_{i,y} * EF_{CO2,i,y})}{EG_y} \quad \textbf{(25)}$$

Where:
$EF_{grid,OM-ave,y}$ = Average operating margin CO2 emission factor in year y (tCO2/MWh)
$FC_{i,y}$ = Amount of fossil fuel type i consumed in the project electricity system in year y (mass or volume unit)
$NCV_{i,y}$ = Net calorific value (energy content) of fossil fuel type i in year y (kJ/kg)
$EF_{CO2,i,y}$ = CO2 emission factor of fossil fuel type i in year y (tCO2/GJ)
EG_y = Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost/must-run power plants/units, in year y (MWh)
i = All fossil fuel types combusted in power sources in the project electricity system in year y
y = The relevant year as per the data vintage chosen in Step 3

STEP 5. Calculate the build margin (BM) emission factor;

Plants in the relevant power grids of the DPR Korea have units that are different in the launched date, generation output and consumption of fuel. The information of each power unit in the relevant power grids of the DPR Korea is very difficult to acquire in DPR Korea. So, the sample group of power units used to calculate BM could not be determined as per the procedure in the methodology. Thus, BM emission factor is zero.

STEP 6. Calculate the combined margin (CM) emission factor.

According to the "Tool to calculate the emission factor for an electricity system" (Version 02.2.1), the calculation of the combined margin (CM) emission factor (EFgrid,CM,y) is based on one of the following methods:

(a) Weighted average CM; or
(b) Simplified CM.

CPAs in this POA shall use the simplified CM method because:
The project activity is located in a country with less than 10 registered projects at the starting date of validation; and
The data requirements for the application of step 5 cannot be met.

According to the “Tool to calculate the emission factor for an electricity system” (Version 02.2.1),

the formula for the Simplified CM is used to calculated the combined margin CO2 emission factor for the project electricity system in year y:

$$EF_{grid,y} = EF_{grid,OM-ave,y} * w_{OM-ave} + EF_{grid,BM,y} * w_{BM} \quad \textbf{(26)}^{14}$$

Where:

EF_{grid} = Combined margin CO2 emission factor for the project electricity system in year y
$EF_{grid,OM-ave,y}$ = Operating margin CO2 emission factor in year y (tCO2/MWh)
$EF_{grid,BM,y}$ = Build margin CO2 emission factor in year y (tCO2/MWh)
w_{OM-ave} = 1
w_{BM} = 0

Under the simplified CM, the operating margin emission factor ($EF_{grid,OM-ave,y}$) must be calculated using the average OM (option (d) in step 3).

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:

$$EF_{captive,y} = \frac{EF_{CO2,j}}{Eff_{captive}} \cdot \frac{44}{12} \cdot \frac{3.6TJ}{1000MWH} \quad \textbf{(27)}^{15}$$

$EF_{captive,y}$	=	Emissions factor for captive power generation (tCO_2/MWh)
$EF_{CO2,j}$	=	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.

$$EF_{ELEC,y} = s_{grid} \cdot EF_{grid,y} + s_{captive} \cdot EF_{captive,y} \quad \textbf{(28)}$$

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 (%)

[14] Equation 13 of the "Tool to calculate the emission factor for an electricity system" (Version 02.2.1) has been updated to reflect that calculations were done using the average operating margin and for consistency with Approved Methodology ACM0008 (Version 07).
[15] Equation 30 of the Approved Methodology ACM0008 (Version 07) was updated to use index j instead of i.

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:

$$EF_{heat,y} = \frac{EF_{CO2,k}}{Eff_{heat}} \cdot \frac{44}{12} \cdot \frac{1TJ}{1000GJ} \quad \textbf{(29)}^{16}$$

Where:

$EF_{heat,y}$	=	Emissions factor for heat generation (tCO_2/GJ)
$EF_{CO2,k}$	=	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 shall 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.

Leakage

The formula for leakage is given as follows:

$$LE_y = LE_{o,y} \quad \textbf{(30)}$$

Where:

LE_y	=	Leakage emissions in year *y* (tCO_2e)
$LE_{o,y}$	=	Leakage emissions due to other uncertainties in year *y* (tCO_2e)

Displacement of baseline thermal energy uses

According to approved methodology ACM0008 (Version 07), leakage may occur if the project activity prevents CMM from being used to meet baseline thermal energy demand, whether as a result of physical constraints on delivery, or price changes. No displacement of baseline thermal energy uses can occur for CPAs eligible to be included in this PoA as each CPA has a baseline of venting of the CMM into the atmosphere only as outlined in Section B.4. of Part II of this PoA-DD. A CPA that shows thermal energy use of CMM in the baseline is accordingly not eligible to be included in this PoA. As there will be no displacement of baseline thermal energy uses, this term has been ignored in Equation 19 above.

Impact of CDM project activity on coal production

The additional 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

[16] Equation 32 of the Approved Methodology ACM0008 (Version 07) was updated to use index k instead of j.

of mining operation), CER value can cover both the cost of CMM 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 CMM extraction is present in the baseline scenario (i.e. the baseline scenario is ventilation of mine gas only).

As the project activity is CMM extraction and the baseline scenario is ventilation only as outlined in Section B.4 of Part II of this PoA-DD, project participants should apply a standard discount factor of 10% for all CPAs.

$LE_{o,y} = BE_y * 10\%$ **(31)**

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:

$$ER_y = BE_y - PE_y - LE_y \quad \textbf{(32)}$$

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)

B.7. Application of the monitoring methodology and description of the monitoring plan

B.7.1. Data and parameters to be monitored by each generic 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 owner
Value(s) applied	CPA specific
Measurement methods and procedures:	Measured by an electricity meter.
Monitoring frequency:	Continuous measurements taken.
QA/QC procedures:	The electricity meter will be calibrated and maintained according to manufacturer specifications and national standards. Data is recorded and stored in accordance with methodological requirements.
Purpose of data	Calculation of project emissions.

Additional 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 owner
Value(s) applied	CPA specific
Measurement methods and procedures:	Measurements are undertaken using flow meters.
Monitoring frequency:	Continuous measurements taken.
QA/QC procedures:	The flow meters will be calibrated and maintained according to manufacturer specifications. Data is recorded and stored in accordance with methodological requirements.
Purpose of data	Calculation of project emissions.
Additional 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 owner
Value(s) applied	CPA specific
Measurement methods and procedures:	Depending on the fossil fuel consumed including flow meters.
Monitoring frequency:	Continuous measurements taken.
QA/QC procedures:	All equipment used shall be calibrated and maintained according to manufacturer specifications. The data shall be stored in accordance with methodological requirements.
Purpose of data	Calculation of project emissions.
Additional comment:	-

Data / Parameter:	$FC_{i,j,y}$
Data unit:	mass or volume unit
Description:	Quantity of fuel type i combusted in process j during the year y
Source of data:	CPA owner

Value(s) applied	CPA specific
Measurement methods and procedures:	Use either mass or volume meters. In cases where fuel is supplied from small daily tanks, rulers can be used to determine mass or volume of the fuel consumed, with the following conditions: The ruler gauge must be part of the daily tank and calibrated at least once a year and have a book of control for recording the measurements (on a daily basis or per shift); Accessories such as transducers, sonar and piezoelectronic devices are accepted if they are properly calibrated with the ruler gauge and receiving a reasonable maintenance; In case of daily tanks with pre-heaters for heavy oil, the calibration will be made with the system at typical operational conditions.
Monitoring frequency:	Continuous measurements taken.
QA/QC procedures:	The consistency of metered fuel consumption quantities should be cross-checked by an annual energy balance that is based on purchased quantities and stock changes. Where the purchased fuel invoices can be identified specifically for the CDM project, the metered fuel consumption quantities should also be cross-checked with available purchase invoices from the financial records. Data is recorded and stored in accordance with methodological requirements.
Purpose of data	Calculation of project emissions.
Additional comment:	-

Data / Parameter:	$w_{c,i,y}$
Data unit:	tC/mass unit of the fuel
Description:	Weighted average mass fraction of carbon in fuel type i in year y
Source of data:	Values provided by the fuel supplier in an invoice (preferable source). If this is not available, then measurements by the CPA owner.
Value(s) applied	CPA specific
Measurement methods and procedures:	The mass fraction of carbon should be obtained for each fuel delivery, from which weighted average annual values should be calculated.
Monitoring frequency:	Measurements are undertaken in line with national or international fuel standards.
QA/QC procedures:	Data is recorded and stored in accordance with methodological requirements.
Purpose of data	Calculation of project emissions.
Additional comment:	Preferable data source should be used for $w_{c,i,y}$

Data / Parameter:	$\rho_{c,i,y}$

Data unit:	mass unit / volume unit of the fuel
Description:	Weighted average density of fuel type i in year y
Source of data:	Values provided by the fuel supplier in an invoice (preferable source). If this is not available, then measurements by the CPA owner
Value(s) applied	CPA specific
Measurement methods and procedures:	The density of the fuel should be obtained for each fuel delivery, from which weighted average annual values should be calculated.
Monitoring frequency:	Measurements are undertaken in line with national or international fuel standards.
QA/QC procedures:	The flow meters will be calibrated and maintained according to manufacturer specifications. Data is recorded and stored in accordance with methodological requirements.
Purpose of data	Calculation of project emissions.
Additional comment:	Applicable where $FC_{i,j,y}$ is measured in a volume unit. Preferable data source should be used for $\rho_{c,i,y}$

Data / Parameter:	MM_{FL}
Data unit:	tCH_4
Description:	Methane measured sent to flare
Source of data:	CPA owner
Value(s) applied	CPA specific
Measurement methods and procedures:	Measurements are undertaken using flow meters.
Monitoring frequency:	Continuous measurements taken.
QA/QC procedures:	The flow meters will be calibrated and maintained according to manufacturer specifications. Data is recorded and stored in accordance with methodological requirements.
Purpose of data	Calculation of project emissions.
Additional 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 measured sent to power plant
Source of data:	CPA owner
Value(s) applied	CPA specific

Measurement methods and procedures:	Measurements are undertaken using flow meters.
Monitoring frequency:	Continuous measurements taken.
QA/QC procedures:	The flow meters will be calibrated and maintained according to manufacturer specifications. Data is recorded and stored in accordance with methodological requirements.
Purpose of data	Calculation of project emissions.
Additional 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 measured sent to heat plant
Source of data:	CPA owner
Value(s) applied	CPA specific
Measurement methods and procedures:	Measurements are undertaken using flow meters.
Monitoring frequency:	Continuous measurements taken.
QA/QC procedures:	The flow meters will be calibrated and maintained according to manufacturer specifications. Data is recorded and stored in accordance with methodological requirements.
Purpose of data	Calculation of project emissions.
Additional 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:	$tCO_2/tNMHC$
Description:	Carbon emission factor for combusted non methane hydrocarbons
Source of data:	CPA owner
Value(s) applied	CPA specific
Measurement methods and procedures:	A sample will be collected and analysed.

Monitoring frequency:	Annually
QA/QC procedures:	All equipment used shall be calibrated and maintained in according to manufacturer specifications. The data shall be stored in accordance with methodological requirements.
Purpose of data	Calculation of project emissions.
Additional 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
Value(s) applied	CPA specific
Measurement methods and procedures:	Measurements taken using concentration meters, optical and calorific.
Monitoring frequency:	Hourly/daily
QA/QC procedures:	All equipment used shall be calibrated and maintained in according to manufacturer specifications. The data shall be stored in accordance with methodological requirements.
Purpose of data	Calculation of project emissions.
Additional 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
Value(s) applied	CPA specific
Measurement methods and procedures:	A sample will be collected and analysed.
Monitoring frequency:	Annually
QA/QC procedures:	All equipment used shall be calibrated and maintained in according to manufacturer specifications. The data shall be stored in accordance with methodological requirements.
Purpose of data	Calculation of project emissions.
Additional comment:	-

Data / Parameter:	MM_i
Data unit:	tCH_4
Description:	Methane measured sent to use *i*
Source of data:	CPA owner
Value(s) applied	CPA specific
Measurement methods and procedures:	Measurements are undertaken using flow meters.
Monitoring frequency:	Continuous measurements taken.
QA/QC procedures:	The flow meters will be calibrated and maintained according to manufacturer specifications. Data is recorded and stored in accordance with methodological requirements.
Purpose of data	Calculation of project emissions.
Additional 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:	CPA owner
Value(s) applied	CPA specific
Measurement methods and procedures:	Measurements are undertaken using flow meters.
Monitoring frequency:	Continuous measurements taken.
QA/QC procedures:	The flow meters will be calibrated and maintained according to manufacturer specifications. Data is recorded and stored in accordance with methodological requirements.
Purpose of data	Calculation of project emissions.
Additional 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:	$F_{CH4,EG,t}$
Data unit:	kg
Description:	Mass flow of methane in the exhaust gas of the flare on a dry basis at reference conditions in the time period *t*
Source of data:	Measurements undertaken by a third party accredited entity
Value(s) applied	CPA specific

Measurement methods and procedures:	Values to be averaged at a one-minute interval or shorter time interval. Measure the mass flow of methane in the exhaust gas according to an appropriate national or international standard e.g. UKs Technical Guidance LFTGN05. The time period *t* over which the mass flow is measured must be at least one hour. The average flow rate to the flare during the time period *t* must be greater than the average flow rate observed for the previous six months.
Monitoring frequency:	Measured on a bi-annual basis.
QA/QC procedures:	According to the standard applied. The data shall be stored in accordance with methodological requirements.
Purpose of data	Calculation of project emissions.
Additional comment:	-

Data / Parameter:	$M_{m,db}$
Data unit:	kg/h
Description:	Mass flow of the residual gas in minute *m* on a dry basis.
Source of data:	CPA owner
Value(s) applied	CPA specific
Measurement methods and procedures:	Measurements are undertaken using flow meters.
Monitoring frequency:	Continuous measurements taken.
QA/QC procedures:	The flow meters will be calibrated and maintained according to manufacturer specifications. The data shall be stored in accordance with methodological requirements.
Purpose of data	Calculation of project emissions.
Additional comment:	-

Data / Parameter:	T_m
Data unit:	K
Description:	Temperature of the residual gas in minute *m*
Source of data:	CPA owner
Value(s) applied	CPA specific
Measurement methods and procedures:	Instruments with recordable electronic signal (analogical or digital) are required. Examples include thermocouples, thermo resistance, etc

Monitoring frequency:	Continuous measurements taken.
QA/QC procedures:	Periodic calibration against a primary device provided by an independent accredited laboratory is mandatory. Calibration and frequency of calibration is according to manufacturer's specifications. The data shall be stored in accordance with methodological requirements.
Purpose of data	Calculation of project emissions.
Additional comment:	This parameter must be monitored continuously to assure the applicability condition related to the gaseous stream flow temperature being below 60ºC is met.

Data / Parameter:	P_m
Data unit:	Pa
Description:	Pressure of the residual gas in minute *m*
Source of data:	CPA owner
Value(s) applied	CPA specific
Measurement methods and procedures:	Instruments with recordable electronic signal (analogical or digital) are required, such as pressure transducers, etc
Monitoring frequency:	Continuous measurements taken.
QA/QC procedures:	Periodic calibration against a primary device must be performed and records of calibration procedures must be kept available as well as the primary device and its calibration certificate. Pressure transducers (either capacitive or resistive) must be calibrated monthly. The data shall be stored in accordance with methodological requirements.
Purpose of data	Calculation of project emissions.
Additional comment:	Provided all parameters are converted to normal conditions during the monitoring process, this parameter may not be needed except for moisture content determination and therefore it should be metered only when performing such measurements (with same frequency).

Data / Parameter:	$v_{CH4,m,db}$
Data unit:	m^3 CH_4/m^3 dry gas
Description:	Volumetric fraction of methane in the residual gas in minute *m* on a dry basis
Source of data:	CPA owner
Value(s) applied	CPA specific
Measurement methods and procedures:	Measurements taken by a gas analyser operating in dry-basis.

Monitoring frequency:	Continuous measurements taken.
QA/QC procedures:	Calibration should include zero verification with an inert gas and at least one reading verification with a standard gas (single calibration gas or mixture calibration gas). All calibration gases must have a certificate provided by the manufacturer and must be under their validity period. The data shall be stored in accordance with methodological requirements.
Purpose of data	Calculation of project emissions.
Additional comment:	The mass flow shall be measured on a dry basis in accordance with Option D of Table 1 of the methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream"(Version 02.0.0).

Data / Parameter:	$v_{N2,m,db}$
Data unit:	m^3 N_2/m^3 dry gas
Description:	Volumetric fraction of nitrogen in the residual gas in minute *m* on a dry basis
Source of data:	CPA owner
Value(s) applied	CPA specific
Measurement methods and procedures:	Measurements taken by a gas analyser operating in dry-basis.
Monitoring frequency:	Continuous measurements taken.
QA/QC procedures:	Calibration should include zero verification with an inert gas and at least one reading verification with a standard gas (single calibration gas or mixture calibration gas). All calibration gases must have a certificate provided by the manufacturer and must be under their validity period. The data shall be stored in accordance with methodological requirements.
Purpose of data	Calculation of project emissions.
Additional comment:	The mass flow shall be measured on a dry basis in accordance with Option D of Table 1 of the methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream"(Version 02.0.0).

Data / Parameter:	$T_{EG,m}$
Data unit:	°C
Description:	Temperature in the exhaust gas of the enclosed flare in minute *m*
Source of data:	CPA owner
Value(s) applied	CPA specific

Measurement methods and procedures:	Measure the temperature of the exhaust gas in the flare by an appropriate temperature measurement equipment. Measurements outside the operational temperature specified by the manufacturer may indicate that the flare is not functioning correctly and may require maintenance. Flare manufacturers must provide suitable monitoring ports for the monitoring of the temperature of the flare. These would normally be expected to be in the middle third of the flare. Where more than one temperature port is fitted to the flare, the flare manufacturer must provide written instructions detailing the conditions under which each location shall be used and the port most suitable for monitoring the operation of the flare according to manufacturers specifications for temperature.
Monitoring frequency:	Measured once per minute.
QA/QC procedures:	Temperature measurement equipment should be replaced or calibrated in accordance with their maintenance schedule. The data shall be stored in accordance with methodological requirements.
Purpose of data	Calculation of project emissions.
Additional comment:	Unexpected changes such as a sudden increase/drop in temperature can occur for different reasons. These events should be noted in the site records along with any corrective action that was implemented to correct the issue. Monitoring of this parameter is applicable in case of enclosed flares. Measurements are required to determine if manufacturer's flare specifications for operating temperature are met.

Data / Parameter:	$Flame_m$
Data unit:	Flame on or Flame off
Description:	Flame detection of flare in the minute m
Source of data:	CPA owner
Value(s) applied	CPA specific
Measurement methods and procedures:	Detection of flame recorded as a minute that the flame was on, otherwise recorded as a minute that the flame was off. Measure using a fixed installation optical flame detector: Ultra Violet detector or Infra Red or both.
Monitoring frequency:	Measured once per minute.
QA/QC procedures:	Equipment shall be maintained and calibrated in accordance with manufacturer's recommendations. The data shall be stored in accordance with methodological requirements.
Purpose of data	Calculation of project emissions.
Additional comment:	Applicable to all flares.

Data / Parameter:	$Maintenance_y$
Data unit:	Calendar dates
Description:	Maintenance events completed in year *y*
Source of data:	CPA owner
Value(s) applied	CPA specific
Measurement methods and procedures:	Record the date that maintenance events were completed in year *y*. Records of maintenance logs must include all aspects of the maintenance including the details of the person(s) undertaking the work, parts replaced, or needing to be replaced, source of replacement parts, serial numbers and calibration certificates.
Monitoring frequency:	Measured annually.
QA/QC procedures:	Records must be kept in a maintenance log for two years beyond the life of the flare. The data shall be stored in accordance with methodological requirements.
Purpose of data	Calculation of project emissions.
Additional comment:	Monitoring of this parameter is required for the case of enclosed flares and the project participant selects Option B to determine flare efficiency. These dates are required so that they can be compared to the maintenance schedule to check that maintenance events were completed within the minimum time between maintenance events specified by the manufacturer (SPEC,flare).

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:	CPA owner
Value(s) applied	CPA specific
Measurement methods and procedures:	Measurements are undertaken using flow meters.
Monitoring frequency:	Continuous measurements taken.
QA/QC procedures:	The flow meters will be calibrated and maintained according to manufacturer specifications. Data is recorded and stored in accordance with methodological requirements.
Purpose of data	Calculation of baseline emissions.
Additional 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:	CPA owner
Value(s) applied	CPA specific
Measurement methods and procedures:	Measurements are undertaken using flow meters.
Monitoring frequency:	Continuous measurements taken.
QA/QC procedures:	The flow meters will be calibrated and maintained according to manufacturer specifications. Data is recorded and stored in accordance with methodological requirements.
Purpose of data	Calculation of baseline emissions.
Additional 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:	GEN_y
Data unit:	MWh
Description:	Electricity generation by project activity in year *y*
Source of data:	CPA owner
Value(s) applied	CPA specific
Measurement methods and procedures:	Measured by an electricity meter.
Monitoring frequency:	Continuous measurements taken.
QA/QC procedures:	The electricity meter will be calibrated and maintained according to manufacturer specifications and national standards. Data is recorded and stored in accordance with methodological requirements.
Purpose of data	Calculation of baseline emissions.
Additional comment:	-

Data / Parameter:	$HEAT_y$
Data unit:	GJ
Description:	Heat generation by project activity in year *y*
Source of data:	CPA owner
Value(s) applied	CPA specific

Measurement methods and procedures:	Measurements are undertaken using flow meters.
Monitoring frequency:	Continuous measurements taken.
QA/QC procedures:	The flow meters will be calibrated and maintained according to manufacturer specifications. Data is recorded and stored in accordance with methodological requirements.
Purpose of data	Calculation of baseline emissions.
Additional comment:	-

Data / Parameter:	$Eff_{captive}$
Data unit:	%
Description:	Energy efficiency of captive power plant
Source of data:	CPA owner
Value(s) applied	CPA specific
Measurement methods and procedures:	Calculated based on electricity generated and fuel used Electricity meters, flow meters or other appropriate equipment will be used to measure the heat and fuel used.
Monitoring frequency:	Calculated annually.
QA/QC procedures:	All equipment used shall be calibrated and maintained in according to manufacturer specifications. The data shall be stored in accordance with methodological requirements.
Purpose of data	Calculation of baseline emissions.
Additional 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:	CPA owner
Value(s) applied	CPA specific
Measurement methods and procedures:	Calculated based on heat generated and fuel used. Flow meters or other appropriate equipment will be used to measure the heat and fuel used.
Monitoring frequency:	Calculated annually.
QA/QC procedures:	All equipment used shall be calibrated and maintained in according to manufacturer specifications. The data shall be stored in accordance with methodological requirements.
Purpose of data	Calculation of baseline emissions.

Additional comment:	-

B.7.2. Description of the monitoring plan for a generic CPA

The CPA adopts the Approved Methodology 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 for each CPA. The CME will ensure that the monitoring plan is consistently applied for each CPA in accordance with the PoA-DD and the Approved Methodology ACM0008 (Version 07).

1. Management Structure and responsibilities
Each CPA owner 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. The CME will support the CPA owner in order to ensure that sufficient training was provided to the CPA owner in order for the CPA owner to be able to collect the monitoring data. The CME, as entity responsible for the coordination and implementation of the PoA will ensure that monitoring will be implemented in accordance with the PoA-DD and the Approved Methodology ACM0008 (Version 07).

The CPA owner will report to the CME on a monthly basis regarding the collection of data and confirm that the monitoring plan is implemented in accordance with PoA guidelines and in accordance with Approved Methodology ACM0008 (Version 07). The CME will make field-checks when appropriate to ensure that the monitoring plans are properly implemented by the CPA owners.

2. Data Collection
The CPA owner will be responsible for the data collection. The CPA will use continuous flow meters and equipment to monitor the temperature and pressure of the CMM collected at the CPA. The equipment will be serviced, calibrated and maintained in accordance with manufacturer’s instructions and the Approved Methodology ACM0008 (Version 07) and complete records of such service, calibration and maintenance will be kept. Measured data will be recorded electronically and converted in accordance with Approved Methodology ACM0008 (Version 07). This data will subsequently be used to calculate emission reductions in accordance with the Approved Methodology ACM0008 (Version 07).

The CPA will determine the project emissions from flaring of the residual gas stream ($PE_{flare,y}$) in accordance with the methodological tool "Project emissions from flaring"(Version 02.0.0).

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

The data, as much as possible, will be collected through electronic transmission of data from the monitoring equipment to the offices of the person appointed by the CPA owner for responsibility for monitoring. Data which cannot be collected through electronic means, shall be collected by qualified and trained personnel only in intervals as required by the Approved Methodology ACM0008 (Version 07).

All data continuously measured will be electronically archived. At the same time, data monitored

will be checked manually every day and recorded in hard copy measurement tables. The electronic records and paper copies are kept for two (2) years after the end of the crediting period in compliance with Approved Methodology ACM0008 (Version 07).

The collected data will be forwarded to the CME on a monthly basis in order to complete sensibility checks on the data and to prepare monitoring reports.

3. Data calibration
All measurements are taken utilising calibrated measurement equipment according to international / national / sectoral / industry standards as applicable. Calibration will be done in accordance with relevant international standards or manufacturer's requirements.

4. Data handling
The CME will develop and implement a protocol for adequate record keeping and data monitoring systems. The data recorded by the CPA owner will be transmitted to the CME within ten business days after the end of each calendar month. Transmission of the data is generally done by electronic means, such as online or via email. If such transmission is not possible, then data shall be provided from the CPA owner to the CME by means of sending the data by mail via electronic storage devices or as hard copies.

5. Data quality control
All data transmitted by the CPA owner to the CME will be checked by the CME 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 owner transmits copies of completed worksheets on a monthly basis while maintaining originals on file. The CPA owner 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 CME will use the collected data to calculate emission reductions. The CME will also be responsible for the preparation of monitoring reports on a monthly basis and work with the DOE on the verification of the monitored data.

7. Data archiving
All data collected as part of monitoring will be archived electronically and be kept at least for two (2) years after the end of the last crediting period. The CPA owner will keep both electronic copies of the data, as well as paper copies of the data at the offices of the CPA owner. Additionally, all monitoring data will be kept electronically and as paper copies by the CME, which ensures that data can centrally be made available to a Designated Operational Entity (DOE) upon request.

8. Training
At least three (3) 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 CME will liaise with the CPA owner to ensure that ongoing training will be provided by the manufacturer of the monitoring equipment to ensure that a sufficient number of technicians is 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.

Appendix 1. Contact information on entity/individual responsible for the PoA

Organization	General Bureau for Cooperation with International Organizations
Street/P.O. Box	PO Box 504, Jungsong-dong, Central District
Building	
City	Pyongyang
State/Region	Pyongyang
Postcode	
Country	Democratic People's Republic of Korea
Telephone	+850 2 381 5926
Fax	+850 2 381 4654
E-mail	gbcio@star-co.net.kp
Website	
Contact person	Mr. Ri Yong Nam
Title	Director
Salutation	Mr.
Last name	Ri
Middle name	
First name	Yong Nam
Department	Carbon Trade Division
Mobile	
Direct fax	+850 2 381 4654
Direct tel.	+850 2 381 5926
Personal e-mail	gbcio@star-co.net.kp

Organization	Carbon Development and Trading Ltd
Street/P.O. Box	Suite 520, 152-160 City Road
Building	Kemp House
City	London
State/Region	London
Postcode	EC1V 2NX
Country	United Kingdom
Telephone	+44 207 125 0385
Fax	+44 207 125 0385
E-mail	carbondevelopment@gmail.com
Website	
Contact person	Ms. Jacqueline Wai Ying Luke
Title	
Salutation	Ms.
Last name	Luke
Middle name	Wai Ying
First name	Jacqueline
Department	
Mobile	
Direct fax	+44 207 125 0385
Direct tel.	+44 207 125 0385
Personal e-mail	carbondevelopment@gmail.com

Appendix 2. Affirmation regarding public funding

No public funding from Annex I Parties is provided.

Appendix 3. Application of methodology(ies)

No additional information provided here.

Appendix 4. Further background information on ex ante calculation of emission reductions

No additional information provided here.

Appendix 5. Further background information on the monitoring plan

No additional information provided here.

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Document information

Version	*Date*	*Description*
03.0	3 December 2012	Revision to clarify the determination of the start date for a PoA and the documentation requirement for generic CPA-DDs. (EB 70, Annex 6).
02.0	11 May 2012	EB 66, Annex 12 Revision required to ensure consistency with the "Guidelines for completing the programme design document form for CDM programmes of activities".
01.0	2 March 2012	EB 33, Annex 41 Initial adoption.

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