Programme of activities design document form
(Version 09.0)

Complete this form in accordance with the instructions attached at the end of this form.

BASIC INFORMATION	
Title of the PoA	Recovery and Avoidance of Methane from Industrial Wastewater Treatment Projects
Version number of the PoA-DD	14
Completion date of the PoA-DD	17/01/2020
Coordinating/managing entity	PT. Knowledge Integration Services (Indonesia)
Host Parties	Indonesia
Applied methodologies and standardized baselines	AMS-III.H "Methane Recovery in Wastewater Treatment" Version 18
Sectoral scopes	13: Waste handling and disposal

PART I. Programme of activities (PoA)

SECTION A. Description of PoA

A.1. Purpose and general description of PoA

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General operating and implementing framework of PoA

This Programme of Activity (hereafter referred to as "PoA") is a small-scale PoA. PT. Knowledge Integration Services (Indonesia) is the Coordinating and/or Managing Entity (hereinafter referred to as "CME") for this PoA. The PoA is in relation to recovery of methane gas from "agricultural product based industrial wastewater" (hereinafter referred to as "industrial wastewater") treatment process which would have otherwise been emitted into the atmosphere. The host party for the PoA is Indonesia.

Policy/measure or stated goal of the PoA

Decomposition of organic content in the industrial wastewater treatment processes generates biogas (i.e., methane) which is a potent greenhouse gas (GHG). Therefore, if this methane is allowed to escape into the atmosphere, it will result in increased GHG emissions.

The purpose of this PoA, through implementation of several CPAs (including Greenfield and replacement projects) will be to recover the biogas generated from industrial wastewater and thus avoid GHG emissions. The recovered biogas might be fully or partially flared; if partially flared, the balance would be utilized for energy generating, for instance heat/steam generation in a burner or boiler or electricity generation in an engine. However, no CERs will be claimed under this PoA from use of recovered biogas (i.e. type I project activities).

The owner(s) of the agricultural product based industrial facilities will sign an agreement with the CME acknowledging the inclusion of their methane recovery project as CPA under this PoA.

With respect to each CPA, the CME/CPA implementer may potentially distribute information about the benefits of undertaking such methane recovery programme including its associated economic, social and environmental benefits. This will help in creating awareness amongst interested stakeholders.

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

The discharge of industrial wastewater in Indonesia is regulated by the Ministry of Environment under MenLH Decree 51/1995[1]. The facility owner has an obligation to treat the wastewater generated in the facility so that the final discharge is within the water quality standards which have been set. However, the treatment technology (e.g. anaerobic digester or aerobic treatment system) to be implemented at the facilities is not specified in this regulation or in other regulatory requirements. In addition, there is no specific requirement stipulated for methane recovery in the wastewater treatment system.

The fact that there is no existing regulatory regime for methane recovery from industrial wastewater demonstrates that this PoA is a voluntary action by the CME.

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[1] MenLH Decree 51/1995, http://www.cets-uii.org/BML/Air/BMLC/kepmen5195/

Contribution of the PoA to sustainable development in Indonesia
The proposed PoA will contribute to the sustainable development in Indonesia as follow:

Environmental Sustainability
- The CPAs under this PoA will involve wastewater treatment through anaerobic digestion using anaerobic tank-based technologies/system with methane recovery. They will thus avoid methane emissions into the atmosphere and therefore contribute in reducing GHG emissions.
- The recovered methane which may replace the use of fossil fuel for energy generation will also contribute in conservation of natural resources to be used as fuel.
- The treated wastewater discharged from the CPAs under this PoA will meet the standards set for the industrial wastewater[2] discharge.
- The CPAs under this PoA will not cause any disturbance to the biodiversity and the natural habitats in the surrounding areas.
- The CPA implementer will ensure compliance with all requirements pertaining to the land use, i.e. permissions and approvals from relevant agencies, will be complied with.
- The CPAs under this PoA will implement best practices for issues related to health and safety, and thus will not impose health risk for the employees or for the local community. Further, the avoidance of methane emissions will reduce the unpleasant odor associated with the wastewater treatments without methane recovery.
- The CPA implementer will ensure that each CPA will comply with the work safety regulations.
- The CPAs under this PoA will document all procedures related to efforts in preventing accidents at the project site and the actions to be taken if accidents happen.

Economic Sustainability
- The CPAs under this PoA will not reduce the income of local community. In fact, the construction and operation of CPAs will require skillful manpower from diverse backgrounds (i.e. engineering, science and finance). Thus, the implementation of PoA will potentially increase employment opportunities in the host country.
- Further, the CPA implementer will ensure that there are no layoff issues, to the extent possible, which may arise due to the CPAs. For any such occurrence, a discussion will be conducted and the CPA implementer will ensure that the national labor laws are complied with.
- The CPAs under this PoA will not reduce the quality of any public service (e.g. health, education, energy, etc) provided to local community, in any way.

Social Sustainability
- The CPAs under this PoA will encourage community participation. A local stakeholder consultation will be conducted at CPA level. More details of the local stakeholder comments and the responses and further actions taken will be provided in the specific CPA-PDD.
- The CPAs under this PoA will not cause any conflicts in the community that can affect the social integrity of the local communities.

Technological Sustainability
- The use of foreign technology in CPAs will stimulate and promote the development and transfer of international wastewater treatment technologies into Indonesia. The CPA implementers will ensure that their employees are able to operate and maintain the project systems effectively and independently.
- The CME will ensure that the technology implemented in the CPAs under this PoA is not obsolete and neither is in trial period.

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[2] MenLH Decree 51/1995, http://www.cets-uii.org/BML/Air/BMLC/kepmen5195/

- The implementation of the CPAs under this PoA will encourage the use of similar technical design technology in Indonesia and thus will promote the sustainability of this technology. Through the technology transfer (i.e. skills upgrading and trainings), the implementation of CPAs will enhance local operator's knowledge and expertise. Thus, the local capability and workforce quality will be improved.

A.2. Physical/geographical boundary of PoA

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The geographical boundary for PoA is entire host country of Indonesia.

Figure 1: Map of Indonesia (Source: Answer.com 2011)

A.3. Technologies/measures

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The purpose of this PoA, is to recover the methane generated from industrial wastewater treatment process, which would have otherwise been emitted into the atmosphere resulting in GHG emissions.

As per paragraph 93 of the "CDM Project Standard for programme of activities" (EB 93, Annex 07), the CME shall list the various combinations of technologies/measures and/or approved methodologies that will be implemented in the PoA.

For the purpose of this PoA, there is one set of technology/measure and approved methodology which is proposed to be implemented:

Serial No.	Description of Technology/Measure	Applicable Approved Methodology
1.	Wastewater treatment by anaerobic digestion using anaerobic tank based technologies/system and recovery of biogas	AMS-III.H (version 18)

A typical CPA under this PoA could include any of the following measures:

a. replacing an existing anaerobic wastewater treatment system without biogas recovery with a new treatment system i.e. anaerobic digestion using anaerobic tank based technologies/system coupled with biogas recovery; or
b. Greenfield wastewater treatment system i.e. a new anaerobic digestion using anaerobic tank based technologies/system coupled with biogas recovery.

The measure implemented in each CPA will be documented in the respective CPA-DD.

The recovered biogas may be fully flared or partially flared with an option of utilizing the remaining quantity for energy generation, for instance heat/steam generation in a burner or boiler or electricity generation in an engine. However, no CERs will be claimed under this PoA from use of recovered biogas (i.e. type I project activities).

Both, the anaerobic digester treatment system (anaerobic tank based technologies/system) as well as the biogas management system (i.e. flaring and/or use for energy generation) will be under the control of the CPA implementer.

Each CPA under the PoA will involve wastewater treatment through anaerobic digestion using anaerobic tank based technologies/system with biogas recovery systems. As per the 3rd eligibility criteria for inclusion of a CPA under this PoA, each CPA will be required to provide a detailed description of the configuration of the technology measure proposed to be implemented.

Each of the CPAs will result in emission reductions not exceeding 60,000 tCO_2e annually.

A.4. Coordinating/managing entity

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Coordinating/managing entity of the PoA is PT. Knowledge Integration Services (Indonesia), which would be the entity who communicates with the Executive Board (EB).

A.5. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Indonesia (host Party)	Private entity- PT. Knowledge Integration Services (Indonesia)	No

Project participants may or may not be involved in the CPAs included in this PoA.

A.6. Public funding of PoA

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There is no public funding for this PoA.

SECTION B. Management system

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The CME has implemented a management system which ensures that each CPA meets the requirements and eligibility criteria under the PoA-DD before it is included in the registered PoA.

The management system is designed as per CDM Project Standard for Programme of Activities (Version 02.0 EB 97 Annex 07) and includes all relevant information as per paragraph 36&37 therein.

The management system consists of the following:

a) Description of the roles and responsibilities of the personnel to be involved in the CPA evaluation process. This will even include a review of their competencies;
b) Schedules for training of personnel for updating them on the latest developments on programmatic CDM and the CDM mechanism as a whole;
c) Procedures for technical review of inclusion of CPAs. These procedures will be developed keeping in view the eligibility criteria to be complied by a CPA before it could be added under the PoA;
d) A procedure to avoid double counting (e.g. to avoid the case of including a new CPA that has already been registered either as a CDM project activity or included as a CPA in another registered CDM PoA);
e) Documentation and control process for each CPA.

A record keeping system for each CPA under the PoA

Following records are to be maintained by the CME for each of the CPA under this PoA:

- Name of entity implementing the CPA;
- Description of the technology specification implemented under the CPA- Referring to section A.4.2.1., “Technology or measures to be employed by the SSC-CPA”, the CPA will implement anaerobic digestion based on anaerobic tank based technologies/system with methane recovery;
- Location where the CPA is implemented- City/Town/Village, State / Union Territory, GPS (latitude and longitude);
- Date of commissioning of the CPA;
- Information pertaining to the baseline alternatives (including specifications) which would have been implemented in the absence of the CPA and how the baseline scenario has been determined;
- Data pertaining to all parameters required for baseline emissions, project emissions and leakage calculation, including source from which such data has been collected. Record of certain parameters which are to be monitored ex-post will be regularly updated based on the information collected from the CPA implementer; and
- CME will be responsible for the verification and CER issuance for each CPA under this PoA, therefore it will also maintain all relevant information (for each CPA) as may be required for the purpose of verification and CER issuance.

Section I.6.2 and section I.7.1 lay down the data parameters which are to be reported in the CPA-DD form and those which are monitored ex-post, respectively. The CME will develop data formats for data collection with respect to these parameters. The formats will be circulated to each of the CPA implementers, for them to provide actual data, including information on assumptions made if any, supporting documents for various parameters and any other relevant information.

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

Prior to adding a new CPA within the proposed PoA, the CME will check the registered PoA database as well as the registered CDM projects database (available on UNFCCC website) to ensure that the proposed CPA has not already been registered as a CDM project or as a CPA of another PoA.

In case the CME concludes that there already exists a similar CDM project activity or a CPA of another PoA, then it will not proceed with the registration of the particular CPA under this PoA. Thus, the CME shall avoid double counting of carbon credits.

Furthermore, at the time of inclusion the CME shall take a declaration from the CPA implementer that there is no double counting of CERs.

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

The Eligibility criteria applicable to CPAs require each CPA to demonstrate that it is not a de-bundled component of another CPA or CDM project activity.

The CME will follow the following guidelines to ensure that the proposed CPA is not a de-bundled component of a large scale activity.

A proposed CPA shall be deemed to be a de-bundled component of a large scale activity if there is already an activity[3], which satisfies both conditions (a) and (b) below:

a) Has the same activity implementer as the proposed CPA or has a CME, which also manages a large scale PoA of the same technology/measure, and;
b) The boundary is within 1 km of the boundary of the proposed CPA, at the closest point.

If a proposed CPA is deemed to be a de-bundled component (based on the above requirements), but the total size of such CPA combined with a registered small-scale CPA of a PoA or a registered CDM project activity does not exceed the limits for small-scale CDM project activities (i.e. aggregate emission reductions are less than or equal to 60,000 tCO2e annually from all Type III components), the CPA can qualify to use simplified modalities and procedures for small-scale CDM project activities.

If each of the independent subsystems/measures (e.g. anaerobic tank) included in the CPA is no larger than 1% of the small-scale thresholds defined by the methodology applied[4], then that CPA will be exempted from performing de-bundling check i.e., considering as not being a de-bundled component of a large scale activity.

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

The CME is responsible for identifying, implementing, registering and managing all CPAs to be included in the proposed PoA. The CME will obtain an authorization letter from each of the CPA implementers intending to participate under this PoA. Further, as per Eligibility Criteria applicable to CPAs, the CPA implementers should waive its right to proceed in getting the CPA registered as an independent CDM project or as a CPA to another PoA, upon subscribing to the PoA.

SECTION C. Demonstration of additionality of PoA

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Annex 7 of EB 93 lays down the standards for demonstration of additionality of GHG emission reductions achieved by a PoA. Followings are the requirements under the standard:

1. It needs to be demonstrated that in the absence of CDM, none of the implemented CPAs would occur.
2. PoAs that will include one or more micro-scale projects as CPA and/or one or more small-scale projects as CPA shall include eligibility criteria in the PoA-DD, from all the relevant guidelines as may be applicable for demonstrating additionality for micro-scale projects/ small-scale projects.
3. The CME shall demonstrate that compliance with the additionality related eligibility criteria in the PoA-DD will ensure that all relevant additionality related guidelines, tools or any requirement embedded in the methodology(ies) are met.

The requirements under the standard are met as follows:

Requirement 1: Find below "PoA level demonstration of additionality" demonstrating why in the absence of CDM, the CPAs considered for inclusion under the PoA would not occur.

Requirement 2: Refer to Eligibility Criteria number 6 of "**Table 1. Eligibility criteria for inclusion of a CPA under this PoA-Replacement CPAs" and "Table 2. Eligibility criteria for inclusion of a CPA under this PoA-Greenfield CPAs**"

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[3] Which may be a (i) registered small-scale CPA of a PoA, (ii) an application to register another small- scale CPA of a PoA or (iii) another registered CDM project activity.

[4] i.e. aggregate emission reductions less than or equal to 60,000 tCO2e annually

Requirement 3: In this section of the PoA-DD provides for the mechanism to be followed by the CME in demonstrating the additionality of a typical CPA. This mechanism has been developed based on: (a) guidelines for demonstrating additionality of micro-scale project activities and (b) Attachment A to Appendix B, of the Simplified modalities and procedures for small-scale CDM project activities.

Thus, PoA-DD ensures that the additionality of the CPA is demonstrated in accordance with either the micro-scale additionality requirements or the small scale additionality requirements, as may be applicable.

PoA level demonstration of additionality

According to the relevant environmental guidelines, "Standards for Wastewater of Industrial Activities- MenLH Decree 51/1995[5]", there is no recommendation on the nature of technology (i.e. anaerobic digestion using anaerobic tank based technologies/system) to be implemented for the wastewater treatment. Furthermore, there is no requirement for methane recovery in the wastewater treatment. Therefore, it can be concluded that this PoA is a voluntary initiative by the CME.

In addition, there are no financial incentives to implement anaerobic tank based technologies/system with methane recovery (they require heavy capital investments). There will be no financial returns that can be generated against the capital investment made.

Even if the recovered biogas is put to productive use, any cost savings from such use is expected to be financially less attractive and may not provide the CPA implementer with the necessary incentives to implement the CPA (refer to the financial assessment done for the 1st CPA submitted along with the request for registration of the PoA).

In the absence of any mandatory requirements from the government to implement anaerobic digestion using anaerobic tank based technologies/system equipped with methane recovery, it is less likely that industrial facilities will incur the additional investment.

Furthermore, the implementation of anaerobic digestion using anaerobic tank based technologies/system and biogas recovery in the industrial wastewater treatment systems requires provision in operation and maintenance of such systems. For instance, anaerobic tank involves a series of biological processes6 which are dependent on various variables. There is a need for control measures in order to ensure that the tank parameters are within appropriate level and the tank performs well.

In addition, there will be a need for precautionary measures for handling biogas (i.e. methane) which is highly explosive and flammable. Gas storage and piping system must be constructed in accordance with standard engineering practice in order to avoid leakages. There is also a risk from hydrogen sulphide (H2S) gas which is present in the biogas. This H2S gas could accumulate in bottom tanks and is harmful in high concentration7. In order to ensure smooth operation while preventing undue safety hazards, well trained and technically skilled manpower will be required for such systems. Therefore, there exists a need to train the existing employees or to search for well trained and technically skilled manpower. Industrial facilities will be required to hire experienced staff to operate the systems and necessary training may also be required to be given to the existing staff so as to ensure that the anaerobic tank equipped with methane recovery is operated in the most efficient and effective manner. However, it has been demonstrated above that there are negligible or low economic incentives for the facility owners to take up such initiatives. It is most likely that the CPA implementers (i.e. the industrial facilities owners) will opt for the most

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[5] MenLH Decree 51/1995, http://www.cets-uii.org/BML/Air/BMLC/kepmen5195/

economical and technically proven wastewater treatment system i.e. systems without methane recovery.

The barriers and the risks associated with anaerobic tank based technologies/systems, identified in demonstrating the additionality at PoA level will need to be quantified and justified at each CPA level (based on the project specific information and circumstances applicable to that CPA) before it can be added to the PoA.

CDM revenues form a serious consideration for implementing this PoA. In the absence of CDM revenues, the barriers associated with the project technology are too prohibitive for the CPA implementer to implement such technology. Such barriers would prevent the implementation of this voluntarily coordinated action in the absence of the PoA.

Similar barriers to implementation of the respective CPAs are expected to be faced by the individual CPA implementers. The demonstration of additionality for each CPA will be provided in the individual CPA- DD.

The PoA as a whole, once implemented, will encourage development of policies to aid similar programmes and greater implementation of methane recovery projects.

Additionality for small-scale CPAs

The following mechanism shall be followed for demonstrating additionality of each CPA. This mechanism has been developed in accordance with Attachment A to Appendix B of the simplified modalities and procedures for small-scale CDM project activities. The CME may use one or more of the barriers (listed below) in demonstrating the additionality of a given CPA.

Investment barrier: The CPA may demonstrate investment barrier by employing one or more of the following:

- By providing an explanation to show that a more financially viable alternative to the CPA would lead to higher emissions.
- Demonstrate that similar activities have only been implemented with grants or other non-commercial finance terms.
- The institution/investor providing financing for the CPA had considered CDM benefits into consideration for financing the CPA.

The CPA implementer may use investment comparison analysis or benchmark analysis or simple cost analysis (as may be applicable to the CPA) for demonstrating investment barrier. The approach taken with selected financial indicator will be well-documented in the CPA-DD. In case of investment comparison analysis or benchmark analysis, calculation of project IRR will be used as the key financial indicator for demonstrating investment barrier. However, for CPAs which are 100% financed through equity, their project IRR will be same their equity IRR.

In case of Greenfield CPAs, only investment comparison approach (if any revenue is expected to be generated from the CPA) or simple cost approach (if no revenue is expected to be generated from the CPA) is applicable. The capital and operation & maintenance cost for baseline alternatives will be determined in a conservative manner. For investment comparison approach, Project IRR will be calculated for baseline alternatives including the CPA itself and compared. For simple cost approach, cost will be calculated for baseline alternatives including the CPA itself and compared

Various assumptions are likely to be made by each CPA for performing the above analysis. Below is the description of the sources from which the data can be sourced for the assumptions used for

demonstrating investment barrier. For assumption specific to any CPA which are not covered in the table below will be estimated for the CPA is a conservative manner.

Calculation of the benchmark

Parameters for calculating benchmark Project IRR

Parameter	**Proposed value**	**Source**	**Fixed in PoA DD**
Required return on equity (in real terms) (Ku)	12.5%	Default value for Group 1 (Energy industries and waste handling and disposal) Source: Appendix A of 'Guidelines on the Assessment of Investment Analysis' (EB 62, Annex5), or its subsequent revision	Yes
Value of debt (D)	50%	If the project is fully financed internally, a value of 0% shall be applied. Where a project is financed by debt and equity, a debt value of 50% is used as the default structure. This is in line with the guidance note of investment analysis provided by the CDM EB.	No
Value of equity (E)	50%	If the project is fully financed internally, a value of 100% shall be applied. Where a project is financed by both debt and equity, an Equity value of 50% is used as the default structure. This is in line with the guidance note of investment analysis provided by the CDM EB.	No
Cost of debt (Kd)	See CPA-DD	Average cost of Debt (Investment Loans) from Bank Indonesia[6] at the time of investment decision.	No
Risk free rate (Rf)	3%	A default value of 3% shall be applied as the Risk-Free rate (Appendix A of 'Guidelines on the Assessment of Investment Analysis')	Yes[7]
Tax Rate (T)	25%	Corporate tax rate applicable at the time of investment decision. Source: Indonesian Pocket Tax Book, PwC 2011[8] or equivalent	Yes[9]

[6] Bank of Indonesia, http://www.bi.go.id/seki/tabel/TABEL1_26.pdf

[7] If the default value changes, the updated value shall be used in the CPA-DD.

[8] PwC, https://emerhub.com/wp-content/uploads/Indonesian-pocket-tax-book_2012-update.pdf

[9] If the tax regulations change, the appropriate value shall be used in the CPA-DD.

Weighted average cost of capital (WACC) if applicable to any CPA (where a CPA has been financed by both debt and equity) will be calculated as follows[10]:

$$WACC = Ku*(1 - DT/(E+D)) + (D/(D+E))*(Kd - R_F)*(1-T)$$

D Value of Debt
E Value of Equity
Kd Cost of Debt
Ku Cost of Unlevered Equity
R_f Risk-free Rate
T Corporate Tax Rate

Calculation of the project IRR

Project IRR shall be determined for each CPA in the CPA-DD. If the CPA contains several projects, Project IRR might be calculated for each project if this is the approach followed to assess the financial attractiveness of the project by the developer at the time of the investment decision.

Data sources for CPA specific assumptions used for investment barrier assessment

Parameter	**Proposed value**	**Source**
Value of debt	See CPA DD	If the CPA is fully financed by equity then the debt portion will be considered zero. If the CPA is financed by debt and equity, the debt to total capital ratio will be determined based on the funding arrangement for the CPA
Cost of debt	See CPA DD	If commercial arrangement not yet in place then average cost of Debt from local banks in the country at the time of investment decision will be used. If commercial arrangement already in place, then actual cost of debt will be considered.
Tax	25%	Corporate tax rate applicable at the time of investment decision. Source: Indonesian Pocket Tax Book, PwC 2011[11] or equivalent
Capital cost	See CPA DD	Value will be taken from (in order of priority): • The actual contract for the CPA • Quotes from the manufacturers/technology providers • Feasibility study
Life of the CPA	See CPA DD	Value will be taken from the following available source: Technology provider certificate
Depreciation	See CPA DD	Straight line method of depreciation will be used
Period of assessment	Minimum 10 years and maximum 20 years	This is in line with the guidelines on the assessment of investment analysis (Annex 5 EB 62)
Salvage value of	See CPA DD	In case the period of assessment is smaller than the

[10] WACC formula: Damodaran (1994)- Appendix 2 of "Valuing Companies by Cash Flow Discounting: Ten Methods and Nine Theories" by Pablo Fernandez, IESE Business School, University of Navarra

[11] PwC, https://emerhub.com/wp-content/uploads/Indonesian-pocket-tax-book_2012-update.pdf

CPA's Assets		life of the CPA, the remaining book value of the CPA's assets +/- reasonable expectation of profit/loss (profit added and loss deducted) on the realization of the assets will be recorded as salvage value.
CDM verification expenses	See CPA DD	Estimated annual CER verification expenses
Operation and maintenance cost	See CPA DD	Value will be taken from the following available sources: Manpower cost: Number of manpower required: data from technology provider Salary of manpower (in order of priority): • CPA implementer's salary structure • Publicly available salary surveys Chemicals consumption cost: Data from technology provider Maintenance and upkeep: Data from technology provider
Estimated cost savings/revenues from the CPA	See CPA DD	Estimated biomass savings (if applicable - in the event if biogas is used to replace biomass in a boiler) Quantity of savings (in order of priority): • As per CPA implementer's estimations • Data from technology provider Selling price of biomass: third party buyer quotation in the region Estimated fossil fuel savings (if applicable - in the event if biogas is used to replace fossil fuel in burners or a boiler or any engine): Quantity of savings (in order of priority): • As per CPA implementers estimations based on historical data • Data from technology provider Price: invoices of fossil fuel purchase by CPA implementer. Estimated grid electricity savings (if applicable - in the event if biogas is used for in-house electricity generation which otherwise would have been imported from the grid, with any surplus of biogas

		based electricity generation being exported to the grid) Quantity of savings (in order of priority): • As per CPA implementers estimations based on historical data on electricity consumption of the facility as well as installed capacity of the newly installed in-house electricity generation unit. • Data from technology provider Price: Electricity tariff paid by the CPA implementer for buying electricity from the grid.

The exact parameters might vary depending on the CPA. Further, a sensitivity analysis will also be performed to demonstrate how variations in key parameters affect the financial analysis for the CPA. Variables that constitute more than 20% of either total project cost or total project revenues will be subject to sensitivity analysis. A ±10% variation in the key parameters will be analysed.

Technological barriers: The CPA may demonstrate technology barrier by employing one or more of the following:

- By providing an explanation to show that a less technological advance alternative to the project involves low risk (on account of performance uncertainty), however, leads to higher emissions; or the project technology has a low market share.
- Risk of technological failure: the process/technology failure risk in the local circumstances is significantly greater than of other technologies that provide services or outputs comparable to those of the proposed CPA, as demonstrated by relevant scientific literature or technology manufacturer information.
- The particular technology used in the proposed CPA is not available in the relevant region.
- The technology implemented for the CPA has marginal penetration in the current market scenario.

Barriers due to Prevailing practices: The CPA may prove “Barriers due to prevailing practices” by employing the following test:

• The CPA is first of its kind. If applicable, first of its kind barrier can only be used by the 1st CPA in a given sector, for demonstrating additionality.

The CPA implementer may demonstrate the technological barriers or barriers due to prevailing practice using the following data sources:

a) Publicly available information
b) National/regional data
c) Local expert
d) Survey
e) Past historical performance data of the existing facility,
f) Past historical performance data of a comparable facility in the country,
g) Estimation by CPA implementer

Additionality for micro-scale CPAs

Additionality for micro-scale projects (emission reductions resulting from the methane recovery activity is at a scale of no more than 20 ktCO2e per year) will be demonstrated using the following

mechanism. This mechanism has been developed in accordance with the “Guidelines for Demonstrating Additionality of Micro-scale Project Activities”.

CPAs that aim to achieve emission reductions at a scale of no more than 20 ktCO2e per year are additional if both the conditions below are satisfied:

(a) Each independent subsystem/measure in the CPA achieves an estimated annual emission reduction equal to or less than 600 tCO2e per year; and

(b) End users of the subsystem or measure are household/communities/SMEs.

To determine whether the end user of the subsystem or measure is a SME or not, the definition of SME will be derived from the Small Enterprise Act No. 9 of 1995, as may be updated from time to time.

The following criteria have to be addressed for assessing additionality of a CPA when it is proposed to be included in the registered PoA. If any of the criteria below are not met, CPA shall not be included in the PoA.

- The CPA shall provide an explanation to show that it would not have occurred anyway due to at least one of the barriers identified above.

The CPA must demonstrate that the participation of the CPA is voluntary and there is no requirement or enforcement under existing national/state/local regulations to introduce anaerobic tank based technologies/system equipped with methane recovery.

SECTION D. Start date and duration of PoA

D.1. Start date of PoA

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The start date for this PoA was 13/10/2011, the date when the PoA-DD was uploaded on the CDM UNFCCC website for global stakeholder’s consultation.

D.2. Duration of PoA

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28 years 00 months
The PoA duration as per registered PoA DD from 13/10/2011 to 12/10/2039.
The first renewal crediting period was from 29/10/2012 to 28/10/2019.
The second renewal crediting period is from 29/10/2019 to 28/10/2026

SECTION E. Environmental impacts

E.1. Level at which environmental impacts analysis is undertaken

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Individual CPAs under this PoA will be implemented at different geographical locations involving uniquely identified separate technological measures. Environmental impacts, if any, associated with the implementation of each CPA is, therefore, expected to occur at individual CPA level. Hence, the environmental analysis will be conducted at individual CPA levels as and when a new CPA is intended to be added to this PoA.

E.2. Analysis of environmental impacts

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The CPAs will not have any adverse environmental impacts, including transboundary impact. It has been described earlier that there does not exist any regulatory regime for recovery of methane from industrial wastewater.

The CPAs do not result in negative impacts to the environment and will provide the following environmental benefits:

- Reduction of methane emissions
- Potential performance improvement of existing wastewater treatment system (in the case of replacement projects)
- Reduction of risk of water contamination
- Generation of energy from renewable sources (i.e. biogas) which may be put to productive use.
- Reduction of fossil fuel use due to potential use of biogas for energy generation.

Although the CPAs under this PoA are less likely to have any environmental impact including transboundary impact, the Environmental Impact Assessment (EIA) requirement will be assessed on case to case basis for each individual CPA.

E.3. Environmental impact assessment

>>

A typical of CPA under this PoA involve wastewater treatment in an agricultural product based industrial facility through anaerobic digestion using anaerobic tank based technologies/system equipped with methane recovery. In Indonesia, MenLH Decree 11/2006 [12] prescribes the businesses and/or activities of various sectors which require an Environmental Impact Assessment (EIA). Each of the activities is linked with a scale. All the activities that are beyond the scale will require an EIA.

Each CPA under this PoA will be assessed against the aforementioned regulation to determine whether an EIA will be required or not.

SECTION F. Local stakeholder consultation

F.1. Level at which local stakeholder consultation is undertaken

>>

Individual CPAs under this PoA will be implemented at different geographical locations involving uniquely identified technological measures. The stakeholder concerns for each CPA might be different depending upon the CPA specific circumstances under which that CPA will be implemented. Therefore, stakeholder consultation will be conducted at each CPA level rather than at PoA level, so as to gather, evaluate and address stakeholder concerns for each CPA.

F.2. Modalities for local stakeholder consultation

>>

This will be done at SSC-CPA level.

F.3. Summary of comments received

>>

This will be done at SSC-CPA level.

F.4. Consideration of comments received

>>

NA

SECTION G. Approval and authorization

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The host country approval is achieved on PoA level.

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[12] MenLH Decree 11/2006 “Business and/or activity type which require an Environmental Impact Assessment (EIA)”

PART II. Generic component project activity (CPA)

SECTION H. Description of generic CPA

H.1. Title of generic CPA

>>

Recovery and Avoidance of Methane from Industrial Wastewater Treatment Projects – CPA No.<XXX>

H.2. Reference number of generic CPA

>>

CPA No. XXX

H.3. Purpose and general description of generic CPA

>>

Under this section the CPA implementer will be required to include the following information:

- The geographical location where the CPA is being implemented
- The type and category of the CPA, and the measures implemented under the CPA

Table XX. Applicable measure in the CPA

Please tick where applicable	Measure
	Replacing an existing wastewater treatment system with a new treatment system i.e. anaerobic digestion using anaerobic tank based technologies/system coupled with biogas recovery.
	A Greenfield wastewater treatment system i.e. anaerobic digestion using anaerobic tank based technologies/system coupled with biogas recovery

The objective(s) of the CPA is -

- How the CPA contributes to GHG emissions reduction?
- Description of the technology implemented for the project
- Salient features of such technology

CPA Implementer to also elaborate on the contributions of the CPA towards sustainable development:

- Environmental Sustainability
- Economic Sustainability
- Social Sustainability
- Technological Sustainability

H.4. Technologies/measures

>>

The project activity will involve anaerobic treatment of wastewater (POME) generated during the production of palm oil from Fresh Fruit Bunch (FFB) in the closed digester system (XXX reactor) and recovery of methane enriched biogas in an efficient manner. The project activity consists of installation of XXX bio-digesters for the anaerobic treatment of the POME. The anaerobic digester

system converts organic matter of wastewater into methane rich biogas, by a consortium of anaerobic bacteria inside the reactor. The biogas thus generated is extracted, captured in the digester and released through pressure releaser installed on rooftop near gas dome for releasing high pressure inside digester to the boiler through gas washer. The technology is supplied by XXX is a well-known name in the industry.

The CPA will reduce emission of greenhouse gases (GHG) by installation of anaerobic digester system to treat the POME from the palm oil mill and recover the biogas generated during the treatment. The recovered biogas will be combusted in steam boiler (within the mill) for energy generation. The biogas will displace the use of palm kernel shell (PKS) in the steam boiler. Any excess of the recovered biogas will be flared in a controlled manner in an open flare. Both, the anaerobic digester system as well as the biogas management system (i.e. energy generation with any excess being flared) will be under the control of the CPA implementer. The emission reductions resulting from the use of biogas will not be accounted for in the CPA.

The technology used in the CPA comprises of following sub-activities:

1. XXX
2. XXX
3. XXX

The anaerobic digester to be used in the CPA will have the following characteristics:

- Capacity: XXX m3
- Hydraulic residence time: around XXX days
- COD removal efficiency: XXX%

The POME will be treated biologically to reduce the COD content. The digester will be equipped with biogas recovery system to recover the generated biogas. The sludge generated from the digestion process will then be separated from the POME in a clarifier and a portion of the sludge will be re-circulated to the digester to maintain adequate population of microorganism for optimum digestion process. The remaining sludge will be XXX. In the aerobic digestion the sludge is sufficiently mineralized and does not require further treatment before dewatering and disposal. Sand filtration drying beds will be provided, where sludge will be dewatered by filtration through sand bed and drying of the dewatered sludge by solar radiation. Sludge drying beds are constructed in brick masonry with a sand media supported by gravel bed and suitable under-drainage arrangement.

The clarified overflow POME from the clarifier will be discharged to the XXX, which will be converted into well-managed aerobic lagoons. The final treated POME will be used for XXX. The lifetime of the bio-digester to be employed by CPA will be XXX years as per manufacturing specification.

SECTION I. Application of methodologies and standardized baselines

I.1. References to methodologies and standardized baselines

>>
AMS-III.H “Methane recovery in wastewater treatment” (Version-18.0) EB 86 A16 (https://cdm.unfccc.int/methodologies/DB/5JGU2EUK716KG3UAE2HBVCK16K199K)

Tools:
1. Project emissions from flaring (Version-03.0.0) EB102 A06 (http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-06-v3.0.pdf)

2. Emissions from solid waste disposal sites (Version-08.0) EB 94 A7 (http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-04-v8.0.pdf)

3. Tool to calculate baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation (version-03.0) EB96 A5
(https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v3.0.pdf)
4. Tool to calculate project or leakage CO_2 emission from fossil fuel combustion (Version-03.0) EB96 A4
(https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v3.pdf)
5. Tool to determine the mass flow of a greenhouse gas in a gaseous stream (Version 3) EB87 A10
(https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-08-v3.0.pdf)
6. Tool to calculate the emission factor for an electricity system (Version 7) EB100 A4
(https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf)

Standard:
CDM Project Standard for programme of activities (Version-02.0) EB93 A07

Guidelines:
General Guidelines for SSC CDM methodologies (Version-22.1) EB66 A23

I.2. Applicability of methodologies and standardized baselines

>>
Applicability conditions under the methodology:
The principle methodology applicable to each CPA under the PoA is AMS-III.H (version 18).
As per registered PoA following applicability conditions under AMS-III.H (version 18) to be complied by each CPA.

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;[13] (e) Introduction of anaerobic wastewater treatment with biogas recovery and combustion, with or without	Each proposed SSC-CPA under this PoA will be in relation to recovery of methane (i.e. biogas) from anaerobic treatment of industrial wastewater in anaerobic tank based technologies/system, which would have otherwise been emitted into the atmosphere. This applicability condition has been also included as part of the Eligibility Criteria for including a CPA under this PoA.

[13] Other technologies in Table 6.3 of Chapter 6: Wastewater Treatment and Discharge of 2006 IPCC Guidelines for National Greenhouse Gas Inventories are included.

	anaerobic sludge treatment, to an untreated 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.	In cases where the baseline system is anaerobic lagoons, the CME will ensure that the lagoons are in compliance with these conditions. The average ambient temperature in Indonesia is 27.7°C [14], above the required temperature of 15°C. This applicability condition has been included as part of the Eligibility Criteria for including a CPA under this PoA.
3	The recovered biogas from the above measures may also be utilised for the following applications instead of combustion/flaring: (a) Thermal or mechanical, [15] electrical energy generation directly; (b) Thermal or mechanical, electrical energy generation after bottling of upgraded	This applicability condition has been included as part of the Eligibility Criteria for including a CPA under this PoA.

[14] https://www.climatestotravel.com/climate/indonesia

[15] For example combusted in a prime mover such as an engine coupled to a machine such as grinding machine.

	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 Appendix shall be followed: (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 4 (a), that component of the project activity can use a corresponding methodology under Type I.	The PoA will not claim any emission reductions resulting from controlled combustion for energy generation. Thus, this applicability condition is not applicable.
5	For project activities covered under paragraph 4 (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 "Thermal energy production with or without electricity".	The PoA will not claim any emission reductions resulting from controlled combustion for energy generation. Thus, this applicability condition is not applicable.
6	For project activities covered under paragraph 4 (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.	The PoA will not claim any emission reductions resulting from controlled combustion for energy generation. Thus, this applicability condition is not applicable.

7	For project activities covered under paragraph 4 (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.	The PoA will not claim any emission reductions resulting from controlled combustion for energy generation. Thus, this applicability condition is not applicable.
8	In particular, for the case of 4 (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 18 of Appendix of AMS-III.H "Methane recovery in wastewater treatment" shall be followed in this regard.	The PoA will not claim any emission reductions resulting from controlled combustion for energy generation. Thus, this applicability condition is not applicable.
9	For project activities covered under paragraph 4 (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).	The PoA will not claim any emission reductions resulting from controlled combustion for energy generation. Thus, this applicability condition is not applicable.
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 "Hydrogen production using methane extracted from biogas".	The PoA will not claim any emission reductions resulting from controlled combustion for energy generation. Thus, this applicability condition is not applicable.
11	If the recovered biogas is used for project activities covered under paragraph 4 (e), that component of the project activity shall use corresponding methodology AMS-III.AQ "Introduction of Bio-CNG in road transportation".	The PoA will not claim any emission reductions resulting from controlled combustion for energy generation. Thus, this applicability condition is not applicable.
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". In addition the requirements for demonstrating the remaining lifetime of the equipment replaced, as described in the general guidelines shall be followed.	In cases where the proposed SSC-CPA is a Greenfield project, this requirement will be considered and complied with. This applicability condition has been included as part of the Eligibility Criteria for including a CPA under this PoA.
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 the wastewater treatment plant as well as the source generating the wastewater will be uniquely defined and described in the specific SSC-CPA-DD.

		This applicability condition has been included as part of the Eligibility Criteria for including a CPA under this PoA.
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 Type III components of the project activity.	A typical SSC-CPA will result in emission reductions less than or equal to 60,000 tCO2e. This applicability condition has been included as part of the Eligibility Criteria for including a CPA under this PoA.

I.3. Application of multiple methodologies

>>

Not applicable

I.4. Project boundary, sources and greenhouse gases (GHGs)

>>

Source		GHGs	Included?	Justification/Explanation
Baseline scenario	Emission from baseline wastewater treatment system	CO_2	No	CO_2 emission is not accounted because this is generated from the decomposition of organic matter.
		CH_4	Yes	CH_4 is the major component in the biogas produced from decomposition of organic matter in the anaerobic treatment/poorly managed aerobic treatment of industrial wastewater.
		N_2O	No	Excluded for simplification.
	Emissions from the baseline sludge treatment system	CO_2	No	PoA does not involve sludge treatment system.
		CH_4	No	
		N_2O	No	
	Emissions on account of electricity or fossil fuel used.	CO_2	Yes	May be an important source of emission. To be considered when baseline involves use of electricity or combustion of fossil fuel.
		CH_4	No	Excluded for simplification.
		N_2O	No	Excluded for simplification.
	Emissions from the discharge of the wastewater into river/lake/sea	CO_2	No	CO2 emission is not accounted because this is generated from the decomposition of organic matter.
		CH_4	Yes	May be an important source of emissions. CH4 is the major component in emissions produced from decomposition of residual organic matter in the discharged effluent to the downstream.
		N_2O	No	Excluded for simplification.
	Emissions from anaerobic decay of final sludge	CO_2	No	Excluded for simplification.
		CH_4	Yes	May be an important source of emissions. CH4 is the major component in emissions produced from decomposition of residual organic matter in the final sludge. To be considered when baseline involves disposal of final sludge under anaerobic condition.
		N_2O	No	Excluded for simplification.

Project scenario	Emission from electricity or fuel consumption in the project activity.	CO_2	Yes	May be an important source of emission. To be considered when CPA involves use of electricity or combustion of fossil fuel.
		CH_4	No	Excluded for simplification.
		N_2O	No	Excluded for simplification.
	Emissions from wastewater treatment system affected by the project activity and not equipped with biogas recovery	CO_2	No	CO2 emission is not accounted because this is generated from the decomposition of organic matter.
		CH_4	Yes	May be an important source of emissions. CH4 is the major component in emissions produced from decomposition of residual organic matter in anaerobic treatment of wastewater.
		N_2O	No	Excluded for simplification.
	Emissions from sludge treatment system affected by the project activity and not equipped with biogas recovery	CO_2	No	PoA does not involve sludge treatment system.
		CH_4	No	
		N_2O	No	
	Emissions from the discharge of the effluent into river/lake/sea	CO_2	No	CO2 emission is not accounted because this is generated from the decomposition of organic matter.
		CH_4	Yes	May be an important source of emissions. CH4 is the major component in emissions produced from decomposition of residual organic matter in the discharged effluent to the downstream.
		N_2O	No	Excluded for simplification.
	Emissions due to incomplete flaring of biogas	CO_2	No	CO2 emission is not accounted because this is generated from the decomposition of organic matter. It is assumed that CO2 emissions from recovered biogas do not lead to changes of carbon pools in the LULUCF sector.
		CH_4	Yes	May be an important source of emissions. Incomplete combustion of biogas due to inefficiency of flaring system leads to fugitive emission of methane.
		N_2O	No	Excluded for simplification.
	Emissions from biomass stored under anaerobic conditions	CO_2	No	Excluded for simplification
		CH_4	Yes	May be an important source of emission. To be considered if biomass stored under anaerobic conditions in any CPA.
		N_2O	No	Excluded for simplification
	Emissions from anaerobic decay of the final sludge	CO_2	No	Excluded for simplification
		CH_4	Yes	May be an important source of emission. CH4 is the major component in emissions produced from decomposition of residual organic matter in the final sludge. To be considered when CPA involves disposal of final sludge under anaerobic condition.
		N_2O	No	Excluded for simplification
	Emission from biogas release in capture system	CO_2	No	CO2 emission is not accounted because this is generated from the decomposition of organic matter.

		CH_4	Yes	Inefficiency in methane capture will contribute to methane emissions to atmosphere.
		N_2O	No	Excluded for simplification. This emissions source is assumed to be negligible.

I.5. Establishment and description of baseline scenario

>>

In line with para 288 of CDM project standard for programme of activities, V02, "To demonstrate the validity of the original baseline or its update, the coordinating/managing entity is not required to re-assess the baseline scenario. Instead, the coordinating/managing entity shall assess the modalities to calculate GHG emission reductions or net anthropogenic GHG removals that would have resulted from that scenario.

Further para 289 states that "The coordinating/managing entity shall assess and incorporate the impact of national and/or sectoral policies and circumstances existing at the time of requesting renewal of the PoA period on the modalities to estimate baseline GHG emissions for the subsequent crediting period of each corresponding CPA, without reassessing the baseline scenario.

If data and parameters used for determining the original baseline, that were determined ex-ante and not monitored during the PoA period, are no longer valid, the coordinating/managing entity shall update such data and parameters in accordance with the "Methodological tool: Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period".

The impact of national/sectoral policies and ex-ante parameter due to update of applied approved methodology version and CDM IPCC value change are assessed according to "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period" (*Version 03.0.1, EB 66, Annex 47*); the following sub-steps are used to assess the continued validity of the current baseline:

Step 1: Assess the validity of the current baseline for the next crediting period

Step 1.1: Assess compliance of the current baseline with relevant mandatory national and/or sectoral policies

The registered PoA considers two types of CPAs i.e. replacement of existing technology/system and Greenfield projects.

The most ***plausible baseline scenarios*** (business-as-usual) identified for Greenfield CPAs in line with AMS III.H are

(a) Aerobic wastewater treatment system without biogas recovery
(b) Anaerobic wastewater treatment system (such as lagoon, septic tank or an on-site industrial plant) without biogas recovery
(c) Untreated wastewater stream.

The most ***plausible baseline scenario*** (business-as-usual) identified for replacement of an existing wastewater treatment system is continuation of current practice.

The current baseline options in both cases are in compliance with all relevant mandatory national and/or sectoral policies, which are applicable at the time of requesting renewal of the crediting period. There is no mandatory legal requirement on selection of technology for treatment of wastewater in Indonesia. The project activity is required to treat the wastewater stream and sludge to achieve COD level specified by the host country.

At the time of registration of PoA, the existing regulation applicable to projects was MenLH Decree 51/1995, wherein there were no regulation on technology selection and only waste water quality standard for discharge to sea/river was mentioned as BOD 250 mg/l and COD 500 mg/l.

During the renewal of crediting period there is a new regulation Ministerial Regulation of Environment number 5/2014 about Waste Water Quality Standards", which also have no regulation on technology selection, however, the waste water quality can be discharged to sea/river is updated as BOD 100 mg/l and COD 350 mg/l.

The above mentioned changes do not impact calculation of emission reduction or baseline scenarios of the CPAs.

Therefore, the current baseline does not need to be updated and can proceed to Step 1.2.

Step 1.2: Assess the impact of circumstances

The most ***plausible baseline scenario*** (business-as-usual) identified for the CPAs under this PoA are continuation of current practice or assumption to treat wastewater with aerobic/anaerobic technology without biogas recovery and the atmospheric release of the CH_4, as project activity falls under type III Greenfield project, the most plausible baseline scenario for the project activity has to be demonstrated as per the baseline determination provided in the AMS-III.H Version 18 and paragraph 28 “General Guidelines to SSC CDM methodologies” Version 22.1.

No changes in market characteristics that is related with or/and has any impacts to wastewater treatment in palm oil mills are found, which means that the current baseline does not need to be updated.

The conditions used to determine the baseline emissions in the previous crediting period are still valid and therefore, can proceed to Step 1.3.

Step 1.3: Assess whether the continuation of use of current baseline equipment(s) or an investment is the most likely scenario for the crediting period for which renewal is requested

Not applicable as per step 1.2

Step 1.4: Assessment of the validity of the data and parameters

Data and parameters that are determined at the start of the crediting period and not monitored during the crediting period that need to be updated are Global Warming Potential (GWP_{CH4}) and Grid Emission Factor ($EF_{EL,k,y}$). The updates are shown in Step 2.2 below.

Step 2: Update the current baseline and the data and parameters

Step 2.1: Update the current baseline

The current baseline emissions for the renewal of crediting period will be updated based on the latest approved version of the methodology and tools applicable at the CPA level.

Step 2.2: Update the data and parameters

Data and parameters that are determined at the start of the crediting period and not monitored during the crediting period that need to be updated are as follow:

GWP_{CH4} (Global Warming Potential (GWP) of methane) – With reference to decision 4/CMP7 and paragraph 66 of the EB 69 Meeting Report, for the second commitment period of the Kyoto Protocol, the global warming potentials used by Parties to calculate the carbon dioxide equivalence of anthropogenic emissions by sources and removals by sinks of the greenhouse gases listed in Annex A to the Kyoto Protocol shall be those listed in the column entitled “Global Warming Potential for Given Time Horizon” in Table 2.14 of the errata to the contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, based on the effects of greenhouse gases over a 100-year time horizon, i.e. 25 tCO_2/tCH_4.

As per AMS-III.H version 18 (hereinafter referred to as the “baseline and monitoring methodology”), in case of existing industrial wastewater treatment facilities, the baseline will be the continuation of the existing system for wastewater treatment. This is evident in the paragraph 26 and 38 of the baseline and monitoring methodology where the past historic records or baseline measurement campaign undertaken before CPA implementation is required for estimating emissions associated with the prevailing baseline.

However, in case of Greenfield industrial wastewater treatment facilities, the CPA is only eligible to use the baseline and monitoring methodology if they are able to demonstrate using the “General Guidelines to SSC CDM Methodologies” that the most plausible baseline scenario for the project activity is the baseline provided in the baseline and monitoring methodology.

Following steps as per the “General Guidelines to SSC CDM Methodologies” will be followed for determining the baseline scenario for Greenfield CPAs:

Step 1:
Identifying the various alternatives available to the CPA implementer that deliver comparable level of service including the proposed CPA undertaken without being added as a CPA under the PoA.

Step 2:
If any of the identified baseline scenarios is not in compliance with the local regulations then it will be exclude from further analysis.

Step 3:
Elimination and ranking alternatives identified in Step 2 taking into account barrier tests. Additionality Section provides detailed description on the different types of barriers applicable and the various sources from which barrier specific data can be collected for elimination and ranking of alternatives.

Step 4:
If only one alternative remains that is:

- Not the proposed CPA undertaken without being added under the PoA; and
- It corresponds to one of the baseline scenarios provided in the methodology; then the project activity is eligible under the methodology.

If more than one alternative remains that correspond to the baseline scenarios provided in the methodology, then the CME will choose the alternative with the least emissions, as the baseline.

The baseline for Greenfield CPAs under this PoA, determined using the above steps, will be one of the following:
(a) Aerobic wastewater treatment system without biogas recovery
(b) Anaerobic wastewater treatment system (such as lagoon, septic tank or an on-site industrial plant) without biogas recovery

(c) Untreated wastewater stream.

I.6. Estimation of emission reductions

I.6.1. Explanation of methodological choices

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A typical CPA will involve technological measure as explained in the PoA-DD. Following are the methodological choices used for calculating emission reductions.

Baseline Emissions
Baseline emissions will include greenhouse gas (GHG) emissions associated with the following sources:

(a) Emissions associated with electricity or fuel consumption in the baseline wastewater treatment system- In case the baseline wastewater treatment consumes electricity or fossil fuel, GHG emissions associated with such electricity or fossil fuel consumption will be accounted for.

(b) Emissions associated with baseline wastewater treatment not equipped with a biogas recovery system and which is affected by the CPA- organic content in the wastewater will be decomposed in the baseline treatment system and would result in generation of methane. Since the baseline wastewater system is not equipped with methane recovery system, it will result in GHG emissions into the atmosphere.

(c) Emissions associated with discharge of treated wastewater into sea/river/lake- this is in relation to the amount of chemical oxygen demand (COD) present in the wastewater even after being treated by the baseline wastewater system. If such treated wastewater is discharged to downstream such as sea/river/lake, baseline emissions to account for the un-removed COD in the treated wastewater.

(d) Emissions associated with anaerobic decay of final sludge- if in the baseline scenario, the sludge is allowed to decay under anaerobic conditions it will result in generation of methane which will be emitted into the atmosphere, baseline emissions will account for this source of emissions.

(e) Emission associated with baseline sludge treatment system not equipped with biogas recovery system and which is affected by the CPA, degradable organic content in the sludge will be decomposed in the baseline treatment system and would result in generation of methane.

Baseline emission for CPAs with existing project:

In line with para 38 of applied methodology, in determining the baseline emissions, past historic records of at least one year prior to project implementation shall be used. This includes COD removal efficiency of the wastewater treatment systems, the amount of dry matter in sludge, power and electricity consumption per m^3 of wastewater treated, the amount of final sludge generated per tonne of COD removed of at least one year prior to the CPA implementation shall be used.

For the existing wastewater treatment plants without the historical data, in line with para 39 of the applied methodology the baseline emissions in year y will be taken as the minimum between the results of:

(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 per cent to 50 per cent). The parameters from the measurement campaign are used to calculate the baseline emission in year y;

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

Baseline emission for CPAs with Greenfield projects:

As per para 40 of applied methodology, in the case of Greenfield and capacity addition projects, or existing plant without three years operating history, the following procedures shall be used to determine the baseline emissions

(a) For existing plant without three years operating history, procedures in paragraph 39 shall be followed;

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

(i) Value obtained from a measurement campaign in a comparable existing wastewater treatment plant i.e. having similar environmental and technological circumstances for example treating 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 per cent to 50 per cent) 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 following conditions can be fulfilled:

a) 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;

b) 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 per cent; and

c) For project activity 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:

i. The ratio COD/BOD (related to the proportion of biodegradable organic matter) does not differ by more than 20 per cent; and

ii. The ratio 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 per cent.

(ii) 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 per cent plants with lowest emission rate per tonne 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.

The approach (e.g. past historic records, 10-day measurement campaign, value from manufacturer/designer) and the associated data which are selected and applied in determining the baseline emissions shall be recorded in the CPA-DD.

Project Emissions

Project emissions will include greenhouse gas (GHG) emissions associated with the following sources:

(a) Emissions associated with electricity or fuel consumption in the project wastewater treatment system- In case the CPA wastewater treatment consumes electricity or fossil fuel, GHG emissions associated with such electricity or fossil fuel consumption will be accounted for.

(b) Emissions associated with wastewater treatment system affected by CPA and not equipped with a biogas recovery system in the project scenario - organic content in the wastewater will be decomposed in the treatment system and would result in generation of methane. Since the affected wastewater treatment system is not equipped with methane recovery, it will result in GHG emissions emitted into the atmosphere. Project emissions will account for this source of emissions.

(c) Emissions associated with discharge of treated wastewater into sea/river/lake- This is in relation to the amount of chemical oxygen demand (COD) present in the wastewater even after being treated by the CPA, therefore if such treated wastewater is discharged to sea/river/lake, project emissions will account for the un-removed COD in the wastewater

(d) Emissions associated with anaerobic decay of final sludge- if in the project scenario, the sludge is allowed to decay under anaerobic conditions it will result in generation of methane which will be emitted into the atmosphere, project emissions will account for this source of emissions.

(e) Emissions associated with inefficiencies in the project anaerobic wastewater treatment system- project emissions to account for inefficiencies in the methane recovery system.

(f) In case the recovered biogas is flared, project emissions to also account for incomplete flaring of the biogas.

(g) In case biomass is stored in the project scenario (and not in baseline scenario) under anaerobic conditions, the project emissions to also include methane emissions due to anaerobic decay of the biomass.

Leakages
If the equipments under the CPA are transferred from another activity, leakage effects at site of the other activity to be considered and estimated.

Emissions Reduction
Emission reduction is calculated as a difference between baseline emission and sum of project emissions and leakages.

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

Baseline emissions

Baseline emissions are calculated as follows:

$BE_y = BE_{power,y} + BE_{ww,treatment,y} + BE_{s,treatment,y} + BE_{ww,discharge,y} + BE_{s,final,y}$

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 CPA in year y (tCO_2e)

$BE_{s,treatment,y}$ = Baseline emissions of the sludge treatment systems affected by the project activity in year y (t CO_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).

- **Baseline emissions from electricity or fuel consumption $BE_{power,y}$ will be determined as follows:**

Baseline emissions from electricity consumption

It will be calculated as per the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" as follows:

One of the following scenarios may be applicable to or selected by CPA

Scenario A: Electricity consumption from the grid. The electricity is purchased from the grid only, and either no captive power plant(s) is/are installed at the site of electricity consumption or, if any captive power plant exists on site, it is either not operating or it is not physically able to provide electricity to the electricity consumer;

Scenario B: Electricity consumption from an off-grid fossil fuel fired captive power plant. One or more fossil fuel fired captive power plants are installed at the site of the electricity consumption source and supply the source with electricity. The captive power plant(s) is/are not connected to the electricity grid.

Scenario C: Electricity consumption from the grid and fossil fuel fired captive power plant(s). One or more fossil fuel fired captive power plants operate at the site of the electricity consumption source. The captive power plant(s) can provide electricity to the electricity consumption source. The captive power plant(s) is/are also connected to the electricity grid.

Scenario A: Electricity consumption from the grid

In this case, project participants may choose among the following options

Option A1:

Calculate the combined margin emission factor of the applicable electricity system, using the procedures in the latest approved version of the "Tool to calculate the emission factor for an electricity system" ($EF_{EL,j/k/l,y} = EF_{grid,CM,y}$)

Option A2:

Use the following conservative default values:

a) A value of 1.3 tCO_2/MWh if:

(i) Scenario A applies only to project and/or leakage electricity consumption sources but not to baseline electricity consumption sources; or

(ii) Scenario A applies to: both baseline and project (and/or leakage) electricity consumption sources; and the electricity consumption of the project and leakage sources is greater than the electricity consumption of the baseline sources;

(b) A value of 0.4 t CO_2/MWh for electricity grids where hydro power plants constitute less than 50% of total grid generation in 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production, and a value of 0.25 t CO_2/MWh for other electricity grids. These values can be used if:

(i) Scenario A applies only to baseline electricity consumption sources but not to project or leakage electricity consumption sources; or
(ii) Scenario A applies to: both baseline and project (and/or leakage) electricity consumption sources; and the electricity consumption of the baseline sources is greater than the electricity consumption of the project and leakage sources.

Scenario B: Electricity consumption from an off-grid captive power plant
The CME has decided to use option B2 conservative default value

Option B2:

(a) A value of 1.3 t CO_2/MWh if:

(i) The electricity consumption source is a project or leakage electricity consumption source; or
(ii) The electricity consumption source is a baseline electricity consumption source; and the electricity consumption of all baseline electricity consumptions sources at the site of the captive power plant(s) is less than the electricity consumption of all project electricity consumption sources at the site of the captive power plant(s);

(b) A value of 0.4 t CO_2/MWh if:

(i) The electricity consumption source is a baseline electricity consumption source; or
(ii) The electricity consumption source is a project electricity consumption source and the electricity consumption of all baseline electricity consumptions sources at the site of the captive power plant(s) is greater than the electricity consumption of all project electricity consumption sources at the site of the captive power plant(s).

Scenario C: Electricity consumption from the grid and (a) fossil fuel fired captive power plant(s)
Under this scenario, the consumption of electricity in the project, the baseline or as a source of leakage may result in different emission levels, depending on the situation of the project activity. The following three cases can be differentiated:

(a) Case C.I: Grid electricity. The implementation of the project activity only affects the quantity of electricity that is supplied from the grid and not the operation of the captive power plant. This applies, for example:

(i) If at all times during the monitored period the total electricity demand at the site of the captive power plant(s) is, both with the project activity and in the absence of the project activity, larger than the electricity generation capacity of the captive power plant(s); or
(ii) If the captive power plant is operated continuously (apart from maintenance) and feeds any excess electricity into the grid, because the revenues for feeding electricity into the grid are above the plant operation costs; or
(iii) If the captive power plant is centrally dispatched and the dispatch of the captive power plant is thus outside the control of the project participants;

(b) Case C.II: Electricity from captive power plant(s). The implementation of the project activity is clearly demonstrated to only affect the quantity of electricity that is generated in the captive power plant(s) and does not affect the quantity of electricity supplied from the grid. This applies, for example, in the following situation: A fixed quantity of electricity is purchased from the grid due to physical transmission constraints, such as a limited capacity of the transformer that provides electricity to the relevant source. In this situation, case C.II would apply if the total electricity

demand at the site of the captive power plant(s) is at all times during the monitored period, both with the project activity and in the absence of the project activity, larger than the quantity of the electricity that can physically be supplied by the grid;

(c) Case C.III: Electricity from both the grid and captive power plant(s). The implementation of the project activity may affect both the quantity of electricity that is generated in the captive power plant(s) and the quantity of electricity supplied from the grid. This applies, for example:

(i) If the captive power plant(s) is/are not operating continuously; or
(ii) If grid electricity is purchased during a part of the monitored period; or
(iii) If electricity from the captive power plant is fed into the grid during a part of the monitored period.

Where case C.I has been identified, the guidance for scenario A above should be applied (either option A1 or option A2 can be used). Where case C.II has been identified, the guidance for scenario B above should be applied (use option B2). Where case C.III has been identified, as a conservative simple approach, the emission factor for electricity generation should be the more conservative value between the emission factor determined as per guidance for scenario A and B, respectively. This means that the more conservative value should be chosen between a) the result of applying either option A1 or A2 and b) the result of applying either option B2.

Baseline emissions from fossil fuel consumption

In line with para 28 of applied approved methodology the baseline emission on account of fossil fuel consumption can be calculated using “Tool to calculate project or leakage CO2 emissions from fossil fuel combustion”.

CO_2 emissions from fossil fuel combustion in process j are calculated based on the quantity of fuels combusted and the CO_2 emission coefficient of those fuels, as follows:

$$BE_{FC,j,y} = \Sigma_i \; FC_{i,j,y} * COEF_{i,y}$$

where:

$BE_{FC,j,y}$	The CO_2 emissions from fossil fuel combustion in process j during the year y (tCO_2/yr)
$FC_{i,j,y}$	Quantity of fuel type i combusted in process j during the year y (mass or volume unit/yr).
$COEF_{i,y}$	CO_2 emission coefficient of fossil fuel type i in year y (tCO_2/mass or volume unit).
i	Fuel type combusted in process k during the year y.

The CO_2 emission coefficient $COEF_{i,y}$ can be calculated using one of the following two Options, depending on the availability of data on the fossil fuel type i, as follows:

(a) Option A: The CO_2 emission coefficient $COEF_{i,y}$ is calculated based on the chemical composition of the fossil fuel type i, using the following approach:
If $FC_{i,j,y}$ is measured in a mass unit:

$$COEF_{i,y} = w_{c,i,y} \times 44/12$$

If $FC_{i,j,y}$ is measured in a volume unit:

$$COEF_{i,y} = w_{c,i,y} \times \rho_{I,y} \times 44/12$$

Where,

$COEF_{i,y}$ = Is the CO_2 emission coefficient of fuel type i (tCO_2/mass or volume unit);
$w_{c,i,y}$ = Is the weighted average mass fraction of carbon in fuel type i in year y (tC/mass unit of the fuel)
$\rho_{I,y}$ = Is the weighted average density of fuel type i in year y (mass unit/volume unit of the fuel)
i = Are the fuel types combusted in process j during the year y

(b) Option B: The CO_2 emission coefficient $COEF_{i,y}$ is calculated based on net calorific value and CO_2 emission factor of the fuel type i, as follows:

$$COEF_{i,y} = NCV_{i,y} * EF_{CO2,i,y}$$

Where,
$COEF_{i,y}$ Is the CO_2 emission coefficient of fuel type i (tCO_2/mass or volume unit);
$NCV_{i,y}$ Weighted average net calorific value of the fuel type i in the year y (GJ/mass or volume unit).
$EF_{CO2,i,y}$ Weighted average CO_2 emission factor of fuel type i in year y (tCO_2/GJ).
i Are the fuel types combusted in process k during the year y

The CME has decided to prefer OPTION B as in most of the cases NCV and emission factor will be available for fossil fuel consumption if any. However, where all the data required for Option A available the same will be used.

- **Baseline emissions of the wastewater treatment systems affected by the project activity**

$$BE_{ww,treatment,y} = \Sigma_i(Q_{ww,i,y} * COD_{inflow,i,y} * \eta_{COD,BL,i} * MCF_{ww,treatment,BL,i}) * B_{o,ww} * UF_{BL} * GWP_{CH4}$$

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
$COD_{inflow,i,y}$ 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 40 of AMS III.H
$MCF_{ww,treatment,BL,i}$ Methane correction factor for baseline wastewater treatment systems i (MCF values as per Table.2 of AMS III.H)
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)
UF_{BL} Model correction factor to account for model uncertainties (0.89)
GWP_{CH4} Global Warming Potential for methane (value of 25)

In line with para 38 b) (i) of AMS III.H, for Greenfield CPA cases where measurement campaign is used to determine the parameters for baseline emissions calculations, the average values from the measurement campaign shall be multiplied by 0.89 to account for the uncertainty range (30% to 50%). The details on campaign procedure in line with applied methodology is explained earlier in this section.

- **Baseline methane emissions from sludge treatment system affected by the project activity**

$BE_{treatment,s,y} = \Sigma S_{j,BL,y} * MCF_{s,treatment,BL,j} * DOC_s * UF_{BL} * DOC_F * F * 16/12 * GWP_{CH4}$

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). For ex-ante estimation, forecasted sludge generation volume or the designed capacity of the sludge treatment facility can be used. However, the ex post emissions reduction calculation shall be based on the actual monitored volume of treated sludge
j	Index for baseline sludge treatment system
$MCF_{s,treatment,BL,j}$	Methane correction factor for the baseline sludge treatment system j (MCF values as per Table 2 of AMS III.H)
DOC_s	Degradable organic content of the untreated sludge generated in the year y (fraction, dry basis). Default values of 0.5 for domestic sludge and 0.257 for industrial sludge shall be used
UF_{BL}	Model correction factor to account for model uncertainties (0.89)
DOC_F	Fraction of DOC dissimilated to biogas (IPCC default value of 0.5)
F	Fraction of CH_4 in biogas (IPCC default of 0.5)

As PoA does not envisage sludge treatment in baseline this will not be considered further.

- **Baseline methane emissions from degradable organic carbon in treated wastewater discharged into sea/river/lake**

$BE_{ww,discharge,y} = Q_{ww,y} * GWP_{CH4} * B_{o,ww} * UF_{BL} * COD_{ww,discharge,BL,y} * MCF_{ww,BL,discharge}$

where:

$Q_{ww,y}$	Volume of treated wastewater discharged in year *y* (m^3)
$COD_{ww,discharge,BL,y}$	Chemical oxygen demand of the treated wastewater discharged into sea, river or lake in the baseline situation in the year *y* (t/m^3). If the baseline scenario is the discharge of untreated wastewater, the COD of untreated wastewater will be used.
$MCF_{ww,BL,discharge}$	Methane correction factor based on the discharge pathway in the baseline situation (e.g. into sea, river, lake or land) of the wastewater (MCF values as per Table 2 of AMS-III.H version 18)

To determine $COD_{ww,discharge,BL,y}$: if the baseline treatment system(s) is different from the treatment system(s) in the project scenario, the monitored values of the COD inflow during crediting period will be used to calculate the baseline emissions ex-post. The outflow COD of the baseline systems will be estimated using the removal efficiency of the baseline treatment systems, estimated as paragraph 38, 39 or 40 of AMS-III.H version 18.

- **Baseline methane emissions from anaerobic decay of the final sludge produced**

$BE_{s,final,y} = S_{final,BL,y} * DOC_s * UF_{BL} * MCF_{s,BL,final} * DOC_F * F * 16/12 * GWP_{CH4}$

where:

$S_{final,BL,y}$	Amount of dry matter in the 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
DOC_s	Degradable organic content of the untreated sludge generated in the year y (fraction, dry basis). Default value 0.257[16] for industrial sludge will be used
DOC_F	Fraction of DOC dissimilated to biogas (IPCC default of 0.5)
F	Fraction of CH_4 in biogas (IPCC default of 0.5)

Calculation of the methane correction factor of the disposal site that receives the final sludge ($MCF_{s,BL,final}$)

In line with applied tool "Emissions from solid waste disposal sites" the methane correction factor can be determined as below

Application A:

The MCF should be selected as a default value ($MCF_y = MCF_{default}$) provided in the section "Data and parameters not monitored" of applied tool "Emissions from solid waste disposal sites" Version-8 or Table 2 of applied methodology AMS III.H

Application B:

In case of a water table above the bottom of the SWDS (for example, due to using waste to fill inland water bodies, such as ponds, rivers or wetlands), the MCF should be determined as follows:

$$MCF_y = MAX\left\{\left(1-\frac{2}{d_y}\right),\frac{h_{w,y}}{d_y}\right\}$$ Eq. 12 of Applied tool

where:

MCF_y Methane correction factor for year y

$h_{w,y}$ Height of water table measured from the base of the SWDS (m)

d_y Depth of SWDS (m)

In other situations, the MCF should be selected as a default value ($MCF_y = MCF_{default}$)

Project emissions

a) CO_2 emissions from the electricity and fuel used by the CPA ($PE_{power,y}$)

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

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

d) Methane emissions on account of inefficiency of the CPA wastewater treatment systems and presence of degradable organic carbon in treated wastewater ($PE_{ww,discharge,y}$)

e) Methane emissions from anaerobic decay of the final sludge ($PE_{s,final,y}$)

f) Methane emissions from biogas release in capture systems ($PE_{fugitive,y}$)

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

[16] The IPCC default value of 0.09 for industrial sludge (wet basis, assuming dry matter content of 35%), were corrected for dry basis

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

Project activity emissions from the systems affected by the project activity are calculated as follows:

$PEy = PE_{power,y} + PE_{ww,treatment,y} + PE_{s,treatment,y} + PE_{ww,discharge,y} + PE_{s,final,y} + PE_{fugitive,y} + PE_{biomass,y} + PE_{flaring,y}$

Where

PEy	=	Project activity emissions in the year y (t CO_2e)
$PE_{power,y}$	=	Emissions from electricity or fuel consumption in the year y (t CO_2e). These emissions shall be calculated as per paragraph 28, for the situation of the project scenario, using energy consumption data of all equipment/devices used in the project activity wastewater and sludge treatment systems and systems for biogas recovery and flaring/gainful use
$PE_{ww,treatment,y}$	=	Methane emissions from wastewater treatment systems affected by the project activity, and not equipped with biogas recovery, in year y (t CO_2e). These emissions shall be calculated as per equation (2) in paragraph 29 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:

$MCF_{ww,treatm ent,PJ,k}$	Methane correction factor for project wastewater treatment system k (MCF values as per Table 2 above)
$\eta_{,PJ,k,y}$	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 (t CO2e). These emissions shall be calculated as per equations (3) and (4) in paragraphs 32 and 33, 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)
$MCF_{s,treatment,i}$	Methane correction factor for the project sludge treatment system l (MCF values as per table 2)

$PE_{ww,discharge,y}$	=	Methane emissions from anaerobic decay of the final sludge produced in year y (t CO2e). These emissions shall be calculated as per equation (7) in paragraph 37, 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)

$MCF_{ww,discharge, PJ,y}$ 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 2)

$PE_{s,final,y}$ = Methane emissions from anaerobic decay of the final sludge produced in year y (t CO_2e). These emissions shall be calculated as per equation (7) in paragraph 37, 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 methodological tool “Emissions from solid waste disposal sites”

$S_{final,PJ,y}$ 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, calculated as per paragraph 42 (t CO_2e)

$PE_{biomass,y}$ = Methane emissions from biomass stored under anaerobic conditions. If 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 treatment system I (MCF values as per Table 2 above)

$PE_{flaring,y}$ = Methane emissions due to incomplete flaring in year y (t CO_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 methodological tool “Project emissions from flaring”

- **Project emissions from electricity and fuel used by the project facilities**

Project emissions from electricity and fossil fuel consumption ($PE_{power,y}$) are determined as per the procedures described in the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption” and “Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion”, respectively. The energy consumption shall include all equipment/devices in the project wastewater and sludge treatment facility.

$PE_{power,y}$ Emissions from electricity or fuel consumption in the year y will be calculated as follows:

Project emissions from electricity consumption

It will be calculated as per the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation” as follows:

One of the following scenarios may be applicable to or selected by CPA

Scenario A: Electricity consumption from the grid. The electricity is purchased from the grid only, and either no captive power plant(s) is/are installed at the site of electricity consumption or, if any

captive power plant exists on site, it is either not operating or it is not physically able to provide electricity to the electricity consumer;

Scenario B: Electricity consumption from an off-grid fossil fuel fired captive power plant. One or more fossil fuel fired captive power plants are installed at the site of the electricity consumption source and supply the source with electricity. The captive power plant(s) is/are not connected to the electricity grid.

Scenario C: Electricity consumption from the grid and fossil fuel fired captive power plant(s). One or more fossil fuel fired captive power plants operate at the site of the electricity consumption source. The captive power plant(s) can provide electricity to the electricity consumption source. The captive power plant(s) is/are also connected to the electricity grid.

Scenario A: Electricity consumption from the grid

In this case, project participants may choose among the following options

Option A1:

Calculate the combined margin emission factor of the applicable electricity system, using the procedures in the latest approved version of the "Tool to calculate the emission factor for an electricity system" ($EF_{EL,j/k/l,y} = EF_{grid,CM,y}$)

Option A2:

Use the following conservative default values:

a) A value of 1.3 tCO_2/MWh if:

(i) Scenario A applies only to project and/or leakage electricity consumption sources but not to baseline electricity consumption sources; or
(ii) Scenario A applies to: both baseline and project (and/or leakage) electricity consumption sources; and the electricity consumption of the project and leakage sources is greater than the electricity consumption of the baseline sources;

(b) A value of 0.4 t CO_2/MWh for electricity grids where hydro power plants constitute less than 50% of total grid generation in 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production, and a value of 0.25 t CO_2/MWh for other electricity grids. These values can be used if:

(i) Scenario A applies only to baseline electricity consumption sources but not to project or leakage electricity consumption sources; or
(ii) Scenario A applies to: both baseline and project (and/or leakage) electricity consumption sources; and the electricity consumption of the baseline sources is greater than the electricity consumption of the project and leakage sources.

Scenario B: Electricity consumption from an off-grid captive power plant

The CME has decided to use option B2 conservative default value

Option B2:

(a) A value of 1.3 t CO_2/MWh if:

(i) The electricity consumption source is a project or leakage electricity consumption source; or
(ii) The electricity consumption source is a baseline electricity consumption source; and the electricity consumption of all baseline electricity consumptions sources at the site of the

captive power plant(s) is less than the electricity consumption of all project electricity consumption sources at the site of the captive power plant(s);

(b) A value of 0.4 t CO_2/MWh if:

(i) The electricity consumption source is a baseline electricity consumption source; or
(ii) The electricity consumption source is a project electricity consumption source and the electricity consumption of all baseline electricity consumptions sources at the site of the captive power plant(s) is greater than the electricity consumption of all project electricity consumption sources at the site of the captive power plant(s).

Scenario C: Electricity consumption from the grid and (a) fossil fuel fired captive power plant(s)

Under this scenario, the consumption of electricity in the project, the baseline or as a source of leakage may result in different emission levels, depending on the situation of the project activity. The following three cases can be differentiated:

(a) Case C.I: Grid electricity. The implementation of the project activity only affects the quantity of electricity that is supplied from the grid and not the operation of the captive power plant. This applies, for example:

(i) If at all times during the monitored period the total electricity demand at the site of the captive power plant(s) is, both with the project activity and in the absence of the project activity, larger than the electricity generation capacity of the captive power plant(s); or
(ii) If the captive power plant is operated continuously (apart from maintenance) and feeds any excess electricity into the grid, because the revenues for feeding electricity into the grid are above the plant operation costs; or
(iii) If the captive power plant is centrally dispatched and the dispatch of the captive power plant is thus outside the control of the project participants;

(b) Case C.II: Electricity from captive power plant(s). The implementation of the project activity is clearly demonstrated to only affect the quantity of electricity that is generated in the captive power plant(s) and does not affect the quantity of electricity supplied from the grid. This applies, for example, in the following situation: A fixed quantity of electricity is purchased from the grid due to physical transmission constraints, such as a limited capacity of the transformer that provides electricity to the relevant source. In this situation, case C.II would apply if the total electricity demand at the site of the captive power plant(s) is at all times during the monitored period, both with the project activity and in the absence of the project activity, larger than the quantity of the electricity that can physically be supplied by the grid;

(c) Case C.III: Electricity from both the grid and captive power plant(s). The implementation of the project activity may affect both the quantity of electricity that is generated in the captive power plant(s) and the quantity of electricity supplied from the grid. This applies, for example:

(i) If the captive power plant(s) is/are not operating continuously; or
(ii) If grid electricity is purchased during a part of the monitored period; or
(iii) If electricity from the captive power plant is fed into the grid during a part of the monitored period.

Where case C.I has been identified, the guidance for scenario A above should be applied (either option A1 or option A2 can be used). Where case C.II has been identified, the guidance for scenario B above should be applied (use option B2). Where case C.III has been identified, as a conservative simple approach, the emission factor for electricity generation should be the more conservative value between the emission factor determined as per guidance for scenario A and B, respectively. This means that the more conservative value should be chosen between a) the result of applying either option A1 or A2 and b) the result of applying either option B2.

Project emissions from fossil fuel consumption

In line with para 28 of applied approved methodology the baseline emission on account of fossil fuel consumption can be calculated using “Tool to calculate project or leakage CO2 emissions from fossil fuel combustion”.

CO_2 emissions from fossil fuel combustion in process j are calculated based on the quantity of fuels combusted and the CO_2 emission coefficient of those fuels, as follows:

$$BE_{FC,j,y} = \Sigma_i \; FC_{i,j,y} * COEF_{i,y}$$

where:

$BE_{FC,j,y}$	The CO_2 emissions from fossil fuel combustion in process j during the year y (tCO_2/yr)
$FC_{i,j,y}$	Quantity of fuel type i combusted in process j during the year y (mass or volume unit/yr).
$COEF_{i,y}$	CO_2 emission coefficient of fossil fuel type i in year y (tCO_2/mass or volume unit).
i	Fuel type combusted in process j during the year y.

The CO_2 emission coefficient $COEF_{i,y}$ can be calculated using one of the following two Options, depending on the availability of data on the fossil fuel type i, as follows:

(c) Option A: The CO_2 emission coefficient $COEF_{i,y}$ is calculated based on the chemical composition of the fossil fuel type i, using the following approach:
If $FC_{i,k,y}$ is measured in a mass unit:

$$COEF_{i,y} = w_{c,i,y} \times 44/12$$

If $FC_{i,j,y}$ is measured in a volume unit:

$$COEF_{i,y} = w_{c,i,y} \times \rho_{I,y} \times 44/12$$

Where,

$COEF_{i,y}$	=	Is the CO_2 emission coefficient of fuel type i (tCO_2/mass or volume unit);
$w_{c,i,y}$	=	Is the weighted average mass fraction of carbon in fuel type i in year y (tC/mass unit of the fuel)
$\rho_{I,y}$	=	Is the weighted average density of fuel type i in year y (mass unit/volume unit of the fuel)
i	=	Are the fuel types combusted in process j during the year y

(d) Option B: The CO_2 emission coefficient $COEF_{i,y}$ is calculated based on net calorific value and CO_2 emission factor of the fuel type i, as follows:

$$COEF_{i,y} = NCV_{i,y} * EF_{CO2,i,y}$$

Where,

$COEF_{i,y}$	Is the CO_2 emission coefficient of fuel type i (tCO_2/mass or volume unit);
$NCV_{i,y}$	Weighted average net calorific value of the fuel type i in the year y (GJ/mass or volume unit).
$EF_{CO2,i,y}$	Weighted average CO_2 emission factor of fuel type i in year y (tCO_2/GJ).
i	Are the fuel types combusted in process j during the year y

The CME has decided to use OPTION B.

• **Project emissions from wastewater treatment systems affected by the project activity**

$PE_{ww,treatment,y}$ will be calculated as that of $BE_{ww,treatment,y}$ 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 2 of AMS-III.H version 18)
$\eta_{PJ,k,y}$	COD removal efficiency of the project wastewater treatment system k in year y (t/m^3)

The following equation will be used

$PE_{ww,treatment,y} = \sum(Q_{ww,i,y} * COD_{inflow,i,y} * \eta_{PJ,k,y} * MCF_{ww,treatment,PJ,k}) * B_{o,ww} * UF_{BL} * GWP_{CH4}$

• **Project emissions from sludge treatment systems affected by the project activity**

$PE_{s,treatment,y,}$ Methane emissions from sludge treatment systems affected by the project activity, and not equipped with biogas recovery, in year y (t CO_2e). These emissions shall be calculated as per equations (3) and (4) in paragraphs 32 and 33, 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)
$MCF_{s,treatment,i}$	Methane correction factor for the project sludge treatment system l (MCF values as per table 2)

The following equation will be used

$PE_{treatment,S,y} = \sum_j S_{j,PJ,y} * MCF_{S,treatment,l} * DOC_s * UF_{BL} * DOC_F * F * 16/12 * GWP_{CH4}$

• **Project emissions on account of inefficiency of the CPA wastewater treatment systems and presence of degradable organic carbon in treated wastewater**

$PE_{ww,discharge,y}$ Methane emissions from degradable organic carbon in treated wastewater in year y (tCO_2e). These emission will be calculated as that for $BE_{ww,discharge,y}$, using uncertainty factor of 1.12 and data applicable to the project conditions ($COD_{ww,discharge,PJ,y}$ and $MCF_{ww,PJ,discharge}$) and with the following changed definition of parameters:

$COD_{ww,discharge,PJ,y}$	Chemical oxygen demand of the treated wastewater discharged to 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 the sea, river or lake) (MCF values as per Table 2)

The following equation will be used

$PE_{ww,discharge,y} = Q_{ww,discharge,y} * GWP_{CH4} * B_{o,WW} * UF_{PJ} * COD_{ww,discharge,PJ,y} * MCF_{ww,discharge, PJ,y}$

• **Project emissions from the decay of the final sludge generated by the CPA treatment systems**

$PE_{s,final,y}$ Methane emissions from anaerobic decay of the final sludge produced in year y (tCO_2e). These emissions will be calculated as that for $BE_{s,final,y}$, using an uncertainty factor of 1.12 as data applicable to the project conditions ($MCF_{s,PJ,final}$ and $S_{final,PJ,y}$). If the sludge is controlled combusted, disposed in a landfill with biogas recovery or used for soil application in aerobic conditions in the CPA, this term will be neglected and the sludge treatment and/or use and/or final disposal will be monitored during the crediting period with the following 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 for emissions from solid waste disposal sites"

$S_{final,PJ,y}$ Amount of dry matter in final sludge generated by the project wastewater treatment systems in the year y (t)

The following equation will be used

$$PE_{S,final,y} = S_{final,PJ,y} * DOC_s * UF_{PJ} * B_{o,WW} * UF_{PJ} * MCF_{s,PJ,final} * DOC_F * F * 16/12 * GWP_{CH4}$$

Calculation of the methane correction factor of the disposal site that receives the final sludge ($MCF_{s,PJ,final}$)

In line with applied tool "Emissions from solid waste disposal sites" the methane correction factor can be determined as below

Application A:

The MCF should be selected as a default value ($MCF_y = MCF_{default}$) provided in the section "Data and parameters not monitored" of applied tool "Emissions from solid waste disposal sites" Version-8 or Table 2 of applied methodology AMS III.H

Application B:

In case of a water table above the bottom of the SWDS (for example, due to using waste to fill inland water bodies, such as ponds, rivers or wetlands), the MCF should be determined as follows:

$$MCF_y = MAX\left\{\left(1 - \frac{2}{d_y}\right), \frac{h_{w,y}}{d_y}\right\}$$

Eq. 12 of Applied tool

where:

MCF_y Methane correction factor for year y

$h_{w,y}$ Height of water table measured from the base of the SWDS (m)

d_y Depth of SWDS (m)

In other situations, the MCF should be selected as a default value ($MCF_y = MCF_{default}$)

• **Project emissions due to inefficiencies in capture systems**

(a) Based on the methane emission potential of wastewater and/or sludge:

$PE_{fugitive,y}$ Methane emissions from biogas release in capture systems in year y

$PE_{fugitive,y} = PE_{fugitive,ww,y} + PE_{fugitive,s,y}$

As CME envisage no sludge treatment system in project case for biogas recovery, hence equation simplifies to

$PE_{fugitive,y} = PE_{fugitive,ww,y}$

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 (t CO_2e)

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

where:

CFE_{ww} Capture efficiency of the biogas recovery equipment in the wastewater treatment systems (a value of 0.9 is used, as per AMS-III.H version 18)

$MEP_{ww,treatment,y}$ Methane emission potential of wastewater treatment systems equipped with biogas recovery system in year y (tonne)

$MEP_{ww,treatment,y} = Q_{ww,i,y} * B_{o,ww} * UF_{PJ} * COD_{removed,PJ,k,y} * MCF_{ww,treatment,PJ,k}$

where:

$Q_{ww,i,y}$ Amount of wastewater to be treated in the wastewater treatment system (m^3/year)

$COD_{removed,PJ,k,y}$ The Chemical Oxygen Demand removed[17] by the treatment system k of the CPA 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

(b) Optionally CPA implementer may take a default value of $0.05m^3$ of biogas leaked per m^3 of biogas produced. Each CPA may decide for itself, whether it proposes to follow the aforesaid equations on fugitive emission calculations, or whether it proposes to use the default value. The choice made to be precisely provided in the CPA-DD.

- **Project emissions due to incomplete flaring**

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[17] Calculated based on monitored value as difference between the inflow COD and the outflow COD

$PE_{flaring,y}$ Methane emissions due to incomplete flaring. For ex-ante estimation, project emission calculation for $PE_{ww,treatment,y}$ will be used without the consideration of GWP of CH_4. However, the ex post emission reduction will be calculated as per the “Tool to determine project emissions from flaring gases containing methane” as follows:

Project emissions from flaring of methane will be calculated as:
Methane emissions that occur due to incomplete flaring will be calculated ex post as per the "Project emissions from flaring (Version 3)".

This tool is applicable to the flaring of flammable greenhouse gases where:

- Methane is the component with the highest concentration in the flammable residual gas;
- The source of the residual gas is coal mine methane or a gas from a biogenic source (e.g. biogas, landfill gas or wastewater treatment gas).

The calculation procedure in this tool determines the project emissions from flaring the residual gas ($PE_{flare,y}$) based on the flare efficiency ($\eta_{flare,m}$) and the mass flow of methane to the flare ($F_{CH4,RG,m}$). The flare efficiency is determined for each minute m of year y based either on monitored data or default values.

The project emissions calculation procedure is given in the following steps:
(a) STEP 1: Determination of the methane mass flow of the residual gas;
(b) STEP 2: Determination of the flare efficiency;
(c) STEP 3: Calculation of project emissions from flaring.

Step 1. Determination of the methane mass flow in the residual gas
In the "Project emissions from flaring (Version 3)", the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream (Version 3)” shall be used to determine $F_{CH4,m}$ which is used to determine the mass of methane in kilograms fed to the flare in minute m ($F_{CH4,RG,m}$). $F_{CH4,m}$ shall be determined on a dry basis.

The following requirements apply to use the “tool to determine the mass flow of a greenhouse gas in a gaseous stream”:
(a) The gaseous stream tool shall be applied to the residual gas;
(b) The flow of the gaseous stream shall be measured continuously;
(c) CH_4 is the greenhouse gas i for which the mass flow should be determined;
(d) The simplification offered for calculating the molecular mass of the gaseous stream is valid; and
(e) The time interval t for which mass flow should be averaged is every minute m.

The calculation procedure in this tool determines the project emissions from flaring the residual gas ($PE_{flare,y}$) based on the flare efficiency ($\eta_{flare,m}$) and the mass flow of methane to the flare ($F_{CH4,RG,m}$). The flare efficiency is determined for each minute m of year y based either on monitored data or default values.

According to the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream (Version 3)”, there are six options shown in the below table.

OPTIONS	FLOW OF GASEOUS STREAM	VOLUMETRIC FRACTION
OPTION A	Volume flow - dry basis	Measured on dry basis ($v_{i,t,db}$)
OPTION B	Volume flow - wet basis	Measured on dry basis ($v_{i,t,db}$)
OPTION C	Volume flow - wet basis	Measured on wet basis ($v_{i,t,wb}$)
OPTION D	Mass flow - dry basis	Measured on dry basis ($v_{i,t,db}$)
OPTION E	Mass flow - wet basis	Measured on dry basis ($v_{i,t,db}$)
OPTION F	Mass flow - wet basis	Measured on wet basis ($v_{i,t,wb}$)

As per tool the particular Option from above table can be chosen based on whether residual gas stream is dry or wet.

In case the residual gas stream is wet, it requires determination of absolute humidity of gaseous stream.

Determination of absolute humidity of gaseous stream:
There are two option provided in tool

Option1: **Calculation using measurement of the moisture content**
This option provides a procedure to determine the absolute humidity of the gaseous stream ($m_{H2O,t,db}$) from measurements of the moisture content of the gas

Option2: **Simplified calculation without measurement of the moisture content**
This option provides a simple and conservative approach to determine the absolute humidity by assuming the gaseous stream is dry or saturated depending on which is the conservative situation

The CME has chosen option 2, which mentions
If it is conservative to assume that the gaseous stream is dry, then $m_{H2O,t,db}$ is assumed to equal 0.
If it is conservative to assume that the gaseous stream is saturated, then $m_{H2O,t,db}$ is assumed to equal the saturation absolute humidity ($m_{H2O,t,db,sat}$) and calculated using equation

$$m_{H2O,t,db,sat} = (P_{H2O,t,Sat} \times MM_{H2O})/((P_t - P_{H2O,t,Sat}) \times MM_{t,db}))$$

Where,

$m_{H2O,t,db,sat}$ =	Saturation absolute humidity in time interval t on a dry basis (kg H_2O/kg dry gas)
$P_{H2O,t,Sat}$ =	Saturation pressure of H_2O at temperature Tt in time interval t (Pa)
T_t =	Temperature of the gaseous stream in time interval t (K)
P_t =	Absolute pressure of the gaseous stream in time interval t (Pa)
MM_{H2O} =	Molecular mass of H_2O (kg H_2O/kmol H_2O)
$MM_{t,db}$ =	Molecular mass of the gaseous stream in a time interval t on a dry basis (kg dry gas/kmol dry gas)

$MM_{t,db}$ is calculated using below equation

$$MM_{t,db} = \sum_k (v_{k,t,db} \times MM_k)$$

Where,

$v_{k,t,db}$ =	Volumetric fraction of gas k in the gaseous stream in time interval t on a dry basis (m³ gas k/m³ dry gas)
MM_k =	Molecular mass of gas k (kg/kmol)
k =	All gases, except H2O, contained in the gaseous stream (e.g. N2, CO2, O2, CO, H2, CH4, N2O, NO, NO2, SO2, SF6 and PFCs). See available simplification below

The determination of the molecular mass of the gaseous stream ($MM_{t,db}$) requires measuring the volumetric fraction of all gases (k) in the gaseous stream. However, as a simplification, the volumetric fraction of only the gases k that are greenhouse gases and are considered in the emission reduction calculation in the underlying methodology must be monitored and the difference to 100% may be considered as pure nitrogen.

Further the tool provides various options of gaseous stream, either Option A or Option B will be applicable to CPAs under this PoA

Option A: To demonstrate that residual gas stream is dry basis, or
Option B: Volumetric flow of the gaseous stream in time interval t on a dry basis ($V_{t,db}$) is determined by converting the measured volumetric flow from wet basis to dry basis

As per proposed technologies to be employed by CPA under the PoA, the temperature of residual gas stream will be less than 60^0C, hence in line with para 23 (b) of the tool dry basis monitoring is possible, hence CME decided to apply Option A for actual CPAs.

Option A

Flow measurement on a dry basis is not doable for a wet gaseous stream. Therefore, it is necessary to demonstrate that the gaseous stream is dry to use this option. There are two ways to do this:

a) Measure the moisture content of the gaseous stream ($C_{H2O,t,db,n}$) and demonstrate that this is less or equal to 0.05 kg H_2O/m^3 dry gas; or
b) Demonstrate that the temperature of the gaseous stream (T_t) is less than 60ºC (333.15 K) at the flow measurement point.

Project participant will measure temperature of the biogas (Tt) at the flow measurement point and demonstrate that (Tt) is less than 60ºC (333.15 K) at the flow measurement point.

The mass flow of methane is determined as follows:

$$F_{i,t} = V_{t,db} * v_{i,t,db} * \rho_{i,t}$$

Where:

$F_{i,t}$ Mass flow of greenhouse gas i in the gaseous stream in time interval t (kg gas/h)
$V_{t,db}$ Volumetric flow of the gaseous stream in time interval t on a dry basis (m^3 dry gas/h)
$v_{i,t,db}$ Volumetric fraction of greenhouse gas i in the gaseous stream in a time interval t on a dry basis (m^3 gas i/m^3 dry gas)
$\rho_{i,t}$ Density of greenhouse gas i in the gaseous stream in time interval t (kg gas i/m^3gas i)

With:

$$\rho_{i,t} = (P_t \times MM_i) / (R_u \times T_t)$$

Where,

P_t = Absolute pressure of the gaseous stream in time interval *t* (Pa)
MM_i = Molecular mass of greenhouse gas *i* (kg/kmol)
R_u= Universal ideal gases constant ($Pa.m^3/kmol.K$)
T_t = Temperature of the gaseous stream in time interval *t* (K)

Step2. Determination of flare efficiency

Open flares: Thus, according to the "Project emissions from flaring (Version 3)", the flare efficiency in the minute m ($n_{flare,m}$) is 50% when the flame is detected in the minute m ($Flame_m$), otherwise $n_{flare,m}$ is 0%.

Enclosed flares: Use a 90% default value. Continuous monitoring of compliance with manufacturer's specification of flare (temperature, flow rate of residual gas at the inlet of the flare) will be performed. If in a specific hour any of the parameters are out of the limit of manufacturer's specifications, a 50% default value for the flare efficiency will be used for the calculations for that specific hour.
If there is no record of the temperature of the exhaust gas of the flare or if the recorded temperature is less than 500 °C for any particular hour, it will be assumed that during that hour the flare efficiency is zero.

Step3. Calculation of project emissions from flaring

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

Where:

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

$F_{CH4,RG,m} = F_{i,t} / 60 * OM_y$

Where:

$F_{CH4,RG,m}$ =	Mass flow of methane in the residual gas in the minute m (kg)
$F_{i,t}$ =	Mass flow of greenhouse gas i in the gaseous stream in time interval t (kg gas/h)
OM_y =	Operating minutes in year y

However, for ex ante estimation, in accordance with AMS-III.H version 18 equation 8, baseline emission calculation for wastewater treatment (i.e. equation 2 of AMS-III.H) can be used but without the consideration of GWP for CH_4 according to AMS-III.H. Thus, ex ante methane emissions due to incomplete flaring in year y is calculated as follows:

$PE_{Flare,y} = Q_{ww,i,y} * COD_{inflow,i,y} * \eta_{COD,BL,I} * MCF_{ww,treatment,BL.i} * B_{o,ww} * UF_{BL}$

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

$COD_{inflow,i,y}$ 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 28(2)

$MCF_{ww,treatment,BL.i}$ Methane correction factor for baseline wastewater treatment systems i (MCF values as per Table III.H.2)

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)

UF_{BL} Model correction factor to account for model uncertainties (0.89)

The ex-ante estimation of project emission due to flaring will be estimated using above equation in CPAs. The ex post emission reduction will be calculated as per “Tool to determine project emissions from flaring gases containing methane” by using actual monitored data.

- **Project emissions from biomass stored under anaerobic conditions**

$PE_{biomass,y}$ Methane emissions from biomass stored under anaerobic conditions. If storage of biomass under anaerobic conditions takes place in the project scenario and does not occur in the baseline scenario, methane emissions due to anaerobic decay of the biomass will be considered and be determined as per the procedure in the “Tool for emissions from solid waste disposal sites”. “Application B” under the tool, i.e. “the CPA activity involves the disposal of waste at a SWDS” is applicable to this PoA.

$PE_{biomass,y} = \varphi_y*(1-f_y)*GWP_{CH4}*(1-OX)*(16/12)*F*DOC_{f,y}*MCF_y*\sum^{y}_{x=1} \sum_j (W_{j,x}*DOC_j*e^{-kj*(y-x)}*(1-e^{-kj}))$

where:

φ_y	Model correction factor to account for model uncertainties for year y
f_y	Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere in year y
GWP_{CH4}	Global Warming Potential of methane
OX	Oxidation factor (reflecting the amount of methane from SWDS that is oxidised in the soil or other material covering the waste)
F	Fraction of methane in the SWDS gas (volume fraction)
MCF_y	Methane correction factor for year y
DOC_j	Fraction of degradable organic carbon in the waste type j (weight fraction) k_j Decay rate for the waste type j (1 / yr)
j	Type of residual waste or types of waste in the MSW
x	Years in the time period in which waste is disposed at the SWDS, extending from the first year in the time period (x = 1) to year y (x = y).
y	Year of the crediting period for which methane emissions are calculated (y is a consecutive period of 12 months)
$DOC_{f,y}$	Fraction of degradable organic carbon (DOC) that decomposes under the specific conditions occurring in the SWDS for year y (weight fraction)
$W_{j,x}$	Amount of solid waste type j disposed or prevented from disposal in the SWDS in the year x (t)

As the tool is applied to a residual waste, the CPA shall determine $DOC_{f,y}$ based on measurements of the biochemical methane potential of the residual waste type j (BMPj), as follows:

$$DOC_{f,y} = DOC_{f,m} = 0.7 \cdot \frac{12}{16} \cdot \frac{BMP_j}{F \cdot DOC_j}$$

Where

$DOC_{f,y}$	Fraction of degradable organic carbon (DOC) that decomposes under the specific conditions occurring in the SWDS for year y (weight fraction)
BMP_j	Biochemical methane potential for the residual waste type j disposed or prevented from disposal (t CH4 / t waste)
F	Fraction of methane in the SWDS gas (volume fraction)
DOC_j	Fraction of degradable organic carbon in the waste type j (weight fraction)
j	Residual waste type applied to the tool
y	Year of the crediting period for which methane emissions are calculated (y is a consecutive period of 12 months)
m	Month of the crediting period for which methane emissions are calculated

Leakage

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

Emission reduction

Emission reductions will be estimated ex-ante in the SSC CPA-DD as follows:

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

where:

$ER_{y,ex\ ante}$ Ex-ante emission reduction in year y (tCO_2e)

$BE_{y,ex\ ante}$ Ex-ante baseline emissions in year y (tCO_2e)

$PE_{y,ex\ ante}$ Ex-ante project emissions in year y (tCO_2e)

$LE_{y,ex\ ante}$ Ex-ante leakage emissions in year y (tCO_2e)

Ex-post emission reductions will be calculated for case 1(a) and 1(e) of paragraph 1 in baseline and monitoring methodology as per paragraph 36 of the baseline and monitoring methodology. While for cases 1(d) and 1(f) of para 1 of the baseline and monitoring methodology, ex-post emission reductions will be based on the lowest value of the following:

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 CPA.

For cases 1(f), it is possible that the CPA involves wastewater 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 actual monitored data for the CPA.

The emission reductions achieved in any year are the lowest value of the following:

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

where:

$ER_{y,ex\ post}$	Emission reductions achieved by the CPA based on monitored values for year y (tCO_2e)
$BE_{y,ex\ post}$	Baseline emissions calculated as per paragraph 29 of AMS-III.H version 18 using ex post monitored values (tCO_2e)
$PE_{y,ex\ post}$	Project emissions calculated as per paragraph 32 of AMS-III.H version 18 using ex post monitored values (tCO_2e)
MD_y	Methane captured and destroyed/gainfully used by the CPA in the year y (tCO_2e)
$LE_{y,ex\ post}$	Leakage as per paragraph 46 of AMS-III.H version 18 (tCO_2e)

In the case of flaring/combustion MD_y will be calculated as:

$MD_y = BG_{burnt,y} * w_{CH4,y} * D_{CH4} * FE * GWP_{CH4}$

Where

$BG_{burnt,y}$	Annual volume of biogas burnt in year y (m^3/year)
$w_{CH4,y}$	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% will be applied

GWP_{CH4} Global warming potential of methane

For case 1(a) and 1(e) of paragraph 1 in baseline and monitoring methodology, the emission reduction achieved by the CPA (ex-post) will be the difference between the baseline emissions and the sum of the project emissions and leakage:

$$ER_y = BE_{y,ex\ post} - (PE_{y,ex\ post} + LE_{y,ex\ post})$$

I.6.2. Data and parameters fixed ex ante

This section contains all potential parameters as may be applicable for different categories of CPAs which are eligible to be added under this PoA (refer to section A.4.2.1 of the registered PoA-DD). It may happen that not all data parameters may be applicable to a specific CPA based on the nature and characteristics of the CPA. For the purpose the CPA-DD, please include only those parameters that are relevant to the characteristics of the specific CPA under considerations.

Data/Parameter	$MCF_{ww,treatment,BL,i}$
Data unit	--
Description	Methane correction factor for baseline wastewater treatment system i
Source of data	Table-2 of AMS-III.H (version 18)
Value(s) applied	Will be based on type of the wastewater treatment system in the baseline scenario of each CPA
Choice of data or Measurement methods and procedures	In line with the requirement of the baseline and monitoring methodology
Purpose of data	To calculate baseline emission
Additional comment	-

Data/Parameter	$B_{o,ww}$
Data unit	kg CH_4/kg COD
Description	Methane producing capacity of the wastewater
Source of data	Paragraph 29 of AMS-III.H (version 18)
Value(s) applied	0.25
Choice of data or Measurement methods and procedures	In line with the requirement of the baseline and monitoring methodology
Purpose of data	To calculate baseline emission
Additional comment	--

Data/Parameter	UF_{BL}
Data unit	--
Description	Model correction uncertainty factor to account for model uncertainties
Source of data	AMS-III.H (version 18) paragraph 29
Value(s) applied	0.89
Choice of data or Measurement methods and procedures	In line with the requirement of the baseline and monitoring methodology
Purpose of data	To calculate baseline emission
Additional comment	--

Data/Parameter	GWP_{CH4}
Data unit	--
Description	Global warming potential of methane
Source of data	IPCC value for second commitment period
Value(s) applied	25
Choice of data or Measurement methods and procedures	IPCC default value for second commitment period
Purpose of data	To calculate baseline and project emission
Additional comment	--

Data/Parameter	DOC_s
Data unit	--
Description	Degradable organic content of the untreated sludge generated in the year y (fraction, dry basis).
Source of data	Default value as per paragraph 32 of AMS-III.H version 18
Value(s) applied	Wet basis: 0.09 Dry basis: 0.257
Choice of data or Measurement methods and procedures	In line with the requirement of the baseline and monitoring methodology. The wastewater considered in this PoA is industrial wastewater.
Purpose of data	To calculate baseline emission
Additional comment	--

Data/Parameter	DOC_F
Data unit	--
Description	Fraction of DOC dissimilated to biogas
Source of data	IPCC default value as per paragraph 32 of AMS-III.H version 18
Value(s) applied	0.5
Choice of data or Measurement methods and procedures	In line with the requirement of the baseline and monitoring methodology
Purpose of data	To calculate baseline and project emission
Additional comment	--

Data/Parameter	F
Data unit	--
Description	Fraction of CH_4 in biogas
Source of data	IPCC default value as per paragraph 32 of AMS-III.H version 18
Value(s) applied	0.5
Choice of data or Measurement methods and procedures	In line with the requirement of the baseline and monitoring methodology
Purpose of data	To calculate baseline and project emission
Additional comment	--

Data/Parameter	**$MCF_{BL,discharge}$**
Data unit	--
Description	Methane correction factor based on the discharge pathway in the baseline situation (e.g. into sea, river or lake) of the wastewater
Source of data	Values from Table 2 of AMS-III.H version 18
Value(s) applied	Will be based on type of the discharge pathway in the baseline wastewater treatment system of each CPA
Choice of data or Measurement methods and procedures	In line with the requirement of the baseline and monitoring methodology
Purpose of data	To calculate baseline emission
Additional comment	--

Data/Parameter	**$COD_{WW,discharge,BL,y}$**
Data unit	t/m^3
Description	Chemical oxygen demand of treated wastewater discharged into sea, river or lake
Source of data	To be determined in accordance with paragraph 38, 39 or 40 of the baseline and monitoring methodology.
Value(s) applied	To be determined based on nature of CPA.
Choice of data or Measurement methods and procedures	In line with the requirement of the baseline and monitoring methodology
Purpose of data	To calculate baseline emission
Additional comment	--

Data/Parameter	**$MCF_{s,BL,final}$**
Data unit	--
Description	Methane correction factor of the disposal site that receives the final sludge in the baseline situation.
Source of data	Estimated as per the procedures described in the methodological tool “Emissions from solid waste disposal sites”
Value(s) applied	Will be based on type of sludge disposal site in the baseline scenario of each CPA
Choice of data or Measurement methods and procedures	In line with the requirement of the baseline and monitoring methodology
Purpose of data	To calculate baseline emission
Additional comment	--

Data/Parameter	**$\eta_{COD,BL,i}$**
Data unit	%
Description	COD removal efficiency of the baseline treatment system i.
Source of data	To be determined in accordance with paragraph 38, 39 or 40 of the baseline and monitoring methodology.
Value(s) applied	To be determined for each CPA
Choice of data or	In line with the requirement of the baseline and monitoring methodology

Measurement methods and procedures	
Purpose of data	To calculate baseline emission
Additional 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 the year y
Source of data	Measurement by CPA implementer
Value(s) applied	To be determined for each CPA
Choice of data or Measurement methods and procedures	--
Purpose of data	--
Additional comment	--

Data/Parameter	**DF**
Data unit	--
Description	10-day measurement campaign factor to account for the uncertainty range (30% to 50%)
Source of data	As per AMS-III.H (version 18) paragraph 39
Value(s) applied	0.89
Choice of data or Measurement methods and procedures	In line with the requirement of the baseline monitoring methodology
Purpose of data	To calculate baseline emission
Additional comment	--

Data/Parameter	$EC_{BL,k,y}$
Data unit	MWh/year
Description	Quantity of electricity that would be consumed by the baseline electricity consumption source k in year y
Source of data	As per AMS-III.H (version 18) paragraph 38, 39 and 40.
Value(s) applied	To be determined for each CPA
Choice of data or Measurement methods and procedures	--
Purpose of data	To calculate baseline emission
Additional comment	--

Data/Parameter	$EF_{EL,k,y}$
Data unit	tCO_2/MWh
Description	Emission factor for electricity generation for source k in year y
Source of data	Value to be determined based on the source of electricity as explained under section I.6.1
Value(s) applied	to be determined for each CPA

Choice of data or Measurement methods and procedures	--
Purpose of data	To calculate baseline emission
Additional comment	--

Data/Parameter	**$FC_{i,k,y}$**
Data unit	mass or volume unit/yr
Description	Quantity of fuel type i combusted in process k during the year y
Source of data	As per AMS-III.H (version 18) paragraph 38, 39 and 40.
Value(s) applied	to be determined for each CPA
Choice of data or Measurement methods and procedures	--
Purpose of data	To calculate baseline emission
Additional comment	--

Data/Parameter	**$MCF_{default}$**
Data unit	--
Description	Methane correction factor
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value(s) applied	In case that the SWDS does not have a water table above the bottom of the SWDS and in case of application A, then select the applicable value from the following: • 1.0 for anaerobic managed solid waste disposal sites. These must have controlled placement of waste (i.e. Waste directed to specific deposition areas, a degree of control of scavenging and a degree of control of fires) and will include at least one of the following: (i) cover material; (ii) mechanical compacting; or (iii) levelling of the waste; • 0.5 for semi-aerobic managed solid waste disposal sites. These must have controlled placement of waste and will include all of the following structures for introducing air to the waste layers: (i) permeable cover material; (ii) leachate drainage system; (iii) regulating pondage; and (iv) gas ventilation system; • 0.8 for unmanaged solid waste disposal sites . deep. This comprises all SWDS not meeting the criteria of managed SWDS and which have depths of greater than or equal to 5 meters; • 0.4 for unmanaged-shallow solid waste disposal sites or stockpiles that are considered SWDS. This comprises all SWDS not meeting the criteria of managed SWDS and which have depths of less than 5 meters. This includes stockpiles of solid waste that are considered SWDS (according to the definition given for a SWDS)
Choice of data or Measurement methods and procedures	Default value in line with applied methodology
Purpose of data	To calculate baseline emission
Additional comment	MCF accounts for the fact that unmanaged SWDS produce less methane from a given amount of waste than managed SWDS, because a larger fraction of waste decomposes aerobically in the top layers of unmanaged SWDS. In case of a water table above the bottom of the SWDS, a larger proportion of the SWDS is anaerobic and MCF shall be estimated.

Parameters for calculating project emissions

Data/Parameter	$MCF_{ww,treated,PJ,k}$
Data unit	--
Description	Methane correction factor for project wastewater treatment system k
Source of data	Table 2 of AMS-III.H version 18 or Table 6.8 of Volume 5 Chapter 6 IPCC 2006 Guideline
Value(s) applied	Will be based on type of wastewater treatment of each CPA
Choice of data or Measurement methods and procedures	In line with the requirement of the baseline and monitoring methodology
Purpose of data	To calculate project emission
Additional comment	--

Data/Parameter	UF_{PJ}
Data unit	--
Description	Model correction to account for model uncertainties
Source of data	AMS-III.H (version 18) paragraph 41
Value(s) applied	1.12
Choice of data or Measurement methods and procedures	Default value as per AMS-III.H (version 18) paragraph 41
Purpose of data	In line with the requirement of the baseline and monitoring methodology
Additional comment	To calculate project emission
	--

Data/Parameter	$MCF_{WW,PJ,discharge}$
Data unit	--
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	Table 2. of AMS-III.H version 18
Value(s) applied	Will be based on the discharge pathway of wastewater treatment system of each CPA
Choice of data or Measurement methods and procedures	In line with the requirement of the baseline and monitoring methodology
Purpose of data	To calculate project emission
Additional comment	--

Data/Parameter	$MCF_{s,PJ,final}$
Data unit	--
Description	Methane correction factor of disposal site that receives the final sludge in the project situation.
Source of data	Estimated as per the procedures described in section above.
Value(s) applied	Will be based on the sludge disposal site in the project scenario of each CPA
Choice of data or Measurement methods and procedures	In line with the requirement of the baseline and monitoring methodology
Purpose of data	To calculate project emission
Additional comment	--

Data/Parameter	**CEF_{ww}**
Data unit	--
Description	Capture efficiency of the biogas recovery equipment in the wastewater treatment systems
Source of data	Default value as per paragraph 42 of AMS-III.H version 18
Value(s) applied	0.9
Choice of data or Measurement methods and procedures	In line with the requirement of the baseline and monitoring methodology
Purpose of data	To calculate project emission
Additional comment	--

Data/Parameter	**$\rho_{CH4,n}$**
Data unit	Kg/m^3
Description	Density of methane gas at normal conditions.
Source of data	Tool to determine project emissions from flaring gases containing methane
Value(s) applied	0.716
Choice of data or Measurement methods and procedures	Default value as per AMS-III.H (version 18)
Purpose of data	To calculate project emission
Additional comment	--

Data/Parameter	**$\eta_{COD,PJ,j}$**
Data unit	%
Description	COD removal efficiency of the project treatment system j
Source of data	The COD removal efficiency is obtained from the supplier of the technology.
Value(s) applied	Will be based on the technology installed in the CPA
Choice of data or Measurement methods and procedures	
Purpose of data	To calculate project emission
Additional comment	--

Data/Parameter	**$FE_{combusted}$**
Data unit	%
Description	Flare efficiency in year y
Source of data	AMS-III.H (version 18).
Value(s) applied	100
Choice of data or Measurement methods and procedures	This default value is as per the baseline and monitoring methodology para 47 of applied methodology for calculation of MD_y, if the biogas used for gainful purpose i.e. combusted in boiler or engine the flare efficiency may be considered as100%
Purpose of data	To calculate baseline emission
Additional comment	--

Data/Parameter	**$EF_{EL,j,y}$**
Data unit	tCO_2/MWh
Description	Emission factor for electricity generation for source j in year y
Source of data	Value determined based on the source of electricity as explained under methodological above.
Value(s) applied	to be determined for each CPA
Choice of data or Measurement methods and procedures	--
Purpose of data	To calculate project emission
Additional comment	--

Data/Parameter	**$\eta_{flare,h}$**
Data unit	%
Description	Flare efficiency in hour h
Source of data	"Tool to determine project emissions from flaring gases containing methane"
Value(s) applied	Refer to "Project emissions due to incomplete flaring" under section methodological choices as may be applicable to enclosed or open flaring
Choice of data or Measurement methods and procedures	--
Purpose of data	To calculate project emission
Additional comment	--

Data/Parameter	**$\Phi_{default}$**
Data unit	--
Description	Default value for the model correction factor to account for model uncertainties
Source of data	Tool for emissions from solid waste disposal sites
Value(s) applied	1
Choice of data or Measurement methods and procedures	As per the Tool for emissions from solid waste disposal sites. Default value for project and leakage emission. Please refer Data/Parameter Table-1 of applied tool "Emission from solid waste Disposal site"
Purpose of data	To calculate project emission
Additional comment	--

Data/Parameter	**OX**
Data unit	--
Description	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)
Source of data	Based on an extensive review of published literature on this subject, including the IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value(s) applied	0.1
Choice of data or Measurement methods and procedures	As per the Tool for emissions from solid waste disposal sites. "Application B" under the tool is applicable to the PoA.
Purpose of data	To calculate project emission
Additional comment	When methane passes through the top-layer, part of it is oxidized by methanotrophic bacteria to produce CO2. The oxidation factor represents the

	proportion of methane that is oxidized to CO2 This should be distinguished from the methane correction factor (MCF) which is to account for the situation that ambient air might intrude into the SWDS and prevent methane from being formed in the upper layer of SWDS

Data/Parameter	**F**
Data unit	--
Description	Fraction of methane in the SWDS gas (volume fraction)
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value(s) applied	0.5
Choice of data or Measurement methods and procedures	As per the Tool for emissions from solid waste disposal sites. “Application B” under the tool is applicable to the PoA.
Purpose of data	To calculate project emission
Additional comment	Upon biodegradation, organic material is converted to a mixture of methane and carbon dioxide

Data/Parameter	**DOC_j**
Data unit	--
Description	Fraction of degradable organic carbon in the waste type j (weight fraction)
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Tables 2.4 and 2.5)
Value(s) applied	Table for Default values for DOC_j (see table below) For the following residual waste types, project participants may use or derive default values, as follows: • For empty fruit brunches (EFB), as their characteristics are similar to garden waste, the value for garden, yard and park waste in above table may be used as a default. • For industrial sludge, either a value of 9% (% wet sludge) may be used as a default, assuming an organic dry matter content of 35 percent, or alternatively, if the percentage of organic dry matter content is known, then the DOC value may be calculated as follows: DOCj (% wet sludge) = 9 *(% organic dry matter content/35). If a waste type is not comparable to MSW and can not clearly be described as a combination of waste types in the table above or if a default value is not available or if the project participants wish to measure DOCj, then project participants should measure DOCj in an ignition loss test according to the procedure in EN 15169 or similar national or international standards. This measurement is only required once for each waste type j and the value determined for DOCj remains valid during the crediting period.
Choice of data or Measurement methods and procedures	As per the Tool for emissions from solid waste disposal sites. “Application B” under the tool is applicable to the PoA.

Table for Default values for DOC_j

Waste type j	DOC_j
	% wet waste
Wood and wood products	43
Pulp, paper and cardboard (other than sludge)	40
Food, food waste, beverages and tobacco (other than sludge)	15
Textiles	24
Garden, yard and park waste	20
Glass, plastic, metal, other inert waste	0

Purpose of data	To calculate project emission
Additional comment	The procedure for the ignition loss test is described in BS EN 15169:2007 Characterization of waste. Determination of loss on ignition in waste, sludge and sediments. The percentages listed in Table above are based on a wet waste basis which are concentrations in the waste as it is delivered to the SWDS. The IPCC Guidelines also specify DOC values on a dry waste basis, which are the concentrations after complete removal of all moist from the waste, which is not believed practical for this situation

Data/Parameter	**K_j**
Data unit	1/year
Description	Decay rate for the waste type j
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Table 3.3)
Value(s) applied	Apply the following default values for the different waste types j Default values for the decay rate (kj)

Waste type j		Boreal and Temperate (MAT ≤ 20°C)		Tropical (MAT > 20°C)	
		Dry (MAP/PET < 1)	Wet (MAP/PET > 1)	Dry (MAP < 1000mm)	Wet (MAP > 1000mm)
Slowly degrading	Pulp, paper cardboard (other than sludge), textiles	0.04	0.06	0.045	0.07
	Wood, wood products and straw	0.02	0.03	0.025	0.035
Moderately degrading	Other (non-food) organic putrescible garden and park waste	0.05	0.1	0.065	0.17
Rapidly Degrading	Food, food waste, sewage sludge, beverages and tobacco	0.06	0.185	0.085	0.40

NB: MAT . mean annual temperature, MAP . Mean annual precipitation, PET- potential evapotranspiration. MAP/PET is the ratio between the mean annual precipitation and the potential evapotranspiration

If a waste type disposed in a SWDS can not clearly be attributed to one of the waste types in the table above, project participants should choose, among the waste types that have similar characteristics, the waste type where the values of DOCj and kj result in a conservative estimate (lowest emissions), or request a revision of/deviation from this methodology

In the case of EFB, as their characteristics are similar to garden waste, the parameter values correspondent of garden waste shall be used. In case of

	sludge from pulp and paper industry, a conservative value of 0.03 shall be used for all precipitation and temperature combinations
Choice of data or Measurement methods and procedures	As per the Tool for emissions from solid waste disposal sites. “Application B” under the tool is applicable to the PoA.
Purpose of data	To calculate project emission
Additional comment	Document in the CPA-DD the climatic conditions at the SWDS site (temperature, precipitation and, where applicable, evapotranspiration). Use long term averages based on statistical data, where available. Provide references

Data/Parameter	**BMP_j**
Data unit	tCH_4/ t waste
Description	Biochemical methane potential (BMP) of MSW or the residual waste type j disposed or prevented from disposal
Source of data	Samples
Value(s) applied	To be determined for each CPA
Choice of data or Measurement methods and procedures	Conduct a fermentation test on a sample of the MSW or the residual waste that is at least 500 g in weight. The test should be undertaken according to a national or international standard, which may need to be adapted to conduct the test on a sample that is 500 g or more in weight. The duration of the fermentation test should be until no further methane is generated (indicating the complete conversion of BMP to methane). Take the average of at least three test results At least three samples from different batches. Once calculated, the value determined is valid during the crediting period. “Application B” under the tool is applicable to the PoA.
Purpose of data	To calculate project emission
Additional comment	The BMP is the basis of estimating DOCf,y which describes the fraction of DOC that degrades under the specific conditions occurring in the SWDS (for example the moisture, temperature and salt content of the SWDS).

I.6.3. Modalities for ex ante calculation of emission reductions

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Baseline emissions

Baseline emissions are calculated as follows:

$BE_y = \{BE_{power,y} + BE_{ww,treatment,y} + BE_{ww,discharge,y} + BE_{s,final,y}\}$

Applicability of baseline emissions

No.	**Emissions**	**Explanation**	**Value**
1	$BE_{power,y}$	Emissions on account of electricity or fossil fuel used.	The emission from electricity or fossil fuel used in baseline is not considered.
2	$BE_{ww,treatment,y}$	Methane emissions from baseline wastewater treatment systems	Applicable. Methane is the major component in the biogas produced from the open anaerobic lagoons in the baseline scenario.
3	$BE_{ww,discharge,y}$	Methane emissions on account of inefficiencies in the baseline wastewater treatment systems and presence of	Assumption that wastewater will be discharged to Land Application. Baseline methane emission from degradable organic carbon in treated wastewater used for land application is assumed to be 0.

		biodegradable organic carbon in untreated wastewater discharged to sea / river / lake	
4	$BE_{s,final,y}$	Methane emissions from the decay of the final sludge generated by baseline treatment system	Assumed that there is no sludge treatment system in baseline as it is a greenfield project. Hence emission considered as zero, which is conservative.

Based on table above, the baseline emission is simplified as follow:

$BE_y = BE_{ww,treatment,y}$

$BE_{ww,treatment,y} = \Sigma(Q_{ww,i,y} * COD_{untreated,i,y} * \eta_{COD,BL,i} * MCF_{ww,treatment,BL,i}) * B_{o,ww} * UF_{BL} * GWP_{CH4}$

Values of parameters used for baseline emissions estimation

$B_{o,ww}$	0.25 kg CH_4/kgCOD	Value as per AMS-III.H
$COD_{untreated,i,y}$	0.06500 tCOD/m^3	The value of COD is to be obtained from 10-day measurement campaign.
$\eta_{COD,BL,i}$	92%	The COD removal efficiency value is to be obtained from 10-day measurement campaign in the existing wastewater treatment.
$Q_{ww,i,y}$	239580 m^3/year	Assumed for for *ex-ante* estimation. However, for *ex-post* estimation of emission reductions, Qww,i,y will be monitored in line with the requirements of the baseline and monitoring methodology.
$MCF_{ww,treatment,BL,anaerobic}$	0.8	IPCC value as per Table 2 in AMS-III.H version 18.
UF_{BL}	0.89	Value as per AMS-III.H (version 18) paragraph 29.
GWP_{CH4}	25	IPCC default value

$BE_{ww,treatment,y}$ = 239,580 m3 *(0.06500 t COD/m^3 * 92% * 0.89 * 0.8) * 0.25 t CH4/tone COD * 25
= 63755 tCO2e/year

$BE_y = BE_{ww,treatment,y}$
= 63755 tCO2e/year

Project emissions

The project emissions from the systems affected by the CPA are calculated as follows;

$PE_y = PE_{power,y} + PE_{ww,treatment,y} + PE_{ww,discharge,y} + PE_{s,final,y} + PE_{fugitive,y} + PE_{flaring,y} + PE_{biomass,y}$

Applicability of project emissions

No.	Project emissions	Descriptions	Remarks
1	$PE_{power,y}$	Emissions from electricity or fuel consumption in the year *y*	Assumption that CPA is not connected to grid and electricity used to operate the project activity's facilities or power auxiliary equipment shall be supplied from biomass/biogas based captive power plant. For ex ante calculation emission is considered as zero. However, project emission due to project activity electricity consumption if any from DG set in emergency will be monitored ex-post and shall be

			calculated.
2	$PE_{ww,treatment,y}$	Methane emissions from wastewater treatment systems affected by the project activity, and not equipped with biogas recovery, in year *y*	Not Applicable. Since the wastewater treatment system will be equipped with biogas recovery, hence emission are considered as zero.
3	$PE_{ww,discharge,y}$	Methane emissions from degradable organic in treated wastewater in year *y*	Assumed that in the project activity, the treated wastewater will be utilized for land application, it can be assumed that the use of treated wastewater is in aerobic condition and well managed.
4	$PE_{s,final,y}$	Methane emissions from anaerobic decay of the final sludge produced in year *y*	Assumption that sludge will be used for land application after aerobic treatment. Ex-post will be calculated based on actual practice.
5	$PE_{fugitive,y}$	Methane emissions from biogas release in capture systems in year *y*	Applicable. The emission due to inefficiency of capture system in anaerobic digesters will contribute to methane emission to the atmosphere.
6	$PE_{flaring,y}$	Methane emissions due to incomplete flaring in year *y*	The ex-ante estimation of project emission due to flaring will be estimated using baseline equation in methane terms i.e. without applying GWP. Ex-post the project emission will be calculated based on monitored value as per applied tool.
7	$PE_{biomass,y}$	Methane emissions from biomass storage under anaerobic conditions	For ex-ante assumed that CPA does not involve biomass storage under anaerobic conditions.

Based on the table above, the project emissions are simplified as follow:

$PE_y = PE_{power,y} + PE_{ww,treatment,y} + PE_{ww,discharge,y} + PE_{s,final,y} + PE_{fugitive,y} + PE_{flaring,y} + PE_{biomass,y}$

$\boldsymbol{= 0 + 0 + 0 + PE_{fugitive,y} + 0}$

$\boldsymbol{= PE_{fugitive,y}}$

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

In case electricity is generated with biogas:

$PE_{power,y} = 0\ tCO_2e$

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

Assumption that project activity does not have wastewater treatment system without biogas recovery. Hence $PE_{ww,treatment,\ y} = 0\ tCO_2e$

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

Project emissions on account of inefficiency of the project wastewater treatment system are only relevant for those systems that are affected by the project activity and that discharge treated wastewater. In the project activity, the treated wastewater will be utilized for land application (MCF=0), it can be assumed that the use of treated wastewater is in aerobic condition and well managed, hence $\mathbf{PE_{ww,discharge,y}=0}$

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

Not Applicable as sludge in the project activity used for soil application. $PE_{s,final,\ y}$ = 0 tCO2e

v. Methane fugitive emissions due to inefficiencies in capture systems ($PE_{fugitive,y}$);

Project activity emissions from methane release in capture systems are determined as follows: This emission source is relevant to any project scenario as it applies to any installed biogas digester generating biogas. The calculation of this emission source is as follows

$PE_{fugitive,y} = PE_{fugitive,ww,y} + PE_{fugitive,s,y}$

$PE_{fugitive,ww,y}$ Fugitive emissions through capture inefficiencies in the anaerobic wastewater treatment systems (i.e. anaerobic digester) in the year *y* (tCO2e)

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

CFE_{ww} = Capture efficiency of the biogas recovery equipment in the wastewater treatment systems (a value of 0.9 is used, as per AMS-III.H version 18)

$MEP_{ww,treatment,y}$ = Methane emission potential of wastewater treatment systems equipped with biogas recovery system in year *y* (tonne)

$$MEP_{ww,treatment,y} = Q_{ww,y} * B_{o,ww} * UF_{PJ} * \sum COD_{removed,PJ,k,y} * MCF_{ww,treatment,PJ,k}$$

Values of parameters used for *ex-ante* estimation of project emissions

Parameter	Value	Source
$Q_{ww,i,y}$	239,580 m^3/year	Assumed for *ex-ante* estimation. However, for *ex-post* estimation of emission reductions, $Q_{ww,i,y}$ will be monitored in line with the requirements of the baseline and monitoring methodology.
$Q_{ww,y}$	239,580 m^3/year	Assumed for *ex-ante* estimation. However, for *ex-post* estimation of emission reductions, $Q_{ww,y}$ will be monitored in line with the requirements of the baseline and monitoring methodology.
GWP_{CH4}	25	Value as per AMS-III.H
$B_{o,ww}$	0.25 kg CH_4/kg COD	Value as per AMS-III.H
UF_{PJ}	1.12	Value as per AMS-III.H
$COD_{removed,PJ,k,y}$	0.05525 tCOD/m^3	For *ex-ante* estimation, it is based on assumption that (a) CODuntreated (design value) and (b) COD removal efficiency of the project system (provided by the technology provider), i.e. 85% * 0.05525. *For ex-post* monitoring, the $COD_{removed,PJ,k,y}$ will be calculated as the difference between the monitored values of $COD_{untreated,y}$ and $COD_{treated,y}$.
$MCF_{ww,treatment,PJ,k}$	0.8	IPCC value as per Table 6.8 Volume 5 Chapter 6 of IPCC 2006 Guideline for anaerobic reactor.
CFE_{ww}	0.9	Default value as per AMS-III.H

$MEP_{ww,treatment,y} = Q_{ww,y} * B_{o,ww} * UF_{PJ} * COD_{removed,PJ,k,y} * MCF_{ww,treatment,PJ,k},$
= 239,580 m^3/year * 0.25 t CH4/t COD * 1.12 * 0.05525 t COD/m^3 * 0.8
= 2965.04 t CH_4/year

$PE_{fugitive,ww,y} = (1 - CFE_{ww}) * MEP_{ww,treatment,y} * GWP_{CH4}$
= (1 - 0.9) * 2965.04 * 25 = 7413 tCO2e

$PE_{fugitive,y}$ = 7413 tCO2e/year

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

$PE_{flaring,y}$: Methane emissions due to incomplete flaring

As per applied methodology for ex-ante estimation of $PE_{flare,y}$ the following equation can be used

$PE_{flaring,y} = Q_{ww,y} * COD_{inflow,i,y} * \eta_{COD,BL,i} * MCF_{ww,treatment,BL,i} * B_{o,ww} * UF_{BL}$

$B_{o,ww}$	0.25 kg CH_4/kgCOD	Value as per AMS-III.H
$COD_{untreated,i,y}$	0.06500 tCOD/m^3	The value of COD is to be obtained from 10-day measurement campaign.
$\eta_{COD,BL,i}$	92%	The COD removal efficiency value is to be obtained from 10-day measurement campaign in the existing wastewater treatment.
$Q_{ww,i,y}$	239580 m^3/year	Assumed for for *ex-ante* estimation. However, for *ex-post* estimation of emission reductions, $Q_{ww,i,y}$ will be monitored in line with the requirements of the baseline and monitoring methodology.
$MCF_{ww,treatment,BL,anaerobic}$	0.8	IPCC value as per Table 2 in AMS-III.H version 18.
UF_{BL}	0.89	Value as per AMS-III.H (version 18) paragraph 29.

Hence

$PE_{flaring,y}$ = 239,580 m3 *0.06500 t COD/m^3 * 92% * 0.8 * 0.25 t CH4/tone COD* 0.89

$PE_{flaring,y}$ =2550 tCO_2e

During monitoring period, the ex post emission reduction shall be calculated as per the “Tool to determine project emissions from flaring gases containing methane” by using actual monitored data as below:

Ex-post calculation will be done as per procedure established in PoA DD.

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

Anaerobic storage of biomass due to the project activity is excluded by the formulated eligibility criteria. Thus:

$PE_{biomass,y}$ = 0 tCO_2e

Total project emission:
PE_y = 9963 tCO2e/year

Leakages
The CPA does not involve equipment transfer from another activity thus there are no leakages to be accounted for this CPA.
LEy = 0

Emission reduction

As per paragraph 48 of AMS-III.H version 18, the emission reduction is calculated as per following equation:

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

where:

$ER_{y,ex\ ante}$ *Ex-ante* emission reduction in year *y* (tCO2e)

$LE_{y,ex\ ante}$ *Ex-ante* leakage emissions in year *y* (tCO2e)

PEy,ex ante Ex-ante project emissions in year *y* (tCO2e)

$BE_{y\ ex\ ante}$ *Ex-ante* baseline emissions in year *y* (tCO2e)

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

ERy ex ante = 63755 tCO2e – (9963 tCO2e + 0 tCO2e)

ERy ex ante = 53791 tCO_2e/year

I.7. Monitoring plan

I.7.1. Data and parameters to be monitored

This section contains all potential parameters as may be applicable for different categories of CPAs which are eligible to be added under this PoA. Monitoring of data parameters will be carried out by the CPA implementer, supported by CDM as and when required. It may happen that not all data parameters may be applicable to a specific CPA based on the nature and characteristics of the CPA. For the purpose of section B.6.1 of the CPA-DD, please include only those parameters that are relevant to the characteristics of the specific CPA under consideration.

Data/Parameter	$Q_{WW,i,y}$
Data unit	m^3/month
Description	The flow of wastewater
Source of data	Plant log book
Value(s) applied	XXX To be determined for each CPA
Measurement methods and procedures	Measurements will be undertaken by using flow meter at inlet to the CPA wastewater treatment system. Details e.g. location, configuration, accuracy, class of the measurement device are to be provided in the CPA-DD.
Monitoring frequency	Monitored continuously (at least hourly measurements are undertaken, if less, confidence/precision level of 90/10 shall be attained)
QA/QC procedures	Calibration of the flow meters will also be conducted as specified by vendor or at least once in three years, whichever is less.
Purpose of data	To calculate baseline emission
Additional comment	Data will be archived for 2 years from the end of the crediting period or the last request for issuance whichever is later.

Data/Parameter	$Q_{WW,y}$
Data unit	m^3/month
Description	The flow of treated wastewater
Source of data	Plant log book
Value(s) applied	XXX To be determined for each CPA
Measurement methods and procedures	Measurements will be undertaken by using flow meter at inlet to the CPA wastewater treatment system. Details e.g. location, configuration, accuracy, class of the measurement device are to be provided in the CPA-DD.
Monitoring frequency	Monitored continuously (at least hourly measurements are undertaken, if less, confidence/precision level of 90/10 shall be attained)D
QA/QC procedures	Calibration of the flow meters will also be conducted as specified by vendor or at least once in three years, whichever is less.
Purpose of data	To calculate baseline emission
Additional comment	Data will be archived for 2 years from the end of the crediting period or the last request for issuance whichever is later.

Data/Parameter	**$COD_{ww,untreated,y}$**
Data unit	$tCOD/m^3$
Description	Chemical oxygen demand of the wastewater entering the CPA treatment system
Source of data	Representative Sampling by PP
Value(s) applied	XXXTo be determined for each CPA
Measurement methods and procedures	Measurement of COD is according to national or international standards at in- house and/or by an accredited laboratory. COD is measured through representative sampling. Refer to Section I.7.2 for further information on sample size determination.
Monitoring frequency	Samples and measurements shall ensure a 90/10 confidence/precision level
QA/QC procedures	Average value will be used through sampling with 90/10 confidence/precision level.
Purpose of data	To calculate baseline emission
Additional comment	Data will be archived for 2 years from the end of the crediting period or the last request for issuance whichever is later.

Data/Parameter	**$EF_{grid,CM,y}$**
Data unit	tCO_2/MWh
Description	Combined margin emission factor for the grid in year y
Source of data	Calculate based on the information available on the applicable electricity grid system
Value(s) applied	XXXTo be determined for each CPA
Measurement methods and procedures	As per applicable tool i.e. “Tool to calculate the emission factor for an electricity system” V07 and/or Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation, V03
Monitoring frequency	In line with applied tool mentioned above as applicable
QA/QC procedures	In line with applied tool mentioned above as applicable
Purpose of data	To calculate baseline emission
Additional comment	Only applicable to scenarios A and C for calculating emissions from electricity consumption.

Data/Parameter	**$TDL_{j,y}$, $TDL_{k,y}$**
Data unit	--
Description	Average technical transmission and distribution losses for providing electricity to source j, k in year y
Source of data	In case of electricity supply from the captive unit, transmission loss = 0 as a simplification. In case of electricity supply from the grid, data will be collected from recent, accurate and reliable data available within the host country.
Value(s) applied	XXX
Measurement methods and procedures	$TDL_{j/k,y}$ should be estimated for the distribution and transmission networks of the electricity grid of the same voltage as the connection where the proposed CDM project activity is connected to. The technical distribution losses should not contain other types of grid losses (e.g. commercial losses/theft). The distribution losses can either be calculated by the CME/CPA implementer or be based on references from utilities, network operators or other official documentation.
Monitoring frequency	Annual
QA/QC procedures	In the absence of data from the relevant year, most recent figures should be used, but not older than 5 years.
Purpose of data	To calculate baseline emission
Additional comment	Data will be archived for 2 years from the end of the crediting period or the last request for issuance whichever is later.

Calculation of project emissions

Data/Parameter	**$COD_{ww,treated,y}$**
Data unit	$tCOD/m^3$
Description	Chemical oxygen demand of the treated wastewater leaving the project treatment system
Source of data	Representative Sampling by PP
Value(s) applied	XXXTo be determined for each CPA
Measurement methods and procedures	Measurement of COD is according to national or international standards at in- house and/or by an accredited laboratory. COD is measured through representative sampling. Refer to Section I.7.2 for further information on sample size determination.
Monitoring frequency	Samples and measurements shall ensure a 90/10 confidence/precision level
QA/QC procedures	Average value will be used through sampling with 90/10 confidence/precision level.
Purpose of data	To calculate project emission
Additional comment	Data will be archived for 2 years from the end of the crediting period or the last request for issuance whichever is later.

Data/Parameter	**$COD_{PJ,outflow,k}$**
Data unit	$tCOD/m^3$
Description	Chemical oxygen demand of the treated wastewater leaving the wastewater treatment systems affected by the project activity and not equipped with biogas recovery in year y
Source of data	Representative Sampling by PP
Value(s) applied	XXXTo be determined for each CPA
Measurement methods and procedures	Measurement of COD is according to national or international standards at in- house and/or by an accredited laboratory. COD is measured through representative sampling. Refer to Section I.7.2 for further information on sample size determination.
Monitoring frequency	Samples and measurements shall ensure a 90/10 confidence/precision level
QA/QC procedures	Average value will be used through sampling with 90/10 confidence/precision level.
Purpose of data	To calculate project emission
Additional comment	This may be applicable, for instance, where the baseline scenario is the use of open anaerobic lagoons and the project scenario is introduction of anaerobic tank based technologies/system prior to the existing open anaerobic ponds (i.e. without replacing the existing open anaerobic lagoons). Data will be archived for 2 years from the end of the crediting period or the last request for issuance whichever is later.

Data/Parameter	**$COD_{WW,discharge,PJ,y}$**
Data unit	$tCOD/m^3$
Description	Chemical oxygen demand of the treated wastewater discharged to river/water/lake.
Source of data	Representative Sampling by PP
Value(s) applied	XXXTo be determined for each CPA
Measurement methods and procedures	Measurement of COD is according to national or international standards at in- house and/or by an accredited laboratory. COD is measured through representative sampling. Refer to Section I.7.2 for further information on sample size determination.
Monitoring frequency	Samples and measurements shall ensure a 90/10 confidence/precision level
QA/QC procedures	Average value will be used through sampling with 90/10 confidence/precision level.
Purpose of data	To calculate project emission
Additional comment	Data will be archived for 2 years from the end of the crediting period or the last request for issuance whichever is later.

Data/Parameter	**$S_{final,PJ,y}$**
Data unit	Tonnes
Description	Amount of dry matter in final sludge
Source of data	Plant log book
Value(s) applied	XXXTo be determined for each CPA
Measurement methods and procedures	Measure the total quantity of sludge on a wet basis. The volume (m3) and density or direct weighing will be used to determine the sludge amount (wet basis). Representative samples are taken to determine the moisture content to calculate the total sludge amount on dry basis. 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.
Monitoring frequency	Monitoring of 100 per cent of the sludge amount through continuous or batch measurements and moisture content through representative sampling to ensure the 90/10 confidence/precision level
QA/QC procedures	100% of the sludge will be monitored.
Purpose of data	To calculate project emission
Additional comment	Data will be archived for 2 years from the end of the crediting period or the last request for issuance whichever is later.

Data/Parameter	**$BG_{burnt,y}$**
Data unit	m^3
Description	Biogas volume in year y
Source of data	Plant log book
Value(s) applied	XXX Not applicable for ex-ante calculation
Measurement methods and procedures	In all cases, the amount of biogas recovered, fuelled, flared or otherwise utilized (e.g. injected into a natural gas distribution grid or distributed via a dedicated piped network) shall be measured using continuous flow meters. If the biogas streams flared and fuelled (or utilized) are monitored separately, the two fractions can be added together to determine the total biogas recovered, without the need to monitor the recovered biogas before separation. The methane content measurement shall be carried out close to the biogas flow meters. Details e.g. location, configuration, accuracy, class of the measurement device are to be provided in the CPA-DD.
Monitoring frequency	Continuous monitoring (at least hourly measurements are undertaken, if less, confidence/precision level of 90/10 shall be attained)
QA/QC procedures	Meters will be calibrated as per vendor’s specifications or at least once in 3 years, whichever is less.
Purpose of data	To calculate project emission
Additional comment	Data will be archived for 2 years from the end of the crediting period or the last request for issuance whichever is later.

Data/Parameter	w_{CH4}
Data unit	%
Description	Methane content in biogas in year y
Source of data	Plant log book
Value(s) applied	XXX Not applicable for ex-ante calculation
Measurement methods and procedures	The fraction of methane in the gas will be measured with a continuous analyser or, alternatively, with periodical measurements. It will 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 CO2 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. Details e.g. location, configuration, accuracy, class of the measurement device are to be provided in the CPA-DD. The equipment will be able to measure methane directly in the biogas. The measurement will be carried out close to a location in the system where a biogas flow measurement takes place. In case of periodic measurements, the same will be taken at least once a month.
Monitoring frequency	At least once in a month
QA/QC procedures	The measurement will be monitored regularly and the analyser used will be calibrated periodically as per vendor’s specifications or at least once in 3 years, whichever is less.
Purpose of data	To calculate project emission
Additional comment	Data will be archived for 2 years from the end of the crediting period or the last request for issuance whichever is later.

Data/Parameter	**T**
Data unit	^{0}C
Description	Temperature of the biogas
Source of data	Plant log book
Value(s) applied	XXX To be determined for each CPA according to the technical specification of the project systems.
Measurement methods and procedures	The temperature of the biogas 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. The temperature will be monitored continuously. Details e.g. location, configuration, accuracy, class of the measurement device are to be provided in the CPA-DD.
Monitoring frequency	Shall be measured at the same time when methane content in biogas ($w_{CH4,y}$) is measured
QA/QC procedures	Calibration of the meter will be as per vendor’s specifications or once in 3 years, whichever is less.
Purpose of data	To calculate project emission
Additional comment	Data will be archived for 2 years from the end of the crediting period or the last request for issuance whichever is later.

Data/Parameter	**P**
Data unit	Pa
Description	Pressure of the biogas
Source of data	Plant log book
Value(s) applied	XXX Measurements from the pressure indicator
Measurement methods and procedures	The pressure of the biogas 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. The pressure will be monitored continuously. Details e.g. location, configuration, accuracy, class of the measurement device are to be provided in the CPA-DD.
Monitoring frequency	Shall be measured at the same time when methane content in biogas ($w_{CH4,y}$) is measured.
QA/QC procedures	To be determined for each CPA according to the technical specification of the project systems. Calibration of the meter will be as per vendor's specifications or once in 3 years, whichever is less.
Purpose of data	To calculate project emission
Additional comment	Data will be archived for 2 years from the end of the crediting period or the last request for issuance whichever is later.

Data/Parameter	**$EC_{PJ,I,y}$**
Data unit	MWh/yr
Description	Quantity of electricity that would be consumed by the project electricity consumption source j in year y
Source of data	Electricity meter
Value(s) applied	XXX To be determined for each CPA
Measurement methods and procedures	The electricity consumption will be continuously monitored by electricity meter and aggregated monthly.
Monitoring frequency	Continuously, aggregated at least monthly
QA/QC procedures	The accuracy and class of the meter will as per industry standard. Calibration of the meter will be done periodically according to the manufacturer's recommendation or once every 3 years, whichever is lesser.
Purpose of data	To calculate project emission
Additional comment	Data will be archived for 2 years from the end of the crediting period or the last request for issuance whichever is later.

Data/Parameter	$FC_{i,j,y}$
Data unit	mass or volume unit/yr
Description	Quantity of fuel type i combusted in process j during the year y
Source of data	Plant log book
Value(s) applied	XXX To be determined for each CPA
Measurement methods and procedures	Use either mass or volume meters. In cases where fuel is supplied from small daily tanks, rulers can be used to determine mass or volume of the fuel consumed, with the following conditions: The ruler gauge must be part of the daily tank and calibrated at least once a year and have a book of control for recording the measurements (on a daily basis or per shift); • Accessories such as transducers, sonar and piezo electronic devices are accepted if they are properly calibrated with the ruler gauge and receiving a reasonable maintenance; • In case of daily tanks with pre-heaters for heavy oil, the calibration will be made with the system at typical operational conditions.
Monitoring frequency	Continuously
QA/QC procedures	The consistency of metered fuel consumption quantities should be cross-checked by an annual energy balance that is based on purchased quantities and stock changes. Where the purchased fuel invoices can be identified specifically for the CPA, the metered fuel consumption quantities should also be cross-checked with available purchase invoices from the financial records. Calibration of the meter will be as per vendor's specifications or once in 3 years, whichever is less.
Purpose of data	To calculate project emission
Additional comment	Data will be archived for 2 years from the end of the crediting period or the last request for issuance whichever is later.

Data/Parameter	$NCV_{i,y}$
Data unit	GJ/mass or volume unit
Description	Average net calorific value of the fuel type i used by the project power unit(s) in year y
Source of data	IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories.
Value(s) applied	XXX To be determined for each CPA
Measurement methods and procedures	Any future revision of the IPCC Guidelines will be taken into account
Monitoring frequency	Annual
QA/QC procedures	NA
Purpose of data	To calculate project emission
Additional comment	Data will be archived for 2 years from the end of the crediting period or the last request for issuance whichever is later.

Data/Parameter	$EF_{CO2,l,y}$
Data unit	tCO_2/GJ
Description	Emission factor for fuel “f”
Source of data	IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in the 2006 IPCC Guidelines on National GHG Inventories.
Value(s) applied	XXX To be determined for each CPA
Measurement methods and procedures	Any future revision of the IPCC Guidelines will be taken into account
Monitoring frequency	Annual
QA/QC procedures	NA
Purpose of data	To calculate project emission
Additional comment	Data will be archived for 2 years from the end of the crediting period or the last request for issuance whichever is later.

Data/Parameter	$v_{i,t,db}$
Data unit	m^3 of gas i/m^3 dry gas
Description	Volumetric fraction of component i in the residual gas in the minute m where i = CH_4
Source of data	Plant log book
Value(s) applied	XXX To be determined for each CPA
Measurement methods and procedures	The fraction of methane in the gas will be measured with a continuous analyser or, alternatively, with periodical measurements taken at least once a month. 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 CO2 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. The accuracy and class of the equipment will be as per applicable industry standard.
Monitoring frequency	Continuous analyser or at least once in a month
QA/QC procedures	The measurement equipment will be periodically calibrated according to the manufacturer’s recommendation or once every 3 years, whichever is less. A zero check and a typical value check may be performed by comparison with a standard certified gas.
Purpose of data	To calculate project emission
Additional comment	As a simplified approach, project proponent will only measure the methane content of the residual gas and consider the remaining part as N2. Data will be archived for 2 years from the end of the crediting period or the last request for issuance whichever is later.

Data/Parameter	**$V_{t,db}$**
Data unit	m^3
Description	Volumetric flow rate of the residual gas in dry basis at normal conditions in the minute m
Source of data	Plant log book
Value(s) applied	XXX To be determined for each CPA
Measurement methods and procedures	Both measurements (flow rate of the residual gas and volumetric fraction of methane in the residual gas) will be measured with the same reference condition that may be dry or wet basis. If the residual gas moisture is significant (temperature greater than 60ºC), the measured flow rate of the residual gas will be corrected to dry basis. The parameter will be monitored on continuous basis. Values will be averaged hourly or at a shorter time interval. The accuracy and class of the meter will be as per applicable industry standard.
Monitoring frequency	Continuous
QA/QC procedures	Calibration of the flow meter will be done periodically according to the manufacturer’s recommendation or once every 3 years, whichever is less.
Purpose of data	To calculate project emission
Additional comment	Data will be archived for 2 years from the end of the crediting period or the last request for issuance whichever is later.

Data/Parameter	**T_{flare}**
Data unit	^0C
Description	Temperature in the exhaust gas of the flare
Source of data	Plant log book
Value(s) applied	XXX To be determined for each CPA.
Measurement methods and procedures	Measure the temperature of the exhaust gas stream in the flare by a Type N thermocouple. A temperature above 500 ºC indicates that a significant amount of gases are still being burnt and that the flare is operating.
Monitoring frequency	Continuous
QA/QC procedures	Thermocouples should be replaced or calibrated every year.
Purpose of data	To calculate project emission
Additional comment	Applicable in case of enclosed flaring. An excessively high temperature at the sampling point (above 700 ºC) may be an indication that the flare is not being adequately operated or that its capacity is not adequate to the actual flow. Data will be archived for 2 years from the end of the crediting period or the last request for issuance whichever is later.

Data/Parameter	Other flare operation parameters
Data unit	--
Description	This should include all data and parameters that are required to monitor whether the flare operates within the range of operating conditions according to the manufacturer's specifications including a flame detector in case of open flares.
Source of data	Plant log book
Value(s) applied	XXX
Measurement methods and procedures	--
Monitoring frequency	Continuous measurement
QA/QC procedures	--
Purpose of data	To calculate project emission
Additional comment	Applicable as default values used. Data will be archived for 2 years from the end of the crediting period or the last request for issuance whichever is later.

Data/Parameter	f_y
Data unit	--
Description	Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere in year y
Source of data	Select the maximum value from the following: (a) contract or regulation requirements specifying the amount of methane that must be destroyed/used (if available) and (b) historic data on the amount captured
Value(s) applied	XXX
Measurement methods and procedures	NA
Monitoring frequency	Annually
QA/QC procedures	NA
Purpose of data	--
Additional comment	Data will be archived for 2 years from the end of the crediting period or the last request for issuance whichever is later.

Data/Parameter	$W_{i,x}$
Data unit	T
Description	Total amount of waste disposed in a SWDS in year x or month i
Source of data	Plant log book
Value(s) applied	XXX
Measurement methods and procedures	Measure on wet basis Continuously, aggregated at least annually for year x
Monitoring frequency	Continuous measurement
QA/QC procedures	--
Purpose of data	To calculate project emission
Additional comment	Data will be archived for 2 years from the end of the crediting period or the last request for issuance whichever is later. "Application B" under the tool is applicable to the PoA.

Data/Parameter	d_y
Data unit	M
Description	Depth of SWDS
Source of data	Plant log book
Value(s) applied	XXX
Measurement methods and procedures	Monitoring well that is also used to measure the height of the water table (hw,y) Average annual values to be used in the case of application of the yearly model
Monitoring frequency	Annual
QA/QC procedures	NA
Purpose of data	To calculate project emission
Additional comment	This parameter needs to be monitored to identify whether the SWDS has a water table above the bottom of the SWDS, such as due to using waste to fill inland water bodies, such as ponds, rivers or wetlands. If the SWDS does have a water table above the bottom of the SWDS, then this parameter is used to determine the MCF. "Application B" under the tool is applicable to the PoA.

Data/Parameter	$h_{w,y}$
Data unit	M
Description	Height of the water table in the SWDS
Source of data	Plant log book
Value(s) applied	XXX
Measurement methods and procedures	Monitoring well Average annual values to be used in the case of application of the yearly model
Monitoring frequency	Monthly
QA/QC procedures	NA
Purpose of data	To calculate project emission
Additional comment	This parameter needs to be monitored to identify whether the SWDS has a water table above the bottom of the SWDS, such as due to using waste to fill inland water bodies, such as ponds, rivers or wetlands. If the SWDS does have a water table above the bottom of the SWDS, then this parameter is used to determine the MCF. "Application B" under the tool is applicable to the PoA.

Calculation of project emissions related to electricity and/or fossil fuel consumption in year y. A CPA may calculate electricity/fossil fuel consumption either as per the methodological process provided in PoA DD, it shall be assumed that all relevant electrical equipment operate at full rated capacity, plus 10% to account for distribution losses, for 8760 hours per annum.
Each CPA must precisely provide the alternative chosen in the CPA-DD.

I.7.2. Sampling plan

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Sample Plan:

The monitoring plan is designed to monitor the parameters listed in Section above, which are required for calculation of the actual GHG emission reduction achieved by the CPA using ex post sampling survey. The COD value of inflow wastewater, treated wastewater and wastewater discharged (if applicable) will be determined based on sampling procedures as outlined below. The CME will be responsible for conducting the sampling of wastewater and maintaining the records.

As per the Guideline for Sampling and Surveys for CDM Project Activities and Programme of Activities, version 04, the sampling plan is the following:

(a) Sampling Design

As wastewater flow is continuous with little variation in COD values both at inlet of digester and corresponding treated wastewater, the reasonable precision in value used for calculation of emission reduction required. Further it is not practically possible to get continuous measurement of COD values. Therefore, representative sampling will be undertaken as part of a CPA-wide Sampling Plan that is designed in line with the requirements of the “Sampling and surveys for CDM project activities and programme of activities”, version 04. As each CPA may have different characteristics based on technology used in mill and other factors, CPA wise sampling is more appropriate.

(i) Objective and Reliability Requirements:

The objective is to obtain an unbiased and reliable estimate of the proportion or mean value of the following key variables over the course of the crediting period, and with 90/10 confidence/precision for each CPA is sampled.

Monitored Parameter:

COD_{inflow}	Chemical oxygen demand of the treated wastewater leaving the project treatment system
$COD_{outflow}$	Chemical oxygen demand of the treated wastewater leaving the wastev treatment systems affected by the project activity and not equipped with bi recovery in year y
$COD_{discharge}$	Chemical oxygen demand of the treated wastewater discharge river/water/lake.

(ii) Target Populations:

The target population for the mean value of COD of the CPAs are number of days of operation of the plant/CPA during monitoring period.

(iii) Sampling Frame

The CPAs are to be implemented in industrial units and parameter of interest is COD value of wastewater, thus each CPA requires to sample the wastewater in their specific location. The sampling frame will be number of days of operation.

(iv) Sampling Method

During monitoring period, COD levels, which will be determined through sampling. Representative sample size will be taken to ensure at least 90/10 confidence/precision level requirement. Each CPA will follow the “Best Practice Examples Focusing on Sample Size and Reliability Calculations” (hereinafter referred to as “Best Practice Examples”) for determining the number of COD samples to be taken in order to ensure 90/10 confidence precision level. The CPA will follow the relevant guidance applicable to “Measurement in Biogas Projects” from clause 97 through clause 108 of the best practice examples.

Random COD samples will be taken over a campaign period of 10 days at the start of any monitoring period for obtaining the COD values. These monitored results will be used to calculate the mean and standard deviation for COD results as input parameters in equation 39 (page 27, Annex 6, EB 67 Report) for determining the actual/required sample size for COD measurements over the entire monitoring period.

The output of the above will be compared with proposed schedule as per clause 109 (page 21, Annex 6, EB 67 Report), to select the exact COD monitoring schedule for the relevant monitoring period.

Sample size calculation:

The calculation of the required sample size for the selected parameter during monitoring period is illustrated below for a 90/10 level of confidence and precision. In all cases a conservative approach is taken, however, if the required 90/10 confidence/precision is not met then the CME will apply the deduction in CERs as a conservative approach.

Please refer example 10 of EB 67 Annex-06 for sample size calculation.

Oversampling is strongly encouraged, not only to compensate for any attrition, outliers or non-response associated with the sample, but also to prevent a situation at the analysis stage where the required reliability is not achieved as in proposed PoA case it is not possible to do sampling at later stage.

I.7.3. Other elements of monitoring plan

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The key considerations for developing monitoring plans in individual CPAs are discussed below.

1. Introduction

The Monitoring Plan (MP) would present a plan to meet the requirements for the collection, processing and reporting of data. It will describe the systems and procedures to be implemented by CME upon implementation of each CPA in order to ensure consistency between the project operation as well as monitoring, processing and reporting of data required for the calculation of emission reductions (ERs) taking into account the guidance presented in the relevant CDM guidelines.

2. Obligations of CME

It will be the responsibility of the CME to develop and implement a management and operational system for a CPA that will meet the requirements of the MP.

3. Description of data required to be monitored

The MP will identify the various data parameters to be monitored in order to calculate the emission reductions. Data parameters which need to be monitored will be recorded in the following format.

4. Recommendations for improvisation in the monitoring plan

During the course of monitoring and verification; if the CME or the CPA implementer is of the opinion that there exist potential to improve the monitoring process which would eventually result in improving the quality of monitoring and reporting of emission reductions, then such quality enhancement measures may be implemented in the monitoring process.

5. Detailed description on monitoring of each of the data parameters

This section will contain a detailed description of the data collection and recording measures to be implemented for each of the data parameter which is monitored under the CPA. This section will address the following criteria for each of the monitoring data parameter:

- Description of the primary source of data from where the information pertaining to the data parameter will be collected
- Description of the data collection process
- Description of the data recording process
- Description of the measurement instruments, in case a given parameter is to be measured (for e.g. meters used for measuring energy consumption, operating hours)
- Calibration requirement of the measurement instrument
- Description of data storage process
- Other information, if required

6. Independent monitoring of scrapping of replaced equipments:

In case CPA involves replacement of equipment, and leakage effect of the use of replaced

equipment in another activity is neglected, because the replaced equipment is scrapped, independent monitoring of scrapping of replaced equipment 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.

7. Erroneous measurements for data parameters:
In case of faulty measurement equipments which result in erroneous measurement of data parameters, the relevant parameters will be determined in the most conservative manner through alternative approaches.

The CME will develop detailed procedures on how to conservatively estimate the value of a data parameter, where it is found that the measurement instrument used for such parameter is faulty and requires to be replaced.

SECTION J. Crediting period type and duration

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Renewal crediting period
3x7 years 00 months

SECTION K. Eligibility criteria for inclusion of CPAs

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Two sets of eligibility criteria are provided under the PoA:

1. (a) Eligibility criteria applicable to Replacement CPAs – wherein the CPA involves substitution of existing anaerobic wastewater treatment system without biogas recovery with new treatment system i.e. anaerobic digestion using anaerobic tank based technologies/system coupled with biogas recovery.
2. (b) Eligibility criteria applicable to Greenfield CPAs – wherein the CPA involves introduction of new anaerobic digestion using anaerobic tank based technologies/system coupled with biogas recovery.

Table 1- Eligibility criteria for inclusion of a CPA under this PoA – “Replacement CPAs”

No.	Eligibility criterion - Category	Eligibility criterion - Required condition	Supporting evidence for inclusion
1	The geographical boundary of the CPA including any time-induced boundary consistent with the geographical boundary set in the PoA	Each CPA must be located in Indonesia.	Evidence document include details on the CPA geographical location collected from the CPA implementer. Based on such information, CME to ensure that the CPA is located in Indonesia.
2	Conditions that avoid double counting of emission reductions like unique identification of product and end-user locations	Each CPA to be uniquely identified based on the location of the CPA and its GPS coordinates. The CME before adding a CPA under this PoA shall review the project activity database on the UNFCCC website to ensure that the CPA is not already registered as a CDM project or a CPA of another PoA.	The CME will check the registered PoA database as well as the registered CDM projects database (available on UNFCCC website) to ensure that the proposed CPA has not already been registered as a CDM project or a CPA of another PoA. CME shall also take a declaration from the CPA implementer that there is no double counting of CERs.

3	The specifications of technology/measure including the level and type of service, performance specifications including compliance with testing/certifications	The CPA-DD shall incorporate relevant details on the technological specifications, including level and type of service, performance specifications including compliance with testing/certifications. Technology /measures proposed to be employed under each CPA to be in compliance with the PoA-DD.	Evidence document will be based on the contract documents for the CPA. However, if the contract has not yet been awarded, the specifications will be based on the proposal received by the CPA implementer.
4	Conditions to check the start date of the CPA through documentary evidence	Each CPA to provide documentary evidence to demonstrate start date. Start date of CPA is the earliest of the date of real action or construction or implementation of the CPA.	The CPA implementer shall provide necessary documentary evidence to substantiate the start date of the CPA. Documentary evidence may be in the form of Engineering Procurement Construction (EPC) Contract for implementing the project.
5	Conditions that ensure compliance with applicability and other requirements of single or multiple methodologies applied by CPAs	The principle methodology applicable to each CPA under the PoA is AMS-III.H (version 18). Following applicability conditions under AMS-III.H (version 18) to be complied by each CPA:	
5(a)		A CPA shall comprise 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 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).	An eligible CPA will involve replacement of an existing anaerobic wastewater treatment system without methane recovery with anaerobic digestion using anaerobic tank based technologies/system coupled with biogas recovery. Therefore, eligible CPAs will fall under option (f). Treatment of sludge is not covered in this PoA. Evidence document on the baseline system will include existing drawings, designs, plans for the baseline wastewater treatment system.

5(b)		Each CPA shall provide necessary information to demonstrate compliance with the following applicability conditions: In cases where baseline system under the CPA is anaerobic lagoon: 1. 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; 2. Ambient temperature above 15°C, at least during part of the year, on a monthly average basis; 3. The minimum interval between two consecutive sludge removal events shall be 30 days.	Evidence document includes: (a) Characteristics of the lagoon: based on the design and drawings of the existing baseline system. (b) Ambient temperature: based on publicly available date on ambient temperature. (c) Sludge removal interval: based on the past records on wastewater treatment operations.
5(c)		The recovered biogas from the above measures may also be utilised for the following applications instead of combustion/flaring: 1. Thermal or mechanical, electrical energy generation directly; 2. Thermal or mechanical, electrical energy generation after bottling of upgraded biogas; or 3. Thermal or mechanical, electrical energy generation after upgrading and distribution, in this case additional guidance provided in Appendix shall be followed: 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. 4. Hydrogen production. 5. Use as fuel in transportation applications after upgrading.	The recovered biogas may be used for energy generation as provided in section A.2 above. The use of recovered biogas will be documented in the CPA-DD. However, CPA will not claim any emission reductions due to use of biogas.
5(d)		If the recovered biogas is used for project activities covered under paragraph 4 (a), that component of the project activity can use a corresponding methodology under Type I.	Not applicable. The CPA will not claim any emission reductions due to use of biogas.

5(e)		For project activities covered under paragraph 4 (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 CO2 emissions avoided by the displacement of fossil fuel can be claimed under the corresponding Type I methodology, e.g. AMS-I.C "Thermal energy production with or without electricity".	Not applicable. The CPA will not claim any emission reductions due to use of biogas. There will be no CPA under this PoA under para 4(b) category.
5(f)		For project activities covered under paragraph 4 (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.	Not applicable. The CPA will not claim any emission reductions due to use of biogas.
5(g)		For project activities covered under paragraph 4 (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.	Not applicable. The CPA will not claim any emission reductions due to use of biogas.
5(h)		In particular, for the case of 4 (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 Appendix of AMS-III.H "Methane recovery in wastewater treatment" shall be followed in this regard.	Not applicable. The CPA will not claim any emission reductions due to use of biogas. There will be no CPA under this PoA under para 3(b) and (c) (iii) category.
5(i)		For project activities covered under paragraph 4 (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).	Not applicable. The CPA will not claim any emission reductions due to use of biogas. There will be no CPA under this PoA under para 3(b) and (c) category.
5(j)		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 "Hydrogen production using methane extracted from biogas".	Not applicable. The CPA will not claim any emission reductions due to use of biogas.
5(k)		If the recovered biogas is used for project activities covered under paragraph 4 (e), that component of the project activity shall use corresponding methodology AMS-III.AQ "Introduction of Bio-CNG in road transportation".	Not applicable. The CPA will not claim any emission reductions due to use of biogas.

5(l)		New facilities (Greenfield projects) and CPAs involving a change of equipment resulting in a capacity addition of the wastewater and/or sludge treatment system compared to the designed capacity of the baseline treatment system shall comply with the relevant requirements in the "General guidelines to SSC CDM methodologies". In addition the requirements for demonstrating the remaining lifetime of the equipment replaced, as described in the general guidelines shall also be followed.	Not applicable- this is a list of eligibility criteria applicable to CPAs involving replacement.
5(m)		Detailed description of the wastewater treatment plant as well as the source generating the wastewater shall be uniquely defined and described in the CPA-DD.	Evidence document include technical design, diagrams, plans of the existing wastewater treatment plant as well as the source generating the wastewater. Evidence document will be collected from the CPA implementer.
5(n)		Aggregate emissions reductions are less than or equal to 60 kt CO2 equivalent annually from all Type III components of the CPA.	CME shall ensure that the aggregate emissions reductions are less than or equal to 60 kt CO_2e equivalent annually from each CPA.
6	The conditions that ensure that the CPA meets the requirements pertaining to the demonstration of additionality	The PoA-DD provides on how additionality of a typical CPA will be demonstrated. Each CPA shall comply with the requirements of the PoA-DD.	Refer to additionality section of PoA DD provides the various sources from which data can be sourced by each CPA to demonstrate additionality.
7	The PoA-specific requirements stipulated by the CME including any conditions related to undertaking local stakeholder consultations and environmental impact analysis	Each CPA to conduct an independent local stakeholder consultation and relevant details on such consultation to be incorporated in the respective CPA-DD.	Evidence document include public notification or invitation to the stakeholders, minutes of the meeting for the local stakeholder consultation along with the attendance sheet identifying the attendees present at the meeting.
8	Condition for environmental impact assessment	Each CPA to assess independently whether an environmental impact assessment is required to be conducted for the project as per the applicable regulatory framework. If such requirement does exist, relevant details on such environmental impact assessment to be incorporated in the respective CPA- DD.	As per prevailing regulations, an environmental impacts assessment (EIA) is not required as the CPAs will involve reduction of GHG emissions through recovery of methane/biogas, there are no significant environmental impacts identified. However, in case any specific CPA is required to do an EIA, the evidence documents will include the EIA report for the CPA.

9	Conditions to provide an affirmation that funding from Annex I Parties, if any, does not result in a diversion of official development assistance	Each CPA to demonstrate that funding from Annex-1 parties, if any, does not result in diversion of official development assistance	Evidence includes the documentation on the actual funding for the CPA. If the funding arrangement is not yet finalized, evidence will include internal minutes of meeting or any board resolution passed by the CPA implementers on the proposed financing arrangement for the CPA.
10	Where applicable, target group (e.g. domestic/commercial/industrial, rural/urban, grid- connected/off-grid) and distribution mechanisms (e.g. direct installation)	The CPAs under proposed PoA will be implemented in Industrial units only.	The details of CPA implementer along with industry type will be provided to DOE. The same can also be checked from consent to operated.
	Where applicable, the conditions related to sampling requirements for the PoA in accordance with the “Standard for sampling and surveys for CDM project activities and programme of activities”	Monitoring of all CPAs will adhere to all requirements related to sampling for a PoA in accordance with the sampling guidelines including all annexes and amendments till EB 86 Annex 04	Specification of the sampling methods applied and compliance with the sampling requirements are established at the PoA-DD. For each CPA-DD Sampling will be undertaken as part of the PoA Sampling Plan, and in the CPA-DD describes how the PoA Sampling Plan is to be applied.
11	Where applicable, the conditions that ensure that every CPA (in aggregate if it comprises of independent sub units) meets the small-scale or microscale threshold and remains within those thresholds throughout the crediting period of the CPA	The CPA shall remain under the applicable SSC limits for type III small scale project activity i.e. emission reduction for each CPA will be less than or equal to 60000 tCO_2e/year.	Each CPA will establish the eligibility by calculating emission reduction and if required the same shall be capped.
12	Where applicable, the requirements for the debundling check, in case the CPAs belongs to small-scale or microscale project categories.	The PoA-DD provides the process which the CME will follow to determine whether a proposed CPA is a de-bundled project or not.	Evidence will be the database of PoAs and CDM projects available on the UNFCCC website. CME will ensure that the CPA is not a de-bundled project.
13	Approval of CPA by CME	Each CPA must be approved by the CME and DOE prior to its incorporation into the PoA.	Evidence document for approval by CME: the agreement between CME and CPA implementers to develop the project as a CPA under the PoA. Evidence document for approval by DOE: positive validation report.

14	CER ownership	The CPA implementer shall waive its right to proceed in getting the CPA registered as an independent CDM project or as a CPA to another PoA which may result in double counting of credits.	Evidence document include the agreement between CME and CPA implementers to develop the project as a CPA under the PoA.
15	Awareness and agreement of those operating a CPA on PoA subscription	Each CPA is to subscribe to the PoA.	Evidence document include the agreement between CME and CPA implementers to develop the project as a CPA under the PoA.
16	Host country requirement if any	For each CPA it will be checked if it is required to comply with any CDM eligibility requirement(s) lay down by the host country DNA.	There are no specific CDM eligibility requirements lay down by the Indonesian DNA. However, if there are any in future, new CPAs to demonstrate compliance with such eligibility requirement through appropriate supporting document verifiable by the CME.
17	Baseline	The baseline shall be in compliance with all mandatory applicable legal and regulatory requirements on wastewater treatment and discharge in Indonesia, even if these laws and regulations have objectives other than GHG reductions, e.g. to mitigate local air pollution. The applicable legal and regulatory requirements will be cited in the Environmental permit(s) for each CPA. If the baseline scenario does not comply with all mandatory applicable legislation and regulations, then it has to be demonstrated that, based on an examination of current practice in the country or region in which the law or regulation applies, those applicable legal or regulatory requirements are systematically not enforced and that non-compliance with those requirements is widespread in the country or region.	Evidence document will include the latest compliance report submitted by the CPA implementer to the relevant government department. In case the regulatory requirements are systematically not enforced, the same will be demonstrated based on the publicly available information on the current practice in the country or region.
18	Remaining lifetime	The CPA implementer shall document in the CPA-DD how the remaining lifetime of the existing equipment has been the determined. It will include a check on the existing system whether it has the capacity to treat the expected waste water volume.	If applicable, technical lifetime, operational lifetime and capacity to treat expected waste water volume of the baseline equipments will be determined based on the technical specifications and past operational records of the baseline equipment.
19	Baseline technology	The existing wastewater treatment system shall not be covered lagoon/covered tank nor be equipped with methane recovery system.	Evidence document include layout diagrams, technical specifications, pictures of the baseline system.

20	Baseline technology	The existing wastewater treatment system shall not be only mechanical aerobic system.	Evidence document include layout diagrams, technical specifications, pictures of the baseline system.

Table 2- Eligibility criteria for inclusion of a CPA under this PoA – "Greenfield CPAs"

No.	Eligibility criterion - Category	Eligibility criterion - Required condition	Supporting evidence for inclusion
1	The geographical boundary of the CPA including any time-induced boundary consistent with the geographical boundary set in the PoA	Each CPA must be located in Indonesia.	Evidence document include details on the CPA geographical location collected from the CPA implementer. Based on such information, CME to ensure that the CPA is located in Indonesia.
2	Conditions that avoid double counting of emission reductions like unique identification of product and end-user locations	Each CPA to be uniquely identified based on the location of the CPA and its GPS coordinates. The CME before adding a CPA under this PoA shall review the project activity database on the UNFCCC website to ensure that the CPA is not already registered as a CDM project or a CPA of another PoA.	The CME will check the registered PoA database as well as the registered CDM projects database (available on UNFCCC website) to ensure that the proposed CPA has not already been registered as a CDM project or a CPA of another PoA. CME shall also take a declaration from the CPA implementer that there is no double counting of CERs.
3	The specifications of technology/measure including the level and type of service, performance specifications including compliance with testing/certifications	Technology /measures proposed to be employed under each CPA to be in compliance with the PoA-DD.	Evidence document will be based on the contract documents for the CPA. However, if the contract has not yet been awarded, the specifications will be based on the proposal received by the CPA implementer.
4	Conditions to check the start date of the CPA through documentary evidence	Each CPA to provide documentary evidence to demonstrate start date. Start date of CPA is the earliest of the date of real action or construction or implementation of the CPA.	The CPA implementer shall provide necessary documentary evidence to substantiate the start date of the CPA. Documentary evidence may be in the form of Engineering Procurement Construction (EPC) Contract for implementing the project.
5	Conditions that ensure compliance with applicability and other requirements of single or multiple methodologies applied by CPAs	The principle methodology applicable to each CPA under the PoA is AMS-III.H (version 18). Following applicability conditions under AMS-III.H (version 18) to be complied by each CPA:	

5(a)		A CPA shall comprise 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 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).	An eligible CPA will involve implementation of a Greenfield wastewater treatment through anaerobic digestion using anaerobic tank based technologies/ system with methane recovery. Evidence document on the baseline system will include design document, layout plans from the consultant/technology provider for the industrial facility on the wastewater treatment system.
5(b)		Each CPA shall provide necessary information to demonstrate compliance with the following applicability conditions: In cases where baseline system under the CPA is anaerobic lagoon: 1. 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; 2. Ambient temperature above 15°C, at least during part of the year, on a monthly average basis; 3. The minimum interval between two consecutive sludge removal events shall be 30 days.	Evidence document includes: (a) Characteristics of the lagoon: design document, layout plans from the consultant/technology provider for the industrial facility on the effluent treatment system, other practices on treatment of similar effluent in the region, industrial guidelines for treatment of similar effluent. (b)Ambient temperature: based on publicly available date on ambient temperature. (c)Sludge removal interval: design document, layout plans from the consultant/technology provider for the industrial facility on the effluent treatment system, other practices on treatment of similar type of wastewater in the region, industrial guidelines for treatment of similar type of wastewater.

5(c)		The recovered biogas from the above measures may also be utilised for the following applications instead of combustion/flaring: 4. Thermal or mechanical, electrical energy generation directly; 5. Thermal or mechanical, electrical energy generation after bottling of upgraded biogas; or 6. Thermal or mechanical, electrical energy generation after upgrading and distribution, in this case additional guidance provided in Appendix shall be followed: 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. 7. Hydrogen production. 8. Use as fuel in transportation applications after upgrading.	The recovered biogas may be used for energy generation. The use of recovered biogas will be documented in the CPA-DD. However, CPA will not claim any emission reductions due to use of biogas.
5(d)		If the recovered biogas is used for project activities covered under paragraph 4 (a), that component of the project activity can use a corresponding methodology under Type I.	Not applicable. The CPA will not claim any emission reductions due to use of biogas.
5(e)		For project activities covered under paragraph 4 (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 CO2 emissions avoided by the displacement of fossil fuel can be claimed under the corresponding Type I methodology, e.g. AMS-I.C "Thermal energy production with or without electricity".	Not applicable. The CPA will not claim any emission reductions due to use of biogas. There will be no CPA under this PoA under para 4(b) category.
5(f)		For project activities covered under paragraph 4 (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.	Not applicable. The CPA will not claim any emission reductions due to use of biogas.
5(g)		For project activities covered under paragraph 4 (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.	Not applicable. The CPA will not claim any emission reductions due to use of biogas.

5(h)		In particular, for the case of 4 (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 Appendix of AMS-III.H "Methane recovery in wastewater treatment" shall be followed in this regard.	Not applicable. The CPA will not claim any emission reductions due to use of biogas. There will be no CPA under this PoA under para 4(b) and (c) (iii) category.
5(i)		For project activities covered under paragraph 4 (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).	Not applicable. The CPA will not claim any emission reductions due to use of biogas. There will be no CPA under this PoA under para 4(b) and (c) category.
5(j)		If the recovered biogas is utilized for the production of hydrogen (project activities covered under paragraph 4 (d)), that component of the project activity shall use the corresponding methodology AMS-III.O "Hydrogen production using methane extracted from biogas".	Not applicable. The CPA will not claim any emission reductions due to use of biogas.
5(k)		If the recovered biogas is used for project activities covered under paragraph 4 (e), that component of the project activity shall use corresponding methodology AMS-III.AQ "Introduction of Bio-CNG in road transportation".	Not applicable. The CPA will not claim any emission reductions due to use of biogas.
5(l)		New facilities (Greenfield projects) and CPAs involving a change of equipment resulting in a capacity addition of the wastewater and/or sludge treatment system compared to the designed capacity of the baseline treatment system shall comply with the relevant requirements in the "General guidelines to SSC CDM methodologies". In addition the requirements for demonstrating the remaining lifetime of the equipment replaced, as described in the general guidelines shall also be followed.	The General guidelines require a "Barrier Assessment" approach for identifying the most plausible baseline scenario. Refer to section E.4 for further information on determination of baseline scenario for Greenfield CPAs.
5(m)		Detailed description of the wastewater treatment plant as well as the source generating the wastewater shall be uniquely defined and described in the CPA-DD.	Evidence document include technical design, diagrams, plans of the existing wastewater treatment plant as well as the source generating the wastewater. Evidence document will be collected from the CPA implementer.
5(n)		Aggregate emissions reductions are less than or equal to 60 kt CO2 equivalent annually from all Type III components of the CPA.	CME shall ensure that the aggregate emissions reductions are less than or equal to 60 kt CO2 equivalent annually from each CPA.

	Baseline scenario	Conditions for determination of baseline scenario	Section E.4 of the PoA-DD provides on how baseline scenario for Greenfield CPA will be demonstrated. Each CPA shall comply with the requirements of section E.4 of the PoA-DD.
6	The conditions that ensure that the CPA meets the requirements pertaining to the demonstration of additionality	Section E.5 of the PoA-DD provides on how additionality of a typical CPA will be demonstrated. Each CPA shall comply with the requirements of section E.5 of the PoA-DD.	Refer to section E.5. Section E.5 provides the various sources from which data can be sourced by each CPA to demonstrate additionality.
7	The PoA-specific requirements stipulated by the CME including any conditions related to undertaking local stakeholder consultations and environmental impact analysis	Each CPA to conduct an independent local stakeholder consultation and relevant details on such consultation to be incorporated in the respective CPA-DD.	Evidence document include public notification or invitation to the stakeholders, minutes of the meeting for the local stakeholder consultation along with the attendance sheet identifying the attendees present at the meeting.
8	Condition for environmental impact assessment	Each CPA to assess independently whether an environmental impact assessment is required to be conducted for the project as per the applicable regulatory framework. If such requirement does exist, relevant details on such environmental impact assessment to be incorporated in the respective CPA- DD.	As per prevailing regulations 3 , an environmental impacts assessment (EIA) is not required as the CPAs will involve reduction of GHG emissions through recovery of methane/biogas, there are no significant environmental impacts identified. However, in case any specific CPA is required to do an EIA, the evidence documents will include the EIA report for the CPA.
9	Conditions to provide an affirmation that funding from Annex I Parties, if any, does not result in a diversion of official development assistance	Each CPA to demonstrate that funding from Annex-1 parties, if any, does not result in diversion of official development assistance	Evidence includes the documentation on the actual funding for the CPA. If the funding arrangement is not yet finalized, evidence will include internal minutes of meeting or any board resolution passed by the CPA implementers on the proposed financing arrangement for the CPA.
10	Where applicable, target group (e.g. domestic/commercial/industrial, rural/urban, grid- connected/off-grid) and distribution mechanisms (e.g. direct installation)	The CPAs under proposed PoA will be implemented in Industrial units only.	The details of CPA implementer along with industry type will be provided to DOE. The same can also be checked from consent to operate.

11	Where applicable, the conditions related to sampling requirements for the PoA in accordance with the “Standard for sampling and surveys for CDM project activities and programme of activities”	Monitoring of all CPAs will adhere to all requirements related to sampling for a PoA in accordance with the sampling guidelines including all annexes and amendments till EB 86 Annex 04	Specification of the sampling methods applied and compliance with the sampling requirements are established at the PoA-DD. For each CPA-DD Sampling will be undertaken as part of the PoA Sampling Plan, and in the CPA-DD describes how the PoA Sampling Plan is to be applied.
12	Where applicable, the conditions that ensure that every CPA (in aggregate if it comprises of independent sub units) meets the small-scale or microscale threshold and remains within those thresholds throughout the crediting period of the CPA	The CPA shall remain under the applicable SSC limits for type III small scale project activity i.e. emission reduction for each CPA will be less than or equal to 60000 tCO_2e/year.	Each CPA will establish the eligibility by calculating emission reduction and if required the same shall be capped.
13	Where applicable, the requirements for the debundling check, in case the CPAs belongs to small-scale or microscale project categories.	The PoA-DD provides the process which the CME will follow to determine whether a proposed CPA is a de-bundled project or not.	Evidence will be the database of PoAs and CDM projects available on the UNFCCC website. CME will ensure that the CPA is not a de-bundled project.
14	Approval of CPA by CME	Each CPA must be approved by the CME and DOE prior to its incorporation into the PoA.	Evidence document for approval by CME: the agreement between CME and CPA implementers to develop the project as a CPA under the PoA. Evidence document for approval by DOE: positive validation report.
15	CER ownership	The CPA implementer shall waive its right to proceed in getting the CPA registered as an independent CDM project or as a CPA to another PoA which may result in double counting of credits.	Evidence document include the agreement between CME and CPA implementers to develop the project as a CPA under the PoA.
16	Awareness and agreement of those operating a CPA on PoA subscription	Each CPA is to subscribe to the PoA.	Evidence document include the agreement between CME and CPA implementers to develop the project as a CPA under the PoA.

17	Host country requirement if any	For each CPA it will be checked if it is required to comply with any CDM eligibility requirement(s) lay down by the host country DNA.	There are no specific CDM eligibility requirements lay down by the Indonesian DNA. However, if there are any in future, new CPAs to demonstrate compliance with such eligibility requirement through appropriate supporting document verifiable by the CME.

Appendix 1. Contact information of coordinating/managing entity and project participants

Coordinating/managing entity and/or project participants	☒ Coordinating/managing entity ☒ Project participant
Organization name	PT. Knowledge Integration Services (Indonesia)
Country	Indonesia
Address	Sudirman Central District Business Jl.Jend.Sudirman Kav.52-53 One Pacific Place 15th floor, Jakarta, 12190, Indonesia
Telephone	+6221 2550 2407
Fax	+6221 2550 2555
E-mail	raghu@knowledge-integration.org
Website	www.knowledge-integration.org
Contact person	Mr. KR Raghunath

Appendix 2. Affirmation regarding public funding

No public funding to be used by PoA and CPAs.

Appendix 3. Applicability of methodologies and standardized baselines

NA

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

NA

Appendix 5. Further background information on monitoring plan

NA

Appendix 6. Summary report of comments received from local stakeholders

To be provided at CPA level.

Appendix 7. Summary of post-registration changes

NA

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Document information

Version	Date	Description
09.0	31 May 2019	Revision to: • Ensure consistency with version 02.0 of the "CDM project standard for programmes of activities" (CDM-EB93-A07-STAN); • Make editorial improvements.
08.1	28 June 2017	Revision to: • Remove a duplicated instruction; • Make editorial improvement.
08.0	7 June 2017	Revision to: • Improve consistency with the "CDM project standard for programmes of activities" and with the PDD and CPA-DD forms; • Make editorial improvement.
07.0	25 May 2017	Revision to: • Ensure consistency with the "CDM project standard for programmes of activities" (CDM-EB93-A07-STAN) (version 01.0); • Incorporate the "Programme design document form for small-scale CDM programmes of activities" (CDM-SSC-PoA-DD-FORM); • Make editorial improvement.
06.0	15 April 2016	Revision to ensure consistency with the "Standard: Applicability of sectoral scopes" (CDM-EB88-A04-STAN) (version 01.0).
05.0	9 March 2015	Revision to: • Include provisions related to choice of start date of PoA; • Include provisions related to delayed submission of a monitoring plan; • Provisions related to local stakeholder consultation; • Add exception for generic CPA where technology is under positive lists; • Make editorial improvement.
04.1	5 August 2014	Editorial revision to correct the document information table.
04.0	25 June 2014	Revision to: • Include the Attachment: Instructions for filling out the project design document form for CDM programme of activities (these instructions supersede the Guideline: Completing the programme design document form for CDM programme of activities (Version 04.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for the application of the methodology (ies) to the PoA in B.4 and Appendix 1; • Add general instructions on post-registration changes in paragraphs 2 and 3 of general instructions and Appendix 6; • Change the reference number from F-CDM-PoA-DD to CDM-PoA-DD-FORM; • Make editorial improvement.

Version	*Date*	*Description*
03.0	3 December 2012	EB 70 Revision to reflect changes to the *Guideline: Completing the programme design document form for CDM programmes of activities* (EB 70, Annex 6).
02.0	13 March 2012	EB 66 Revision required to ensure consistency with the "Guidelines for completing the programme design document form for CDM programmes of activities" (EB 66, annex 12).
01.0	27 July 2007	EB 33, Annex 41 Initial publication.

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