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

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NOTE:

(i) This form is for the submission of a CDM PoA whose CPAs apply a small scale approved methodology.

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

SECTION A. General description of small-scale programme of activities (PoA)

A.1 Title of the small-scale programme of activities (PoA):

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Indonesia Biogas Projects

Version: 4.1
Date: 22 August 2012

A.2. Description of the small-scale programme of activities (PoA):

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1. General operating and implementing framework of PoA

The Indonesia Biogas Projects is a small-scale CDM Programme of Activities (hereafter referred to as "PoA") developed by PT. GP Carbon Solutions Services Indonesia (PTGPCS) as a coordinating/managing entity and the proposed project activity will reduce greenhouse gas (GHG) emissions from agro-industry waste water treatment systems by capturing the biogas produced instead of allowing it to escape into the atmosphere. Only small scale CDM projects will participate in this PoA and each CPA will consist of one wastewater treatment plant that can be from one or more processing facilities (e.g. mill, factory etc.). The processing facility owner, a project participant, will sign an agreement with PTGPCS prior to being included in the PoA. PTGPCS will provide complete CDM services and technical support for the management and monitoring of the projects, thus PTGPCS ensuring long-term sustainability of the project activity. PTGPCS has targeted agro-industry processing facilities in Indonesia to be included in the PoA focusing specifically on palm oil mills and cassava mills.

Indonesia is the largest producer of palm oil in the world with more than 400 palm oil mills in operation and 7 million hectares of oil palm plantations; the planting area is expanded at 7.05% annually from 2000 through 2009[1]. In the cassava industry, Indonesia is the one of the largest producer in the world with a total production of more than 21.59 million tonnes in 2008[2]. Based on data obtained from Badan Pusat Statistik (BPS-Statistics Indonesia), production of the crop has increased at 4.87% per annum from 2000 through 2010[3]. The processing facilities generate large amounts of wastewater which is generally treated in an open pond or lagoon system, considered the common practice and least costly solution for both palm oil mills[4] & cassava mills in Indonesia[5]. The decay of organic matter in the anaerobic phase of the ponds or lagoons is accompanied by the production of methane, a highly potent GHG which is released freely into the atmosphere.

2. Policy/measure or stated goal of the PoA

[1] BPS http://dds.bps.go.id/eng/tab_sub/view.php?tabel=1&daftar=1&id_subyek=54&notab=1

[2] FAOSTAT – countries by commodity, 2008 by quantity http://faostat.fao.org/site/339/default.aspx

[3] BPS http://dds.bps.go.id/tnmn_pgn.php?eng=1

[4] F. Schuchardt, *et. al.*Composting of Empty Fruit Bunch (EFB) with simultaneous evaporation of oil mill waste water (POME). 2002 International Oil Palm Conference, Nusa Dua, Bali, Indonesia, July 8 – 12 2002

[5] Eco-Ideal Consulting Sdn. Bhd. (Eco-Ideal). MEWC/PTM/DANIDA: *Study on Clean Development Mechanism Potential in the Waste Sectors in Malaysia*. December 2004.

The main objective of this PoA is to reduce a significant amount of GHG emissions from the wastewater treatment systems of the agro-industry processing facilities. The aim of this PoA is to recover the biogas released from the anaerobic process of the wastewater treatment system by introducing or substituting the current ponds with a biogas recovery system. This would result in more efficient wastewater treatment systems in terms of performance, management and quality control. The PoA also intends to promote biogas utilization and renewable energy production in Indonesia.

The contribution of this PoA to sustainable development is assessed using the sustainable development criteria of Indonesia[6] as listed below:

Environmental criteria

- The project activity provides a higher efficiency alternative for the treatment of wastewater for the agro-industry.
- Higher performance wastewater treatment systems enable better compliance with the final discharge limit that reduces the risk of water contamination.
- Capture of biogas from wastewater systems reduces odor and possible health hazards which would have been generated using the open lagoon treatment system, thus minimizing pollution to the environment.
- The reduction of GHG emissions from methane destruction will improve the quality of the air resulting in the preservation of the environment.
- The project promotes and supports Indonesia's renewable energy programme with biogas utilization.

Economic criteria

- Provides job opportunities especially for the community near the processing facilities
- In addition to providing job opportunities, the project will also catalyze development of the nearby area, especially with processing facilities which are normally located in rural areas.
- The project activity will improve the local economy by increasing business opportunities for local suppliers in transportation, maintenance and repair, supply of equipment and parts, food and other services
- Training will be provided to the local staff to execute and manage the projects in Indonesia, thus increasing the country's qualified manpower and knowledge.
- The project will lead to an increase of the Gross Domestic Product (GDP) and will have a positive impact on the Indonesian annual GDP growth rate.

Social criteria

- Improve the agro-industry companies' way of doing business in a sustainable manner.
- Provide knowledge and awareness to the residents, especially in the local community, with respect to environment, climate change and renewable energy.
- Improve the quality of life and environmental condition of the local community leading to a healthier population.
- The increased job opportunity will reduce social disparity in the community thereby contributing to peace in the society.

Technology criteria

- The project involves the import of advanced wastewater treatment technology.

[6] http://pasarkarbon.dnpi.go.id/web/index.php/dnacdm/cat/5/sustainable-development-criteria-.html

- The project provides an opportunity for local engineers and plant operators to acquire know-how on the optimal maintenance and operation of a state-of-the-art biogas recovery system.
- The project will provide opportunity for technology transfer.

The PoA will assist Indonesia (generally) and the agro-industry and local community (specifically) in achieving sustainable development.

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

The proposed PoA is a voluntary action by PTGPCS since the implementation of biogas recovery systems is a voluntary action at every agro-industry. There are no mandated laws or regulations in Indonesia enforcing the recovery of biogas at wastewater treatment systems and PTGPCS is not obliged by any local legislation to implement the PoA. PTGPCS also does not have any contractual obligation to implement the PoA.

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

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1. Coordinating or managing entity of the PoA as the entity which communicates with the Executive Board

PT. GP Carbon Solutions Services Indonesia (PTGPCS) will act as a coordinating / managing entity for the PoA.

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

PTGPCS is the project participant for this PoA. Other project participants (if any) for individual CPAs will be identified in the respective CPA-DDs.

Name of Party involved (*) ((host) indicates a host Party)	**Private and/or public entity(ies) project participants (*) (as applicable)**	**Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)**
Indonesia (host)	PT. GP Carbon Solutions Services Indonesia	No
United Kingdom of Great Britain and Northern Ireland	GenPower Carbon Solutions, L.P.	No

A.4. Technical description of the small-scale programme of activities:

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A.4.1. Location of the programme of activities:

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The PoA covers the geographical region of Indonesia.

A.4.1.1. Host Party(ies):

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Republic of Indonesia.

A.4.1.2. Physical/ Geographical boundary:

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The proposed PoA will be developed within one country only, Indonesia. The location of which the CPAs will be implemented is between the latitude of 6° 00'00'' N to 11° 00'00'' S and the longitude of 97° 00'00'' E to 141° 00'00'' E[7].

A map indicating the location of the PoA is provided below:

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

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A typical CPA will be an individual agro-industry processing facility that will implement the project activity by installing a new treatment system (digester) with biogas recovery or installing a biogas recovery system for the existing anaerobic treatment system that currently emits biogas containing 60-65% methane[8] directly to the atmosphere. The wastewater will be treated under controlled conditions by the new enclosed digester before being treated further in the existing treatment system. In the project activity, each CPA is expected to install a state-of-the-art biogas recovery system which has better performance in terms of efficiency, reliability and quality than the existing system. The project will capture the biogas and combust the biogas in an enclosed/open flare with the option to utilize the captured biogas as renewable energy, for power or heat based on the necessities at each specific site.

[7] http://www.indonesia.go.id/id/index.php?option=com_content&task=view&id=112&Itemid=1722

[8] B.G. Yeoh "*A Technical and Economic Analysis of Heat and Power Generation from Biomethanation of Palm Oil Mill Effluent*." Electricity Supply Industry in Transition: Issues and Prospect for Asia 14-16 January 2004.

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

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The project activity will apply the AMS III.H. "Methane recovery in wastewater treatment" Version 16 methodology and subsequent versions under the type III project activities "Scope 13 – Waste Handling and Disposal".

A CPA will be an individual agro-industry processing facility that will implement the project activity by installing a new treatment system (digester) with biogas recovery or installing a biogas recovery system for the existing anaerobic treatment system that currently emits biogas containing 60-65% methane[9] directly to the atmosphere. The wastewater will be treated under controlled conditions by the new enclosed digester before being treated further in the existing treatment system. In the project activity, each CPA is expected to install a state-of-the-art biogas recovery system which has better performance in terms of efficiency, reliability and quality than the existing system. It is expected that several technologies will be available to be considered for each CPA and each technology will comprise measures that recover biogas from wastewater systems by means of one or a combination of methods based on AMS-III.H. methodology (version 16 or later).

The project will capture the biogas and combust the biogas in an enclosed/open flare with the option to utilize the captured biogas as renewable energy, for power or heat based on the necessities at each specific site.

Any other technologies or variants that may be developed in coming years are eligible for CPAs to be included in this PoA, provided they meet the eligibility requirements outlined below. The installed project technology at each CPA project site will not be substituted by other or added with more technologies within the project period. Only the equipment/machinery, when needed (for instance when the equipment/machinery is out of order or reached the end of its servicing period), will be replaced.

Each SSC-CPA is expected to reduce up to 60,000 tCO_2e of methane annually from the Type III portion of the project. Additional emission reductions, where applicable, may be available from Type I activities at the project sites.

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

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A description of the criteria for enrolling a CPA is described below; the criteria for demonstrating additionality of a CPA shall be described in section E.5.

1. The project must comprise measures that recover biogas from biogenic organic matter in waste water by means of one, or a combination, of the following options:
   (a) Substitution of aerobic wastewater or sludge treatment systems with anaerobic systems with biogas recovery and combustion;
   (b) Introduction of anaerobic sludge treatment system with biogas recovery and combustion to a wastewater treatment plant without sludge treatment;
   (c) Introduction of biogas recovery and combustion to a sludge treatment system;
   (d) Introduction of biogas recovery and combustion to an anaerobic wastewater treatment system such as anaerobic reactor, lagoon, septic tank or an on-site industrial plant;

[9] B.G. Yeoh "*A Technical and Economic Analysis of Heat and Power Generation from Biomethanation of Palm Oil Mill Effluent*." Electricity Supply Industry in Transition: Issues and Prospect for Asia 14-16 January 2004.

(e) Introduction of anaerobic wastewater treatment with biogas recovery and combustion, with or without anaerobic sludge treatment, to an untreated wastewater stream;

(f) Introduction of sequential stage wastewater treatment with biogas recovery and combustion, with or without sludge treatment, to an anaerobic wastewater treatment system without biogas recovery (e.g. introduction of treatment in an anaerobic reactor with biogas recovery as a sequential treatment step for the wastewater that is presently being treated in an anaerobic lagoon without methane recovery).

2. At the time of inclusion of the CPA in the PoA, there is no enforced regulation in Indonesia that requires the recovery of methane from anaerobic ponds treating wastewater from agro-industry processing plants.
3. CPA must be in compliance with all laws and regulations of Indonesia.
4. Each CPA must be approved by the managing entity prior to its incorporation into the PoA.
5. Each CPA must demonstrate in the CPA-DD that the project activity characteristics are defined in a way that precludes project activities to go beyond the limits:
   i. For type I: project participants shall provide proof that the installed capacity of the proposed project activity will not increase beyond 15 MWe;
   ii. For type III: project participants shall provide an estimation of emission reductions by the project activity over the crediting period and prove that the emission reductions every year will not go beyond the limits of 60 ktCO2e/y over the entire crediting period.
6. Each CPA must demonstrate the project's additionality by applying the "Attachment A to Appendix B" Version 08 or "Non-binding best practise examples to demonstrate additionality for SSC project activities" Version 01 or future updates. Each CPA also will have to demonstrate additionality based on the following criteria before inclusion in the PoA:
   i. Define credible possible alternative scenarios to the project activity. Ensure that the proposed CPA is not the only alternative amongst those considered that is in compliance with mandatory regulations.
   ii. Determine most relevant barrier in terms of investment analysis and barrier analysis to make sure the project activity is additional.
   iii. Either simple cost analysis, investment comparison analysis or benchmark analysis will be carried out to demonstrate the additionality of the project.
   iv. The CPA participation is voluntary and there is no requirement or enforcement under existing national/state/local regulations to introduce or substitute the biogas recovery system.

Every CPA will have to meet all the criteria mentioned above to ensure eligibility to participate in this PoA.

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

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(i) The proposed PoA is a voluntary coordinated action.

The proposed PoA is a voluntary coordinated action from PTGPCS to promote the implementation of biogas recovery systems with an option to combust or utilize the captured biogas as renewable energy.

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

In the absence of the PoA, the agro-industry processing facilities included in the PoA would continue to emit biogas to the atmosphere. Indonesia is the largest palm oil producer in the world and the palm oil producing capacity is increasing every year[10]. In the Indonesia agro-industry sectors, the only regulation and requirement by Indonesia authority regarding wastewater treatment systems is the restriction on the final discharge limit of the wastewater into the water stream or land [11]; common practice is to use open lagoons or ponds.

Without the PoA to provide additional incentive, owners of processing facilities will not implement the biogas recovery projects because there is no mandatory law to enforce such action in Indonesia. Most of the agro-industry processing facilities already comply with the discharge regulation enforced by the local Department of Environment. The incentives such as CDM revenue, energy cost savings and potential renewable energy revenue from the PoA are needed to ensure that the projects are viable and will attract the agro-industry processing facility owners' participation.

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

Not Applicable

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

Not Applicable

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

PTGPCS is the coordinating/managing entity of the management and monitoring plan. The operational plan will be implemented by a project developer or technology provider for each CPA, which may include PTGPCS. Contractual arrangements will be signed with each participating processing facility owner, project developer/technology provider and PTGPCS.

A.4.4.1. Operational and management plan:

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

Each individual CPA will maintain a record keeping system as specified in Section E below. PTGPCS, as the managing entity, will ensure that each CPA will maintain standard records documenting, archive the monitoring data in a secure database and keep the records for the entire crediting period and two years after. Data (paper & electronic) will be transmitted semi-annually to PTGPCS who is responsible for the record keeping relating to production of the Monitoring Reports. PTGPCS will conduct data audits and ensure compliance with the monitoring plan at least twice a year for each CPA.

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

[10] "*Palm Oil - The Sustainable Oil*", A Report by World Growth, September 2009.
[11] Indonesian Environment Ministry Decree No. KEP-51/MENLH/10/1995

Prior to register a new CPA under the proposed PoA, PTGPCS, as the managing entity will check the CPA and PoA databases in the UNFCCC website to ensure that a similar CPA has not been submitted for validation or has been registered already. Currently, there are 3 PoAs under validation but as of yet none registered in Indonesia. The Designated National Authority of Indonesia will also be consulted prior to the inclusion of the CPA to confirm that the participating processing plant has not been registered either as a CDM project activity or as a CPA of another PoA. The individual CPA also has to issue an authorization letter to PTGPCS informing that they are aware of and have agreed that their activity is being subscribed to this proposed PoA and they are not registered either as a CDM project activity or as a CPA of another PoA.

Each CPA included in this PoA will be provided with a unique identification number as a reference. To avoid double counting, each included CPA with its reference number will be linked with the geographic coordinates for each facility's specific site location.

(iii) The SSC-CPA included in the PoA is not a de-bundled component of another CDM programme activity (CPA) or CDM project activity.

PTGPCS will follow the "Guidelines on Assessment of Debundling for SSC Project Activities" Version 03 under "II. Guidance for Determining the Occurrence of Debundling Under a Programme of Activities (PoA)" to ensure that the proposed CPA is not a de-bundled component of another CPA or CDM project activity.

(iv) The provisions to ensure that those operating the CPA are aware of and have agreed that their activity is being subscribed to the PoA.

Prior to the inclusion of a CPA in the proposed PoA, agreements for CER ownership will be signed between PTGPCS and each CPA project participant. The individual CPA will also issue an authorization letter to PTGPCS informing that they are aware of and have agreed that their project is being subscribed to this proposed PoA and the project is not registered either as a CDM project activity or as a CPA of another PoA.

A.4.4.2. Monitoring plan:

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

Not Applicable

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

PTGPCS opted for each CPA to be verified individually. The monitoring plan for each CPA will be developed in accordance with the applied baseline and monitoring methodology at the CPA level. Data parameters will be identified and monitored in accordance with the requirement of the baseline and monitoring methodology.

Each CPA included in this PoA will have a unique identification number as a reference. To avoid double counting during the verification process, the reference (identification number) as mentioned above will be used.

A.4.5. Public funding of the programme of activities (PoA):

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The projects have not received and will not be seeking public funding.

SECTION B. Duration of the programme of activities (PoA)

B.1. Starting date of the programme of activities (PoA):

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Start date of the PoA will be the date on which the PoA is registered with the CDM Executive Board.

B.2. Length of the programme of activities (PoA):

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The length of the PoA is 28 years.

SECTION C. Environmental Analysis

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

1. Environmental Analysis is done at PoA level ☐
2. Environmental Analysis is done at SSC-CPA level X

The Environmental Analysis would be carried out at the CPA level, due to the nature of the individual CPA which is unique and site specific. Each CPA may have a different technology and biogas utilization approach based on the site specific condition and requirement. The impacts are confined to each CPA and all CPAs will follow all regulations under Indonesian law which will guarantee the environmental integrity of each CPA.

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

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The analysis of environmental impacts, including transboundary impacts, will be conducted at CPA level.

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

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As CPA activities are continuous improvements in the existing environmental management, national policies in place indicate that such project activities do not require Environmental Impact Assessments

(EIA)[12]. An Environmental Management and Monitoring Plan (EMMP) will be developed by the CPAs, if necessary, and submitted to the responsible authorities.

SECTION D. Stakeholders' comments

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

1. Local stakeholder consultation is done at PoA level ☐
2. Local stakeholder consultation is done at SSC-CPA level X

Stakeholder consultation will be undertaken at the CPA level in order to reach a wider group of stakeholders due to the CPAs geographical positions and different groups of stakeholders affected. This is to ensure a wider participation and consultation of local stakeholders for each CPA participating in the PoA. The PoA requires all relevant stakeholders to be consulted on the inclusion of each CPA through the local stakeholder consultation.

The stakeholder consultation minutes of meeting is one of the required documents that must be submitted to DNA Indonesia to adhere the procedures of "CDM Project Approval Mechanism" by the Indonesian CDM National Commission[13].

In the procedures, the project proponent (optionally with project consultant) prepares the following application documents: (i) the National Approval Application Form, which provides explanation about the project proposal's conformability to sustainable development criteria; (ii) Project Design Document; (iii) EMMP report (where required); (iv) notes of local stakeholder consultation; (v) recommendation letter from Ministry of Forestry, applicable for forestry CPA project proposal, and/or; (vi) other supporting documents to justify the project. The application documents are submitted to the Secretariat for processing.

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

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This will be addressed at the individual CPA-DD level.

D.3. Summary of the comments received:

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This will be addressed at the individual CPA-DD level.

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

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This will be addressed at the individual CPA-DD level.

SECTION E. Application of a baseline and monitoring methodology

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

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[12] Government Regulation of PP No. 11/2006 lays out requirements for EIAs.

[13] http://dna-cdm.menlh.go.id/en/approval/

E.1. Title and reference of the approved SSC baseline and monitoring methodology applied to a SSC-CPA included in the PoA:

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The approved SSC baseline and monitoring methodology applied to a SSC-CPA included in this PoA is AMS-III.H. "Methane recovery in wastewater treatment" Version 16 or future updates. SSC-CPA can opt to use the combination of methodologies with any Type I methodologies (or future updates) i.e. AMS-I.A/Version 15.0, AMS-I.C/Version 19.0, AMS-I.D/Version 17.0 and AMS-I.F/Version 2.0 or other methodologies covered by AMS-III.H Version 16 (or latest) i.e AMS-III.O/Version 1.0 and AMS-III.AQ/Version 1.0 (also to include future updates) based on the biogas utilization for each specific SSC-CPA.

The managing entity will follow the guidelines in accordance to Annex 38 of EB 55 that lay out the "Procedure for Registration of a Programme of Activities as a Single CDM Project Activity and Issuance of Certified Emission Reductions for a Programme of Activities." These include the procedures for dealing with "Implications of an Approved methodology being put on hold or withdrawn." Revisions are not required where a methodology is simply revised, without initially having been placed on hold or withdrawn.

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

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Requirement for applicability of the methodology	Compliance of CPA with the given requirement	Reference
1. This methodology comprises measures that recover biogas from biogenic organic matter in wastewater by means of one, or a combination, of the following options: (a) Substitution of aerobic wastewater or sludge treatment systems with anaerobic systems with biogas recovery and combustion; (b) Introduction of anaerobic sludge treatment system with biogas recovery and combustion to a wastewater treatment plant without sludge treatment; (c) Introduction of biogas recovery and combustion to a sludge treatment system; (d) Introduction of biogas recovery and combustion to an anaerobic wastewater treatment system such as anaerobic reactor, lagoon, septic tank or an on-site industrial plant; (e) Introduction of anaerobic wastewater treatment with biogas recovery and combustion, with or without anaerobic sludge treatment, to an untreated	Each CPA to be implemented under this PoA will involve biogas recovery from biogenic organic matter in wastewater by means of one or a combination of the listed options in the Methodology. The activity will contribute to the avoidance of methane emissions to the atmosphere.	AMS – III.H./ Version 16 Paragraph 1

wastewater stream; (f) Introduction of a sequential stage of wastewater treatment with biogas recovery and combustion, with or without sludge treatment, to an anaerobic wastewater treatment system without biogas recovery (e.g. introduction of treatment in an anaerobic reactor with biogas recovery as a sequential treatment step for the wastewater that is presently being treated in an anaerobic lagoon without methane recovery).		
2. In cases where baseline system is anaerobic lagoon the methodology is applicable if: (a) The lagoons are ponds with a depth greater than two meters, without aeration. The value for depth is obtained from engineering design documents, or through direct measurement, or by dividing the surface area by the total volume. If the lagoon filling level varies seasonally, the average of the highest and lowest levels may be taken; (b) Ambient temperature above 15°C, at least during part of the year, on a monthly average basis; (c) The minimum interval between two consecutive sludge removal events shall be 30 days.	Anaerobic open lagoon system is the common practice adopted by mills to treat the wastewater because it is the least costly solution. PTGPCS will ensure that each CPA under this PoA complies with the methodological requirement regarding the anaerobic pond criteria.	AMS – III.H./ Version 16 Paragraph 2
3. The recovered biogas from the above measures may also be utilised for the following applications instead of combustion/flaring: (a) Thermal or mechanical, electrical energy generation directly; (b) Thermal or mechanical, electrical energy generation after bottling of upgraded biogas, in this case additional guidance provided in Annex 1 shall be followed; or (c) Thermal or mechanical, electrical energy generation after upgrading and distribution, in this case additional guidance provided in Annex 1 shall be followed:	The CPA involves facilities to combust by flaring the biogas generated or utilize for renewable energy. Each CPA will indicate an option to utilize the biogas recovered for energy, if applicable, instead of flaring depending on each site specifications and requirements.	AMS – III.H./ Version 16 Paragraph 3

(i) Upgrading and injection of biogas into a natural gas distribution grid with no significant transmission constraints; (ii) Upgrading and transportation of biogas via a dedicated piped network to a group of end users; or (iii) Upgrading and transportation of biogas (e.g. by trucks) to distribution points for end users. (d) Hydrogen production; (e) Use as fuel in transportation applications after upgrading.		
4. If the recovered biogas is used for project activities covered under paragraph 3 (a), that component of the project activity can use a corresponding methodology under Type I.	One of the options for the CPA. PTGPCS will ensure that each CPA under this PoA complies with the methodological requirement.	AMS – III.H./ Version 16 Paragraph 4
5. For project activities covered under paragraph 3 (b), if bottles with upgraded biogas are sold outside the project boundary, the end-use of the biogas shall be ensured via a contract between the bottled biogas vendor and the end-user. No emission reductions may be claimed from the displacement of fuels from the end use of bottled biogas in such situations. If however the end use of the bottled biogas is included in the project boundary and is monitored during the crediting period CO_2 emissions avoided by the displacement of fossil fuel can be claimed under the corresponding Type I methodology, e.g. AMS-I.C/Version 17.0 "Thermal energy production with or without electricity".	One of the options for the CPA. PTGPCS will ensure that each CPA under this PoA complies with the methodological requirement.	AMS – III.H./ Version 16 Paragraph 5
6. For project activities covered under paragraph 3 (c) (i), emission reductions from the displacement of the use of natural gas are eligible under this methodology, provided the geographical extent of the natural gas distribution grid is within the host country boundaries.	One of the options for the CPA. PTGPCS will ensure that each CPA under this PoA complies with the methodological requirement.	AMS – III.H./ Version 16 Paragraph 6
7. For project activities covered under paragraph 3 (c) (ii), emission reductions for the displacement of the use of fuels can be claimed following the provision in the corresponding Type I methodology, e.g. AMS-I.C/Version 17.0	One of the options for the CPA. PTGPCS will ensure that each CPA under this PoA complies with the methodological requirement.	AMS – III.H./ Version 16 Paragraph 7

8. In particular, for the case of 3 (b) and (c) (iii), the physical leakage during storage and transportation of upgraded biogas, as well as the emissions from fossil fuel consumed by vehicles for transporting biogas shall be considered. Relevant procedures in paragraph 11 of Annex 1 of AMS-III.H/Version 16 "Methane recovery in wastewater treatment" shall be followed in this regard.	One of the options for the CPA. PTGPCS will ensure that each CPA under this PoA complies with the methodological requirement.	AMS – III.H./ Version 16 Paragraph 8
9. For project activities covered under paragraph 3 (b) and (c), this methodology is applicable if the upgraded methane content of the biogas is in accordance with relevant national regulations (where these exist) or, in the absence of national regulations, a minimum of 96% (by volume).	One of the options for the CPA. PTGPCS will ensure that each CPA under this PoA complies with the methodological requirement.	AMS – III.H./ Version 16 Paragraph 9
10. If the recovered biogas is utilized for the production of hydrogen (project activities covered under paragraph 3 (d)), that component of the project activity shall use the corresponding methodology AMS-III.O/Version 1.0 "Hydrogen production using methane extracted from biogas".	One of the options for the CPA. PTGPCS will ensure that each CPA under this PoA complies with the methodological requirement.	AMS – III.H./ Version 16 Paragraph 10
11. If the recovered biogas is used for project activities covered under paragraph 3 (e), that component of the project activity shall use corresponding methodology AMS-III.AQ/Version 1.0 "Introduction of Bio-CNG in road transportation".	One of the options for the CPA. PTGPCS will ensure that each CPA under this PoA complies with the methodological requirement.	AMS – III.H./ Version 16 Paragraph 11
12. New facilities (Greenfield projects) and project activities involving a change of equipment resulting in a capacity addition of the wastewater or sludge treatment system compared to the designed capacity of the baseline treatment system are only eligible to apply this methodology if they comply with the relevant requirements in the "General guidelines to SSC CDM methodologies" Version 18.0. In addition the requirements for demonstrating the remaining lifetime of the equipment replaced, as described in the general guidelines[14] shall be followed.	PTGPCS will ensure that each CPA under this PoA complies with the methodological requirement and follow the guidelines.	AMS – III.H./ Version 16 Paragraph 12
13. The location of the wastewater treatment plant as well as the source generating the wastewater shall be uniquely defined and described in the PDD.	The location of each CPA will be indentified by specific geographical reference.	AMS – III.H./ Version 16 Paragraph 13
14. Measures are limited to those that result in aggregate emissions reductions of less than or equal to 60 kt CO_2 equivalent annually from all	This PoA only includes individual CPAs with aggregate emissions reductions of less than	AMS – III.H./ Version 16 Paragraph 14

[14] Tool to determine the remaining lifetime of equipment, Version 1

Type III components of the project activity.	or equal to 60 kt CO_2 equivalent annually from all Type III components of the project activity.	

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

>>
The project boundary is the physical, geographical site where the wastewater takes place, in the baseline and project situations. It covers all facilities affected by the project activity including sites where processing, transportation and application or disposal of waste products as well as biogas takes place.

Summary of Gases and Sources included in project boundary

	Source	Gas	Included	Justification / Explanation
Baseline	Direct emissions from the wastewater treatment processes	CO_2	No	Excluded for simplification
		CH_4	Yes	Main emission source
		N_2O	No	Excluded for simplification
	Emissions from electrical energy generation	CO_2	Yes	Main emission source
		CH_4	No	Excluded for simplification
		N_2O	No	Excluded for simplification
	Emissions from thermal energy generation	CO_2	Yes	Main emission source
		CH_4	No	Excluded for simplification
		N_2O	No	Excluded for simplification
Project Activity	Biogas recovery system	CO_2	No	Excluded for simplification
		CH_4	Yes	Main emission source
		N_2O	No	Excluded for simplification
	Wastewater treatment processes without biogas recovery	CO_2	No	Excluded for simplification
		CH_4	Yes	Main emission source
		N_2O	No	Excluded for simplification
	Emissions from electrical energy generation	CO_2	Yes	Main emission source
		CH_4	No	Excluded for simplification
		N_2O	No	Excluded for simplification
	Emissions from thermal energy generation	CO_2	Yes	Main emission source
		CH_4	No	Excluded for simplification
		N_2O	No	Excluded for simplification

Leakage emissions associated with CPAs will be accounted for in accordance with the requirements of the baseline and monitoring methodology (s) to be applied to each CPA.

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

>>
The PoA and consequently each CPA applies the simplified baseline methodology for selected small-scale CDM project activities AMS-III.H "Methane recovery in wastewater treatment" Version 16.

A baseline shall be established on a project-specific basis for each CPA. The baseline scenario will be investigated and identified during the feasibility study in the planning stage or before any project activity

decision is confirmed. This will be done at the CPA level. The identified baseline must be in accordance with the procedures provided in the approved small scale baseline and monitoring methodology of AMS-III.H/Version 16 The option taken must be consistent with mandatory applicable laws and regulations. The Small-Scale CDM Programme Activity Design Document (CDM-SSC-CPA-DD) will describe in detail the identified baseline for each CPA.

Historical records of at least one year prior to the project implementation shall be used for baseline data where available. This shall include for example, the COD removal efficiency of the wastewater treatment systems, the amount of dry matter in sludge, power and electricity consumption per cubic meter of wastewater treated, the amount of final sludge generated per tonne of COD removed, and all other parameters required for determination of baseline emissions.

For a wastewater treatment plant that has been operating for at least three years and if one year of historical data is not available, the following procedures shall be followed:

(a) All the available data in determining the required parameters (COD removal efficiency, specific energy consumption and specific sludge production) shall be used to determine the baseline emissions in year *y*;

(b) An *ex ante* measurement campaign shall be implemented to determine the required parameters (COD removal efficiency, specific energy consumption and specific sludge production). The measurement campaign shall be implemented in the baseline wastewater systems for at least 10 days. The measurements should be undertaken during a period that is representative for the typical operation conditions of the systems and ambient conditions of the site (temperature, etc). Average values from the measurement campaign shall be used and the result shall be multiplied by 0.89 to account for the uncertainty range (30% to 50%). The parameters from the measurement campaign are used to calculate the baseline emissions in year *y*;

(c) The baseline emissions in year *y* is taken as the minimum between the result of (a) and (b).

In the case of Greenfield and capacity addition projects, or existing plants without three year operating history, the following procedures shall be used to determine the baseline emissions:

(1) For existing plants without three year operating history, procedures in paragraphs (a), (b) and (c) as above shall be followed;

(2) For Greenfield and capacity addition projects, one of the following procedures shall be used:

(a) Value obtained from a measurement campaign in a comparable existing wastewater treatment plant (i.e. having similar environmental and technological circumstances treating a similar type of wastewater). Average values from the measurement campaign shall be used and the result shall be multiplied by 0.89 to account for the uncertainty range (30% to 50%) associated with this approach. The treatment plant and wastewater source can be considered as similar as the baseline plant, whereby the measurement campaign can be implemented when the following conditions can be fulfilled:

(i) The two sources of wastewater (wastewater treated in the selected plant and from the project activity) are of the same type, e.g. either domestic or industrial wastewater;

(ii) The selected plant and the baseline plants employ the same treatment technology (e.g. anaerobic lagoons or activated sludge), and the hydraulic retention times in their biological and physical treatment systems do not vary by more than 20%; and

(iii) For project activities treating industrial wastewater, both industries have the same raw material and final products, and apply the same industrial technology. Alternatively, different industrial wastewaters may be considered as similar if the following requirements are fulfilled:

- The ratio of COD/BOD (related to the proportion of biodegradable organic matter) does not differ by more than 20%; and
- The ratio of total COD / soluble COD (related to the proportion of suspended organic matter, and therefore to the sludge generation capacity) does not differ by more than 20%.

(b) Value provided by the manufacturer/designer of a Greenfield wastewater treatment plant using the same technology, demonstrated to be conservative, e.g. average values from the top 20 percent plants with lowest emission rate per ton COD removed among the plants installed in the last five years designed for the same country/region to treat the same type of wastewaters as the project activity.

Baseline emissions for the systems affected by the project activity may consist of:

(i) Emissions on account of electricity or fossil fuel used ($BE_{power,y}$);
(ii) Methane emissions from baseline wastewater treatment systems ($BE_{ww,treatment,y}$);
(iii) Methane emissions from baseline sludge treatment systems ($BE_{s,treatment,y}$);
(iv) Methane emissions on account of inefficiencies in the baseline wastewater treatment systems and presence of degradable organic carbon in the treated wastewater discharged into river/lake/sea ($BE_{ww,discharge,y}$);
(v) Methane emissions from the decay of the final sludge generated by the baseline treatment systems ($BE_{s,final,y}$).

The baseline for utilization of biogas recovered from the waste water treatment plant would be determined at CPA level and in line with the requirements of methodology(ies). As per the case specific to CPA, the relevant methodology (i.e either of the methodologies referred in the section E.1 for biogas utilization) would be applied to CPA and appropriate baseline would be identified and established.

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

The additionality of the programme could be demonstrated considering that there are no mandatory regulations and requirements to capture and utilize the methane produced by the anaerobic activity of wastewater in an agro-industry processing plant. The environmental regulations establish only a restriction on discharging the wastewater into water or on land. The common practice for agricultural waste in Indonesia is to use anaerobic lagoons and polishing aerobic lagoons in order to treat the wastewater up to a required level for discharge.

Investment is required to implement a biogas system with an option for biogas utilization. The possible return by generating said renewable energy for either electricity or heat, if applicable, is rather small. As the implementation cost of the project is too great compared to the current low tech lagoon/pond solution which has proved effective, these projects will only be implemented if revenue from CERs supplements any other income sources possible. The palm oil industry's view is that continuation of existing waste water treatment systems requires no additional investment and is already sufficient to comply with the government regulation on effluent discharge; these investors are not interested in financing projects where there is perceived lack of reliability, knowledge and experience and as such technologies are not often seen as an attractive investment option[15].

In addition, the implementation of biogas recovery needs the voluntary coordination of PTGPCS in order to be implemented, as the likely baseline scenario for the agro industry is to continue to use the anaerobic lagoon/pond solution. The PoA is thus implementing a voluntary coordinated action not required by legislation that would not be implemented in the absence of the PoA.

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

>>

Each CPA included in this PoA is a small scale project activity. The Project's additionality will be demonstrated by applying either the "Attachment A to Appendix B" Version 08 or "Non-binding best practise examples to demonstrate additionality for SSC project activities" Version 01. The additionality will be assessed and demonstrated at the CPA level.

Every CPA will provide an explanation showing that the project activity would not have occurred otherwise due to at least one of the following barriers below and it is voluntarily coordinated and would not be implemented in the absence of CDM. The project participants of each CPA shall provide an explanation to show the project activity would not have occurred anyway due to at least one of the following barriers:

1. Investment barrier

   A financially more viable alternative to the project activity would have led to higher emissions. Best practice examples include but are not limited to, the application of investment comparison analysis using a relevant financial indicator, application of a benchmark analysis or a simple cost analysis. It is recommended to use national or global accounting practices and standards for such an analysis.

   Either simple cost analysis, investment comparison analysis or benchmark analysis will be carried out for each CPA to demonstrate that the project is less financially attractive than the baseline. Currently, there are no direct subsidies or promotional support for the implementation of biogas recovery at agro-industry mills or factories in Indonesia. Each CPA is expected to have high costs required to install a biogas recovery system with a flare or a renewable energy generator. Potential revenue from generating electricity or savings due to displacing fossil fuels in heat generation, if applicable, is rather limited based on specific site requirements. Hence, the CPAs are expected to face investment barriers compared to the usual practice of an open anaerobic lagoon/pond system which has been proven to meet the current requirements.

2. Access-to-finance barrier

[15] Global Network on Energy for Sustainable Development, 2007: Renewable energy technologies and poverty alleviation – Overcoming barriers and unlocking potentials

The project activity could not access appropriate capital without consideration of the CDM revenue. Best practice examples include but are not limited to, the demonstration of limited access to capital in the absence of the CDM, such as a statement from the financing bank that the revenue from the CDM are critical in the approval of the loan.

3. Technological barrier

A less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and would have led to higher emissions. Best practice examples include but are not limited to, the demonstration of non-availability of human capacity to operate and maintain the technology, lack of infrastructure to utilize the technology, unavailability of the technology and high level of technology risk.

The proposed project activity may require special expertise or skilled workers with respect to design of the facility, operation, maintenance, operation control (for example: pressure, temperature, flow equipment) of the new proposed technology. The monitoring part as well is very crucial as all monitoring equipment needs to be maintained and calibrated on a regular basis. The system requires constant and ongoing precise management of a variety of elements to maintain its optimum performance. The expertise and skilled workers are not commonly available to the agro-industry, thus requiring external support.

4. Barrier due to prevailing practice

Prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions. Best practice examples include but are not limited to, the demonstration that project is among the first of its kind in terms of technology, geography, sector, type of investment and investor, market etc.

The open anaerobic ponds system is an effective and low-tech solution that can easily meet the water discharge limits applicable to the agro-industry. The existing system which consists of anaerobic/facultative/aerobic lagoons/ponds has been able to meet the current permitted discharge level of biochemical oxygen demand (BOD) set by the Department of Environment Indonesia. Only a few mills or factories have reported the use and operation of a closed-tank anaerobic bioreactor equipped with a biogas recovery system because it is relatively new in Indonesia and not readily acceptable in the agro-industry in Indonesia.

5. Other barriers

Such as institutional barriers or limited information, managerial resources, organizational capacity, or capacity to absorb new technologies.

The investment barrier, technology barrier and barrier due to prevailing practice are the three major barriers faced by agro-industry mill or factory owners in implementing the project activities and based on these barriers, it is sufficient to demonstrate the additionality of a typical CPA. Each CPA's additionality will be assessed individually.

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

>>

PTGPCS as a managing entity will make sure that the proposed CPA is additional and in compliance with Indonesia's policies and regulations.

Each CPA will have to demonstrate additionality based on the following criteria before inclusion in the PoA:

1. Define credible possible alternative scenarios to the project activity. Ensure that the proposed CPA is not the only alternative amongst those considered that is in compliance with mandatory regulations.
2. Determine most relevant barrier in terms of investment analysis and barrier analysis to make sure the project activity is additional.
3. Either simple cost analysis, investment comparison analysis or benchmark analysis will be carried out to demonstrate the additionality of the project.
4. The CPA participation is voluntary and there is no requirement or enforcement under existing national/state/local regulations to introduce or substitute the biogas recovery system.

Every CPA will have to meet all the criteria mentioned above to ensure eligibility to participate in this PoA.

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

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

>>
A typical CPA is eligible as a small-scale project category under the AMS-III.H/Version 16 "Methane recovery in wastewater treatment." The baseline and monitoring methodology of the AMS-III.H/Version 16 is applied to a typical CPA.

There are 4 Tools that can be used as a reference with the AMS-III.H/Version 16 Methodology.

1. Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion, Version 02
   - It can be used in cases where CO_2 emissions from fossil fuel combustion are calculated based on the quantity of fuel combusted and its properties.
2. Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site, Version 06.0.1
   -To calculate emissions of methane from waste that would in the absence of the project activity be disposed at solid waste disposal sites
3. Tool to determine project emissions from flaring gases containing methane, Version 01
   -To calculate project emissions from flaring of a residual gas stream (RG) containing methane.
4. Tool to calculate baseline, project and/or leakage emissions from electricity consumption, Version 01
   -This tool provides procedures to estimate the baseline, project and/or leakage emissions associated with the consumption of electricity.

For utilization of biogas:

The recovered biogas will be either flared in open/closed flare or utilized as per CPA specific case. The utilization of biogas for particular CPA shall choose to use one of the following applicable methodologies as per requirement[16]:

[16] The demonstration of the applicability of the methodology chosen for the utilization of recovered biogas will be included at CPA level. Also, all the data parameters will be included as per the latest version of the methodology chosen for the CPA at the time of CPA inclusion.

For Type I: AMS-I.A, Version 15.0,
AMS-I.C, Version 19.0,
AMS-I.D, Version 17.0,
AMS-I.F, Version 2.0,
For Type III: AMS-III.O, Version 1.0
AMS-III.AQ/Version 1.0.

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

>>

A. Calculation of Baseline Emissions.

Baseline emissions for the systems affected by the project activity may consist of:

(i) Emissions on account of electricity or fossil fuel used ($BE_{power,y}$);
(ii) Methane emissions from baseline wastewater treatment systems ($BE_{ww,treatment,y}$);
(iii) Methane emissions from baseline sludge treatment systems ($BE_{s,treatment,y}$);
(iv) Methane emissions on account of inefficiencies in the baseline wastewater treatment systems and presence of degradable organic carbon in the treated wastewater discharged into river/lake/sea ($BE_{ww,discharge,y}$);
(v) Methane emissions from the decay of the final sludge generated by the baseline treatment systems ($BE_{s,final,y}$).

$$BE_y = \{BE_{power,y} + BE_{ww,treatment,y} + BE_{s,treatment,y} + BE_{ww,discharge,y} + BE_{s,final,y}\} \quad \textbf{(1)}$$

Where:

BE_y	Baseline emissions in year y (tCO_2e)
$BE_{power,y}$	Baseline emissions from electricity or fuel consumption in year y (tCO_2e)
$BE_{ww,treatment,y}$	Baseline emissions of the wastewater treatment systems affected by the project activity in year y (tCO_2e)
$BE_{s,treatment,y}$	Baseline emissions of the sludge treatment systems affected by the project activity in year y (tCO_2e)
$BE_{ww,discharge,y}$	Baseline methane emissions from degradable organic carbon in treated wastewater discharged into sea/river/lake in year y (tCO_2e)
$BE_{s,final,y}$	Baseline methane emissions from anaerobic decay of the final sludge produced in year y (tCO_2e). If the sludge is controlled combusted, disposed in a landfill with biogas recovery, or used for soil application in the baseline scenario, this term shall be neglected

The tool and equations related to the baseline determination

$BE_{power,y}$	Will be determined by using "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" Version 01 and "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion" Version 02, respectively.

$$BE_{ww,treatment,y} = \sum_i (Q_{ww,i,y} * COD_{\inf low,i,y} * \eta_{COD,BL,i} * MCF_{ww,treatment,BL,i}) * B_{o,ww} * UF_{BL} * GWP_{CH4} \quad \textbf{(2)}$$

Where:

$Q_{ww,i,y}$	Volume of wastewater treated in baseline wastewater treatment system i in year y (m^3). For *ex ante* estimation, forecasted wastewater generation volume

	or the designed capacity of the wastewater treatment facility can be used. However, the *ex post* emissions reduction calculation shall be based on the actual monitored volume of treated wastewater
$COD_{\inf low,i,y}$	Chemical oxygen demand of the wastewater inflow to the baseline treatment system *i* in year *y* (t/m^3). Average value may be used through sampling with the confidence/precision level 90/10
$\eta_{COD,BL,i}$	COD removal efficiency of the baseline treatment system *i*, determined as per the paragraphs (A), (B) or (C) in Section E.4 above
$MCF_{ww,treatment,BL,i}$	Methane correction factor for baseline wastewater treatment systems *i* (*MCF* values as per Table III.H.1)
i	Index for baseline wastewater treatment system
$B_{o,ww}$	Methane producing capacity of the wastewater (IPCC value of 0.25 kg CH_4/kg COD)[17]
UF_{BL}	Model correction factor to account for model uncertainties (0.89)[18]
GWP_{CH4}	Global Warming Potential for methane (value of 21)

The Methane Correction Factor (MCF) shall be determined per the following table:

Table III.H.1. IPCC default values[19] for Methane Correction Factor (*MCF*)

Type of wastewater treatment and discharge pathway or system	*MCF* value
Discharge of wastewater to sea, river or lake	0.1
Aerobic treatment, well managed	0.0
Aerobic treatment, poorly managed or overloaded	0.3
Anaerobic digester for sludge without methane recovery	0.8
Anaerobic reactor without methane recovery	0.8
Anaerobic shallow lagoon (depth less than 2 metres)	0.2
Anaerobic deep lagoon (depth more than 2 metres)	0.8
Septic system	0.5

$$BE_{s,treatment,y} = \sum_j S_{j,BL,y} * MCF_{s,treatment,BL,j} * DOC_s * UF_{BL} * DOC_F * F * 16/12 * GWP_{CH4} \quad \textbf{(3)}$$

Where:

$S_{j,BL,y}$	Amount of dry matter in the sludge that would have been treated by the sludge treatment system *j* in the baseline scenario (t)
j	Index for baseline sludge treatment system
DOC_s	Degradable organic content of the untreated sludge generated in the year *y*
$MCF_{s,treatment,BL,j}$	Methane correction factor for the baseline sludge treatment system *j*
UF_{BL}	Model correction factor to account for model uncertainties

[17] Project activities may use the default value of 0.6 kg CH_4/kg BOD, if the parameter $BOD_{5,20}$ is used to determine the organic content of the wastewater. In this case, baseline and project emissions calculations shall use BOD instead of COD in the equations, and the monitoring of the project activity shall be based in direct measurements of $BOD_{5,20}$, i.e. the estimation of BOD values based on COD measurements is not allowed.

[18] Reference: FCCC/SBSTA/2003/10/Add.2, page 25.

[19] Default values from chapter 6 of volume 5. Waste in 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

DOC_F	Fraction of DOC dissimilated to biogas
F	Fraction of CH_4 in biogas

If the sludge is composted, the following equation shall be applied:

$$BE_{s,treatment,y} = \sum_j S_{j,BL,y} * EF_{composting} * GWP_{CH4} \quad \textbf{(4)}$$

Where:

$EF_{composting}$	Emission factor for composting of organic waste (tCH_4/t waste treated). Emission factors can be based on facility/site-specific measurements, country specific values or IPCC default values.

If the baseline wastewater treatment system is different from the treatment system in the project scenario, the sludge generation rate (amount of sludge generated per unit of COD removed) in the baseline may differ significantly from that of the project scenario. Therefore, for these cases, the monitored values of the amount of sludge generated during the crediting period will be used to estimate the amount of sludge generated in the baseline, as follows:

$$S_{j,BL,y} = S_{l,PJ,y} * \frac{SGR_{BL}}{SGR_{PJ}} \quad \textbf{(5)}$$

Where:

$S_{l,PJ,y}$	Amount of dry matter in the sludge treated by the sludge treatment system *l* in year *y* in the project scenario (t)
SGR_{BL}	Sludge generation ratio of the wastewater treatment plant in the baseline scenario (t of dry matter in sludge / t COD removed). This ratio will be measured *ex ante* through representative measurement campaign, or using historical records of COD removal and sludge generation of at least one year prior to the project implementation as per paragraph 18 or 19 of AMS-III.H./Version 16
SGR_{PJ}	Sludge generation ratio of the wastewater treatment plant in the project scenario (t of dry matter in sludge / t COD removed). Calculated using the monitored values of COD removal and sludge generation in the project scenario

$$BE_{ww,discharge,y} = Q_{ww,y} * GWP_{CH4} * B_{o,ww} * UF_{BL} * COD_{ww,discharge,BL,y} * MCF_{ww,BL,discharge} \quad \textbf{(6)}$$

Where:

$Q_{ww,y}$	Volume of treated wastewater discharged in year *y* (m^3)
UF_{BL}	Model correction factor to account for model uncertainties
$COD_{ww,discharge,BL,y}$	Chemical oxygen demand of the treated wastewater discharged into sea, river or lake in the baseline situation in the year *y* (t/m^3)
$MCF_{ww,BL,discharge}$	Methane correction factor based on discharge pathway in the baseline situation (e.g., into sea, river or lake) of the wastewater

$$BE_{s,final,y} = S_{final,BL,y} * DOC_s * UF_{BL} * MCF_{s,BL,final} * DOC_F * F * 16/12 * GWP_{CH4} \quad \textbf{(7)}$$

Where:

$S_{final,BL,y}$	Amount of dry matter in final sludge generated by the baseline wastewater treatment systems in the year *y* (t)
$MCF_{s,BL,final}$	Methane correction factor of the disposal site that receives the final sludge in the

baseline situation, estimated as per the procedures described in AMS-III.G/Version 7.0

UF_{BL} Model correction factor to account for model uncertainties

For utilization of Biogas:

The following baselines emissions are accounted for utilization of biogas which will be specific to CPA and will be included as per the requirement of the particular CPA:

1. For AMS.I.A (version 15)

Baseline Emissions:

The energy baseline is the fuel consumption of the technology in use or that would have been used in the absence of the project activity to generate the equivalent quantity of energy, estimated using one of the following options which will be CPA specific:

(a) Option 1: the energy baseline will be calculated based on the average annual electricity consumption of the consumers as per the below formula:

$$E_{BL,y} = \sum_i \left(n_i * EC_{i,y}\right) / \left(1 - l\right)$$

Where:

$E_{BL,y}$ Annual energy baseline; kWh

$\sum_i$ The sum over the group of *i* renewable energy technologies (e.g. renewable energy technologies for households, rural health centres, rural schools, grain milling, water pumping, irrigation, etc.) implemented as part of the project activity

n_i Number of consumers supplied by installations of the renewable energy technology belonging to the group of *i* renewable energy technologies during the year

$EC_{i,y}$ Average annual individual energy consumption observed in closest grid electricity systems among rural grid connected consumers belonging to the same group of *i* renewable energy technologies.

L Average technical distribution losses that would have been observed in diesel powered mini-grids installed by public programmes or distribution companies in isolated areas, expressed as a fraction

(b) Option 2 - The energy baseline will be calculated based on annual electricity generation from project renewable energy technologies as per the below formulae:

$$E_{BL,y} = \sum_i EG_{i,y} / \left(1 - l\right)$$

Where:

$E_{BL,y}$ Annual energy baseline; kWh

$\sum_i$ The sum over the group of *i* renewable energy technologies implemented as part of the project activity

$EG_{i,y}$ Annual output of the renewable energy technologies of the group of *i* renewable energy technologies installed; kWh

L Average technical distribution losses that would have been observed in diesel powered mini-grids installed by public programmes or distribution companies in isolated areas, expressed as a fraction

Thus,

$$BE_{CO2,y} = E_{BL,y} * EF_{CO2}$$

Where:

$BE_{CO2,y}$	Emissions in the baseline in year *y*; tCO_2
$E_{BL,y}$	Annual energy baseline in year *y*; kWh
EF_{CO2}	CO_2 emission factor; tCO_2/kWh

(c) Option 3: The emissions baseline is the historic fuel consumption above times the CO_2 emission factor for the fuel displaced.

$$BE_{CO2,y} = \sum_j FC_{j,y} * NCV_j * EF_{CO2,j}$$

Where:

$BE_{CO2,y}$	Emissions in the baseline in year *y*; tCO_2
$FC_{j,y}$	Amount of fuel consumption of fuel type *j*; mass or volume unit in year *y*
NCV_j	Net calorific value of fuel type *j*; gigajoule per mass or volume unit
$EF_{CO_2,j}$	CO_2 emission factor of fuel type *j*; tCO_2/GJ
J	Fuel type used for combustion

2. For AMS.I.C (version 19)

Case 1:
Baseline Emissions for steam/heat produced using fossil fuels the baseline emissions will be calculated at CPA level as follows**:**

$$BE_{thermal,CO_2,y} = (EG_{thermal,y} / \eta_{BL,thermal}) * EF_{FF,CO_2}$$

Where:

$BE_{thermal,CO_2,y}$	The baseline emissions from steam/heat displaced by the project activity during the year *y* (tCO_2)
$EG_{thermal,y}$	The net quantity of steam/heat supplied by the project activity during the year *y* (TJ)
EF_{FF,CO_2}	The CO_2 emission factor of the fossil fuel that would have been used in the baseline plant obtained from reliable local or national data if available, alternatively, IPCC default emission factors can be used (tCO_2/TJ)
$\eta_{BL,thermal}$	The efficiency of the plant using fossil fuel that would have been used in the

absence of the project activity

Case 2:
Baseline Emissions for electricity produced in captive plants will be calculated at CPA level as follows:

$$BE_{captelec,y} = (EG_{captelec,PJ,y} / \eta_{BL,captive\ plant}) * EF_{BL,FF,CO_2}$$

Where:

$BE_{captelec,y}$	The baseline emissions from electricity displaced by the project activity during the year *y* (tCO_2)
$EG_{captelec,PJ,y}$	The amount of electricity produced by the project activity during the year *y* (MWh)
EF_{BL,FF,CO_2}	The CO_2 emission factor of the fossil fuel that would have been used in the baseline plant obtained from reliable local or national data if available; alternatively, IPCC default emission factors can be used (tCO_2/MWh)
$\eta_{BL,captive\ plant}$	The efficiency of the plant using fossil fuel that would have been used in the absence of the project activity

Baseline emissions for supply of electricity to and/or displacement of electricity from a grid shall be calculated as per the procedures detailed in AMS-I.D or AMS-I.F as applicable.

Case 3:

Baseline Emissions for for electricity and thermal energy (steam/heat) produced in a baseline cogeneration unit, will be calculated at CPA level as follows:

$$BE_{cogen,CO_2,y} = [(EG_{PJ,thermal,y} + EG_{PJ,electrical,y} * 3.6) / \eta_{BL,cogen}] * EF_{FF,CO_2}$$

Where:

$BE_{cogen,CO_2,y}$	Baseline emissions from electricity and thermal energy displaced by the project activity during the year *y* (tCO_2)
$EG_{PJ,electrical,y}$	The amount of electricity supplied by the project activity during the year *y*; GWh
3.6	Conversion factor (TJ/GWh)
$EG_{PJ,thermal,y}$	The net quantity of thermal energy supplied by the project activity during the year *y* (TJ)
EF_{FF,CO_2}	The CO_2 emission factor of the fossil fuel that would have been used in the baseline cogeneration plant obtained from reliable local or national data if available, alternatively, IPCC default emission factors can be used-(tCO_2/TJ)
$\eta_{BL,cogen}$	The total annual average efficiency of the cogeneration plant using fossil fuel determined in accordance with paragraphs 28 and 29 in AMS IC version 19.

Case 4:
Baseline Emissions for *for co-fired systems* will be calculated at CPA level as follows:

$$BE_{cofire,CO_2,y} = (EG_{cofire,PJ,y} / \eta_{BL,cofire}) * EF_{cofire,CO_2}$$

Where:

$BE_{cofire,CO_2,y}$	The baseline emissions from thermal and/or electrical energy displaced by the project activity during the year *y* (tCO_2e)
$EG_{cofire,PJ,y}$	The net quantity of energy (electricity/thermal) supplied by the project activity during the year *y* (TJ)
EF_{cofire,CO_2}	CO_2 emission factor of the baseline co-fired plant established using three years average historical data (tCO_2/TJ). In the case where more than one fossil fuel is used by the co-fired plant, the weighted average emission factor (in energy basis) among the identified fossil fuels shall be used
$\eta_{BL,cofire}$	The efficiency of the co-fired plant that would have been used in the absence of the project activity

Case 5:

Baseline emissions for retrofit project activities will be calculated at CPA level as follows

$$EG_{BL,thermal,retrofit,y} = MAX\left(EG_{HY,thermal,retrofit,y}, EG_{estimated,thermal,y}\right) \quad until \quad DATE_{BaselineRretrofit}$$

Where:

$EG_{BL,thermal,retrofit,y}$	Thermal energy production by an existing facility in the absence of the project activity in year *y* (TJ)
$EG_{HY,thermal,retrofit,y}$	Average of historical thermal energy levels delivered by the existing facility, spanning all data from the most recent available year (or month, week or other time period) to the time at which the facility was constructed, retrofitted, or modified in a manner that significantly affected output (i.e. by 5% or more) (TJ)
$EG_{estimated,thermal,y}$	Estimated thermal energy that would have been produced by the existing units under the observed availability of renewable resources in year *y* (TJ)
$DATE_{BaselineRretrofit}$	Date at which the existing generation facility is likely to be replaced or retrofitted in the absence of the CDM project activity

Case 6:

For project activities that seek to retrofit or modify an existing facility to enhance the energy conversion efficiency, the baseline emissions $BE_{retrofit,CO_2,y}$ will be calculated at CPA level as follows:

$$BE_{retrofit,CO2,y} = \left(EG_{thermal,retrofit,y} - EG_{BL,thermal,retrofit,y}\right) * EF_{FF,CO2}$$

Where:

$BE_{retrofit,CO2,y}$	Baseline emissions from the incremental thermal energy supplied due to

	retrofit (tCO_2)
$EG_{thermal,retrofit,y}$	Thermal energy supplied by the project activity (after retrofit) in year *y* (TJ)
$EG_{BL,thermal,retrofit,y}$	Thermal energy production by an existing facility in the absence of the project activity (before retrofit) in year *y* (TJ)
$EF_{FF,CO2}$	The CO_2 emission factor of the fossil fuel that would have been used in the baseline plant to generate the incremental energy obtained from reliable local or national data if available, alternatively, IPCC default emission factors can be used (tCO_2/TJ)

Case 7: Baseline emissions for project activities with capacity less than 45 kW thermal will be calculated at CPA level as follows:

$$BE_y = [HG_{PJ,y} / \eta_{BL}] * EF_{FF,CO2}$$
$$= \{[B_{biomass,PJ,y} * NCV_{biomass} * \eta_{PJ}] / \eta_{BL}\} * EF_{FF,CO2}$$

Where:

BE_y	The baseline emissions from thermal energy displaced by the project activity using renewable biomass during the year *y* (tCO_2)
$HG_{PJ,y}$	The net quantity of thermal energy supplied by the project activity using renewable biomass during the year *y* (TJ)
η_{BL}	Efficiency of the baseline equipment being replaced (determined as per paragraph 30 or 31 of AMS 1 C version 19
η_{PJ}	Efficiency of the project equipment measured using representative sampling methods or based on referenced literature values. The efficiency tests shall be conducted following the guidance provided in the relevant national/international standards
$EF_{FF,CO2}$	The CO_2 emission factor of the fossil fuel that would have been used in the baseline (tCO_2/TJ)
$B_{biomass,PJ,y}$	The net quantity of the biomass consumed in year *y* (tons)
$NCV_{biomass}$	The net calorific value of the biomass (TJ/tons)

3. For AMS.I.D (version 17)

Case 1:
Baseline Emissions for renewable energy units that supply electricity to grid will be calculated at CPA level as follows:

$$BE_y = EG_{BL,y} * EF_{CO_2,y}$$

Where:

BE_y	Baseline Emissions in year *y* (t CO_2)
$EG_{BL,y}$	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh)
$EF_{CO2,grid,y}$	CO_2 emission factor of the grid in year *y* (t CO_2/MWh)

Case 2:
Baseline Emissions for Retrofit of renewable energy units will be calculated at CPA level as follows:

$$BE_{retrofit,CO2,y} = \left(EG_{PJ,retrofit,y} - EG_{BL,retrofit,y}\right) * EF_{CO2}$$

Where:

$$EG_{BL,retrofit,y} = MAX\left(EG_{historical}, EG_{estimated,y}\right) \; until \; DATE_{BaselineRretrofit}$$

$$EG_{BL,retrofit,y} = 0 \; on/after \; DATE_{BaselineRretrofit}$$

Where:

$BE_{retrofit,CO_2,y}$	The baseline emissions in year *y* (t CO_2)
$EG_{PJ,retrofit,y}$	Net electricity supplied by the plant/unit to the grid in year *y* (MWh)
$EG_{BL,retrofit,y}$	Electricity that would have been supplied by the plant/unit to the grid in the absence of the project activity in year *y* (MWh)
$EG_{historical}$	Annual average historical net electricity supplied to the grid by the existing renewable energy plant that was operated at the project site prior to the implementation of the project activity (MWh) Average of historical net electrical energy levels delivered by the existing facility, spanning all data from the most recent available year (or month, week or other time period) to the time at which the facility was constructed, retrofit, or modified in a manner that significantly affected output (i.e. by 5% or more), shall be used. A minimum of three years of data is required. In the case that three years of historical data are not available e.g. due to recent retrofits or exceptional circumstances - a new methodology or methodology revision shall be proposed
$EG_{estimated,y}$	Estimated net electrical energy that would have been produced by the existing units under the observed availability of the renewable resource in year *y* (MWh)
$DATE_{BaselineRretrofit}$	Point in time when the existing equipment would need to be replaced in the absence of the project activity (date)

Case 3:
Baseline Emissions for capacity addition renewable energy units will be calculated at CPA level as follows:

The baseline emissions ($BE_{add,CO_2,y}$) are calculated as:

$$BE_{add,CO2,y} = \left(EG_{PJ,add,y} - EG_{BL,exisiting,y}\right) * EF_{CO2}$$

Where:

$EG_{PJ,add,y}$	The total net electrical energy supplied to a grid in year *y* by all units, existing and new project units; (MWh)
$EG_{BL,existing,y}$	The estimated net electrical energy that would have been produced and supplied to a grid by existing units (installed before the project activity) in year *y* in the absence of the project activity; (MWh)

Where:

$$EG_{BL,existing,y} = MAX(EG_{actual,y}, EG_{estimated,y}) until \ \ DATE_{BaselineRretrofit}$$

and

$EG_{BL,existing,y} = 0$; on/after $DATE_{BaselineRetrofit}$

Where:

$EG_{actual,y}$	The actual, measured net electrical energy produced and supplied to the grid by the existing units in year *y* (MWh)

If the existing units shut down, are derated, or otherwise become limited in production, the project activity should not get credit for generating electricity from the same renewable resources that would have otherwise been used by the existing units (or their replacements). Therefore, the equation for $EG_{BLexisting,y}$ still holds, and the value for $EG_{estimated,y}$ should continue to be estimated assuming the capacity and operating parameters are the same as that at the time of the start of the project activity.

4. For AMS.I.F (version 2)

The baseline emission under AMS I.F would be accounted at CPA level by using the below formula:

$$BE_y = EG_{BL,y} * EF_{CO_2,y}$$

Where:

BE_y	Baseline emissions in year *y* (t CO_2)
$EG_{BL,y}$	Quantity of net electricity displaced as a result of the implementation of the CDM project activity in year *y* (MWh)

$EF_{CO2,y}$ Emission factor (tCO_2/MWh)

- Emission factor of a grid shall be calculated as per the procedures provided in AMS-I.D;
- For a mini-grid system other than described in paragraph 13 above, the baseline emission factor shall be determined as per the weighted average emissions for the current generation mix following the procedure provided in AMS-I.D;
- Emission factor for captive electricity generation shall be calculated as per the procedures described in the latest version of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption"

5. For AMS.III.O (version 1)

Baseline Emissions:

The baseline emissions are calculated as the summation of the following:

(a) CO_2 generated in reactions of LPG (displaced by methane extracted from biogas in the project scenario) as feedstock during the steam-reforming/shift-reaction;

(b) CO_2 generated in the combustion process of LPG (displaced by methane extracted from biogas in the project scenario) as fuel to the reactors.

(a) CO_2 generated in reactions of LPG as feedstock during the steam-reforming/shift-reaction is determined as follows:

$$BE_{LPG_FEED} = R_{CO2/H2} \times m_{H2,BIO} \times MW_{CO2} \times C_1$$

Where:

BE_{LPG_FEED}	Annual baseline CO_2 emissions from the displaced LPG feedstock in the hydrogen production unit (tCO_2e)
$R_{CO2/H2}$	CO_2 generation potential per mol of hydrogen produced with LPG as feedstock (kmol-CO_2/kmol-H_2)
$m_{H2,BIO}$	Molar quantity of hydrogen produced annually from methane extracted from biogas (kmol-H_2)
MW_{CO2}	Molecular weight of CO_2
C_1	Conversion factor kilograms to tonnes

For 100 mol of LPG mixture containing m_1 mol of propane and m_2 mol of butane and as per

para 10 and 11, the reaction G in Table III.O-2, the *hydrogen production potential per mol of LPG* is defined as:

$$R_{H2/LPG} = \frac{\lfloor 10m_1 + 13m_2 \rfloor}{100}$$

and the *CO_2 generation potential per mol of hydrogen produced* is defined as:

$$R_{CO2/H2} = \frac{\lfloor 3m_1 + 4m_2 \rfloor}{[10m_1 + 13m_2]}$$

(b) The CO_2 emissions from LPG combusted, as fuel in the reactors in the baseline shall be calculated as follows on:

(i) The specific fuel consumption of the hydrogen production unit using LPG as fuel

(ii) The amount of hydrogen produced using methane extracted from biogas as fuel

$$BE_{LPG_FUEL} = SFC_{LPG} \times V_{H2,BIO} \times EF_{LPG} \times C_3$$

Where:

BE_{LPG_FUEL}	Annual baseline CO_2 emission from LPG used as fuel in the reactors that is displaced by methane extracted from biogas in the project scenario (tCO_2 e).
SFC_{LPG}	Specific fuel consumption of the hydrogen production unit using LPG as fuel (kg-LPG/Nm^3-H_2)
$V_{H2,BIO}$	Volume of hydrogen produced from methane extracted from biogas under normal condition. (Nm^3-H_2) annually
EF_{LPG}	Emission factor of LPG based on (a) evaluation of carbon content of LPG or (b) IPCC default value (kg-CO_2/kg LPG)
C_3	Conversion factor kilograms to tones

The molar amount of hydrogen produced from methane extracted from biogas ($m_{H2,BIO}$) is calculated as the difference between the total molar amount of hydrogen produced ($m_{H2,T}$) and the molar amount of hydrogen produced from the stand-by LPG ($m_{H2,LPG}$)

$$m_{H2,BIO} = m_{H2,T} - m_{H2,LPG}$$

Where:

$m_{H2,BIO}$	Molar amount of hydrogen produced from methane extracted from biogas annually (kmol-H_2)
$m_{H2,T}$	Total molar amount of hydrogen produced annually. This parameter shall be based on monitoring of volume of hydrogen produced by the hydrogen production unit. If the volume is reported as normal volume, the equivalent molar amount can be calculated using ideal gas relationship (kmol-H_2)
$m_{H2,LPG}$	Molar amount of hydrogen produced from LPG annually (kmol-H_2).

The molar amount of hydrogen produced from LPG ($m_{H2,LPG}$) should be calculated through monitored amount of LPG used as feedstock to the reaction (M_{LPG}) multiplied by the hydrogen production potential

$$m_{H2,LPG} = R_{H2/LPG} \times \frac{M_{LPG}}{MW_{LPG}}$$

$$MW_{LPG} = m_1 \times MW_{C3H8} + m_2 \times MW_{C4H10}$$

Where:

$m_{H2,LPG}$	Molar amount of hydrogen produced from LPG annually (kmol-H_2)
$R_{H2/LPG}$	Hydrogen production potential (kmol H_2/kmol-LPG)
M_{LPG}	Mass of LPG used as reaction feedstock annually (kg-LPG)
MW_{LPG}	Molecular weight of LPG (kg-LPG/kmol-LPG)
m_1	% mol of propane in LPG (mol/mol)
MW_{C3H8}	Molecular weight of propane (kg/kmol)
m_2	% mol of butane in LPG (mol/mol)
MW_{C4H10}	Molecular weight of butane (kg/kmol)

The amount of molecules per volume of low-pressure gas is defined by '*ideal gas*' relationship

$$P_N.V_N = m_{H2}.R.T_N.C_2$$

Where:

$V_{N,H2}$	Normalized volume of hydrogen produced annually (Nm^3)
P_N	Pressure in Pascal at normal condition (Pa)
T_N	Temperature in Kelvin at normal condition (K)
R	Gas constant in SI Unit ($Pa.m^3.mol^{-1}.K^{-1}$)
C_2	Conversion factor kmol to mol
m_{H2}	Molar amount of hydrogen produced (kmol)

6. For AMS.III.AQ (version 1)

Baseline Emissions:

Baseline emissions are calculated based on either of the 2 cases as described below which will be considered at CPA level.

Case 1:

Baseline emissions are calculated based on the amount of Bio-CNG produced and distributed to the retailers and/or CNG filling stations as follows:

When the vehicles are not included in the project boundary and it is conservatively assumed that all Bio-CNG produced will displace CNG from fossil origin and the baseline emissions are calculated as follows:

$$BE_y = FS_{Bio-CNG,y} \times NCV_{Bio-CNG} \times EF_{CO2,CNG}$$

Where:

$FS_{Bio-CNG,y}$	Amount of Bio-CNG distributed/sold directly to retailers, filling stations by the project activity in year *y* (tons)
$EF_{CO2,CNG}$	CO_2 emission factor of CNG (tCO_2e/GJ), determined using reliable local or national data. IPCC default values (lower value of 95% CI) shall be used only when country or project specific data are not available or demonstrably difficult to obtain.
$NCV_{Bio-CNG}$	Net calorific value of Bio-CNG (GJ/ton)

The condition applicable under the case 1 is:

$$FS_{Bio-CNG,y} \leq FP_{Bio-CNG,y}$$

Where:

$FP_{Bio-CNG,y}$	Quantity of the Bio-CNG produced by the project activity in the year *y* (tons)

<u>Case 2:</u>

In cases where the project activity also undertakes the conversion of gasoline vehicles including those vehicles in the project boundary, the baseline emission calculations are calculated as below:

Total baseline emissions for case 2 are calculated on an annual basis as below:

$$BE_y = \sum_k FC_{gasoline,k,y} \times NCV_{gasoline} \times EF_{CO2,gasoline}$$

Where:

BE_y	Total baseline emission in year *y* (tCO_2e)
$NCV_{gasoline}$	Net calorific value of gasoline (GJ/ton), determined using reliable local or national data
$EF_{CO2,gasoline}$	CO_2 emission factor of gasoline (tCO_2e/GJ)
$FC_{gasoline,k,y}$	Amount of gasoline of fossil origin which would have been consumed in the baseline by vehicle *k* in the year *y* (tons)

$$FC_{gasoline,k,y} = FC_{Bio-CNG,k,y} \times \frac{NCV_{Bio-CNG}}{NCV_i} \times n \times f_{FO,gasoline}$$

Where:

$FC_{Bio-CNG,k,y}$	Bio-CNG consumed by the project vehicle *k* in the year *y* (tons)
$NCV_{Bio-CNG}$	Net calorific value of Bio-CNG (GJ/ton)
NCV_i	Net calorific value of gasoline (GJ/ton) that was used by project vehicle *k*. In case the gasoline is blended with biofuels the NCV of the blended gasoline shall be used.
N	Discount factor to account for the possible drop in the fuel efficiency of the retrofitted Bio-CNG vehicles.

$f_{FO,gasoline}$ Fraction of gasoline of fossil fuel origin. 1.0 if pure gasoline has been displaced. In cases where national regulations require mandatory blending of the fuels with biofuels then the fraction of gasoline (on mass basis) in the blend should be applied

The condition applicable under the case 2 is:

$$\sum FC_{Bio-CNG,k,y} \leq FP_{Bio-CNG,y}$$

Where:

$\sum FC_{Bio-CNG,k,y}$ Total consumed Bio-CNG by all project vehicles in year *y* (tons)

B. Calculation of Project Emissions

Project emissions from the systems affected by the project activity are:

(i) CO_2 emissions from electricity and fuel used by the project facilities ($PE_{power,y}$);

(ii) Methane emissions from wastewater treatment systems affected by the project activity, and not equipped with biogas recovery in the project scenario ($PE_{ww,treatment,y}$);

(iii) Methane emissions from sludge treatment systems affected by the project activity, and not equipped with biogas recovery in the project scenario ($PE_{s,treatment,y}$);

(iv) Methane emissions due to inefficiency of the project activity wastewater treatment systems and presence of degradable organic carbon in treated wastewater ($PE_{ww,discharge,y}$);

(v) Methane emissions from the decay of the final sludge generated by the project activity treatment systems ($PE_{s,final,y}$);

(vi) Methane fugitive emissions on account of inefficiencies in capture systems ($PE_{fugitive,y}$);

(vii) Methane emissions due to incomplete flaring ($PE_{flaring,y}$);

(viii) Methane emissions from biomass stored under anaerobic conditions which would not have occurred in the baseline situation ($PE_{biomass,y}$).

$$PE_y = \begin{Bmatrix} PE_{power,y} + PE_{ww,treatment,y} + PE_{s,treatment,y} + PE_{ww,discharge,y} + PE_{s,final,y} + \\ PE_{fugitive,y} + PE_{biomass,y} + PE_{flaring,y} \end{Bmatrix} \quad \textbf{(8)}$$

Where:

PE_y Project activity emissions in the year *y* (tCO_2e)

$PE_{power,y}$ Emissions from electricity or fuel consumption in the year *y* (tCO_2e)

$PE_{ww,treatment,y}$ Methane emissions from wastewater treatment systems affected by the project activity, and not equipped with biogas recovery, in year *y* (tCO_2e). These emissions shall be calculated as per equation 2, using an uncertainty factor of 1.12 and data applicable to the project situation ($MCF_{ww,treatment,PJ,k}$ and $\eta_{,PJ,k,y}$) and with the following changed definition of parameters:

$MCF_{ww,treatment,PJ,k}$	Methane correction factor for project wastewater treatment system *k* (*MCF* values as per Table III.H.1)
$\eta_{,PJ,k,}$	Chemical oxygen demand removal efficiency of the project wastewater treatment system *k* in year *y* (t/m^3), measured based on inflow COD and outflow COD in system *k*
$PE_{s,treatment,y}$	Methane emissions from sludge treatment systems affected by the project activity, and not equipped with biogas recovery, in year *y* (tCO_2e). These emissions shall be calculated as per equations 3 and 4, using an uncertainty factor of 1.12 and data applicable to the project situation ($S_{l,PJ,y}$, $MCF_{s,treatment,l}$) and with the following changed definition of parameters:
$S_{l,PJ,y}$	Amount of dry matter in the sludge treated by the sludge treatment system *l* in the project scenario in year *y* (t)
$MCF_{s,treatment,l}$	Methane correction factor for the project sludge treatment system l (*MCF* values as per Table III.H.1)
$PE_{ww,discharge,y}$	Methane emissions from degradable organic carbon in treated wastewater in year *y* (tCO_2e). These emissions shall be calculated as per equation 6, using an uncertainty factor of 1.12 and data applicable to the project conditions ($COD_{ww,discharge,PJ,y}$, $MCF_{ww,PJ,discharge}$) and with the following changed definition of parameters:
$COD_{ww,discharge,PJ,y}$	Chemical oxygen demand of the treated wastewater discharged into the sea, river or lake in the project scenario in year *y* (t/m^3)
$MCF_{ww,PJ,discharge}$	Methane correction factor based on the discharge pathway of the wastewater in the project scenario (e.g. into sea, river or lake) (*MCF* values as per Table III.H.1)
$PE_{s,final,y}$	Methane emissions from anaerobic decay of the final sludge produced in year *y* (tCO_2e). These emissions shall be calculated as per equation 7, using an uncertainty factor of 1.12 and data applicable to the project conditions ($MCF_{s,PJ,final}$, $S_{final,PJ,y}$). If the sludge is controlled combusted, disposed in a landfill with biogas recovery, or used for soil application in aerobic conditions in the project activity, this term shall be neglected, and the sludge treatment and/or use and/or final disposal shall be monitored during the crediting period with the following revised definition of the parameters:
$MCF_{s,PJ,final}$	Methane correction factor of the disposal site that receives the final sludge in the project situation, estimated as per the procedures described in the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" Version 06.0.1
$S_{final,PJ,y}$	Amount of dry matter in final sludge generated by the project wastewater treatment systems in the year *y* (t)
$PE_{fugitive,y}$	Methane emissions from biogas release in capture systems in year *y* (tCO_2e)
$PE_{flaring,y}$	Methane emissions due to incomplete flaring in year *y* (tCO_2e). For *ex ante* estimation, baseline emission calculation for wastewater and/or sludge treatment (i.e. equation 2 and/or equation 3) can be used but without the consideration of GWP for CH_4. However, the *ex post* emission reduction shall be calculated as per the "Tool to determine project emissions from flaring gases containing methane" Version 01 by using actual monitored data
$PE_{biomass,y}$	Methane emissions from biomass stored under anaerobic conditions. In case storage of biomass under anaerobic conditions takes place in the project and does not occur in the baseline, methane emissions due to anaerobic decay of this biomass shall be considered and be determined as per the procedure in the "Tool to determine methane emissions avoided from disposal of waste at a solid waste

disposal site" Version 06.0.1 (tCO_2e)

The tools and equations related to the Project Activity Emission determination

$PE_{power,y}$ Will be determined by using "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" Version 01

$$PE_{ww,treatment,y} = \sum_i (Q_{ww,k,y} * COD_{\inf low,k,y} * \eta_{COD,PJ,k} * MCF_{ww,treatment,PJ,k}) * B_{o,ww} * UF_{PJ} * GWP_{CH4} \quad \textbf{(9)}$$

Where:

$Q_{ww,k,y}$	Volume of wastewater treated in project wastewater treatment system *k* in year *y* (m^3)
$COD_{inlow,k,y}$	Chemical oxygen demand of the wastewater inflow to the treatment system *k* in year *y* (t/m^3). Average value may be used through sampling with the confidence/precision level 90/10
$MCF_{ww,treatment,PJ,k}$	Methane correction factor for project wastewater treatment system *k*
k	Index for project wastewater treatment system
$B_{o,ww}$	Methane producing capacity of the wastewater
UF_{PJ}	Model correction factor to account for model uncertainties
GWP_{CH4}	Global Warming Potential for methane
$\eta_{COD,PJ,k}$	COD removal efficiency of the treatment system *k*, determined

$$PE_{s,treatment,y} = \sum_l S_{l,PJ,y} * MCF_{s,treatment,PJ,l} * DOC_s * UF_{PJ} * DOC_F * F * 16/12 * GWP_{CH4} \quad \textbf{(10)}$$

Where:

$S_{l,PJ,y}$	Amount of dry matter in the sludge treated by the sludge treatment system *l* in the project scenario in year *y* (t)
l	Index for project sludge treatment system
DOC_s	Degradable organic content of the untreated sludge generated in the year *y*
$MCF_{s,treatment,PJ,l}$	Methane correction factor for the project sludge treatment system *l*
UF_{PJ}	Model correction factor to account for model uncertainties
DOC_F	Fraction of DOC dissimilated to biogas
F	Fraction of CH_4 in biogas

If the sludge is composted, the following equation shall be applied:

$$PE_{s,treatment,y} = \sum_l S_{l,PJ,y} * EF_{composting} * GWP_{CH4} \quad \textbf{(11)}$$

Where:

$EF_{composting}$	Emission factor for composting organic waste (tCH_4/t waste treated). Emission factors can be based on facility/site-specific measurements, country specific values or IPCC default values

$$PE_{ww,discharge,y} = Q_{ww,y} * GWP_{CH4} * B_{o,ww} * UF_{PJ} * COD_{ww,discharge,PJ,y} * MCF_{ww,PJ,discharge} \quad \textbf{(12)}$$

Where:

$Q_{ww,y}$	Volume of treated wastewater discharged in year *y* (m^3)
UF_{PJ}	Model correction factor to account for model uncertainties
$COD_{ww,discharge,PJ,y}$	Chemical oxygen demand of the treated wastewater discharged into the sea, river or lake in the project scenario in year *y* (t/m^3)
$MCF_{ww,PJ,discharge}$	Methane correction factor based on the discharge pathway of the wastewater in the project scenario (e.g. into sea, river or lake)

$$PE_{s,final,y} = S_{final,PJ,y} * DOC_s * UF_{PJ} * MCF_{s,PJ,final} * DOC_F * F * 16/12 * GWP_{CH4} \quad \textbf{(13)}$$

Where:

$S_{final,PJ,y}$	Amount of dry matter in final sludge generated by the project wastewater treatment systems in the year *y* (t)
$MCF_{s,PJ,final}$	Methane correction factor of the disposal site that receives the final sludge in the project situation, estimated as per the procedures described in AMS-III.G/Version 7.0
UF_{PJ}	Model correction factor to account for model uncertainties

$$PE_{fugitive,y} = PE_{fugitive,ww,y} + PE_{fugitive,s,y} \quad \textbf{(14)}$$

Where:

$PE_{fugitive,ww,y}$	Fugitive emissions through capture inefficiencies in the anaerobic wastewater treatment systems in the year *y* (tCO_2e)
$PE_{fugitive,s,y}$	Fugitive emissions through capture inefficiencies in the anaerobic sludge treatment systems in the year *y* (tCO_2e)

$$PE_{fugitive,ww,y} = (1 - CFE_{ww}) * MEP_{ww,treatment,y} * GWP_{CH4} \quad \textbf{(15)}$$

Where:

CFE_{ww}	Capture efficiency of the biogas recovery equipment in the wastewater treatment systems
$MEP_{ww,treatment,y}$	Methane emission potential of wastewater treatment systems equipped with biogas recovery system in year *y* (t)

$$MEP_{ww,treatment,y} = Q_{ww,y} * B_{o,ww} * UF_{PJ} * \sum_k COD_{removed,PJ,k,y} * MCF_{ww,treatment,PJ,k} \quad \textbf{(16)}$$

Where:

$COD_{removed,PJ,k,y}$	The chemical oxygen demand removed by the treatment system *k* of the project activity equipped with biogas recovery in the year *y* (t/m^3)
$MCF_{ww,treatment,PJ,k}$	Methane correction factor for the project wastewater treatment system *k* equipped with biogas recovery equipment
UF_{PJ}	Model correction factor to account for model uncertainties

$$PE_{fugitive,s,y} = (1 - CFE_s) * MEP_{s,treatment,y} * GWP_{CH4} \quad \textbf{(17)}$$

Where:

CFE_s	Capture efficiency of the biogas recovery equipment in the sludge treatment systems
$MEP_{s,treatment,y}$	Methane emission potential of the sludge treatment systems equipped with a biogas recovery system in year *y* (t)

$$MEP_{s,treatment,y} = \sum_l (S_{l,PJ,y} * MCF_{s,treatment,PJ,l}) * DOC_s * UF_{PJ} * DOC_F * F * 16/12 \quad \textbf{(18)}$$

Where:

$S_{l,PJ,y}$	Amount of sludge treated in the project sludge treatment system *l* equipped with a biogas recovery system (on a dry basis) in year *y* (t)
$MCF_{s,treatment,PJ,l}$	Methane correction factor for the sludge treatment system equipped with biogas recovery equipment
UF_{PJ}	Model correction factor to account for model uncertainties

$PE_{flaring,y}$	Will be determined by using "Tool to determine project emissions from flaring gases containing methane" Version 01 (tCO_2e)
$PE_{biomass,y}$	Will be determined by using "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" Version 06.0.1 (tCO_2e)

For Biogas Utilization:

The following project emissions are accounted for utilization of biogas which will be CPA specific and will be included as per the requirement of the particular CPA:

1. For AMS.I.A (version 15)

For most renewable energy project activities, $PE_y = 0$

2. For AMS.I.C (version 19)

a. CO2 emissions from on-site consumption of fossil fuels due to the project activity shall be calculated using the latest version of the .Tool to calculate project or leakage CO2 emissions from fossil fuel combustion.
b. CO2 emissions from electricity consumption by the project activity using the latest version of the .Tool to calculate baseline, project and/or leakage emissions from electricity consumption.
c. Any other significant emissions associated with project activity within the project boundary.

3. For AMS.I.D (version 17)

For most renewable energy project activities, $PE_y = 0$

CO_2 emissions from on-site consumption of fossil fuels due to the project activity shall be calculated using the latest version of the .Tool to calculate project or leakage CO2 emissions from fossil fuel combustion.

4. For AMS.I.F (version 2)

For most renewable energy project activities, $PE_y = 0$

CO_2 emissions from on-site consumption of fossil fuels due to the project activity shall be calculated using the latest version of the "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion".

5. For AMS.III.O (version 1)

The project activity emissions are calculated as the summation of the following unless it is demonstrated that electricity/steam used is generated from renewable energy sources with no possibility for emissions:

1. The emissions from fossil fuels and/or electricity used for operating the biogas purification system calculated in accordance with the methods specified in *AMS I.D*
2. Emissions from fossil fuels used to generate steam for the purpose of regeneration of the biogas purification system calculated in accordance with the latest version of *'Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion'*

The Project Emission to be accounted at CPA level, as may be required case specific

6. AMS.III.AQ (version 1)

The project emissions should be calculated as follows:

$$PE_y = PE_{elec,y} + PE_{fuel,y} + PE_{transport,y} + PE_{cultivation,y} + PE_{CH4,y}$$

Where:

PE_y	Project emissions in year *y* (tCO_2e)
$PE_{elec,y}$	Project emissions due to electricity consumption in year *y* (tCO_2)
$PE_{fuel,y}$	Project emissions due to fossil fuels consumption in year y (tCO2)
$PE_{transport,y}$	Project emissions from transportation of the renewable biomass from the places of their origin to the biogas production site and the processed biogas from the biogas processing facility to the filling stations in year y (tCO2)
$PE_{cultivation,y}$	Project emissions of N2O from renewable biomass cultivation in year y (tCO2e)
$PE_{CH4,y}$	Project emissions due to the physical leakage of methane from the systems affected by the project activity for production, processing, purification, compression; storage and filling of the Bio-CNG in year y (tCO2e)

Calculation of $PE_{elec,y}$

The emissions include electricity consumption (including auxiliary use) $PE_{elec,y}$ associated with the operation of Bio-CNG plant are calculated as per the parameter $PE_{EC,y}$ in the *"Tool to calculate baseline, project and/or leakage emissions from electricity consumption"*.

Calculation of $PE_{fuel,y}$

The emissions include fossil fuel consumption (including auxiliary use) $PE_{fuel,y}$ associated with the operation of Bio-CNG plant, calculated as per the parameter $PE_{FC,j,y}$ in the *"Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"*, where each combustion processes *j* in the tool should correspond to one of the fossil fuel consumption sources of the plant.

Calculation of $PE_{transport,y}$

Project emissions from transportation are not included as there is no transfer of renewable biomass and/or waste organic matters from the places of their origin to the biogas production site.

Calculation of $PE_{cultivation,y}$

Project emissions from renewable biomass cultivation is not included as there is no cultivation of any renewable biomass

Calculation of $PE_{CH4,y}$

Project emissions associated with the physical leakage of methane from the systems affected by the project activity are already calculated as per AMS.III.H

C. Leakage

If the technology is using equipment transferred from another activity, leakage effects at the site of the other activity are to be considered and estimated (LE_y).

In case the project activity involves the replacement of equipment, and the leakage effect of the use of the replaced equipment in another activity is neglected, because the replaced equipment is scrapped, an independent monitoring of scrapping of replaced equipment needs to be implemented. The monitoring should include a check if the number of project activity equipment distributed by the project and the number of scrapped equipment correspond with each other. For this purpose scrapped equipment should be stored until such correspondence has been checked. The scrapping of replaced equipment should be documented and independently verified.

For Biogas Utilization:

The following leakage emissions are accounted for utilization of biogas which will be specific CPA and will be included as per the requirement of the particular CPA –

1. For AMS.I.A (version 15)

If the energy generating equipment is transferred from another activity, leakage is to be considered.

2. For AMS.I.C (version 19)

If the energy generating equipment currently being utilised is transferred from outside the boundary to the project activity, leakage is to be considered.

In cases where the collection/processing/transportation of biomass residues is outside the project boundary CO2 emissions from the collection/processing/transportation of biomass residues to the project site shall be taken into account as leakage.

3. For AMS.I.D (version 17)

If the energy generating equipment is transferred from another activity, leakage is to be considered.

4. For AMS.I.F (version 2)

If the energy generating equipment is transferred from another activity, leakage is to be considered.

5. For AMS.III.O (version 1)

If the project equipment is transferred from another activity, or if the displaced equipment is transferred to another activity, leakage is to be considered which will be determined at CPA level.

6. For AMS.III.AQ (version 1)

Leakage emissions to be included in the CPA will be CPA specific and will be determined at CPA level. Leakage emissions that can be included are as follows:

a) As per the methodology $LE_{BIOMASS,\ y}$ is not applicable to the PoA as no biomass is used in the project activity.

b) The substitution of Bio-CNG for CNG from fossil origin reduces indirect ("upstream") emissions associated with the production of fossil CNG and is treated as negative leakage $LE_{PROCESS,\ y,CNG}$ (leakage emissions due to fossil fuel combustion/electricity consumption associated with the liquefaction, transportation, re-gasification and compression of LNG into a natural gas transmission or distribution system during the year *y* in tCO_2e) that can be calculated as per the relevant provisions of *AM0029 "Methodology for Grid Connected Electricity Generation Plants using Natural Gas"*.

c) The substitution of Bio-CNG for gasoline reduces indirect ("upstream") emissions associated with the production of gasoline and is treated as negative leakage $LE_{PROCESS,\ y,GAS}$ (leakage emissions related to production and refining of the gasoline) that can be calculated as per the relevant sections of *ACM0017 "Production of biodiesel for use as fuel"* and its equations 16, 17 and 18 using the following default values for gasoline:

EF_{REF}	Emission factor related to oil refining expressed by per ton of gasoline (tCO_2e/t).
	A default value of 0.241[20] tCO2e/t gasoline shall be used
EF_{PROD}	Emission factor for production of crude oil (tCO_2e/t)
	A default value of 0.075[21] tCO2e/t gasoline shall be used

Negative leakage emissions related to the avoided production of Fossil Fuel (CNG, gasoline) (tCO_2/yr) shall be calculated as per the equation below:

$$LE_{PROCESS,y,FF} = LE_{PROCESS,y,CNG} + LE_{PROCESS,y,GAS}$$

Where:

$LE_{PROCESS,y,FF}$	Leakage related to the avoided production of Fossil Fuel (tCO_2/yr)

D. Calculation of Emission Reduction.

For all scenarios in paragraph 1, i.e. 1 (a) to 1 (f),[22] emission reductions shall be estimated *ex ante* in the PDD using the equations provided in the baseline, project and leakage emissions sections above. Emission reductions shall be estimated *ex ante* as follows:

$$ER_{y,ex\,ante} = BE_{y,ex\,ante} - \left(PE_{y,ex\,ante} + LE_{y,ex\,ante}\right)$$

Where: **(19)**

$ER_{y,ex\,ante}$	*Ex ante* emission reduction in year *y* (tCO_2e)
$LE_{y,ex\,ante}$	*Ex ante* leakage emissions in year *y* (tCO_2e)
$PE_{y,ex\,ante}$	*Ex ante* project emissions in year *y* calculated as per equation 8 (tCO_2e)
$BE_{y,ex\,ante}$	*Ex ante* baseline emissions in year *y* calculated as per equation 1 (tCO_2e)

Ex post emission reductions shall be determined for case 1 (a) and 1 (e) as per equation 21. For cases 1 (b), 1 (c), 1 (d) and 1 (f), *ex post* emission reductions shall be based on the lowest value of the following, as per equation 19:

(i) The amount of biogas recovered and fuelled or flared (MD_y) during the crediting period, that is monitored *ex post*;

(ii) *Ex post* calculated baseline, project and leakage emissions based on actual monitored data for the project activity.

For cases 1 (b), 1 (c), 1 (d) and 1 (f): it is possible that the project activity involves wastewater and sludge treatment systems with higher methane conversion factors (MCF) or with higher efficiency than the treatment systems used in the baseline situation. Therefore the emission reductions achieved by the project activity is limited to the *ex post* calculated baseline emissions minus project emissions using the

[20] This value was calculated using ACM0017 approach.

[21] This value was calculated using ACM0017 approach.

[22] AMS-III.H./Version 16, page 1.

actual monitored data for the project activity. The emission reductions achieved in any year are the lowest value of the following:

$$ER_{y,ex\ post} = \min((BE_{y,ex\ post} - PE_{y,ex\ post} - LE_{y,ex\ post}), (MD_y - PE_{power,y} - PE_{biomass,y} - LE_{y,ex\ post})) \quad \textbf{(20)}$$

Where:

$ER_{y,ex\ post}$	Emission reductions achieved by the project activity based on monitored values for year *y* (tCO_2e)
$BE_{y,ex\ post}$	Baseline emissions calculated as per equation 1 using *ex post* monitored values
$PE_{y,ex\ post}$	Project emissions calculated as per equation 8 using *ex post* monitored values
MD_y	Methane captured and destroyed/gainfully used by the project activity in the year *y* (tCO_2e)

In the case of flaring/combustion MD_y will be measured using the conditions of the flaring process:

$$MD_y = BG_{burnt,y} * w_{CH4,y} * D_{CH4} * FE * GWP_{CH4} \quad \textbf{(21)}$$

Where:

$BG_{burnt,y}$	Biogas flared/combusted in year *y* (m^3)
$w_{CH4,y}$	Methane content of the biogas in the year *y* (volume fraction)
D_{CH4}	Density of methane at the temperature and pressure of the biogas in the year *y* (t/m^3)
FE	Flare efficiency in year *y* (fraction). If the biogas is combusted for gainful purposes, e.g. fed to an engine, an efficiency of 100% may be applied.

For the cases listed in baseline scenario as:

(a) Substitution of aerobic wastewater or sludge treatment systems with anaerobic systems with biogas recovery and combustion; and

(e) Introduction of anaerobic wastewater treatment with biogas recovery and combustion, with or without anaerobic sludge treatment, to an untreated wastewater stream,

the emission reduction achieved by the project activity (*ex post*) will be the difference between the baseline emissions and the sum of the project emissions and leakage.

$$ER_y = BE_{y,ex\ post} - \left(PE_{y,ex\ post} + LE_{y,ex\ post}\right) \quad \textbf{(22)}$$

The historical records of electricity and fuel consumption, the COD content of untreated and treated wastewater, and the quantity of sludge produced by the replaced units will be used for the baseline calculation.

In case (a) if the volumetric flow and the characteristic properties (e.g. COD) of the inflow and outflow of the wastewater are equivalent in the project and the baseline scenarios (i.e. the project and baseline systems have the same efficiency for COD removal for wastewater treatment), then the higher energy consumption and sludge generation in the baseline scenario are the only significant differences contributing to emission reductions in the project case. In this case, the emission reductions can be

calculated as the difference between the historical energy consumption of the replaced unit and the recorded energy consumption of the new system, plus the difference in emissions from sludge treatment and/or disposal. Project emissions from fugitive emissions and incomplete flaring ($PE_{fugitive,y}$, $PE_{flaring,y}$) shall also be considered in the calculation of the emission reductions; however, the emissions from the wastewater outflow and sludge ($PE_{ww,discharge,y}$, $PE_{s,final,y}$) may be disregarded, if they are equivalent in the baseline and project scenarios.

For utilization of recovered biogas:
The emission reduction against the utilization of biogas under a CPA would be estimated ex-ante or ex-post at CPA level, in line with the applicable methodology (i.e either of the methodologies listed under the section E.1) to be applied case-specific to the CPA. All the monitoring parameters related to baseline emissions are listed in the subsequent sections of this PoA-DD for use at each CPA, specific to the case.

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

Parameters for waste water treatment and methane recovery activity:

1. **Data Parameters for calculating baseline emissions**

Data / Parameter:	**$Q_{ww,i,y}$**
Data unit:	m^3
Description:	Volume of wastewater treated in baseline wastewater treatment system *i* in year *y*
Source of data used:	Historical data or measurement campaign. For Greenfield and capacity addition projects: (i) The value obtained from measurement campaign of comparable existing wastewater plant or (ii) The value provided by the manufacturer/designer of Greenfield wastewater treatment plant using the same technology, demonstrated to be conservative
Value applied:	To be determined with respect to each CPA
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	

Data / Parameter:	**$COD_{inflow,i,y}$**
Data unit:	t COD/m3
Description:	Chemical oxygen demand of wastewater (POME) inflow to the baseline treatment system in the year y.
Source of data used:	Historical data or measurement campaign. For Greenfield and capacity addition projects: (i) The value obtained from measurement campaign of comparable existing wastewater plant or (ii) The value provided by the manufacturer/designer of Greenfield wastewater treatment plant using the same

	technology, demonstrated to be conservative
Value applied:	To be determined with respect to each CPA
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	

Data / Parameter:	**η $COD_{,BL,i}$**
Data unit:	-
Description:	Chemical oxygen demand removal efficiency of treatment system with methane capture.
Source of data to be used:	Measured during the project activity.
Source of data used:	To be determined with respect to each CPA
Value applied:	Calculated by: $(COD_{inflow} – COD_{outflow})/ COD_{inflow}$
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	

Data / Parameter:	**$MCF_{ww, treatment,BL,i}$**
Data unit:	Fraction
Description:	Methane correction factor for baseline wastewater treatment systems *i*
Source of data used:-	Table III.H.1, AMS III.H./Version 16
Value applied:	Will be based on type of wastewater system
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	

Data / Parameter:	**$B_{o,ww}$**
Data unit:	kg CH_4 per kg COD
Description:	Methane producing capacity of the wastewater
Source of data used:	IPCC value in AMS III.H./Version 16
Value applied:	0.25
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	The parameter will remain constant for the entire crediting period for each CPA

Data / Parameter:	**UF_{BL}**
Data unit:	Fraction
Description:	Model correction factor to account for model uncertainties
Source of data used:-	IPCC value in AMS III.H./Version 16
Value applied:	0.89

Justification of the choice of data or description of measurement methods and procedures actually applied :	To account for the uncertainty associated with calculation model
Any comment:	The parameter will remain constant for the entire crediting period for each CPA

Data / Parameter:	**GWP_{CH4}**
Data unit:	Fraction
Description:	Global Warming Potential for methane
Source of data used:-	IPCC value in AMS III.H./Version 16
Value applied:	21
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	The parameter will remain constant for the entire crediting period for each CPA

Data / Parameter:	**$S_{j,BL,y}$**
Data unit:	T
Description:	Amount of dry matter in the sludge that would have been treated by the sludge treatment system *j* in the baseline scenario
Source of data used:	Calculation, historical data or measurement campaign. For Greenfield and capacity addition projects: (i) The value obtained from measurement campaign of comparable existing wastewater plant (ii) The value provided by the manufacturer/designer of Greenfield wastewater treatment plant using the same technology, demonstrated to be conservative
Value applied:	To be determined with respect to each CPA
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	If the baseline wastewater treatment system is different from the treatment system in the project scenario, the sludge generation rate (amount of sludge generated per unit of COD removed) in the baseline may differ significantly from that of the project scenario. Equation 5 above will be used to determine **$S_{j,BL,y}$**

Data / Parameter:	**DOC_s**
Data unit:	Fraction
Description:	Degradable organic content of the untreated sludge generated in the year *y* (dry basis)
Source of data used:	Default value in AMS III.H./Version 16
Value applied:	To be determined with respect to each CPA
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	Default values of 0.5 for domestic sludge and 0.257 for industrial sludge shall be used. The IPCC default values of 0.05 for

	domestic sludge (wet basis, considering a default dry matter content of 10 percent) or 0.09 for industrial sludge (wet basis, assuming dry matter content of 35 percent), were corrected for dry basis

Data / Parameter:	**$MCF_{s, treatment,BL,j}$**
Data unit:	Fraction
Description:	Methane correction factor for the baseline sludge treatment system *j*
Source of data used:-	Table III.H.1, AMS III.H./Version 16
Value applied:	Will be based on type of wastewater system
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	

Data / Parameter:	**DOC_F**
Data unit:	Fraction
Description:	Fraction of degradable organic content dissimilated to biogas
Source of data used:	IPCC default value in AMS III.H./Version 16
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	The parameter will remain constant for the entire crediting period for each CPA

Data / Parameter:	**F**
Data unit:	Fraction
Description:	Fraction of CH_4 in biogas
Source of data used:	IPCC default value in AMS III.H./Version 16
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	The parameter will remain constant for the entire crediting period for each CPA

Data / Parameter:	**$EF_{composting}$**
Data unit:	t CH_4/t waste (sludge) treated
Description:	Emission factor for composting organic waste
Source of data used:	IPCC default value in AMS III.H./Version 16
Value applied:	0.01 (dry weight basis)
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	Emission factors can be based on facility/site-specific measurements, country specific values or IPCC default values

	(Table 4.1, chapter 4, Volume 5, 2006 IPCC Guidelines for National Greenhouse Gas Inventories)

Data / Parameter:	**$Q_{ww,y}$**
Data unit:	m^3
Description:	Volume of treated wastewater discharged in year *y*
Source of data used:	Historical data or measurement campaign. For Greenfield and capacity addition projects: (i) The value obtained from measurement campaign of comparable existing wastewater plant (ii) The value provided by the manufacturer/designer of Greenfield wastewater treatment plant using the same technology, demonstrated to be conservative
Value applied:	To be determined with respect to each CPA
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	

Data / Parameter:	**$COD_{ww,discharge,BL,y}$**
Data unit:	t COD/m^3
Description:	Chemical oxygen demand of the treated wastewater discharged into sea, river or lake in the baseline in year *y*
Source of data used:	Historical data or measurement campaign. For Greenfield and capacity addition projects: (i) The value obtained from measurement campaign of comparable existing wastewater plant (ii) The value provided by the manufacturer/designer of Greenfield wastewater treatment plant using the same technology, demonstrated to be conservative
Value applied:	To be determined with respect to each CPA
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	If the baseline scenario is the discharge of untreated wastewater, the COD of untreated wastewater shall be used

Data / Parameter:	**$MCF_{ww,BL,discharge}$**
Data unit:	Fraction
Description:	Methane correction factor based on discharge pathway in the baseline situation (e.g. into sea, river or lake) of the wastewater
Source of data used:	Table III.H.1, AMS III.H./Version 16
Value applied:	Will be based on type of discharge pathway system
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	

Data / Parameter:	**$S_{final,BL,y}$**

Data unit:	T
Description:	Amount of dry matter in the final sludge generated by the baseline wastewater treatment systems in year *y*
Source of data used:	Calculation, historical data or measurement campaign. For Greenfield and capacity addition projects: (i) The value obtained from measurement campaign of comparable existing wastewater plant (ii) The value provided by the manufacturer/designer of Greenfield wastewater treatment plant using the same technology, demonstrated to be .conservative
Value applied:	To be determined with respect to each CPA
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	If the baseline wastewater treatment system is different from the project system, it will be estimated using the monitored amount of dry matter in the final sludge generated by the project activity (**$S_{final,PJ,y}$**) corrected for the sludge generation ratios of the project and baseline systems as per Equation 5

Data / Parameter:	**$MCF_{s,BL,final}$**
Data unit:	Fraction
Description:	Methane correction factor of the disposal site that receives the final sludge in the baseline situation
Source of data used:-	Table III.H.1, AMS III.H./Version 16
Value applied:	Estimated as per the procedures described in the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" Version 06.0.1
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	

2. Data Parameters for calculating project emissions

Data / Parameter:	**$Q_{ww,k,y}$**
Data unit:	m^3
Description:	Volume of wastewater treated in project wastewater treatment system *k* in year *y*
Source of data used:	Calculation, historical data or measurement campaign. For Greenfield and capacity addition projects: (i) The value obtained from measurement campaign of comparable existing wastewater plant (ii) The value provided by the manufacturer/designer of Greenfield wastewater treatment plant using the same technology, demonstrated to be conservative
Value applied:	To be determined with respect to each CPA
Justification of the choice of data or	In line with the requirement of the baseline monitoring

description of measurement methods and procedures actually applied :	methodology
Any comment:	

Data / Parameter:	**$MCF_{ww, treatment,P,J,k}$**
Data unit:	Fraction
Description:	Methane correction factor for project wastewater treatment system *k*
Source of data used:-	Table III.H.1, AMS III.H./Version 16
Value applied:	Will be based on type of discharge pathway system
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	

Data / Parameter:	**$COD_{inflow,k,y}$**
Data unit:	t COD/m3
Description:	Chemical oxygen demand of wastewater (POME) inflow to the anaerobic treatment system with methane capture in the year y.
Source of data used:	Historical data or measurement campaign. For Greenfield and capacity addition projects: (i) The value obtained from measurement campaign of comparable existing wastewater plant (ii) The value provided by the manufacturer/designer of Greenfield wastewater treatment plant using the same technology, demonstrated to be conservative
Value applied:	To be determined with respect to each CPA
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	

Data / Parameter:	**η_{PJ}**
Data unit:	-
Description:	Chemical oxygen demand removal efficiency of treatment system with methane capture.
Source of data to be used:	Measured during the project activity.
Source of data used:	To be determined with respect to each CPA
Value applied:	Calculated by: $(COD_{inflow} – COD_{outflow})/ COD_{inflow}$
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	

Data / Parameter:	**UF_{PJ}**
Data unit:	Fraction

Description:	Model correction factor to account for model uncertainties
Source of data used:-	IPCC value in AMS III.H./Version 16
Value applied:	1.12
Justification of the choice of data or description of measurement methods and procedures actually applied :	To account for the uncertainty associated with calculation model
Any comment:	The parameter will remain constant for the entire crediting period for each CPA

Data / Parameter:	$S_{l,PJ,y}$
Data unit:	T
Description:	Amount of dry matter in the sludge treated by the sludge treatment system *l* in the project scenario in year *y*
Source of data used:	Weighed
Value applied:	To be determined with respect to each CPA
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	

Data / Parameter:	$MCF_{s,treatment,l}$
Data unit:	Fraction
Description:	Methane correction factor for the project sludge treatment system *l*
Source of data used:-	Table III.H.1, AMS III.H./Version 16
Value applied:	Will be based on type of wastewater system
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	

Data / Parameter:	$COD_{discharge,PJ,y}$
Data unit:	t COD/m^3
Description:	Chemical oxygen demand of the treated wastewater discharged into the sea, river or lake in the project scenario in year *y*
Source of data used:	Measured
Value applied:	To be determined with respect to each CPA
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	

Data / Parameter:	$MCF_{ww,PJ,discharge}$
Data unit:	Fraction
Description:	Methane correction factor based on the discharge pathway of the wastewater in the project scenario (e.g. into sea, river or lake)
Source of data used:-	Table III.H.1, AMS III.H./Version 16
Value applied:	Will be based on type of discharge pathway system

Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	

Data / Parameter:	**$MCF_{s,P,J,final}$**
Data unit:	Fraction
Description:	Methane correction factor of the disposal site that receives the final sludge in the project scenario
Source of data used:-	Table III.H.1, AMS III.H./Version 16
Value applied:	Estimated as per the procedures described in the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" Version 06.0.1
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	

Data / Parameter:	**$S_{final,P,J,y}$**
Data unit:	T
Description:	Amount of dry matter in final sludge generated by the project wastewater treatment system in year *y*
Source of data used:	Measured
Value applied:	To be determined with respect to each CPA
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	

Data / Parameter:	**CFE_{ww}**
Data unit:	Fraction
Description:	Capture efficiency of the biogas recovery equipment in the wastewater treatment system
Source of data used:	Measured or used default value in AMS III.H./Version 16
Value applied:	To be determined with respect to each CPA
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	

Data / Parameter:	**$MEP_{ww,treatment,y}$**
Data unit:	T
Description:	Methane emission potential of wastewater treatment system equipped with biogas recovery system in year *y*
Source of data used:	Calculated as per Equation 16
Value applied:	To be determined with respect to each CPA
Justification of the choice of data or description of measurement methods	In line with the requirement of the baseline monitoring methodology

and procedures actually applied :	
Any comment:	

Data / Parameter:	**CFE_s**
Data unit:	Fraction
Description:	Capture efficiency of the biogas recovery equipment in the sludge treatment system
Source of data used:	Default value in AMS III.H./Version 16
Value applied:	0.9
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	

Data / Parameter:	**$MEP_{s,treatment,y}$**
Data unit:	T
Description:	Methane emission potential of the sludge treatment system equipped with a biogas recovery system in year *y*
Source of data used:	Calculated as in Equation 13
Value applied:	To be determined with respect to each CPA
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	

Data / Parameter:	**$S_{l,P,J,y}$**
Data unit:	T
Description:	Amount of sludge treated in the project sludge treatment system *l* equipped with a biogas recovery system (on a dry basis) in year *y*
Source of data used:	Weighed
Value applied:	To be determined with respect to each CPA
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	

Data / Parameter:	**$MCF_{s,treatment,P,J,l}$**
Data unit:	Fraction
Description:	Methane correction factor for the sludge treatment system equipped with biogas recovery equipment
Source of data used:-	Table III.H.1, AMS III.H./Version 16
Value applied:	Will be based on type of discharge pathway system
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	

Data / Parameter:	**$BG_{burnt,y}$**

Data unit:	m^3
Description:	Biogas flared/combusted in year *y*
Source of data used:	To be determined with respect to each CPA
Value applied:	Measured
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	Biogas volume and methane content measurements shall be on the same basis (wet or dry)

Data / Parameter:	$w_{CH4,y}$
Data unit:	Volume fraction
Description:	Methane content of the biogas in year *y*
Source of data used:	To be determined with respect to each CPA
Value applied:	Measured
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	Biogas volume and methane content measurements shall be on the same basis (wet or dry)

Data / Parameter:	D_{CH4}
Data unit:	t/m^3
Description:	Density of methane at the temperature and pressure of the biogas in year *y*
Source of data used:	To be determined with respect to each CPA
Value applied:	Measured
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	

Data / Parameter:	**FE**
Data unit:	Fraction
Description:	Flare efficiency in year *y*
Source of data used:	To be determined with respect to each CPA
Value applied:	Based on the "Tool to determine project emissions from flaring gases containing methane" Version 01
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	If the biogas is combusted for gainful purposes, e.g. fed to an engine, an efficiency of 100% may be applied

Parameters for Utilization of Biogas:

All the monitoring parameters related to utilization of biogas are listed below in tables methodology-wise (at latest version) for use at CPA level, as per the case specific to the CPA. (If any additional parameter(s)

other than the below listed ones which may require to be introduced specific to the CPA case, would be included in the CPA-DD at the time inclusion)

1. For AMS.I.A (version 15)

Data / Parameter:	**$FC_{y,j}$**
Data unit:	Litres
Description:	Amount of diesel consumption
Source of data used:	Historic data
Value applied:	The value applied will be CPA specific
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data applied is as per AMSI.A.
Any comment:	-

Data / Parameter:	**$EF_{CO2,j}$**
Data unit:	T CO_2/GJ
Description:	CO_2 emission factor of diesel fuel
Source of data used:	IPCC default value or country specific value or default value as prescribed in the methodology
Value applied:	The value will be applied at CPA level.
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data applied is as per AMSI.A.
Any comment:	-

Data / Parameter:	**NCV_j**
Data unit:	GJ/litre
Description:	Net calorific value of diesel; gigajoule per volume unit
Source of data used:	IPCC default value or country specific value
Value applied:	The value will applied at CPA level
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data applied is as per AMSI.A.
Any comment:	-

Data / Parameter:	**L**
Data unit:	%
Description:	Average transmission and distribution losses
Source of data used:	Site or country specific data
Value applied:	The value will applied at CPA level
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data applied is as per AMSI.A.
Any comment:	-

2. For AMS.I.C (version 19)

Data / Parameter:	EF_{FF,CO_2}
Data unit:	tCO_2/TJ
Description:	Emission factor for fossil fuel used in the project activity
Source of data used:	local or national data/IPCC values
Value applied:	The value will be applied at CPA level
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data applied is as per AMSI.C
Any comment:	-

Data / Parameter:	$\eta_{BL,thermal}$
Data unit:	%
Description:	The efficiency of the equipment that would have been used in the absence of the project activity.
Source of data used:	As per AMS IC
Value applied:	The value will be applied at CPA level
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data applied is as per AMSI.C
Any comment:	-

Data / Parameter:	EF_{BL,FF,CO_2}
Data unit:	tCO_2/Mwh
Description:	Emission factor for fossil fuel used in the project activity
Source of data used:	local or national data/IPCC values
Value applied:	The value will be applied at CPA level
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data applied is as per AMSI.C
Any comment:	-

Data / Parameter:	$\eta_{BL,captive\ plant}$
Data unit:	%
Description:	The efficiency of the plant using fossil fuel that would have been used in the absence of the project activity
Source of data used:	As per AMS IC
Value applied:	The value will be applied at CPA level
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data applied is as per AMSI.C
Any comment:	-

Data / Parameter:	$\eta_{BL,cogen}$
Data unit:	%
Description:	The total annual average efficiency of the cogeneration plant

	using fossil fuel determined in accordance with paragraphs 28 and 29 in AMS IC version 19
Source of data used:	As per AMS IC
Value applied:	The value will be applied at CPA level
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data applied is as per AMSI.C
Any comment:	-

Data / Parameter:	$\eta_{BL,cofire}$
Data unit:	%
Description:	The efficiency of the co-fired plant that would have been used in the absence of the project activity
Source of data used:	As per AMS IC
Value applied:	The value will be applied at CPA level
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data applied is as per AMSI.C
Any comment:	-

Data / Parameter:	η_{BL}
Data unit:	%
Description:	Efficiency of the baseline equipment being replaced (determined as per paragraph 30 or 31 of AMS 1 C version 19
Source of data used:	As per AMS IC
Value applied:	The value will be applied at CPA level
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data applied is as per AMSI.C
Any comment:	-

Data / Parameter:	η_{PJ}
Data unit:	%
Description:	Efficiency of the project equipment measured using representative sampling methods or based on referenced literature values.
Source of data used:	As per AMS IC
Value applied:	The value will be applied at CPA level
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data applied is as per AMSI.C
Any comment:	-

3. For AMS.I.D (version 17)

Data / Parameter:	$EF_{CO2,grid,y}$
Data unit:	tCO_2/kWh

Description:	Emission factor for grid
Source of data used:	Indonesia National Commission for CDM
Value applied:	0.743
Justification of the choice of data or description of measurement methods and procedures actually applied :	Sumatra Grid emission factor (2008)
Any comment:	-

4. For AMS.I.F (version 2)

Data / Parameter:	**$EF_{CO2,y}$**
Data unit:	tCO_2/kWh
Description:	Emission factor for grid
Source of data used:	Indonesia National Commission for CDM
Value applied:	0.743
Justification of the choice of data or description of measurement methods and procedures actually applied :	Sumatra Grid emission factor (2008)
Any comment:	-

Data / Parameter:	**$EF_{CO2\ mini\ grid}$**
Data unit:	tCO_2/kWh
Description:	CO_2 emission factor for the mini-grid
Source of data used:	AMS IF latest available version
Value applied:	The value will be applied at CPA level
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data applied is as per AMSI.F
Any comment:	-

Data / Parameter:	**$EF_{EL,j,y}$**
Data unit:	tCO2/MWh
Description:	Emission factor for electricity generation for source *j* in year *y*
Source of data used:	Tool to calculate baseline, project and/or leakage emissions from electricity consumption.
Value applied:	The value will be applied at CPA level
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data applied is as per tool to calculate baseline, project and/or leakage emissions from electricity consumption.
Any comment:	-

Data / Parameter:	**$TDL_{j,y}$**
Data unit:	-
Description:	Average technical transmission and distribution losses for providing electricity to source *j* in the year *y*
Source of data used:	Tool to calculate baseline, project and/or leakage emissions from electricity consumption.
Value applied:	The value will be applied at CPA level

Justification of the choice of data or description of measurement methods and procedures actually applied :	The data applied is as per tool to calculate baseline, project and/or leakage emissions from electricity consumption.
Any comment:	-

5. For AMS.III.O (version 1)

Data / Parameter:	**EF_{LPG}**
Data unit:	kg-CO_2/kg LPG
Description:	Emission factor of LPG
Source of data used:	Evaluation of carbon content of LPG or IPCC default value
Value applied:	The value will be applied at CPA level.
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data applied is as per AMS.III.O
Any comment:	-

Data / Parameter:	**MW_{CO2}**
Data unit:	kg/kmol
Description:	Molecular weight of CO_2
Source of data used:	Default value as prescribed in the methodology
Value applied:	44
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data applied is as per AMS.III.O
Any comment:	-

Data / Parameter:	**C_1/C_3**
Data unit:	No unit
Description:	Conversion factor kilograms to tones
Source of data used:	Default value as prescribed in the methodology
Value applied:	0.0001
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data applied is as per AMS.III.O
Any comment:	-

Data / Parameter:	**SFC_{LPG}**
Data unit:	kg-LPG/Nm^3-H_2
Description:	Specific fuel consumption of the hydrogen production
Source of data used:	Historical data or Manufacturer's specification
Value applied:	The value applied will be CPA specific
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data applied is as per AMS.III.O
Any comment:	-

Data / Parameter:	**m_1**

Data unit:	mol/mol
Description:	% mol of propane in LPG
Source of data used:	Manufacturer's specification or Lab tests
Value applied:	The value applied will be CPA specific
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data applied is as per AMS.III.O
Any comment:	-

Data / Parameter:	**m_2**
Data unit:	mol/mol
Description:	% mol of butane in LPG
Source of data used:	Manufacturer's specification or Lab tests
Value applied:	The value applied will be CPA specific
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data applied is as per AMS.III.O
Any comment:	-

Data / Parameter:	**M_{LPG}**
Data unit:	Kg-LPG
Description:	Mass of LPG used as reaction feedstock
Source of data used:	Design specification or historical data
Value applied:	The value applied will be CPA specific
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data applied is as per AMS.III.O
Any comment:	-

Data / Parameter:	**MW_{C3H8}**
Data unit:	kg/kmol
Description:	Molecular weight of CO_2
Source of data used:	Default value as prescribed in the methodology
Value applied:	44
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data applied is as per AMS.III.O
Any comment:	-

Data / Parameter:	**MW_{C4H10}**
Data unit:	kg/kmol
Description:	Molecular weight of CO_2
Source of data used:	Default value as prescribed in the methodology
Value applied:	66
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data applied is as per AMS.III.O
Any comment:	-

Data / Parameter:	**C_2**
Data unit:	No unit
Description:	Conversion factor kmol to mol
Source of data used:	Default value as prescribed in the methodology
Value applied:	1000
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data applied is as per AMS.III.O
Any comment:	-

Data / Parameter:	**P_N**
Data unit:	Pascal
Description:	Pressure at normal conditions
Source of data used:	Default value as prescribed in the methodology
Value applied:	The value applied will be CPA specific
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data applied is as per AMS.III.O
Any comment:	-

Data / Parameter:	**T_N**
Data unit:	Kelvin
Description:	Temperature at normal conditions
Source of data used:	Default value as prescribed in the methodology
Value applied:	273
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data applied is as per AMS.III.O
Any comment:	-

Data / Parameter:	**R**
Data unit:	$Pa.m^3.mol^{-1}.K^{-1}$
Description:	Gas constant
Source of data used:	Default value as prescribed in the methodology
Value applied:	8.314
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data applied is as per AMS.III.O
Any comment:	-

6. For AMS.III.AQ (version 1)

Data / Parameter:	**$EF_{CO2,CNG}$**
Data unit:	tCO_2/GJ
Description:	CO_2 emission factor of CNG
Source of data used:	IPCC default value or country specific
Value applied:	The value will be applied at CPA specific

Justification of the choice of data or description of measurement methods and procedures actually applied :	The data applied is as per AMS.III.AQ
Any comment:	-

Data / Parameter:	**$NCV_{gasoline}$**
Data unit:	GJ/ton
Description:	Net calorific value of gasoline used in vehicles
Source of data used:	IPCC default value or country specific
Value applied:	The value applied will be CPA specific
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data applied is as per AMS.III.AQ
Any comment:	This is used for ex ante calculations

Data / Parameter:	**n**
Data unit:	No unit
Description:	Discount factor to account for the possible drop in the fuel efficiency of the retrofitted Bio-CNG vehicles
Source of data used:	Default value as per methodology for converted vehicles or calculated value for retrofit vehicles
Value applied:	The value will be included at CPA level
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data applied is as per AMS.III.AQ
Any comment:	-

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

E.7.1. Data and parameters to be monitored by each SSC-CPA:

A. Parameters for waste water treatment and methane recovery activity:

Data / Parameter:	**$Q_{ww,i,y}$**
Data unit:	m^3
Description:	Volume of wastewater treated in baseline wastewater treatment system *i* in year *y*
Source of data to be used:	Measured during the project activity
Value of data applied for the purpose of calculating expected emission reductions in section E.6.	To be determined with respect to each CPA
Description of measurement methods and procedures to be applied:	The effluent inflow will be monitored continuously using flow meter
QA/QC procedures to be applied:	• The data will be measured directly • The data are monitored continuously (at least hourly measurements are taken) • Data are recorded and stored electronically in a data log file

	• The flow meter undergoes maintenance/calibration per manufacturer's specifications
Any comment:	Confidence and precision level of 90/10 shall be attained if the measurements are less than hourly

Data / Parameter:	**$COD_{ww,untreated,y}$**
Data unit:	t COD/m^3
Description:	Chemical oxygen demand of untreated wastewater before the treatment system affected by the project activity
Source of data to be used:	Measured during the project activity
Value of data applied for the purpose of calculating expected emission reductions in section E.6.	To be determined with respect to each CPA
Description of measurement methods and procedures to be applied:	• The COD measurement will be onsite or by a third party laboratory • COD measurement must be according to national or international standard • The COD is measured through representative sampling
QA/QC procedures to be applied:	• Monthly measurement or shorter interval • COD reports are recorded manually and stored in a data log file • COD measurement cross checks are done at least once a year in an external laboratory to confirm onsite measurements • The COD measurement equipment undergoes maintenance/calibration per manufacturer's specifications • A trained and qualified person will be in charge of the COD measurement
Any comment:	Samples and measurements shall ensure a 90/10 confidence/ precision level

Data / Parameter:	**$COD_{ww,treated,y}$**
Data unit:	t COD/m^3
Description:	Chemical oxygen demand of treated wastewater after the treatment system affected by the project activity
Source of data to be used:	Measured during the project activity
Value of data applied for the purpose of calculating expected emission reductions in section E.6.	To be determined with respect to each CPA
Description of measurement methods and procedures to be applied:	• The COD measurement will be onsite or by a third party laboratory • COD measurement must be according to national or international standard • The COD is measured through representative sampling
QA/QC procedures to be applied:	• Monthly measurement or shorter interval • COD reports are recorded manually and stored in a data log file • COD measurement cross checks are done at least once a

	year in an external laboratory to confirm onsite measurements • The COD measurement equipment undergoes maintenance/calibration per manufacturer's specifications • A trained and qualified person will be in charge of the COD measurement
Any comment:	Samples and measurements shall ensure a 90/10 confidence/ precision level

Data / Parameter:	**$COD_{ww,discharge,PJ,y}$**
Data unit:	t COD/m^3
Description:	Chemical oxygen demand of discharged wastewater after the treatment system affected by the project activity
Source of data to be used:	Measured during the project activity
Value of data applied for the purpose of calculating expected emission reductions in section E.6.	To be determined with respect to each CPA
Description of measurement methods and procedures to be applied:	• The COD measurement will be onsite or by a third party laboratory • COD measurement must be according to national or international standard • The COD is measured through representative sampling
QA/QC procedures to be applied:	• Monthly measurement or shorter interval • COD reports are recorded manually and stored in a data log file • COD measurement cross checks are done at least once a year in an external laboratory to confirm onsite measurements • The COD measurement equipment undergoes maintenance/calibration per manufacturer's specification. • A trained and qualified person will be in charge of the COD measurement
Any comment:	Samples and measurements shall ensure a 90/10 confidence/ precision level

Data / Parameter:	**$S_{l,PJ,y}$**
Data unit:	T
Description:	Amount of dry matter in the sludge treated by the sludge treatment system in the project activity
Source of data to be used:	Measured during the project activity
Value of data applied for the purpose of calculating expected emission reductions in section E.6.	To be determined with respect to each CPA
Description of measurement methods and procedures to be applied:	• Monitoring of 100% of the sludge amount through continuous or batch measurements and moisture content through representative sampling
QA/QC procedures to be applied:	• The volume (m^3) and density or direct weighing may be used to determine the sludge amount

	• Representative samples are taken to determine the moisture content to calculate the total sludge amount on dry basis • The weight measurement equipment undergoes maintenance/calibration per manufacturer's specifications
Any comment:	• Samples and measurements shall ensure a 90/10 confidence/precision level • If the methane emissions from anaerobic decay of the final sludge are to be neglected because the sludge is controlled, combusted, disposed of in a landfill with methane recovery, or used for soil application, then the end-use of the final sludge will be monitored during the crediting period • If the baseline emissions include the anaerobic decay of final sludge generated by the baseline treatment systems in a landfill without methane recovery, the baseline disposal site shall be clearly defined, and verified by the DOE

Data / Parameter:	$S_{final,P,J,y}$
Data unit:	T
Description:	Amount of dry matter in the final sludge generated by the project activity
Source of data to be used:	Measured during the project activity
Value of data applied for the purpose of calculating expected emission reductions in section E.6.	To be determined with respect to each CPA
Description of measurement methods and procedures to be applied:	• Monitoring of 100% of the sludge amount through continuous or batch measurements and moisture content through representative sampling
QA/QC procedures to be applied:	• The volume (m^3) and density or direct weighing may be used to determine the sludge amount • Representative samples are taken to determine the moisture content to calculate the total sludge amount on dry basis • The weight measurement equipment undergoes maintenance/calibration per manufacturer's specifications
Any comment:	• Samples and measurements shall ensure a 90/10 confidence/precision level • If the methane emissions from anaerobic decay of the final sludge are to be neglected because the sludge is controlled, combusted, disposed of in a landfill with methane recovery, or used for soil application, then the end-use of the final sludge will be monitored during the crediting period • If the baseline emissions include the anaerobic decay of final sludge generated by the baseline treatment systems in a landfill without methane recovery, the baseline disposal site shall be clearly defined, and verified by the DOE

Data / Parameter:	**$BG_{burnt,y}$**
Data unit:	m^3
Description:	Biogas flared/combusted in year *y*
Source of data to be used:	Measured during the project activity
Value of data applied for the purpose of calculating expected emission reductions in section E.6.	To be determined with respect to each CPA
Description of measurement methods and procedures to be applied:	• Biogas volume and methane content measurements shall be on the same basis (wet or dry) • If the biogas stream is flared or fuelled (or utilized), the biogas volumes will be monitored separately, the two fractions can be added together to determine the total biogas recovered without the need to monitor the recovered biogas before the separation • The methane content measurement shall be carried out close to a location in the system where a biogas flow measurement takes place
QA/QC procedures to be applied:	• The data will be measured directly from the flow meter • The data are monitored continuously (at least hourly measurements are taken) • Data are recorded and stored electronically in a data log file • The flow meter undergoes maintenance/calibration per manufacturer's specifications
Any comment:	• Confidence and precision level of 90/10 shall be attained if the measurements are less than hourly • The project proponents shall maintain a biogas (or methane) balance based on: (a) Continuous measurement of the amount of biogas captured at the wastewater treatment system (b) Continuous measurement of the amount of biogas used for various purposes in the project activity: e.g. heat, electricity, flare, hydrogen production, injection into natural gas distribution grid, etc. The difference is considered as loss due to physical leakage and deducted from the emission reductions

Data / Parameter:	**$w_{CH4,y}$**
Data unit:	Volume fraction
Description:	Methane content of the biogas in the year *y*
Source of data to be used:	Measured during the project activity
Value of data applied for the purpose of calculating expected emission reductions in section E.6.	To be determined with respect to each CPA
Description of measurement methods and procedures to be applied:	• The fraction of methane in the gas should be measured with a continuous analyser or, alternatively, with periodic measurements at a 90/10 confidence/precision level • Biogas volume and methane content measurements shall be on the same basis (wet or dry)

	• It shall be measured using equipment that can directly measure methane content in the biogas - the estimation of methane content of biogas based on measurement of other constituents of biogas such as CO_2 is not permitted • The methane content measurement shall be carried out close to a location in the system where a biogas flow measurement takes place
QA/QC procedures to be applied:	• The data will be measured directly • Data are recorded and stored electronically in a data log file • The flow meter undergoes maintenance/calibration per manufacturer's specification
Any comment:	

Data / Parameter:	**T**
Data unit:	ºC
Description:	Temperature of the biogas
Source of data to be used:	Measured during the project activity
Value of data applied for the purpose of calculating expected emission reductions in section E.6.	To be determined with respect to each CPA
Description of measurement methods and procedures to be applied:	• Measured at the same time when the methane content in the biogas is measured • The temperature of the gas is required to determine the density of the methane combusted • If the biogas flow meter employed measures flow, pressure and temperature and displays or outputs the normalised flow of biogas, then there is no need for separate monitoring of pressure and temperature of the biogas
QA/QC procedures to be applied:	• Data are recorded by and stored electronically in a data log file • Maintenance and calibration as per manufacturer's specifications
Any comment:	

Data / Parameter:	**P**
Data unit:	Pa
Description:	Pressure of the biogas
Source of data to be used:	Measured during the project activity
Value of data applied for the purpose of calculating expected emission reductions in section E.6.	To be determined with respect to each CPA
Description of measurement methods and procedures to be applied:	• Measured at the same time when the methane content in the biogas is measured • The pressure of the gas is required to determine the density of the methane combusted • If the biogas flow meter employed measures flow, pressure and temperature and displays or outputs the normalised flow of biogas, then there is no need for separate

	monitoring of pressure and temperature of the biogas
QA/QC procedures to be applied:	• Data are recorded by and stored electronically in a data log file • Maintenance and calibration as per manufacturer's specifications
Any comment:	

Data / Parameter:	**FE**
Data unit:	%
Description:	Flare efficiency
Source of data to be used:	Measured during the project activity
Value of data applied for the purpose of calculating expected emission reductions in section E.6.	To be determined with respect to each CPA
Description of measurement methods and procedures to be applied:	• As per the "Tool to determine project emissions from flaring gases containing methane" Version 01 • Regular maintenance shall be carried out to ensure optimal operation of flares
QA/QC procedures to be applied:	• Data are recorded and stored electronically in a data log file • Maintenance and calibration as per manufacturer's specifications
Any comment:	

B. Parameters[23] For Utilization of Biogas:

1. For AMS.I.A (version 15)

Data / Parameter:	**$EG_{i,y}$**
Data unit:	kWh
Description:	Annual output of the renewable energy technologies
Source of data to be used:	The data will be monitored using appropriate monitoring systems which will be CPA specific
Value of data applied for the purpose of calculating expected emission reductions in section E.6.	Value will be included at CPA level
Description of measurement methods and procedures to be applied:	Method will be identified at CPA level
QA/QC procedures to be applied:	Procedures will be determined at CPA level
Any comment:	-

Data / Parameter:	**$EC_{i,y}$**
Data unit:	kWh
Description:	Average energy consumed by consumers belonging to the group of *i* renewable energy technologies

[23] If any additional parameter(s) other than the listed ones which may require to be introduced specific to the CPA case, would be included in the CPA-DD at the time inclusion

Source of data to be used:	The data will be monitored using appropriate monitoring systems which will be CPA specific
Value of data applied for the purpose of calculating expected emission reductions in section E.6.	Value will be included at CPA level
Description of measurement methods and procedures to be applied:	Method will be identified at CPA level
QA/QC procedures to be applied:	Procedure will be determined at CPA level
Any comment:	-

2. For AMS.I.C (version 19)

Data / Parameter:	$EG_{thermal,y}$
Data unit:	TJ
Description:	Net amount of thermal energy generated by the project activity
Source of data to be used:	Monitored at the CPA level
Value of data applied for the purpose of calculating expected emission reductions in section B.5.	The value will be applied at CPA level
Description of measurement methods and procedures to be applied:	Method will be identified at CPA level
QA/QC procedures to be applied:	Procedure will be determined at CPA level
Any comment:	

Data / Parameter:	$\mathbf{FC}_{\text{fossil fuel},y}$
Data unit:	Ton
Description:	Total amount of fossil fuel used in year y
Source of data to be used:	Monitored at the CPA level
Value of data applied for the purpose of calculating expected emission reductions in section B.5.	The value will be applied at CPA level
Description of measurement methods and procedures to be applied:	This method will be identified at CPA level
QA/QC procedures to be applied:	Procedure will be determined at CPA level
Any comment:	

Data / Parameter:	$\mathbf{NCV}_{\text{fossil fuel}}$
Data unit:	TJ/tons
Description:	NCV of fossil fuel used in year y
Source of data to be used:	Monitored at the CPA level
Value of data applied for the purpose	The value will be applied at CPA level

of calculating expected emission reductions in section B.5.	
Description of measurement methods and procedures to be applied:	Method will be identified at CPA level
QA/QC procedures to be applied:	Procedure will be determined at CPA level
Any comment:	

Data / Parameter:	$EG_{captelec,PJ,y}$
Data unit:	MWh
Description:	The amount of electricity produced by the project activity during the year *y* (MWh)
Source of data to be used:	Monitored at the CPA level
Value of data applied for the purpose of calculating expected emission reductions in section B.5.	The value will be applied at CPA level
Description of measurement methods and procedures to be applied:	Method will be identified at CPA level
QA/QC procedures to be applied:	Procedure will be determined at CPA level
Any comment:	

Data / Parameter:	$EG_{PJ,electrical,y}$
Data unit:	MWh
Description:	The amount of electricity produced by the project activity during the year *y* (MWh)
Source of data to be used:	Monitored at the CPA level
Value of data applied for the purpose of calculating expected emission reductions in section B.5.	The value will be applied at CPA level
Description of measurement methods and procedures to be applied:	Method will be identified at CPA level
QA/QC procedures to be applied:	Procedure will be determined at CPA level
Any comment:	

Data / Parameter:	$EG_{PJ,thermal,y}$
Data unit:	TJ
Description:	The amount of electricity produced by the project activity during the year *y* (MWh)
Source of data to be used:	Monitored at the CPA level
Value of data applied for the purpose of calculating expected emission reductions in section B.5.	The value will be applied at CPA level
Description of measurement methods	Method will be identified at CPA level

and procedures to be applied:	
QA/QC procedures to be applied:	Procedure will be determined at CPA level
Any comment:	

Data / Parameter:	$EG_{cofire,PJ,y}$
Data unit:	TJ
Description:	The net quantity of energy (electricity/thermal) supplied by the project activity during the year *y* (TJ)
Source of data to be used:	Monitored at the CPA level
Value of data applied for the purpose of calculating expected emission reductions in section B.5.	The value will be applied at CPA level
Description of measurement methods and procedures to be applied:	Method will be identified at CPA level
QA/QC procedures to be applied:	Procedure will be determined at CPA level
Any comment:	

Data / Parameter:	$EG_{BL,thermal,retrofit,y}$
Data unit:	TJ
Description:	Thermal energy production by an existing facility in the absence of the project activity in year *y*
Source of data to be used:	Monitored at the CPA level
Value of data applied for the purpose of calculating expected emission reductions in section B.5.	The value will be applied at CPA level
Description of measurement methods and procedures to be applied:	Method will be identified at CPA level
QA/QC procedures to be applied:	Procedure will be determined at CPA level
Any comment:	

Data / Parameter:	$EG_{HY,thermal,retrofit,y}$
Data unit:	TJ
Description:	Average of historical thermal energy levels delivered by the existing facility, spanning all data from the most recent available year (or month, week or other time period) to the time at which the facility was constructed, retrofitted, or modified in a manner that significantly affected output (i.e. by 5% or more)
Source of data to be used:	Monitored at the CPA level
Value of data applied for the purpose of calculating expected emission reductions in section B.5.	The value will be applied at CPA level

Description of measurement methods and procedures to be applied:	Method will be identified at CPA level
QA/QC procedures to be applied:	Procedure will be determined at CPA level
Any comment:	

Data / Parameter:	$EG_{estimated,thermal,y}$
Data unit:	TJ
Description:	Estimated thermal energy that would have been produced by the existing units under the observed availability of renewable resources in year *y*
Source of data to be used:	Monitored at the CPA level
Value of data applied for the purpose of calculating expected emission reductions in section B.5.	The value will be applied at CPA level
Description of measurement methods and procedures to be applied:	Method will be identified at CPA level
QA/QC procedures to be applied:	Procedure will be determined at CPA level
Any comment:	

Data / Parameter:	$DATE_{BaselineRretrofit}$
Data unit:	Date
Description:	Date at which the existing generation facility is likely to be replaced or retrofitted in the absence of the CDM project activity
Source of data to be used:	Monitored at the CPA level
Value of data applied for the purpose of calculating expected emission reductions in section B.5.	The value will be applied at CPA level
Description of measurement methods and procedures to be applied:	Method will be identified at CPA level
QA/QC procedures to be applied:	Procedure will be determined at CPA level
Any comment:	

Data / Parameter:	$EG_{thermal,retrofit,y}$
Data unit:	TJ
Description:	Thermal energy supplied by the project activity (after retrofit) in year *y*
Source of data to be used:	Monitored at the CPA level
Value of data applied for the purpose of calculating expected emission reductions in section B.5.	The value will be applied at CPA level
Description of measurement methods and procedures to be applied:	Method will be identified at CPA level

QA/QC procedures to be applied:	Procedure will be determined at CPA level
Any comment:	

Data / Parameter:	$EG_{BL,thermal,retrofit,y}$
Data unit:	TJ
Description:	Thermal energy production by an existing facility in the absence of the project activity (before retrofit) in year *y*
Source of data to be used:	Monitored at the CPA level
Value of data applied for the purpose of calculating expected emission reductions in section B.5.	The value will be applied at CPA level
Description of measurement methods and procedures to be applied:	Method will be identified at CPA level
QA/QC procedures to be applied:	Procedure will be determined at CPA level
Any comment:	

Data / Parameter:	$HG_{PJ,y}$
Data unit:	TJ
Description:	The net quantity of thermal energy supplied by the project activity using renewable biomass during the year *y*
Source of data to be used:	Monitored at the CPA level
Value of data applied for the purpose of calculating expected emission reductions in section B.5.	The value will be applied at CPA level
Description of measurement methods and procedures to be applied:	Method will be identified at CPA level
QA/QC procedures to be applied:	Procedure will be determined at CPA level
Any comment:	

Data / Parameter:	$B_{biomass,PJ,y}$
Data unit:	Tons
Description:	The net quantity of the biomass consumed in year *y*
Source of data to be used:	Monitored at the CPA level
Value of data applied for the purpose of calculating expected emission reductions in section B.5.	The value will be applied at CPA level
Description of measurement methods and procedures to be applied:	Method will be identified at CPA level
QA/QC procedures to be applied:	Procedure will be determined at CPA level
Any comment:	

Data / Parameter:	$NCV_{biomass}$
Data unit:	TJ/tons
Description:	The net calorific value of the biomass
Source of data to be used:	Monitored at the CPA level
Value of data applied for the purpose of calculating expected emission reductions in section B.5.	The value will be applied at CPA level
Description of measurement methods and procedures to be applied:	Method will be identified at CPA level
QA/QC procedures to be applied:	Procedure will be determined at CPA level
Any comment:	

Data / Parameter:	Biomass $_{Moisture}$
Data unit:	%
Description:	Moisture content of the biomass (wet basis)
Source of data used:	Measured
Value applied:	The value will be applied at CPA level
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per Methodology requirement
Any comment:	-

Data / Parameter:	T
Data unit:	°C
Description:	Temperature of Steam or Hot fluid and/or gases
Source of data to be used:	Monitored at the CPA level
Value of data applied for the purpose of calculating expected emission reductions in section B.5.	The value will be applied at CPA level
Description of measurement methods and procedures to be applied:	Will be identified at CPA level
QA/QC procedures to be applied:	Will be determined at CPA level

Data / Parameter:	P
Data unit:	kg/cm^2
Description:	Pressure of superheated steam
Source of data to be used:	Monitored at the CPA level
Value of data applied for the purpose of calculating expected emission reductions in section B.5.	The value will be applied at CPA level
Description of measurement methods	Will be identified at CPA level

and procedures to be applied:	
QA/QC procedures to be applied:	Will be determined at CPA level

Data / Parameter:	$Q_{steam/hot\ air}$
Data unit:	Nm^3/hr
Description:	Quantity of steam/Hot Air
Source of data to be used:	Monitored at the CPA level
Value of data applied for the purpose of calculating expected emission reductions in section B.5.	The value will be applied at CPA level
Description of measurement methods and procedures to be applied:	Will be identified at CPA level
QA/QC procedures to be applied:	Will be determined at CPA level

3. For AMS.I.D (version 17)

Data / Parameter:	$EG_{BL,y}$
Data unit:	kWh/year
Description:	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y
Source of data to be used:	Monitored at the CPA level
Value of data applied for the purpose of calculating expected emission reductions in section B.5.	The value will be applied at CPA level
Description of measurement methods and procedures to be applied:	Method will be identified at CPA level
QA/QC procedures to be applied:	Parameter will be determined at CPA level
Any comment:	

Data / Parameter:	$EG_{,export}$
Data unit:	kWh/year
Description:	Net electricity export by the project activity
Source of data to be used:	Monitored at the CPA level
Value of data applied for the purpose of calculating expected emission reductions in section B.5.	The value will be applied at CPA level
Description of measurement methods and procedures to be applied:	Method will be identified at CPA level
QA/QC procedures to be applied:	Procedure will be determined at CPA level
Any comment:	

Data / Parameter:	$EG_{,import}$
Data unit:	kWh/year
Description:	Net electricity import by the project activity

Source of data to be used:	Monitored at the CPA level
Value of data applied for the purpose of calculating expected emission reductions in section B.5.	The value will be applied at CPA level
Description of measurement methods and procedures to be applied:	Method will be identified at CPA level
QA/QC procedures to be applied:	Procedure will be determined at CPA level
Any comment:	

Data / Parameter:	$FC_{fossil\ fuel,y}$
Data unit:	Ton
Description:	Total amount of fossil fuel used in year y
Source of data to be used:	Monitored at the CPA level
Value of data applied for the purpose of calculating expected emission reductions in section B.5.	The value will be applied at CPA level
Description of measurement methods and procedures to be applied:	Method will be identified at CPA level
QA/QC procedures to be applied:	Procedure will be determined at CPA level
Any comment:	

Data / Parameter:	$EG_{PJ,retrofit,y}$
Data unit:	kWh/year
Description:	Net electricity supplied by the plant/unit to the grid in year *y*
Source of data to be used:	Measured during the project activity.
Value of data applied for the purpose of calculating expected emission reductions in section B.5.	The value will be applied at CPA level
Description of measurement methods and procedures to be applied:	Method will be identified at CPA level
QA/QC procedures to be applied:	Procedure will be determined at CPA level
Any comment:	

Data / Parameter:	$EG_{BL,retrofit,y}$
Data unit:	kWh/year
Description:	Electricity that would have been supplied by the plant/unit to the grid in the absence of the project activity in year *y*.
Source of data to be used:	Measured during the project activity.
Value of data applied for the purpose of calculating expected emission reductions in section B.5.	The value will be applied at CPA level
Description of measurement methods and procedures to be applied:	Method will be identified at CPA level
QA/QC procedures to be applied:	Procedure will be determined at CPA level

Any comment:	

Data / Parameter:	$EG_{historical}$
Data unit:	kWh/year
Description:	Annual average historical net electricity supplied to the grid by the existing renewable energy plant that was operated at the project site prior to the implementation of the project activity
Source of data to be used:	Measured during the project activity.
Value of data applied for the purpose of calculating expected emission reductions in section B.5.	The value will be applied at CPA level
Description of measurement methods and procedures to be applied:	Method will be identified at CPA level
QA/QC procedures to be applied:	Procedure will be determined at CPA level
Any comment:	

Data / Parameter:	$DATE_{BaselineRretrofit}$
Data unit:	Date
Description:	Point in time when the existing equipment would need to be replaced in the absence of the project activity
Source of data to be used:	
Value of data applied for the purpose of calculating expected emission reductions in section B.5.	The value will be applied at CPA level
Description of measurement methods and procedures to be applied:	Method will be identified at CPA level
QA/QC procedures to be applied:	Procedure will be determined at CPA level
Any comment:	

Data / Parameter:	$EG_{PJ,add,y}$
Data unit:	kWh/year
Description:	The total net electrical energy supplied to a grid in year *y* by all units, existing and new project units
Source of data to be used:	Measured during the project activity.
Value of data applied for the purpose of calculating expected emission reductions in section B.5.	The value will be applied at CPA level
Description of measurement methods and procedures to be applied:	Method will be identified at CPA level
QA/QC procedures to be applied:	Procedure will be determined at CPA level
Any comment:	

Data / Parameter:	$EG_{BL,existing,y}$
Data unit:	kWh/year
Description:	The estimated net electrical energy that would have been produced and supplied to a grid by existing units (installed before the project activity) in year *y* in the absence of the project activity.

Source of data to be used:	Measured during the project activity.
Value of data applied for the purpose of calculating expected emission reductions in section B.5.	The value will be applied at CPA level
Description of measurement methods and procedures to be applied:	Method will be identified at CPA level
QA/QC procedures to be applied:	Procedure will be determined at CPA level
Any comment:	

Data / Parameter:	$EG_{actual,y}$
Data unit:	kWh/year
Description:	The actual, measured net electrical energy produced and supplied to the grid by the existing units in year *y*
Source of data to be used:	Measured during the project activity.
Value of data applied for the purpose of calculating expected emission reductions in section B.5.	The value will be applied at CPA level
Description of measurement methods and procedures to be applied:	Method will be identified at CPA level
QA/QC procedures to be applied:	Procedure will be determined at CPA level
Any comment:	

Data / Parameter:	$B_{biomass,PJ,y}$
Data unit:	Tons
Description:	The net quantity of the biomass consumed in year *y*
Source of data to be used:	Monitored at the CPA level
Value of data applied for the purpose of calculating expected emission reductions in section B.5.	The value will be applied at CPA level
Description of measurement methods and procedures to be applied:	Method will be identified at CPA level
QA/QC procedures to be applied:	Procedure will be determined at CPA level
Any comment:	

Data / Parameter:	$NCV_{biomass}$
Data unit:	TJ/tons
Description:	The net calorific value of the biomass
Source of data to be used:	Monitored at the CPA level
Value of data applied for the purpose of calculating expected emission reductions in section B.5.	The value will be applied at CPA level
Description of measurement methods and procedures to be applied:	Method will be identified at CPA level
QA/QC procedures to be applied:	Procedure will be determined at CPA level

Any comment:	

Data / Parameter:	$NCV_{fossil\ fuel}$
Data unit:	TJ/tons
Description:	The net calorific value of the biomass
Source of data to be used:	Monitored at the CPA level
Value of data applied for the purpose of calculating expected emission reductions in section B.5.	The value will be applied at CPA level
Description of measurement methods and procedures to be applied:	Method will be identified at CPA level
QA/QC procedures to be applied:	Procedure will be determined at CPA level
Any comment:	

Data / Parameter:	EF fossil fuel, y
Data unit:	tCO_2/TJ
Description:	Emission factor for fossil fuel used in the project activity
Source of data used:	As per "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"
Value applied:	The value will be applied at CPA level
Description of measurement methods and procedures to be applied:	As per "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"
QA/QC procedures to be applied:	Procedure will be determined at CPA level
Any comment:	-

Data / Parameter:	$Biomass_{Moisture}$
Data unit:	%
Description:	Moisture content of the biomass (wet basis)
Source of data used:	Measured
Value applied:	The value will be applied at CPA level
Description of measurement methods and procedures to be applied:	As per Methodology requirement
QA/QC procedures to be applied:	Procedure will be determined at CPA level
Any comment:	-

4. For AMS.I.F (version 2)

Data / Parameter:	$EG_{BL,y}$
Data unit:	kWh/year
Description:	Net electricity generated by the unit
Source of data to be used:	Measured during the project activity.
Value of data applied for the purpose of calculating expected emission reductions in section B.5.	The value will be applied at CPA level
Description of measurement methods and procedures to be applied:	Method will be identified at CPA level

QA/QC procedures to be applied:	Procedure will be determined at CPA level
Any comment:	

Data / Parameter:	$B_{biomass,PJ,y}$
Data unit:	Tons
Description:	The net quantity of the biomass consumed in year *y*
Source of data to be used:	Monitored at the CPA level
Value of data applied for the purpose of calculating expected emission reductions in section B.5.	The value will be applied at CPA level
Description of measurement methods and procedures to be applied:	Method will be identified at CPA level
QA/QC procedures to be applied:	Procedure will be determined at CPA level
Any comment:	

Data / Parameter:	$NCV_{biomass}$
Data unit:	TJ/tons
Description:	The net calorific value of the biomass
Source of data to be used:	Monitored at the CPA level
Value of data applied for the purpose of calculating expected emission reductions in section B.5.	The value will be applied at CPA level
Description of measurement methods and procedures to be applied:	Method will be identified at CPA level
QA/QC procedures to be applied:	Procedure will be determined at CPA level
Any comment:	

Data / Parameter:	$FC_{fossil\ fuel,y}$
Data unit:	Ton
Description:	Total amount of fossil fuel used in year y
Source of data to be used:	Monitored at the CPA level
Value of data applied for the purpose of calculating expected emission reductions in section B.5.	The value will be applied at CPA level
Description of measurement methods and procedures to be applied:	Method will be identified at CPA level
QA/QC procedures to be applied:	Procedure will be determined at CPA level
Any comment:	

Data / Parameter:	$NCV_{fossil\ fuel}$

Data unit:	TJ/tons
Description:	The net calorific value of the biomass
Source of data to be used:	Monitored at the CPA level
Value of data applied for the purpose of calculating expected emission reductions in section B.5.	The value will be applied at CPA level
Description of measurement methods and procedures to be applied:	Method will be identified at CPA level
QA/QC procedures to be applied:	Will be determined at CPA level
Any comment:	

Data / Parameter:	EF fossil fuel, y
Data unit:	tCO_2/TJ
Description:	Emission factor for fossil fuel used in the project activity
Source of data used:	As per "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"
Value applied:	The value will be applied at CPA level
Description of measurement methods and procedures to be applied:	As per "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"
Any comment:	-

Data / Parameter:	$Biomass_{Moisture}$
Data unit:	%
Description:	Moisture content of the biomass (wet basis)
Source of data used:	Measured
Value applied:	The value will be applied at CPA level
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per Methodology requirement
Any comment:	-

5. For AMS.III.O (version 1)

Data / Parameter:	$m_{H2,T}$
Data unit:	Kmol-H_2
Description:	Total molar amount of hydrogen produced annually
Source of data to be used:	The data will be monitored using appropriate monitoring systems which will be CPA specific
Value of data applied for the purpose of calculating expected emission reductions in section E.6.	Value will be included at CPA level
Description of measurement methods and procedures to be applied:	Method will be identified at CPA level
QA/QC procedures to be applied:	Procedure will be determined at CPA level
Any comment:	-

Data / Parameter:	V_{H2}

Data unit:	Nm^3
Description:	Volume amount of hydrogen produced annually
Source of data to be used:	The data will be monitored using appropriate monitoring systems which will be CPA specific
Value of data applied for the purpose of calculating expected emission reductions in section E.6.	Value will be included at CPA level
Description of measurement methods and procedures to be applied:	Method will be identified at CPA level
QA/QC procedures to be applied:	Procedure will be determined at CPA level
Any comment:	-

Data / Parameter:	$LPG_{Feedstock}$
Data unit:	Kg
Description:	Amount of LPG used as feedstock at hydrogen production unit
Source of data to be used:	The data will be monitored using appropriate monitoring systems which will be CPA specific
Value of data applied for the purpose of calculating expected emission reductions in section E.6.	Value will be included at CPA level
Description of measurement methods and procedures to be applied:	Method will be identified at CPA level
QA/QC procedures to be applied:	Procedure will be determined at CPA level
Any comment:	-

Data / Parameter:	LPG_{molar}
Data unit:	Mol
Description:	LPG molar composition analysis
Source of data to be used:	The data will be analysed as per appropriate standard analysis which will be CPA specific
Value of data applied for the purpose of calculating expected emission reductions in section E.6.	Value will be included at CPA level
Description of measurement methods and procedures to be applied:	Method will be identified at CPA level
QA/QC procedures to be applied:	Procedure will be determined at CPA level
Any comment:	-

Data / Parameter:	SFC_{LPG}
Data unit:	kg-LPG/Nm^3-H_2
Description:	Specific fuel consumption of LPG when biogas is not available
Source of data to be used:	The data will be monitored using appropriate monitoring systems which will be CPA specific
Value of data applied for the purpose of calculating expected emission reductions in section E.6.	Value will be included at CPA level
Description of measurement methods and procedures to be applied:	Method will be identified at CPA level

QA/QC procedures to be applied:	Procedure will be determined at CPA level
Any comment:	-

Data / Parameter:	$E_{biogas\ purification\ plant}$
Data unit:	kWh
Description:	Electricity used by biogas purification plant
Source of data to be used:	The data will be monitored using appropriate monitoring systems which will be CPA specific
Value of data applied for the purpose of calculating expected emission reductions in section E.6.	Value will be included at CPA level
Description of measurement methods and procedures to be applied:	Method will be identified at CPA level
QA/QC procedures to be applied:	Procedure will be determined at CPA level
Any comment:	-

Data / Parameter:	$F_{biogas\ purification\ plant}$
Data unit:	Litres
Description:	Fuel used by biogas purification plant
Source of data to be used:	The data will be monitored using appropriate monitoring systems which will be CPA specific
Value of data applied for the purpose of calculating expected emission reductions in section E.6.	Value will be included at CPA level
Description of measurement methods and procedures to be applied:	Method will be identified at CPA level
QA/QC procedures to be applied:	Procedure will be determined at CPA level
Any comment:	-

6. For AMS.III.AQ (version 1)

Data / Parameter:	$FS_{Bio\text{-}CNG,\ y}$
Data unit:	Tons
Description:	Amount of Bio-CNG distributed by filling stations
Source of data to be used:	Monitored continuously as per appropriate monitoring systems installed at CPA level
Value of data applied for the purpose of calculating expected emission reductions in section E.6.	Value will be included at CPA level
Description of measurement methods and procedures to be applied:	Measurements of the amount of Bio-CNG distributed/sold to retailers/filling stations are undertaken using calibrated meters at the delivery section of Bio-CNG production site.
QA/QC procedures to be applied:	Measurements results shall be cross checked with records for sold amount (e.g. invoices/receipts) and with the amount of biogas produced
Any comment:	-

Data / Parameter:	$FC_{Bio\text{-}CNG,k,y}$

Data unit:	Tons
Description:	Bio-CNG consumed by the project vehicle *k* in the year
Source of data to be used:	Monitored continuously as per appropriate monitoring systems installed at CPA level
Value of data applied for the purpose of calculating expected emission reductions in section E.6.	Value will be included at CPA level
Description of measurement methods and procedures to be applied:	Measurements of the amount of Bio-CNG filled into vehicles of the end users are undertaken using calibrated meters at the filling station site
QA/QC procedures to be applied:	Measurements results shall be cross-checked with production and sales data
Any comment:	-

Data / Parameter:	$FP_{Bio\text{-}CNG,y}$
Data unit:	Tons
Description:	Quantity of the Bio-CNG produced by the project activity in the year y
Source of data to be used:	Monitored continuously as per appropriate monitoring systems installed at CPA level
Value of data applied for the purpose of calculating expected emission reductions in section E.6.	Value will be included at CPA level
Description of measurement methods and procedures to be applied:	Measurements are undertaken using calibrated meters at the outlet of the biogas upgrading section of the Bio-CNG production site
QA/QC procedures to be applied:	Will be determined at CPA level
Any comment:	-

Data / Parameter:	$NCV_{Bio\text{-}CNG}$
Data unit:	GJ/ton
Description:	Net calorific value of Bio-CNG
Source of data to be used:	Measured monthly or as prescribed by the applied national/international standard
Value of data applied for the purpose of calculating expected emission reductions in section E.6.	Value will be included at CPA level
Description of measurement methods and procedures to be applied:	Measured according to relevant national/international standards through sampling.
QA/QC procedures to be applied:	Analysis will be carried out by accredited laboratory
Any comment:	-

Data / Parameter:	NCV_i
Data unit:	GJ/ton
Description:	Net calorific value of gasoline/blended gasoline that was used by project vehicle *k*
Source of data to be used:	Measured at validation and annually
Value of data applied for the purpose of calculating expected emission	Value will be included at CPA level

reductions in section E.6.	
Description of measurement methods and procedures to be applied:	Measured according to relevant national/international standards through sampling.
QA/QC procedures to be applied:	Analysis will be carried out by accredited laboratory
Any comment:	-

Data / Parameter:	$f_{FO,gasoline}$
Data unit:	Fraction
Description:	Fraction of gasoline from fossil fuel origin in the displaced gasoline
Source of data to be used:	Continuously or in batches as per appropriate method identified at CPA level
Value of data applied for the purpose of calculating expected emission reductions in section E.6.	Value will be included at CPA level
Description of measurement methods and procedures to be applied:	As per the following options (in preferential order): (i) Data from the supplier of the gasoline; (ii) If it accrues to national regulations requiring mandatory blending of biofuels, the regulatory blend fraction may be used; (iii) If measured, it shall be according to relevant national/international standards through sampling
QA/QC procedures to be applied:	Will be determined at CPA level
Any comment:	-

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

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MONITORING PLAN

The purpose of this Monitoring Plan (MP) is to provide a standard monitoring procedure to all CPAs under this PoA. PTGPCS as the managing entity will manage the monitoring done by each CPA to ensure that each CPA will meet the requirements for data collection, processing and reporting. The MP shall be in accordance with all relevant rules and regulations of the CDM. The MP is an integral part of this design document and can be utilized to facilitate accurate and consistent monitoring of the project's Certified Emission Reductions (CERs).

The MP will be followed for the duration of the project activity in order to measure and track the impacts of the project activity, and at the same time, prepare for the periodic verification process required confirming the amount of CERs achieved.

Specifically, the MP facilitates the following:

- Establishing and maintaining a suitable monitoring system
- Establishing and maintaining a reliable and accurate monitoring system
- Guide for the implementation of necessary measurement and management operations
- Guide for meeting CDM requirements for verification and certification

PTGPCS, as the coordinating/managing entity, will ensure all individual CPAs are verified based on each unique identification number as a reference to assure single counting of the CERs. The CPA with the reference will be linked with geographic coordinates marked by GPS coordinates based on each specific fixed site location.

Monitoring obligations

In order to facilitate an accurate CER determination, each CPA must fulfill a number of operational and data collection obligations. This will ensure that CERs are calculated in a transparent manner and monitoring is carried out as specified in the CDM Operations and Monitoring Manual which will be prepared before the start of the first crediting period. All data required for baseline and emission reduction determination shall be monitored as described in each CPA-DD.

PTGPCS, as the managing entity, will maintain all monitoring reports for all CPAs in accordance with the record keeping system and also make available all monitoring reports requested by the DOE for verification purposes.

Management and operational systems

The project participant of each CPA will have a well defined management and operational system that meets the requirements of the project activity to ensure successful operation of the CPA and the credibility and verifiability of the CERs achieved. This includes:

Data handling

- Each CPA will develop and implement a protocol that establishes a transparent system for the collection, computation and storage of data, including adequate record keeping and data monitoring systems which will be fit for an independent auditing and verification process
- Every individual CPA will maintain its own monitoring system, data collection system and record keeping system
- PTGPCS as the managing entity will oversee and ensure that each CPA maintains standard record documenting, archives the monitored data in a secure database and keeps the records during the entire crediting period of each CPA and two years after the crediting period
- Data (paper & electronic) will be transmitted semi-annually to PTGPCS who is responsible for the compilation of the Monitoring Reports. PTGPCS will conduct a data audit and compliance review utilizing the MP at least twice a year for each CPA

Quality assurance

- Key personnel will be assigned for overall project management, operation, monitoring and reporting as required by the project activity
- A competent manager will be appointed to be in charge of and accountable for the generation of CERs including monitoring, record keeping, computation of ERs, audits and verification. The person will officially sign-off on all GHG Emission worksheets
- Well-defined protocols and routine procedures, with good, professional data entry, extraction and reporting will be encouraged to maximize transparency of data archiving
- Proper management processes and recording of official data

Training

- Internal training will be made available to the new dedicated operational staff to enable them to undertake the tasks required by this MP. Initial staff training will be provided before the Project starts operating and generating CERs

– Health and safety requirements also will be given priority

If corrective action or improvement is required, then the project proponent will inform the managing entity for corrective or enhancement measures.

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

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The baseline study and monitoring methodology was completed on 30 April 2011 by:
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Annex 1

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The projects have not received and will not be seeking public funding.

Annex 3

BASELINE INFORMATION

No additional information.

Annex 4

MONITORING INFORMATION

No additional information.

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