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

CONTENTS

Annexes

NOTE:

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

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

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

A.1 Title of the programme of activities:

TBEC Biogas Programme for South East Asia
Version: 03.4
Date: 16/08/2012

A.2. Description of the programme of activities:

General operating and implementing framework of PoA

The Thai Biogas Energy Company Limited (TBEC) biogas programme for South East Asia, herein referred to as the Programme of Activities (PoA), has the intended purpose of diffusing biogas systems throughout South East Asia, including the Kingdom of Thailand. This PoA will be operated by Thai Biogas Energy Company Limited (TBEC), hereinafter refer to TBEC.

This PoA is applicable to activities that aim to reduce methane emissions from industrial wastewater treatment. It is applicable to both existing facilities and Greenfield facilities where the baseline scenario is demonstrated to result in greenhouse gas emissions. TBEC is the “Coordinating/Managing Entity” hereinafter referred to as CME who will be responsible for identifying suitable projects to be included as CDM Programme Activities (CPAs) under this PoA. The technologies and practices implemented to reduce greenhouse gas emissions from industrial wastewater treatment shall be addressed as the “Project Activity”. The PoA will involve CPAs under the direct management of TBEC and the implementer(s) of the activities included in this PoA will be identified within the CPA-DD of each individual CPA.

TBEC is a company which has extensive experience in the design, operation and maintenance of biogas systems which convert organic wastewater into usable energy. As the CME, TBEC will ensure that each CPA identified for inclusion in this PoA meets the necessary requirements outlined in the remainder of this document. TBEC will implement the operational, management and monitoring plan described in section A.4.4 of the PoA-DD and will be directly responsibility for co-coordinating with all parties involved with implementation of the PoA, these include: CPA implementers, project owners, end users and any other third parties. TBEC will ensure that all parties involved provide the necessary data and documents required for preparation of the CPA-DD associated with each CPA. In addition, TBEC will oversee the implementation of the monitoring plans for each CPA to ensure all necessary data and documents required for preparation of the monitoring reports will be recorded in accordance with the monitoring plans described in the CPA-DDs.

All CPAs included in this PoA will aim to reduce greenhouse gas emissions from industrial wastewater treatment system associated with the baseline technology for treating wastewater and/or through the replacement of energy generated from fossil fuel and/or replacement of electricity consumption from the national/state/regional grid system or dedicated power plant(s). The PoA will apply the large scale CDM methodology ACM0014 which quantifies the emissions reductions achieved by the capture/destruction of methane, production of renewable electricity and production of renewable biogas fuel for energy use.

Policy/measure or stated goal of the PoA

The stated goal of this PoA is to reduce greenhouse gas emissions from industrial wastewater treatment and promote the consumption of renewable energy by using biogas generated from wastewater treatment systems as a fuel throughout South East Asia, the current version of the PoA only implements the activities within Thailand. The project will implement environmentally safe and sound technology which will reduce methane emissions from wastewater processing. TBEC has a proven track record of implemented biogas systems in Thailand which employ environmentally safe and sound technology and that have been registered as CDM projects. The PoA will involve technology transfer. For example, Jenbacher gas engines (or other biogas engines of appropriate quality) imported to Thailand for use in any CPA for which such biogas engine technology is determined to be appropriate. The use of Jenbacher engines (and the generation of electricity) is not a mandatory requirement for all CPAs in this PoA.

Contribution to Sustainable Development

1. Environment and Natural Resources
    - The PoA will improve the local and global environment, by improving wastewater management and result in reducing odour and greenhouse gas emissions, therefore reduce air pollution. The project will introduce a sequential stage of water management. The project will not have a significant effect on soil, biodiversity, mineral resources, forests and water resources, in the project area.
2. Social
    - The PoA will create employment opportunities associated with operation of the project plants. During the project construction there will be additional jobs created. Local stakeholder consultations will be undertaken and all relevant stakeholders will be invited; including local villagers, government representatives, women and the elderly. Presentations will be given to the stakeholders to enable them to understand the project and provide feedback on the environmental and social impacts. All stakeholders will be provided with an opportunity to ask questions and raise their concerns. The CPA projects will comply with local labour laws and ensure workers are provided with reasonable working conditions.
3. Economic
    - The jobs created by the PoA will improve local human capacity and diversity of employment opportunities through training of technical roles which may include: project managers, lab technicians and operators. The PoA will result in the production of biogas which will be used as fuel, reducing the dependence on fossil fuels. Where feasible, the project will source material and equipment locally and this will stimulate the local economy.
4. Technology
    - TBEC has extensive experience in the design, operation and maintenance of biogas systems in South East Asia. TBEC will use its expertise in the construction and operation of the biogas plants to ensure that the PoA results in the implementation of suitable technology Local staff will be trained to ensure they have adequate skills to meet the requirements of the job.

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

The implementation of biogas systems is a voluntary action by TBEC, a private entity with no legal obligation to pursue the implementation of such biogas systems. TBEC is a company whose business is focused on the implementation of biogas systems and the CDM is central to the TBEC business model. All four of TBEC's operational biogas projects have been developed as CDM projects in which CER

revenue is essential to the business case. Each of the four projects has been registered by the CDM board whereby the additionality has been confirmed in accordance with the procedures of the CDM.

The biogas systems will be implemented at facilities where wastewater is commonly treated in anaerobic open lagoons that have clearly anaerobic conditions and where there is no legal obligation to change the method of treatment. The Thailand Industrial Work Department Limitations on Wastewater Discharge[1] does not mandate the proposed project technology of covered anaerobic digestion for the treatment of wastewater. This PoA will enable TBEC to facilitate the roll out of biogas systems by ensuring that CER revenue is available to support the business case for developing the biogas systems. The anaerobic digester system will be implemented at facilities where wastewater is treated in anaerobic open lagoons and where there is no legal obligation to change the method of treatment. Implementation of technology for methane destruction at installations with an industrial wastewater treatment facility is not mandated in the Factory Licensing[2] regulation. As such there is no mandatory enforcement of the proposed project technology.

Based on the first specifc-CPA annual emission reductions available at the time of validation, the PoA is expected to reduce approximately 21,279 tCO_2e of greenhouse gas annually within the first crediting period.

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

TBEC is the Coordinating/Managing Entity of the PoA and the entity which will communicate with the CDM-EB. Project Participants being registered in relation to the PoA are shown below. Additional Project Participants may be added after registration of the PoA in accordance with the relevant guidelines of the CDM.

Name of Party involved	Private and/or public entity(ies) project participants	Kindly indicate if the Party involved wishes to be considered as project participant
Thailand (host)	Thai Biogas Energy Company Limited (TBEC)	No

[1] Thailand Industrial Ministry Announcement, 2nd Issued (B.E.2359), Refers to Factory Act 2535, Subject: Attributes of Wastewater from Factory.

[2] Thailand Factory license (Ror Ngor 4)

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

A.4.1. Location of the programme of activities:

Figure A.4.1: Map of Thailand

The PoA is intended to be applied to countries through South East Asia and will commence with the first CPA in Thailand. The boundary will be amended post-registration to include additional countries in accordance with the procedure provide in EB60, Annex 26.

Location: Thailand (additional countries to be added via post-registration amendments to the PoA)

The location of each CPA will be identified in the CPA-DD which will include the following details:

Description	**Data**
Geographic Co-ordinates	*to be provided for each CPA*
Province (*or equivalent*)	*to be provided for each CPA*
District & Sub-District (*or equivalent*)	*to be provided for each CPA*

A.4.1.1. Host Party(ies):

The boundary will be amended post-registration to include additional Host Parties in accordance with the procedure provide in EB60, Annex 26.

Host Party: Thailand (additional countries to be added via post-registration amendments to the PoA)

A.4.1.2. Physical/ Geographical boundary:

At commencement of the PoA, the physical boundary is the national borders of Thailand. After registration of the PoA, the boundary will be amended to add additional countries in accordance with the procedure provide in EB60, Annex 26. A map of Thailand is shown below. Additional maps will be provided in any post-registration amendments to the boundary.

Figure A.4.1.2: Map of Thailand

All applicable national and/or sectoral policies and regulations of each host country within the chosen boundary have been taken into consideration and deemed in compliance with the design of the PoA. Relevant sectoral policies and regulations identified as potentially relevant to the PoA are:

• The 'Notification on type and size of project or enterprise that must report an Environmental Impact Assessment' announced by Ministry of natural Resource and Environment dated 16/6/2009.
• 'Building Control Act B.E.2522 (1979)' dated 8/5/1979.
• 'Notification on Assigning Sub-district Administration Organization be 'Local Governor' according to Building Control Act B.E.2522 (1979)' announced by Ministry of Interior dated 5/10/1995.
• 'Factory Act B.E. 2535 (1992)' dated 2/4/1992.
• 'Announcement on Attributes of Wastewater from Factory', 2nd Issued, B.E.2359, Thailand Ministry of Industry
• 'Announcement on buying electricity from VSPP' announced by Provincial Electricity Authority dated 7/12/2006
• 'Announcement on Adder for buying electricity from VSPP' announced by Provincial Electricity Authority dated 19/8/2009

• 'PEA Grid Code Regulation' announced by Provincial Electricity Authority, 2008
• 'Energy Industry Act, B.E.2550 (2007)' dated 9/12/2007
• 'Notification on type and period of energy industry license B.E.2551 (2008)' announced by Energy Regulatory Commission dated 4/12/2008

In addition, the "Tool for the demonstration and assessment of additionality" requires the consideration of EB guidance on national/local/sectoral policies in the calculation of financial indicators utilised for the assessment of additionality. EB22, Annex 3, specifies that national policies or regulations that give comparative advantage to less emissions-intensive technologies (E- policies) may be excluded if the national policy or regulation was implemented after 11 November 2001. Renewable energy projects are eligible to receive an adder tariff in accordance with the National Energy Policy Council (NEPC) policy for 'adder payments' which was approved by the NEPC in the third resolution of its 106th meeting (3/2006) on 4 September 2006[3]. The Thailand adder tariff is specifically for renewable energy projects which are less carbon intensive than conventional sources of electricity and the tariff can be fully attributed to policy changes at the national level. As such, the adder tariff can be excluded.

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

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

The PoA will apply to technologies which conform to Scenario 1 in Table 1 of ACM0014 whereby the project activity involves treatment of wastewater in a new anaerobic digester. The biogas extracted from the anaerobic digester and, if applicable, biogas generated from the treatment of solid materials, is flared and/or used to generate electricity and/or heat. The residual from the anaerobic digester, after treatment, is directed to open lagoons or is treated under clearly aerobic conditions (e.g. dewatering and land application). As such, a typical CPA (that will be included in this PoA) will involve the installation of an anaerobic digester with methane recovery and may include one or more individual project sites. In many countries of South East Asia, the default industrial wastewater treatment system at processing facilities is the use of anaerobic open lagoons which release methane directly to the atmosphere. The project activity in a CPA of this PoA must include the following technology measure:

(1) Installation of a new anaerobic digester with methane recovery for treatment of wastewater

In addition, the project activity may include one or more of the following technology measures:

(2) Destruction of recovered methane in a burner to produce useful heat energy
(3) Destruction of recovered methane in power generation equipment to produce renewable electricity
(4) Destruction of recovered methane in a flare

As a general description, the new anaerobic digester system will treat the wastewater in a manner that enables the biogas to be collected and extracted for combustion. Where suitable, the biogas will be used to generate heat for industrial processes or used to generate electricity which may be used on-site and/or exported to the grid/other users. Excess biogas will typically be combusted in a flare.

[3] http://www.eppo.go.th/nepc/kpc/kpc-106.htm

The main essential feature of the anaerobic digester system is a vessel to retain organic wastewater in which methane is produced and captured from the anaerobic digestion process. The vessel will typically be an in-ground anaerobic reactor but may include other configurations in order to suit the specific requirements of each project site such as above ground tanks. The anaerobic digester system will also typically include but not be limited to:

- a control system for distributing wastewater in the digestion vessel
- a system for collecting and distributing the biogas
- biogas treatment systems which may include H_2S removal and moisture removal
- equipment for destroying the collected methane which may include, biogas engines for electricity generation, burners for heat generation and flares for destruction of excess biogas
- infrastructure to distribute the treated wastewater from the biogas system to open lagoons or aerobic treatment (this may include land application).

This PoA is applicable to activities that aim to reduce methane emissions from industrial wastewater treatment. It is applicable to both existing facilities and Greenfield facilities where the baseline scenario is demonstrated to result in greenhouse gas emissions. In accordance with Scenario 1 of the methodology, the CPA will alter the pre-project scenario of open lagoons by installing a new anaerobic digester. In the pre-project situation, wastewater from the industrial facility would be directed to open lagoons. In the project situation, wastewater from the industrial facility is directed to a new anaerobic digester. The treated wastewater from the project will then typically be directed to the existing open lagoons. The CPA implementer will not alter the existing lagoons managed by the industrial facility operator as the obligation to treat wastewater to relevant standards remains the obligation of the industrial facility operator. The industrial facility operator will maintain/operate any post treatment systems (i.e. existing open lagoons) in a manner which ensures compliance to relevant local standards. As such, each CPA will alter the existing wastewater treatment installation and process by introducing a sequential stage of wastewater treatment (anaerobic digester) prior to the open lagoons.

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

For a CPA to be eligible under this PoA all applicability conditions below have to be met:

#	Eligibility	Description	Reference/Supporting Document
1	The CPA implementer is identified in the CPA-DD	The CPA implementer must be identified in the CPA-DD and recorded in the CME database	CPA-DD Specific
2	The wastewater treatment technology implemented by the CPA conforms to the Project Activity described in the methodology ACM0014 Version 04.1.0.	The CPA wastewater treatment technology involves the installation of an anaerobic digester with methane recovery.	One of the following: (a) Project Investment Memorandum (b) Project Feasibility Study (c) Project Design Drawings
3	The methane destruction	If relevant, the CPA achieves	One of the following:

	technology implemented by the CPA conforms to the Project Activity described in the methodology ACM0014 Version 04.1.0.	destruction of recovered methane through one or more of the following options: (1) Flare(s) (2) Electricity generation equipment (i.e. gas genset) (3) Heat generation equipment (i.e. boiler with gas burner or other types suitable to individual CPAs)	(a) Project Investment Memorandum (b) Project Feasibility Study (c) Project Design Drawings
4	The CPA conforms to all applicability conditions and other requirements of the methodology and tools applied by the CPA.	The CPA will conform to all applicability conditions and other requirements of the methodologies and tools listed in section E.1.	CPA-DD Specific and the supporting documents specified in section E.2 will be submitted to the DOE during the CPA inclusion process.
5	The CPA is located in the physical geographical boundary described in this PoA-DD.	The PoA will commence with projects located in Thailand and may be expanded to other countries in South East Asia through post-registration changes to the PoA.	GPS-co-ordinates of CPA site location
6	The CPA is uniquely identifiable.	Each CPA must be assigned a unique identification number and be recorded in the CMEs database.	(a) Unique Identification Number (recorded in CPA-DD Specific) (b) CME's PoA database
7	The CPA does not result in double accounting of greenhouse gases.	CPA implementer will provide a signed declaration to confirm that the CPA is not registered either as a CDM project activity or as a CPA of another PoA. The CME will also review the UNFCCC CDM online database verifying this CPA is not registered either as a CDM project activity or as a CPA of another PoA.	Signed declaration by CPA implementer. Review of the UNFCCC CDM online database verifying this CPA is not registered either as a CDM project activity or as a CPA of another PoA.
8	The CPA conforms to specifications of technology/ measure including the level and	The CPA measure is: Methane destruction, and if applicable, with energy production.	The design process flow diagram and design specification provided

	type of service, performance specifications including compliance with testing/certifications.	The CPA technology is: Biogas capture for destruction and/or energy production. The CPA service is: Recovery and combustion of methane at an industrial wastewater treatment facility, and if applicable, energy production. With reference to the relevant regulations in section A.4.1.2 there are no national standards for level of service, performance specification or compliance with testing/certifications. However, TBEC will comply with all regulations and have established the following criteria: Level of service: Production of energy in the form of biogas with methane content greater than 40% and COD removal ratio greater than 50% between the anaerobic digester inlet and outlet. At the time of CPA inclusion, testing/certification is not required due to the nature of the CPA projects which will involve construction of site specific processing facilities at industrial installations. The design process flow diagram and design specifications provided by engineering consultants or equipment suppliers is sufficient to demonstrate compliance with the above level of service. Any COD tests carried out by TBEC will be conducted to international standards. TBEC's will utilize the Hach meter (or equivalent) following international COD standard method 5220 D. Due to the variable nature of wastewater from industrial facilities, the above criteria will only be	by engineering consultants or equipment suppliers (if available at time of CPA-DD development) are considered sufficient evidence for this PoA. If the CPA is in operation at the time of inclusion, any measurements of COD will be according to national or international standards.

		considered to be applicable when the biogas facility is operating at a level consistent with the normal design parameters for the specific site. As such, the above criteria are not relevant when the industrial plant is shut down or during start-up periods.	
9	The PoA will involve CPAs under the direct management of TBEC.	The CPA implementer identified in the CPA-DD will be TBEC.	Contractual agreement regarding implementation of the CPA.
10	The CPA implementer is aware that they have agreed that their activity is being subscribed to the PoA.	The CME must receive a signed declaration from the CPA implementer confirming that they are aware and have agreed that their activity is being subscribed to the PoA	Signed declaration by CPA implementer.
11	The CPA implementer is undertaking a voluntary action and is not implementing a mandatory policy/regulation	The CME must receive a signed declaration from the CPA implementer confirming that they are undertaking a voluntary action and not implementing a mandatory policy/regulation. The CME will also cross-check against local regulations to ensure that the CPA is not implementing a mandatory policy/regulation, this will be recorded in the CPA-DD.	(a) Declaration by CPA implementer stating that it is a voluntary initiative. (b) The details of relevant policy/regulations will be recorded in the CPA-DD Specific
12	The CPA is additional.	The additionality of each CPA will be demonstrated by establishing that in the absence of CDM, none of the implemented CPAs would occur. The PoA will include large scale projects as CPAs and therefore will apply the additionality requirements of the large scale methodology ACM0014 which specifies that the additionality will be demonstrated by applying the "Tool for the demonstration and assessment of additionality", Version 6.0.0, EB65. The additionality will be assessed	"Tool for the demonstration and assessment of additionality" Version 6.0.0, EB65, Annex 21 "Guidelines on the assessment of investment analysis" Version 5.0.0., EB62, Annex 5 "Guidelines for objective demonstration and assessment of barriers", Version 1.0, EB50 Annex 13

		and demonstrated at the CPA level and each CPA will provide an explanation of how the above procedures have been applied to the specific CPA project situation. In the assessment of Step 1 in section E.5.1 below, the key criteria to be applied shall be in accordance with the "Procedure for the identification of the most plausible baseline scenario" in ACM0014, Version 4.1.0, EB58. In the assessment of Step 2 in section E.5.1 below, the key criteria to be applied shall be in accordance with the "Guidelines on the assessment of investment analysis" Version 5.0.0., EB62, Annex 5. In the assessment of Step 3 in section E.5.1 below, the key criteria to be applied shall be in accordance with the "Guidelines for objective demonstration and assessment of barriers", Version 1.0, EB50 Annex 13. In the assessment of Step 4 in section E.5.1 below, the key criteria to be applied shall be in accordance with paragraphs 6,7,8,9 and 47 of the "Tool for the demonstration and assessment of additionality" Version 6.0.0, EB65, Annex 21.	Compliance with the above requirements will be recorded in the CPA-DD Specific and the supporting documents to justify the same will be submitted to the DOE for validation.
13	The CPA start date is not prior to the start date of validation of the PoA.	The earliest date at which either the implementation or construction or real action of the CPA is not prior to the start date of validation of the PoA which was 21/12/2011.	If available, purchase orders and equipment contracts associated with construction or real action.
14	Local stakeholder comments have been invited at the CPA level.	A local stakeholder consultation meeting will be organized and	Local Stakeholder Consultation report.

		documented in the CPA-DD.	
15	The environmental analysis has been performed at the CPA level.	An environmental analysis will be organized and documented in the CPA-DD.	Environmental analysis report.
16	The CPA crediting period does not exceed the PoA end date.	Each CPA crediting period will be defined in the CPA-DD together with a statement that the CPA crediting period will not exceed the PoA end date.	A written affirmation from the CPA implementer that the CPA crediting period will not exceed the PoA end date.
17	Funding from Annex I parties, if any, does not result in a diversion of official development assistance;	Funding for each CPA will not result in a diversion of official development assistance;	A written affirmation from the CPA implementer that the project funding does not result in a diversion of official development assistance;
18	CPA shall be approved by the CME.	The CME shall officially approve each CPA for inclusion in the PoA.	A written affirmation from the CME that the CPA is approved for inclusion in the PoA.
19	The CPA is implemented within the PoA target group.	The PoA target group includes all installations with an industrial wastewater treatment facility.	CPA-DD Specific and the supporting documents to justify the same will be submitted to the DOE during the CPA inclusion process.
20	The CPA technology will treat high strength organic rich wastewater.	Wastewater treated by the CPA technology will have a COD greater than 2,000 mg/l.	Data required for parameter $COD_{in,x}$ described in section E.6.3 of this PoA-DD will be recorded in the CPA-DD and used to confirm the COD of wastewater to be treated by the CPA is greater than 2,000 mg/l, COD tests results conducted by 3rd party laboratory will be used as supporting document.

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

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

The implementation of the PoA is a voluntary action by TBEC and is not required by any mandatory policy or regulation of the government. TBEC is a private entity with no legal obligation to pursue the implementation of the PoA. The anaerobic digester system will be implemented at facilities where wastewater is treated in anaerobic open lagoons and where there is no legal obligation to change the method of treatment. In accordance with the measure described in section A.4.2.2 above, a typical CPA will involve technology which achieves methane destruction. Implementation of any technology for methane destruction at installations with an industrial wastewater treatment facility is not mandated in the following relevant legal obligations:

(1) Thailand Industrial Ministry Announcement, 2nd Issued (B.E.2359), Refers to Factory Act 2535, Subject: Attributes of Wastewater from Factory.
(2) Thailand Factory license (Ror Ngor 4)

As such there is no mandatory enforcement of the proposed project technology.

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

The PoA is implementing a voluntary coordinated action that would not be implemented in the absence of the PoA. Furthermore, each CPA included in the PoA would not be implemented in the absence of the PoA. As per the “standard for demonstration of additionality, development of eligibility criteria, and application of multiple methodologies for programme of activities” (EB65, Annex 3), PoAs that include one or more large-scale projects as CPA shall include eligibility criteria derived from all relevant requirements contained in the additionality section of the large-scale methodology.

In accordance with the methodology ACM0014 Version 4.1.0, the additionality for activities under this PoA will be demonstrated at CPA level in accordance with the latest version of the “Tool for the demonstration and assessment of additionality” (at the time of drafting the PoA-DD Version 06.0.0), and in doing so, ensure consistency with the guidance provided in the “Procedure for the identification of the most plausible baseline scenario” of ACM0014. A common practise analysis will also be applied as necessary. These aspects are addressed in Section E.5.1 and E.5.2.

The decision to demonstrate additionality on CPA level is governed by the variability of factors that affect the possible investment or barrier analysis. Over time, factors like investment cost and exchange rates may vary to an extent that makes the investment analysis presented in the PoA void. Similarly for barrier analysis, the state of political, market, technological and investment barriers may change significantly over the length of the PoA.

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

Not applicable

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

Not applicable

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

A.4.4.1. Operational and management plan:

TBEC is the Managing/Coordinating Entity for this PoA TBEC is also a technology provider of biogas systems. TBEC will have overall responsibility for the Operational and Management plan including responsibility for liaison with all parties involved with the PoA and CPAs. TBEC will maintain an Inclusion Management System electronic database of information on each CPA that subscribed to the PoA as follows:

i) **A record keeping system for each CPA under the PoA**
The record keeping is outlined in TBEC's Inclusion Management System. CME will maintain a database containing the identification information of each CPA included in the PoA, including the unique identification number. The CME will request the CPA implementer to provide all necessary information to complete the CPA-DD document using the generic form registered with the PoA. The CME will oversee completion of the CPA-DD and ensure all supporting documents are filed electronically within electronic project folders for each CPA. The electronic file system will be located within the CME's computer system located at the TBEC head office. Each completed CPA-DD document will be retained by the CME in both Word and PDF electronic file format. TBEC's corporate data management systems will be used to ensure data is sufficiently maintained and archived.

Documents and Records will be stored on TBECs server and with the necessary infrastructure for managing document security, access and version control. All records will be retained for at least two years after the end of the crediting period during which the data was recorded. All electronic data will be backed up electronically on a secondary storage device.

ii) **A system/procedure to avoid double accounting e.g. to avoid the case of including a new CPA that has been already registered either as CDM project activity or as a CPA of another PoA**,
TBEC's Inclusion Management System includes a template for an agreement with the CPA implementer to confirm that the CPA has not been registered either as CDM project activity or as a CPA of another PoA. In addition, the CME will review the UNFCCC CDM online database to verify that the CPA is not registered either as a CDM project activity or as a CPA of another PoA.

iii) **The provisions to ensure that those operating the CPA are aware and have agreed that their activity is being subscribed to the PoA.**
TBEC's Inclusion Management System includes a template for an agreement between the CPA Implementer and the CME to confirm that implementer is aware that their activity has subscribed to the PoA.

A.4.4.2. Monitoring plan:

All project activities in each CPA will be verified. Therefore, the sampling method/procedure will not be used for verification of the amount of reductions of anthropogenic emission by sources of greenhouse gases achieved by CPAs under this PoA.

(i) Description of the proposed statistically sound sampling method/procedure to be used by DOEs for verification of the amount of reductions of anthropogenic emissions by sources or removals by sinks of greenhouse gases achieved by CPAs under the PoA.
Not Applicable.

(ii) In case the coordinating/managing entity opts for a verification method that does not use sampling but verifies each CPA (whether in groups or not, with different or identical verification periods) a transparent system is to be defined and described that ensures that no double accounting occurs and that the status of verification can be determined anytime for each CPA;
Each CPA will be monitored and verified individually in accordance with the methodology ACM0014 Version 4.1.0. If a particular CPA cannot be monitored in accordance with the requirements of ACM0014 Version 4.1.0 then the monitoring plan for that CPA will be revised in accordance with the latest version of the "Procedures for Revising Monitoring Plans" and the latest version of the "Procedures for requests to the Executive Board for deviation from an approved methodology".

Each CPA will be assigned a unique identification number and its physical location recorded in the CPA-DD to ensure that double accounting does not occur. CPAs will be verified either individually or in groups, as deemed suitable by the CME. The CME database will contain records of all CPAs in the PoA. Each monitoring report prepared for the PoA will record the start/end dates of the monitoring period and the unique identification number of the CPAs included in the monitoring period. These same details will be recorded in the database to enable the status of verification to be determined at anytime.

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

No public funding from Annex 1 Parties will be used for the programme of activities.

SECTION B. Duration of the programme of activities

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

The starting date of the PoA is 31/12/2012

B.2. Length of the programme of activities:

28 years.

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

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

The environmental analysis will be performed at the CPA level because the individual CPA's will vary in their design and this will enable the specific local impacts to be analysed. The environmental analysis will be performed in accordance with the requirements of the Host Government, including the guidelines of the DNA.

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

To be performed at CPA level.

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

In accordance with the Thailand Ministry of Science and Technology "Notification on type and size of project or enterprise that must report an environmental impact assessment" dated 16 June 2009 and published in the Government Gazette dated 31 August 2009; renewable biogas plants are not designated as a project type required to complete an Environmental Impact Assessment (EIA). Therefore, a typical CPA is not required to perform an EIA. All CDM projects which are not specifically required to perform an EIA must complete and submit Initial Environmental Evaluation (IEE) to the TGO prior to receiving a LoA. Each CPA in Thailand will complete an IEE in accordance with the CDM approval procedures for Thailand.

SECTION D. Stakeholders' comments

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

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

Local stakeholder comments will be invited at the CPA level. The choice to perform stakeholder consultations at CPA level because each future project site installed as part of the PoA will have specific stakeholders which cannot be adequately consulted at the PoA level.

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

Local stakeholders will be invited to comment at the CPA level.

D.3. Summary of the comments received:

Local stakeholders will also be invited to comment at the CPA level.

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

Local stakeholders will also be invited to comment at the CPA level.

SECTION E. Application of a baseline and monitoring methodology

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

ACM0014 "Mitigation of greenhouse gas emissions from treatment of industrial wastewater" (Version 04.1.0, EB58)
Tool for the demonstration and assessment of additionality (Version 6.0.0, EB65)
Tool to determine project emissions from flaring gases containing methane (Version 1, EB28)
Tool to calculate the emission factor for an electricity system (Version 2.2.1, EB63)
Tool to calculate baseline, project and/or leakage emissions from electricity consumption (Version 1, EB39)
Tool to calculate project or leakage CO2 emissions from fossil fuel combustion (Version 2, E41)

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

#	Criteria	Typical CPA
ACM0014 "Mitigation of greenhouse gas emissions from treatment of industrial wastewater"		
1	The methodology is applicable to the scenarios described in Table 1 of the methodology. The description of the baseline situation and project activity for each CPA shall conform to **SCENARIO (1)** of the methodology.	**<u>SCENARIO 1</u>** **Description of the Baseline Situation (Scenario 1):** The wastewater is not treated, but directed to open lagoons that have clearly anaerobic conditions. In cases where solid materials are separated before directing the wastewater to the open lagoons, the solid materials have a different treatment than the wastewater. The description of the baseline will be confirmed by the CME to be in accordance with Scenario 1 through review of the open lagoons design drawings from the existing facility and physical inspection of the lagoons (evidenced by photos showing the anaerobic conditions, i.e. methane bubbles). In the case of

		Greenfields projects, the proposed site will be inspected to confirm that an existing facility does not exist and the procedure for the identification of the most plausible baseline scenario in ACM0014 as outlined in Section E.4 will be applied. In the case that any solid materials are separated before directing the wastewater to open lagoons the presence of a different treatment process will be confirmed through inspection. **Description of the Project Activity (Scenario 1):** In a typical CPA, the wastewater is treated in a new anaerobic digester. In cases where solid materials are separated from the wastewater (both in the project and baseline scenarios), they will be treated separately and not treated with the new anaerobic digester employed for treatment of liquid effluents. The biogas extracted from the anaerobic digester and, if applicable, biogas generated from the treatment of solid materials, is flared and/or used to generate electricity and/or heat. The residual from the anaerobic digester, after treatment, is directed to open lagoons or is treated under clearly aerobic conditions (e.g. dewatering and land application). The description of the project will be recorded in the CPA-DD and confirmed by the CME to be in accordance with Scenario 1 through the project design drawings of the anaerobic digester and, if the project has started, the purchase orders of equipment required to construct the anaerobic digester.
2	The average depth of the open lagoons or sludge pits in the baseline scenario is at least 1 m.	A typical CPA project site will have open lagoons exceeding 1m (including the most likely pond design identified for Greenfields projects). This is consistent with TBEC's existing four CDM projects. This will be confirmed by the CME through review of the open lagoons design drawings from the existing facility and physical inspection of the lagoons (evidenced by photos showing the measurement of the depth of the open lagoons). In the case of Greenfields projects, the procedures explained in the section "Identification of alternative scenarios" of the methodology ACM0014 shall be applied.
3	Heat and electricity requirements per unit input of the water treatment facility remain largely unchanged in the baseline scenario and the project activity;	A typical CPA will not alter existing wastewater treatment facilities but instead install a new biogas system as described in criteria #1 above. The baseline scenario is the use of open lagoons that have clearly anaerobic conditions. As such, the heat and electricity

		requirements of the existing system (open anaerobic lagoons) will remain largely unchanged because such systems typically utilize small amounts of electricity for pumps. Equipment installed under the project scenario which is required for the capture, treatment and utilization of biogas is not part of the water treatment process. Electricity requirements of the existing wastewater facility will be determined from design drawings (if available) or alternatively from the specifications of the existing equipment (i.e. pumps). Electricity requirements of the wastewater treatment system installed as part of the project activity will be determined from process design drawing and equipment specifications. From these documents it will be determined that the heat and electricity requirements per unit input of the water treatment facility remain largely unchanged.
4	Data requirements as laid out in the methodology (ACM0014) are fulfilled.	The CME will co-ordinate the collection of all necessary data requirements as laid out in ACM0014. Data from each CPA project site and where relevant public data sources will be recorded in the CPA-DD. Original documents including but not limited to: test reports, design drawings, equipment specifications, financial records, board minutes, purchase orders and equipment contracts will be retained in the CME filing system in soft copy format in an electronic filing system managed by the CME.
5	**For Scenario 1, the following applies:** The residence time of the organic matter in the open lagoon system should be at least 30 days;	Open lagoons at a typical CPA project site will exceed the 30 days residence time. This will be checked through use of the open lagoon design drawings (or on-site measurements of the lagoons where drawings are unavailable). The volume of the open lagoon system and the wastewater flow rate into the open lagoon system will be used to calculate the residence time. This is consistent with TBEC's existing four CDM projects.
6	**For Scenario 1, the following applies:** Local regulations do not prevent discharge of wastewater in open lagoons.	In Thailand local regulations do not prevent discharge of wastewater into open lagoons. Notification No. 2 of the Thai Ministry of Industry (B.E. 2539) regarding wastewater from industrial factory does not prevent discharge of wastewater into open lagoons.
7	**For Scenario 1, the following applies:** Inclusion of solid materials in the project activity is only applicable where: (i) Such solid materials are generated by the industrial facility producing the wastewater, and (ii) The solid materials would be generated both in the project	A typical CPA will only include solid materials where: (i) Such solid materials are generated by the industrial facility producing the wastewater, and (ii) The solid materials would be generated both in the project and in the baseline scenario. The design of the CPA project activity (substantiated

	and in the baseline scenario.	from the technology process flow diagram) will be utilised to demonstrate whether solid materials are included in the process design. Any solid materials indicated for use in the process flow diagram will be confirmed to be: (i) Generated by the industrial facility producing the wastewater through onsite observation of the process equipment and photographic evidence, (ii) The solid materials would be generated both in the project and in the baseline scenario through review of both the project process design and the existing facility design. Data described above will be recorded in the CPA-DD. Original design documents will be retained in the CME filing system in soft copy format in an electronic filing system managed by the CME.
Tool for the demonstration and assessment of additionality		
8	**Applicable geographical area** covers the entire host country as a default; if the technology applied in the project is not country specific, then the applicable geographical area should be extended to other countries. Project participants may provide justification that the applicable geographical area is smaller than the host country for technologies that vary considerably from location to location depending on local conditions.	A typical CPA will employ technology that is applicable to the entire host country of Thailand. National regulations in Thailand (i.e. Thailand Industrial Work Department Limitations on Wastewater Discharge) are applicable on a national basis. Hence, the applicable geographic area applies to the entire host country as a default.
9	**Measure** (for emission reduction activities) is a broad class of greenhouse gas emission reduction activities possessing common features. Four types of measures are currently covered in the framework: (a) Fuel and feedstock switch; (b) Switch of technology with or without change of energy source (including energy efficiency improvement as well as use of renewable energies); (c) Methane destruction; (d) Methane formation avoidance.	A typical CPA will involve technology which achieves measure (c) methane destruction. This is consistent with TBEC's existing four CDM projects. The CME will confirm that the project involves methane destruction through the project design drawings of the anaerobic digester and, if the project has started, the purchase orders of equipment required to construct the anaerobic digester.
10	This tool does not replace the need for the baseline methodology to provide a step-wise approach to identify the baseline scenario. Project participants that propose new baseline methodologies shall ensure consistency between the determination of additionality of a project activity and the determination of a baseline scenario. Project participants can	ACM0014 includes a baseline methodology to provide a step-wise approach to identify the baseline scenario and this will be applied and recorded in the CPA-DD for each specific project activity.

	also use the combined tool to identify the baseline scenario and demonstrate additionality.	
Tool to determine project emissions from flaring gases containing methane		
11	This tool is applicable under the following conditions: • The residual gas stream to be flared shall be obtained from decomposition of organic material (through landfills, bio-digesters or anaerobic lagoons, among others) or from gases vented in coal mines (coal mine methane and coal bed methane).	A typical CPA will involve methane rich biogas from anaerobic wastewater treatment, as such: • The residual gas stream to be flared will be obtained from decomposition of organic material (through anaerobic lagoons). The CME will confirm this through review of the project design drawings indicating that the flare is supplied with a gas stream originating from the decomposition of organic material.
Tool to calculate the emission factor for an electricity system		
12	This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity, i.e. where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).	A typical CPA will install a new anaerobic digester and, if applicable, biogas generated from the treatment of solid materials, is flared and/or used to generate electricity and/or heat. CPAs which generate electricity from the destruction of methane for sale to the Thai electricity grid will apply the Tool to calculate the emission factor for an electricity system. The CME will confirm this through the design drawings of the project and: (a) if the project sells electricity to the grid, a review of the Power Purchase Agreement (if already available) for sale of electricity to the grid. (b) In the case that the project supplies electricity to a user that would otherwise be provided by the grid, review of electricity purchase receipts and/or physical inspection of the grid connection will be performed. For Greenfields projects, a review of design drawings will be conducted.
13	Under this tool, the emission factor for the project electricity system can be calculated either for grid power plants only or, as an option, can include off-grid power plants. In the latter case, the conditions specified in “Annex 2 - Procedures related to off-grid power generation” should be met. Namely, the total capacity of off-grid power plants (in MW) should be at least 10% of the total capacity of grid power plants in the electricity system; or the total electricity generation by off-grid power plants (in MWh) should be at least 10% of the total electricity generation by grid power plants in the electricity system; and that factors which negatively affect the	A typical CPA will be implemented in Thailand. The emission factor for Thailand electricity system is calculated for grid power plants only. This will be confirmed through the documentation for the Thailand emissions factor released by the Thailand DNA, and if not available, through emissions factor calculation as per methodological choice and equation outlined in Section E.6.2.

	reliability and stability of the grid are primarily due to constraints in generation and not to other aspects such as transmission capacity.	
14	In case of CDM projects the tool is not applicable if the project electricity system is located partially or totally in an Annex I country.	A typical CPA will be implemented in Thailand. The Thailand grid is not located partially or totally in an Annex I country.
Tool to calculate baseline, project and/or leakage emissions from electricity consumption		
15	The tool is only applicable if one out of the following three scenarios applies to the sources of electricity consumption: Scenario A: **Electricity consumption from the grid.** The electricity is purchased from the grid only. Either no captive power plant is installed at the site of electricity consumption or, if any on-site captive power plant exits, it is not operating or it can physically not provide electricity to the source of electricity consumption. Scenario B: **Electricity consumption from (an) off-grid fossil fuel fired captive power plant(s).** 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 (a) 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.	As per Scenario A, a typical CPA will consume electricity from the grid as either a primary electricity source or as a backup supply to the biogas generator installed as part of the project activity. The CME will confirm this through review of the project design drawings and through inspection of the project site to confirm that a grid connection is possible at the project site.
16	This tool is not applicable in cases where captive renewable power generation technologies are installed to provide electricity in the project activity, in the baseline scenario or to sources of leakage. The tool only accounts for CO_2 emissions.	A typical CPA will not involve captive renewable power generation technologies as a typical CPA will have a connection to the national grid. The CME will confirm this through inspection of the project site to confirm availability of the grid connection.
Tool to calculate project or leakage CO2 emissions from fossil fuel combustion		
17	This tool provides procedures to calculate project and/or leakage CO_2 emissions from the combustion of fossil fuels. It can be used in cases where CO_2 emissions from fossil fuel	A typical CPA will not combust fossil fuels and the procedures in the Tool will not be required. In the case that a CPA must combust fossil fuels then the CO_2 emissions from fossil fuel

	combustion are calculated based on the quantity of fuel combusted and its properties.	combustion are calculated based on the quantity of fuel combusted and its properties.

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

Description of the Spatial Boundary

The spatial boundary of a typical CPA is comprised of the following elements: (a) the anaerobic digester, (b) the treatment system which receives effluent form the digester, (c) the final discharge location of effluent (d) the equipment associated with production, collection cleaning and distribution of biogas, (e) the equipment associated with destruction and gainful use of biogas, and (f) equipment used to supply electricity/energy to the project equipment. If the CPA includes solid materials that are part of the waste stream within the project boundary, no baseline emissions (either for the methane avoidance or for any energy generation) is accounted for in the baseline scenario (as per footnote 6 of ACM14). If the CPA involves the sale of electricity to the national electricity grid system, the grid system will also be included in the spatial boundary. Each CPA will prepare a diagram of the spatial boundary including the relevant elements described above.

	Source	Gas		Justification / Explanation
Baseline	Wastewater treatment processes or sludge disposal	CH_4	Included	The major source of emissions in the baseline from open lagoons (Scenario 1). Any methane emissions from solid materials are not accounted for in baseline scenario.
		N_2O	Excluded	Excluded for simplification. This is conservative
		CO_2	Excluded	CO_2 emissions from the decomposition of organic waste are not accounted for
	Electricity consumption / generation	CO_2	Included	Electricity may be consumed for the operation of the wastewater system in the baseline scenario. If electricity is generated with biogas from an anaerobic digester under the project activity, electricity generation in the grid or on-site is displaced by the project activity. Any electricity generated from solid materials will be excluded from baseline. Each CPA will be assessed on a case by case basis in the CPA-DD to determine if this is an applicable emissions source.
		CH_4	Excluded	Excluded for simplification. This is conservative
		N_2O	Excluded	Excluded for simplification. This is conservative
	Thermal energy generation	CO_2	Included	If thermal energy is generated with biogas from an anaerobic digester under the project activity, on-site thermal energy generation is displaced by the project activity. Any heat generated from solid materials will be excluded from baseline. Each CPA will be assessed on a case by case basis in the CPA-DD to determine if this is an applicable emissions source.
		CH_4	Excluded	Excluded for simplification. This is conservative
		N_2O	Excluded	Excluded for simplification. This is conservative

	Source	Gas		Justification / Explanation
Project Activity	Wastewater treatment processes or sludge treatment process	CH_4	Included	The treatment of wastewater or sludge under the project activity may cause different emissions, each CPA will be assessed on a case by case basis in the CPA-DD to determine which of the following are applicable emissions sources: (i) Methane emissions from the lagoons (if effluent from the treatment under the project activity is directed to lagoons); (ii) Physical leakage of methane from the digester system; (iii) Methane emissions from flaring (if biogas from the digester is flared); (iv) Methane emissions from land application of wastewater/sludge; (v) Methane emissions from wastewater removed in the dewatering process
		CO_2	Excluded	CO_2 emissions from the decomposition of organic waste are not accounted for
		N_2O	Included	Included in case of projects that involve land application of sludge. Each CPA will be assessed on a case by case basis in the CPA-DD to determine if this is an applicable emissions source.
	On-site electricity use	CO_2	Included	May be an important emission source. If electricity is generated with biogas from an anaerobic digester, these emissions are not accounted for. Any on-site electricity consumption should be subtracted from the electricity generation of the digester. Each CPA will be assessed on a case by case basis in the CPA-DD to determine if this is an applicable emissions source.
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small
	On-site fossil fuel consumption	CO_2	Included	May be an important emission source. Each CPA will be assessed on a case by case basis in the CPA-DD to determine if this is an applicable emissions source.
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small.

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

ACM0014 outlines the procedure for identification of the most plausible baseline scenario through the following four steps.

Step 1: Identification of alternative scenarios
Step 2: Eliminate alternatives that are not complying with applicable laws and regulations
Step 3: Eliminate alternatives that face prohibitive barriers
Step 4: Compare economic attractiveness of remaining alternatives

Step 1: Identification of alternative scenarios
The list of plausible alternative scenarios for the treatment of wastewater include the following:

W1: The use of open lagoons for the treatment of the wastewater;
W2: Direct release of wastewaters to a nearby water body;
W3: Aerobic wastewater treatment facilities (e.g., activated sludge or filter bed type treatment);
W4: Anaerobic digester with methane recovery and flaring;
W5: Anaerobic digester with methane recovery and utilization for electricity or heat generation;
W6: Wastewater is directed to land application without dewatering;
W7: Wastewater is dewatered and directed to land application/used as fuel in energy applications.

For project activities implemented in Greenfield facilities, the specifications of the W1 scenario will be defined in the CPA-DD following four steps:

(a) Define several lagoon design options for the particular wastewater stream that meet the relevant regulations and take into consideration local conditions (e.g. environmental legislation, ground water table, land requirement, temperature). Design specifications shall include average depth and surface area of the lagoon, electricity consumption (EC_{BL}), residence time of the organic matter and effluent adjustment factor (AD_{BL}), as well as any other key parameters. Document the different design options in a transparent manner and provide transparent and documented evidence of key assumptions and data used, and offer conservative interpretations of this evidence;

(b) Carry out an economic assessment of the identified options, as per the guidance under Step 4 below. Choose the least cost lagoon design option from the options defined in Step 1 taking into account all relevant local conditions (e.g. land requirements, land prices, ground water level). If several options with comparably low costs exist, choose the one with the lowest lagoon depth as the baseline lagoon design;

(c) Verify the average depth of the baseline lagoon design, as determined in Step (b), based on a review of published literature establishing an average lagoon depth for a particular industry (particular type of waste water). If such literature does not exist, conduct a survey within the industry based on a control group of the five most recently constructed lagoon systems in the particular industry;

(d) If the average depth of the lagoon design option identified in Step (b) is deeper than the depth identified through literature review or the control group in Step (c), provide credible explanations why the assumptions of the least cost design are valid. The explanations have to be supported by credible evidences that the depth identified in Step (c) is not a feasible option for the project activity. Provide transparent and documented evidence, and offer conservative interpretations of this evidence.

If the project activity includes electricity generation with biogas from a new anaerobic digester, plausible alternative scenarios for the generation of electricity should be determined. These may include, but are not limited to, the following:

E1: Power generation using fossil fuels in a captive power plant;
E2: Electricity generation in the grid;
E3: Electricity generation using renewable sources.

If the project activity includes heat generation with biogas from a new anaerobic digester, plausible alternative scenarios for the generation of heat should be determined. These may include, but are not limited to, the following:

H1: Co-generation of heat using fossil fuels in a captive cogeneration power plant;
H2: Heat generation using fossil fuels in a boiler;
H3: Heat generation using renewable sources.

In case of Scenario 1, plausible alternative scenarios for the treatment of solid materials (SM), if applicable, should be determined. These may include, but not limited to, the following:

SM1: The solid materials are dumped or left to decay under anaerobic or aerobic conditions;
SM2: The solid materials are used as animal fodder;
SM3: The solid materials are burnt in an uncontrolled manner without utilizing it for energy purposes;
SM4: The solid materials are burnt for energy purposes.

Step 2: Eliminate alternatives that are not complying with applicable laws and regulations
Alternatives that are not in compliance with applicable legal and regulatory requirements must be eliminated as per Sub-step 1b of the "Tool for the demonstration and assessment of Additionality" Version 6.0.0, EB65.

Under Thai regulations, it is illegal to directly discharge untreated wastewater from factories (as per Thailand Industrial Ministry Announcement, 2nd Issued (B.E.2359), Refers to Factory Act 2535, Subject: Attributes of Wastewater from Factory). Therefore alternative scenarios W2, W6 and W7 which involve the release of untreated wastewaters from the factory are not in compliance with the Thai regulations and therefore must be eliminated. Regardless of the end-use of wastewater, whether it be discharged to water bodies or application to land with or without dewatering, the wastewater must first be treated before discharge. Hence, scenarios W2, W6 and W7 are all not in compliance with the relevant regulation stipulated above.

The use of open lagoons for the treatment of wastewater is in compliance with regulation, and it is not mandatory to use specific technologies such as biogas digesters, therefore open lagoons faces no barrier for continuation of the existing practice which is alternative scenario W1. To date, there is no existing legislation that enforces aerobic or anaerobic wastewater treatment with coupled biogas collection and utilization. Thus there is no legal barrier to alternatives W3, W4 & W5.

Therefore, alternative scenarios W2, W6 and W7 do not comply with applicable laws and regulations. W2, W6 and W7 are eliminated and will not be considered further.

None of the scenarios for electricity, heat or solid materials are not complying with applicable laws and regulations. Therefore, the remaining scenarios after step 2 are:

W1. The use of open lagoons for the treatment of the wastewater;
W3: Aerobic wastewater treatment facilities (e.g., activated sludge or filter bed type treatment);
W4: Anaerobic digester with methane recovery and flaring;
W5. Anaerobic digester with methane recovery and utilization for electricity or heat generation.

E1: Power generation using fossil fuels in a captive power plant;
E2: Electricity generation in the grid;
E3: Electricity generation using renewable sources.

H1: Co-generation of heat using fossil fuels in a captive cogeneration power plant;
H2: Heat generation using fossil fuels in a boiler;
H3: Heat generation using renewable sources.

SM1: The solid materials are dumped or left to decay under anaerobic or aerobic conditions;
SM2: The solid materials are used as animal fodder;
SM3: The solid materials are burnt in an uncontrolled manner without utilizing it for energy purposes;
SM4: The solid materials are burnt for energy purposes.

Step 3: Eliminate alternatives that face prohibitive barriers
Scenarios that face prohibitive barriers should be eliminated by applying Step 3 of the "Tool for the demonstration and assessment of additionality", Version 6.0.0, EB65 and in accordance with the "Guidelines for objective demonstration and assessment of barriers", Version 01, EB50.

Sub-step 3a: Identify barriers that would prevent the implementation of the proposed CDM project activity by establishing there are realistic and credible barriers preventing the implementation of the CPA without CDM. Such realistic and credible barriers may include, among others, Investment barriers, Technological Barriers, Barriers due to prevailing practice inter alia, the project activity is the "first of its kind" or other barriers relevant to the project.

The barriers faced for the treatment of wastewater scenarios will depend on the specific details of each CPA site. However, W3 may be eliminated due to technological barrier of technological failure risk, as the process/technology failure risk of aerobic treatment is significantly greater than for the comparable common practice treating wastewater open anaerobic lagoons. This is demonstrated by relevant scientific literature that indicates that the COD of high strength industrial organic rich wastewater is far too high to treat in aerobic process[4]. In addition, aerobic treatment systems are more complicated due to inherent difficulties like oxygen transfer problem, high waste sludge produces and settling problem[5]. This barrier is inherent to the nature of the high strength industrial organic rich wastewater and as such may eliminate the baseline alternative W3 in accordance with the "Guidelines for objective

[4] E. Roberts Alley, *'Water Quality Control Handbook 2007'*, published by McGraw Hill in 2007 (page 10.65). This reference indicates an aerobic treatment process should be considered first if the raw COD concentration of a wastewater is less than 1,000 to 2,000 mg/l and that anaerobic systems for these low COD concentrations would not be economic. All CPAs will involve biogas plants which require higher COD concentrations than 2,000mg/l in order to produce sufficient biogas to make the projects viable.
[5] Francisco J. Cervantes, Spyros G. Pavlostathis, Adrianus C. van Handeel, *'Advanced biological treatment processes for industrial wastewaters, Principles and Applications'* published by IWA in 2006 (page 259)

demonstration and assessment of barriers" because regardless of the financial/technical capacity of the companies involved, the nature of the wastewater stream to be treated cannot be mitigated by additional financial means.

The remaining wastewater scenarios that may be eliminated depending on the specific details of each CPA site are:
W1. The use of open lagoons for the treatment of the wastewater;
W4: Anaerobic digester with methane recovery and flaring;
W5. Anaerobic digester with methane recovery and utilization for electricity or heat generation.

The scenarios for electricity, heat and solid materials that face prohibitive barriers will depend on the specific details of each CPA site. The technology barrier may be faced for electricity generation at each CPA site depending on the following indicative list of potential barriers relating to site details:

(1) Sites which do not contain a captive power plant (but instead have a grid connection) will face barriers to power generation using fossil fuels (E1);
(2) Remote sites which do not have access to grid connections will face a technology barrier to accessing electricity from the grid (E2);
(3) Sites which do not contain sources of renewable energy will face the technology barrier to accessing electricity generation from renewable sources (E3).

The technology barrier may be faced for heat generation at each CPA site depending on the following indicative list of potential barriers relating to site details:

(1) Sites which do not contain a captive cogeneration power will face barriers to co-generation of heat using fossil fuels (H1);
(2) Sites which do not contain fossil fuel boilers will face barriers to heat generation in fossil fuel boilers (H2);
(3) Sites which do not contain sources of renewable energy will face barriers to heat generation using renewable sources (H3);

Plausible baseline scenarios for the use of solid material will depend on the technology employed at the industrial site, the configuration for treating wastewater/solid material in the baseline, the existence and proximity to markets for solid material and other site specific details. The barriers may be faced by each CPA sites for each scenario of solid material use depending on the site details as follows:

(1) Sites which do not include technology configured to remove solid materials from the wastewater will face the technology barrier to the solid materials being dumped or left to decay under anaerobic or aerobic conditions (SM1);
(2) Sites which do not include technology configured to remove solid materials from the wastewater will face the technology barrier to solid materials being used as animal fodder (SM2);
(3) Sites which do not include technology configured to remove solid materials from the wastewater will face the technology barrier to solid material being burnt in an uncontrolled manner without utilizing it for energy purposes (SM3);
(4) Sites which do not include technology configured to remove solid materials from the wastewater will face the technology barrier to solid materials being burnt for energy purposes (SM4);

Outcome of Step 3
If only one alternative remains, this can be considered the baseline for W, E, H and SM. If more than one alternative remains after step 3, then Step 4 must be applied.

Step 4: Compare economic attractiveness of remaining alternative
The economic attractiveness without revenues from CERs for all alternatives that are remaining will be compared by applying Step 2 of the "Tool for the demonstration and assessment of additionality", Version 6.0.0, EB65 applying the investment analysis. The following parameters should be explicitly documented in the CPA-DD:

- Land cost;
- Engineering, Procurement and Construction cost;
- Labour cost;
- Operation and Maintenance cost;
- Administration cost;
- Fuel cost;
- Capital cost and interest;
- Revenue from electricity sales;
- All other costs of implementing the technology of the each alternative option;
- All revenues generated by the implementation of the proposed technology except for carbon credits revenues (including energy savings due to captive use of biogas as fuel for either electricity or heat generation at the project site).

In the case that there are several alternatives remaining after Step 2 and that at least two alternatives are associated with costs, an investment comparison analysis should be conducted. In doing so, compare the IRR (or equivalent financial indicator) of the different alternatives and select the most cost-effective alternative (e.g. with the highest IRR) as the baseline scenario. Include a sensitivity analysis applying Sub-step 2d of the "Tool for the demonstration and assessment of additionality", Version 6.0.0, EB65. The investment comparison analysis provides a valid argument that the most cost-effective scenario is the baseline scenario if it consistently supports (for a realistic range of assumptions) this conclusion. In case the sensitivity analysis is not fully conclusive, select the baseline scenario alternative with least emissions among the alternatives that are the most economically attractive according to the investment analysis and the sensitivity analysis.

If the project undertaken without being registered as a CDM project activity is the only remaining alternative with associated costs, a benchmark analysis is to be used to demonstrate its profitability or non-profitability.

If the project is profitable, it is to be considered as the baseline scenario. If not, the continuation of the current situation is the baseline.

Depending on the specific site details of each CPA, the relevant baseline scenarios for the electricity generation (where applicable), heat generation (where applicable) and use of solid material (where applicable) will be identified in the CPA-DD.

The scenarios identified above in the CPA-DD will be considered the baseline.

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

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

The additionality of each CPA will be demonstrated by establishing that in the absence of CDM, none of the implemented CPAs would occur. The PoA will include large scale projects as CPAs and therefore will apply the additionality requirements of the large scale methodology ACM0014 which specifies that the additionality will be demonstrated by applying the "Tool for the demonstration and assessment of additionality", Version 6.0.0, EB65. The additionality will be assessed and demonstrated at the CPA level and each CPA will provide an explanation of how the above procedures have been applied to the specific CPA project situation.

The procedure for demonstration of additionality outlined in the "Tool for the demonstration and assessment of additionality", Version 6.0.0, EB65 is shown in the figure below:

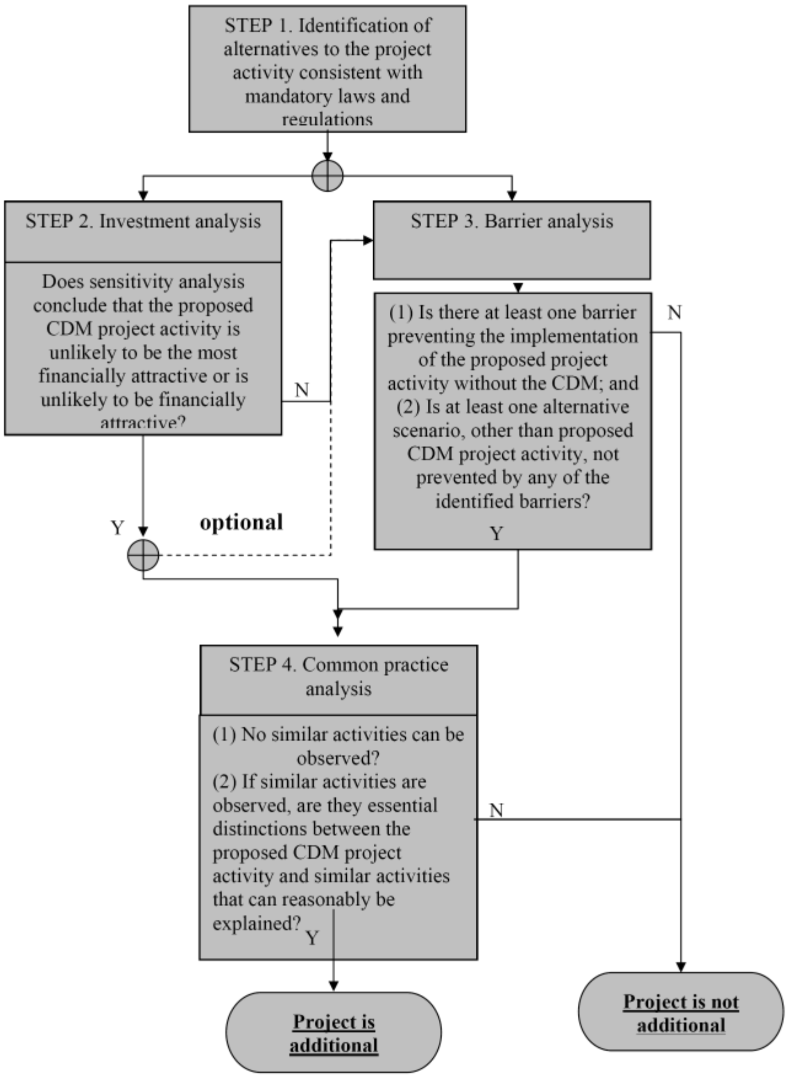


Figure E.5.1: Procedure for assessment of additionality

The definitions, scope and applicability are as follows:

Applicable geographical area covers the entire host country as a default. This is the definition to be applied within each CPA.

Measure (for emission reduction activities) is a broad class of greenhouse gas emission reduction activities possessing common features. The applicable measure for this CPA is:

(c) Methane destruction;

Output is goods or services with comparable quality, properties, and application areas. The output will be selected based on the design flow diagram of each individual CPA. Outputs included in this PoA could be one or more of the following: methane recovery and flaring, electricity provided to the grid, electricity provided to a dedicated user and heat provided to a dedicated user.

Different technologies in the context of common practice are technologies that deliver the same output and differ by at least one of the following (as appropriate in the context of the measure applied in the proposed CDM project and applicable geographical area):

(a) Energy source/fuel;
(b) Feed stock;
(c) Size of installation (power capacity):
    (i) Micro (as defined in paragraph 24 of Decision 2/CMP.5 and paragraph 39 of Decision 3/CMP.6);
    (ii) Small (as defined in paragraph 28 of Decision 1/CMP.2);
    (iii) Large.
(d) Investment climate in the date of the investment decision, inter alia:
    (i) Access to technology;
    (ii) Subsidies or other financial flows;
    (iii) Promotional policies;
    (iv) Legal regulations;
(e) Other features, inter alia:
    (i) Unit cost of output (unit costs are considered different if they differ by at least 20 %);

The Tool provides for a step-wise approach to demonstrate and assess additionality. These Steps include:

(a) Identification of alternatives to the project activity;
(b) Investment analysis to determine that the proposed project activity is either: 1) not the most economically or financially attractive, or 2) not economically or financially feasible;
(c) Barriers analysis; and
(d) Common practice analysis.

Step 1: Identification of alternatives to the project activity consistent with current laws and regulations
Define realistic and credible alternatives to the project activity(s) through the following Sub-steps:

Sub-step 1a: Define alternatives to the project activity:
Identify realistic and credible alternative(s) available to the CPA implementers or similar project developers that provide outputs or services comparable with the proposed CPA. These alternatives are to include:

(a) The proposed project activity undertaken without being registered as a CDM project activity;
(b) Other realistic and credible alternative scenario(s) to the proposed CDM project activity scenario that deliver outputs services or services with comparable quality, properties and application areas, taking into account, where relevant, examples of scenarios identified in the underlying methodology;
(c) If applicable, continuation of the current situation (no project activity or other alternatives undertaken).

If the proposed CPA includes several different facilities, technologies, outputs or services, alternative scenarios for each of them should be identified separately. Realistic combinations of these should be considered as possible alternative scenarios to the proposed project activity.

According to the 'Guidelines for Completing CDM PDDs V7.0 (EB41) Section B.4 and B.5 (in the case of CPA-DDs Section B.2 and B.3) are complimentary and the same information need not be replicated in both sections. Hence, the realistic and credible scenarios from section E.4 above will be applied.

Outcome of Step 1a: Identified realistic and credible alternative scenario(s) to the project activity
Sub-step 1b: Consistency with mandatory laws and regulations:

The alternative(s) shall be in compliance with all mandatory applicable legal and regulatory requirements, even if these laws and regulations have objectives other than GHG reductions, e.g. to mitigate local air pollution. (This Sub-step does not consider national and local policies that do not have legally-binding status.)

If an alternative does not comply with all mandatory applicable legislation and regulations, then show 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 noncompliance with those requirements is widespread in the country. If this cannot be shown, then eliminate the alternative from further consideration;

If the proposed project activity is the only alternative amongst the ones considered by the project participants that is in compliance with mandatory regulations with which there is general compliance, then the proposed CDM project activity is not additional.

Outcome of Step 1b: Identified realistic and credible alternative scenario(s) to the project activity that are in compliance with mandatory legislation and regulations taking into account the enforcement in the region or country and EB decisions on national and/or sectoral policies and regulations.

"Proceed to Step 2 (Investment analysis) or Step 3 (Barrier analysis). (Project participants may also select to complete both Steps 2 and 3."

Step 2: Investment analysis

Determine whether the proposed project activity is not:

(a) The most economically or financially attractive; or

(b) Economically or financially feasible, without the revenue from the sale of certified emission reductions (CERs).

The latest version of the "Guidelines on the assessment of investment analysis" (Version 5.0, EB62, Annex 05), shall be taken into account when applying this step.

To conduct the investment analysis, use the following Sub-steps:

Sub-step 2a: Determine appropriate analysis method
Determine whether to apply simple cost analysis, investment comparison analysis or benchmark analysis (Sub-step 2b). If the CDM project activity and the alternatives identified in Step 1 generate no financial or economic benefits other than CDM related income, then apply the simple cost analysis (Option I). Otherwise, use the investment comparison analysis (Option II) or the benchmark analysis (Option III). The simple cost analysis (Option I) is not deemed suitable because the CPAs generate financial or economic benefits other than CDM related income. Therefore either the investment comparison analysis (Option II) or the benchmark analysis (Option III) will be chosen.

Sub-step 2b: Option I. Apply simple cost analysis
Document the costs associated with the CDM project activity and the alternatives identified in Step 1 and demonstrate that there is at least one alternative which is less costly than the project activity.

Sub-step 2b: Option II. Apply investment comparison analysis
Identify the financial indicator, such as IRR, NPV, cost benefit ratio, or unit cost of service (e.g., levelized cost of electricity production in $/kWh or levelized cost of delivered heat in $/GJ) most suitable for the project type and decision-making context.

Sub-step 2b: Option III. Apply benchmark analysis
Identify the financial/economic indicator, such as IRR, most suitable for the project type and decision context. IRR is considered a suitable indicator for CPA's in this PoA because TBEC has applied this financial indicator in previous CDM projects.

When applying Option II or Option III, the financial/economic analysis shall be based on parameters that are standard in the market, considering the specific characteristics of the project type, but not linked to the subjective profitability expectation or risk profile of a particular project developer.

Discount rates and benchmarks shall be derived from:

(a) Government bond rates, increased by a suitable risk premium to reflect private investment and/or the project type, as substantiated by an independent (financial) expert or documented by official publicly available financial data;

(b) Estimates of the cost of financing and required return on capital (e.g. commercial lending rates and guarantees required for the country and the type of project activity concerned), based on bankers views and private equity investors/funds' required return on comparable projects;

(d) Government/official approved benchmark where such benchmarks are used for investment decisions;

(e) Any other indicators, if the CME can demonstrate that the above Options are not applicable and their indicator is appropriately justified.

Sub-step 2c: Calculation and comparison of financial indicators (applicable to Options III):
Calculate the suitable financial indicator for the proposed CPA and, in the case of Option II above, for the other alternatives. Include all relevant costs (including, for example, the investment cost, the operations and maintenance costs), and revenues (excluding CER revenues, but possibly including inter alia subsidies/fiscal incentives, ODA, etc, where applicable), and, as appropriate, non-market cost and benefits in the case of public investors if this is standard practice for the selection of public investments in the host country.

Present the investment analysis in a transparent manner and provide all the relevant assumptions, preferably in the CPA-DD, or in separate annexes to the CPA-DD, so that a reader can reproduce the analysis and obtain the same results. Refer to all critical techno-economic parameters and assumptions (such as capital costs, fuel prices, lifetimes, and discount rate or cost of capital). In calculating the financial/economic indicator, the projects risks can be included through the cash flow pattern, subject to project-specific expectations and assumptions (e.g. insurance premiums can be used in the calculation to reflect specific risk equivalents).

Assumptions and input data for the investment analysis shall not differ across the project activity and its alternatives, unless differences can be well substantiated.

Present in the CPA-DD a clear comparison of the financial indicator for the proposed CPA and:
(a) The alternatives, if Option II (investment comparison analysis) is used. If one of the other alternatives has the best indicator (e.g. highest IRR), then the CDM project activity can not be considered as the most financially attractive;
(b) The financial benchmark, if Option III (benchmark analysis) is used. If the CDM project activity has a less favourable indicator (e.g. lower IRR) than the benchmark, then the CDM project activity cannot be considered as financially attractive.

Sub-step 2d: Sensitivity analysis (only applicable to Options II and III):
Include a sensitivity analysis that shows whether the conclusion regarding the financial/economic attractiveness is robust to reasonable variations in the critical assumptions. The investment analysis provides a valid argument in favour of additionality only if it consistently supports (for a realistic range of assumptions) the conclusion that the project activity is unlikely to be the most financially/economically attractive (as per Step 2c) or is unlikely to be financially/economically attractive (as per Step 2c).

Outcome of Step 2: If after the sensitivity analysis it is concluded that: (1) the proposed CDM project activity is unlikely to be the most financially/economically attractive (as per Step 2c) or is unlikely to be financially/economically attractive (as per Step 2c), then proceed to Step 4 (Common practice analysis).

Otherwise, unless barrier analysis below is undertaken and indicates that the proposed project activity faces barriers that do not prevent at least one alternative from occurring; the project activity is considered not additional.

Step 3: Barrier analysis

This step serves to identify barriers and to assess which alternatives are prevented by these barriers. The "Guidelines for objective demonstration and assessment of barriers", Version 1.0, EB50 Annex 13, shall be taken into account when applying this step.

If this Step is used, determine whether the proposed CPA faces barriers that:
(a) Prevent the implementation of this type of proposed project activity; and
(b) Do not prevent the implementation of at least one of the alternatives, if the project is not first of its kind according to the definition provided in paragraph 40(c)(i).

For barriers other than barriers due to project being "first of its kind" as defined in paragraph 40(c)(i), the identified barriers are only sufficient grounds for demonstration of additionality if they would prevent potential project proponents from carrying out the proposed CPA undertaken without being registered as a CDM project activity.

For barriers other than barriers due to project being "first of its kind" as defined in paragraph 40(c)(i), if the CDM does not alleviate the identified barriers that prevent the proposed project activity from occurring, then the project activity is not additional.

Use the following Sub-steps:
Sub-step 3a: Identify barriers that would prevent the implementation of the proposed CDM project activity:

Establish that there are realistic and credible barriers that would prevent the implementation of the CPA from being carried out if the project activity was not registered as a CDM activity. Such realistic and credible barriers may include, among others:

(1) Investment barriers, other than the economic/financial barriers in Step 2 above, inter alia:

(b) For alternatives undertaken and operated by private entities: Similar activities have only been implemented with grants or other non-commercial finance terms. Similar activities are defined as activities that rely on a broadly similar technology or practices, are of a similar scale, take place in a comparable environment with respect to regulatory framework and are undertaken in the relevant country/region;

(c) No private capital is available from domestic or international capital markets due to real or perceived risks associated with investment in the country where the proposed CDM project activity is to be implemented, as demonstrated by the credit rating of the country or other country investments reports of reputed origin.

(2) Technological barriers, inter alia:

(a) Skilled and/or properly trained labour to operate and maintain the technology is not available in the relevant country/region, which leads to an unacceptably high risk of equipment disrepair and malfunctioning or other underperformance;

(b) Lack of infrastructure for implementation and logistics for maintenance of the technology (e.g. natural gas cannot be used because of the lack of a gas transmission and distribution network);

(c) Risk of technological failure: the process/technology failure risk in the local circumstances is significantly greater than for other technologies that provide services or outputs comparable to those of the proposed CDM project activity, as demonstrated by relevant scientific literature or technology manufacturer information;

(d) The particular technology used in the CPA is not available in the relevant region.

(3) Barriers due to prevailing practice, *inter alia*:
The project activity is the "first of its kind".

(a) For the measures identified under paragraph 6, a proposed project activity is the First-of-its-kind in the applicable geographical area if:
(ii) The project is the first in the applicable geographical area that applies a technology that is different from any other technologies able to deliver the same output and that have started commercial operation in the applicable geographical area before the start date of the project; and
(iii) Project participants selected a crediting period for the project activity that is a maximum of 10 years with no option of renewal;
(b) For the measures identified under paragraph 6, a proposed project activity that was identified as the First-of-its-kind project activity is additional and Sub-step 3 b does not apply.
(c) For other measures, the project proponents shall propose approach for demonstrating that a project is a "first-of-its-kind" and Sub-step 3 b applies.

(4) Other barriers, preferably specified in the underlying methodology as examples.

Outcome of Step 3a: Identified barriers that may prevent one or more alternative scenarios to occur or conclusion that the project is additional.

Sub-step 3b: Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity):
If the identified barriers also affect other alternatives, explain how they are affected less strongly than they affect the proposed CPA. In other words, demonstrate that the identified barriers do not prevent the implementation of at least one of the alternatives. Any alternative that would be prevented by the barriers identified in Sub-step 3a is not a viable alternative, and shall be eliminated from consideration.

In applying Sub-steps 3a and 3b, provide transparent and documented evidence, and offer conservative interpretations of this documented evidence, as to how it demonstrates the existence and significance of the identified barriers and whether alternatives are prevented by these barriers. Anecdotal evidence can be included, but alone is not sufficient proof of barriers. The type of evidence to be provided should include at least one of the following:

(a) Relevant legislation, regulatory information or industry norms;
(b) Relevant (sectoral) studies or surveys (e.g. market surveys, technology studies, etc) undertaken by universities, research institutions, industry associations, companies, bilateral/multilateral institutions, etc;
(c) Relevant statistical data from national or international statistics;
(d) Documentation of relevant market data (e.g. market prices, tariffs, rules);
(e) Written documentation of independent expert judgments from industry, educational institutions (e.g. universities, technical schools, training centres), industry associations and others.

If both Sub-steps 3a . 3b are satisfied, proceed to Step 4 (Common practice analysis).

If one of the Sub-steps 3a . 3b is not satisfied, the project activity is not additional.

Step 4: Common practice analysis

Each CPA will implement a measure listed in paragraph 6 of the Additionality Tool, therefore additionality is determined through the following four steps:

Step 1: Calculate applicable output range as +/-50% of the design output or capacity of the proposed CPA.

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

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

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

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

(a) the factor F is greater than 0.2, and
(b) $N_{all}-N_{diff}$ is greater than 3.

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

The additionality of each CPA will be demonstrated by establishing that in the absence of CDM, the CPA would not occur. The key criteria to be used in the additionality assessment above is described below:

In the assessment of Step 1 in section E.5.1 above, the key criteria to be applied shall be in accordance with the "Procedure for the identification of the most plausible baseline scenario" in ACM0014, Version 4.1.0, EB58.

In the assessment of Step 2 in section E.5.1 above, the key criteria to be applied shall be in accordance with the "Guidelines on the assessment of investment analysis" Version 5.0.0., EB62, Annex 5.

In the assessment of Step 3 in section E.5.1 above, the key criteria to be applied shall be in accordance with the "Guidelines for objective demonstration and assessment of barriers", Version 1.0, EB50 Annex 13.

In the assessment of Step 4 in section E.5.1 above, the key criteria to be applied shall be in accordance with paragraphs 6,7,8,9 and 47 of the "Tool for the demonstration and assessment of additionality" Version 6.0.0, EB65, Annex 21.

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

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

The approved consolidated baseline and monitoring methodology applied for a typical CPA is ACM0014 "Mitigation of greenhouse gas emission from treatment of industrial wastewater" version 04.1.0, EB 58. All methodological choices listed in the methodology will be available to the implementers of the individual CPAs and these methodological choices will be selected in accordance with the specific site details and technology of the relevant CPA. The methodological choices for each CPA will be fully detailed in the CPA-DD.

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

Emission reductions are calculated by subtracting the project emissions from the baseline emissions. The methodological choices used to determine the calculation methods for baseline and project emissions will be applied on a case by case basis to each CPA depending on the baseline scenario, project design and technology details for each CPA. An example of typical equations applied to a CPA is shown below.

Baseline emissions are calculated as follows:

$BE_y = BE_{CH4,y} + BE_{EL,y} + BE_{HG,y,}$

Where:

BE_y	=	Baseline emissions in year *y* (tCO_2e/yr)
BE_{CH4}	=	Methane emissions from anaerobic treatment of the wastewater in open lagoons (Scenario 1) in the absence of the project activity in year *y* (tCO_2e/yr)
$BE_{EL,y}$	=	CO_2 emissions associated with electricity generation that is displaced by the project activity and/or electricity consumption in the absence of the project activity in year *y* (tCO_2/yr)
$BE_{HG,y}$	=	CO_2 emissions associated with fossil fuel combustion for heating equipment that is displaced by the project in year *y* (tCO_2/yr)

Therefore, the baseline emissions are calculated in three steps as follows:
Step 1: Calculation of baseline emissions from anaerobic treatment of the wastewater or sludge ($BE_{CH4,y}$);
Step 2: Calculation of baseline emissions from generation and consumption of electricity ($BE_{EL,y}$);
Step 3: Calculation of baseline emissions from heat generation ($BE_{HG,y}$);

<u>Step 1: Calculation of baseline emissions from anaerobic treatment of the wastewater or sludge</u>
The methodology proposes two alternative methods for the estimation of methane emissions from open lagoons:
(a) The Methane Conversion Factor Method (described in Step 1a); and
(b) The Organic Removal Ratio Method (described in Step 1b).

Step 1a: Methane Conversion Factor Method

The baseline methane emissions from anaerobic treatment of the wastewater in open lagoons (Scenario 1) are estimated based on the chemical oxygen demand (COD) of the wastewater that would enter the lagoon in the absence of the project activity ($COD_{PJ,y}$), the maximum methane producing capacity (B_o) and a methane conversion factor ($MCF_{BL,y}$) which expresses the proportion of the wastewater that would decay to methane, as follows:

$$BE_{CH4,y} = GWP_{CH4} \times MCF_{BL,y} \times B_o \times COD_{BL,y}$$

Where:

BE_{CH4} = Methane emissions from anaerobic treatment of the wastewater in open lagoons (Scenario 1) in the absence of the project activity in year *y* (tCO_2e/yr)

GWP_{CH4} = Global Warming Potential of methane valid for the commitment period (tCO_2e/tCH_4)

B_o = Maximum methane producing capacity, expressing the maximum amount of CH_4 that can be produced from a given quantity of chemical oxygen demand ($tCH_4/tCOD$)

$MCF_{BL,y}$ = Average baseline methane conversion factor (fraction) in year *y*, representing the fraction of ($COD_{PJ,y}$ x B_o) that would be degraded to CH_4 in the absence of the project activity

$COD_{BL,y}$ = Quantity of chemical oxygen demand that would be treated in open lagoons (Scenario 1) in the absence of the project activity in year *y* (tCOD/yr)

Determination of $COD_{BL,y}$

In principle, the baseline chemical oxygen demand ($COD_{BL,y}$) corresponds to the chemical oxygen demand that is treated under the project activity ($COD_{PJ,y}$) because the wastewater (Scenario 1) treated under the project activity would in the absence of the project activity be directed to the open lagoon (Scenario 1), and thus $COD_{BL,y} = COD_{PJ,y}$.

If there would be an effluent from the lagoons (Scenario 1) in the baseline, COD_{BL} should be adjusted by an effluent adjustment factor which relates the COD supplied to the lagoon with the COD in the effluent, as follows:

$$COD_{BL,y} = AD_{BL} \times COD_{PJ,y}$$

Where:

$COD_{BL,y}$ = Quantity of chemical oxygen demand that would be treated in open lagoons (Scenario 1) in the absence of the project activity in year *y* (t COD/yr)

$COD_{PJ,y}$ = Quantity of chemical oxygen demand that is treated in the anaerobic digester in the project activity in year *y* (t COD/yr)

AD_{BL} = Effluent adjustment factor expression the percentage of COD that is degraded in open lagoons (Scenario 1) in the absence of the project activity

AD_{BL} is determined as follows:

For project activities implemented in existing facilities

(a) In the case when at least one year historical data of the COD inflow and COD effluent are available, AD_{BL} should be determined as follows:

$$AD_{BL} = 1 - \frac{COD_{out,x}}{COD_{in,x}}$$

Where:

AD_{BL}	=	Effluent adjustment factor expression the percentage of COD that is degraded in open lagoons (Scenario 1) in the absence of the project activity
$COD_{out,x}$	=	COD of the effluent in the period *x* (t COD)
$COD_{in,x}$	=	COD directed to the open lagoons (Scenario 1) in the period *x* (t COD)
x	=	Representative historical reference period (at least one year)

(b) In the case when at least one year historical data of the COD inflow and COD effluent are not available, AD_{BL} should be determined as follows:

AD_{BL} is determined by conducting measurements of the COD inflow to and effluent from the lagoon during a measurement campaign of at least 10 days. The measurements should be undertaken during a period that is representative for the typical operation conditions of the plant and ambient conditions of the site (temperature, etc). The average COD_{in} and COD_{out} values from the measurement campaign shall be used in the calculation of AD_{BL} and the result shall be multiplied by 0.89 to account for the uncertainty range (of 30% to 50%) associated with this approach as compared to one-year historical data.

For project activities implemented in Greenfield facilities

In the case of project activities implemented in Greenfield facilities, where the baseline is a new to be built anaerobic lagoon, AD_{BL} is determined based on the design features that were identified as the baseline in the procedure outlined in Step 1 of the "procedure for the identification of the most plausible baseline scenario", by using, in the calculation of AD_{BL}, the design COD inflow for COD_{in} and the design effluent COD flow for $COD_{out.}$

$COD_{PJ,y}$ is determined as follows:

$$COD_{PJ,y} = \sum_{m=1}^{12} F_{PJ,dig,m} \times w_{COD,dig,m}$$

Where:

$COD_{PJ,y}$	=	Quantity of chemical oxygen demand that is treated in the anaerobic digester or under clearly aerobic conditions in the project activity in year *y* (t COD/yr)
$F_{PJ,dig,m}$	=	Quantity of wastewater or sludge that is treated in the anaerobic digester in the project activity in month *m* (m^3/month)
$w_{COD,dig,m}$	=	Average chemical oxygen demand in the wastewater that is treated in the anaerobic digester in the project activity in month *m* (t COD / m^3)
M	=	Months of year *y* of the crediting period

Determination of $MCF_{BL,y}$

The quantity of methane generated from COD disposed to the open lagoon (Scenario 1) depends mainly on the temperature and the depth of the lagoon. Accordingly, the methane conversion factor is calculated based on a factor f_d, expressing the influence of the depth of the lagoon on methane generation, and a factor $f_{T,y}$ expressing the influence of the temperature on the methane generation. In addition, a

conservativeness factor of 0.89 is applied to account for the considerable uncertainty associated with this approach. $MCF_{BL,y}$ is calculated as follows:

$$MCF_{BL,y} = f_d \times f_{T,y} \times 0.89$$

Where:

$MCF_{BL,y}$	=	Average baseline methane conversion factor (fraction) in year *y*, representing the fraction of ($COD_{PJ,y}$ x B_o) that would be degraded to CH_4 in the absence of the project activity
f_d	=	Factor expressing the influence of the depth of the lagoon on methane generation
$f_{T,y}$	=	Factor expressing the influence of the temperature on the methane generation in year *y*
0.89	=	Conservativeness factor

Determination of $f_{T,y}$

In some regions, the ambient temperature varies significantly over the year. Therefore, the factor $f_{T,y}$ is calculated with the help of a monthly stock change model which aims at assessing how much COD degrades in each month. For each month *m*, the quantity of wastewater directed to the lagoon, the quantity of organic compounds that decay and the quantity of any effluent water from the lagoon is balanced, giving the quantity of COD that is available for degradation in the next month: The amount of organic matter available for degradation to methane ($COD_{available,m}$) is assumed to be equal to the amount of organic matter directed to the open lagoon, less any effluent, plus the COD that may have remained in the lagoon from previous months, as follows:

$$COD_{available,m} = COD_{BL,m} + (1 - f_{T,m}) \times COD_{available,m-1} \text{ with}$$

$$COD_{BL,m} = AD_{BL} \times COD_{PJ,m} \text{ and}$$

$$COD_{PJ,m} = F_{PJ,dig,m} \times w_{COD,dig,m}$$

Where:

$COD_{available,m}$	=	Quantity of chemical oxygen demand available for degradation in the open lagoon in month *m* (t COD/month)
$COD_{BL,m}$	=	Quantity of chemical oxygen demand that would be treated in open lagoons (Scenario 1) in the absence of the project activity in month *m* (t COD/month)
$COD_{PJ,m}$	=	Quantity of chemical oxygen demand that is treated in the anaerobic digester in the project activity in month *m* (t COD/month)
AD_{BL}	=	Effluent adjustment factor expressing the percentage of COD that is degraded in open lagoons (Scenario 1)
$F_{PJ,dig,m}$	=	Quantity of wastewater or sludge that is treated in the anaerobic digester in the project activity in month *m* (m^3/month)
$w_{COD,dig,m}$	=	Average chemical oxygen demand in the wastewater that is treated in the anaerobic digester in the project activity in month *m* (t COD/m^3)
$f_{T,m}$	=	Factor expressing the influence of the temperature on the methane generation in month *m*
m	=	Months of year *y* of the crediting period

The carry-over calculations are limited to a maximum of one year. In case the residence time in the open lagoon is less than one year, carry-on calculations are limited to the period where the wastewater remains

in the lagoon. That is in the case of the emptying of a sludge pit, the accumulation of organic matter restarts with the next inflow and the COD available from the previous month should be set to zero. Project participants should provide evidence of the typical residence time of the organic matter in the lagoon.

In the case of project activities implemented in Greenfield facilities, where the baseline is a new to be built anaerobic lagoon, use the residence time of organic matter according to the design features of the lagoon that was identified as the baseline in Step 1 of the section "Procedure for the identification of the most plausible baseline scenario".

The monthly factor to account for the influence of the temperature on methane generation is calculated based on the following "van't Hoff – Arrhenius" approach:

$$f_{T,m} = \begin{cases} 0 & if \quad T_{2,m} < 283\ K \\ \exp\left(\frac{E*(T_{2,m} - T_1)}{R*T_1*T_{2,m}}\right) & if \quad 283\ K < T_{2,m} < 303\ K \\ 1 & if \quad T_{2,m} > 303\ K \end{cases}$$

Where:

$f_{T,m}$	=	Factor expressing the influence of the temperature on the methane generation in month *m*
E	=	Activation energy constant (15,175 cal/mol)
$T_{2,m}$	=	Average temperature at the project site in month *m* (K)
T_1	=	303.16 K (273.16 K + 30 K)
R	=	Ideal gas constant (1.987 cal/K mol)
M	=	Months of year *y* of the crediting period

As indicated above, the value of $f_{T,m}$ cannot exceed 1 and should be assumed to be zero if the ambient temperature is below 10°C.

Based on the monthly values $f_{T,m}$ the annual value $f_{T,y}$ is calculated as follows:

$$f_{T,y} = \frac{\sum_{m=1}^{12} f_{T,m} \times COD_{avaialble,m}}{\sum_{m=1}^{12} COD_{BL,m}}$$

Where:

$f_{T,y}$	=	Factor expressing the influence of the temperature on the methane generation in year *y*
$f_{T,m}$	=	Factor expressing the influence of the temperature on the methane generation in month *m*
$COD_{available,m}$	=	Quantity of chemical oxygen demand available for degradation in the open lagoon in month *m* (t COD/month)
$COD_{BL,m}$	=	Quantity of chemical oxygen demand that would be treated in open lagoons (Scenario 1) in the absence of the project activity in month *m* (t COD/month)
M	=	Months of year *y* of the crediting period

Step 1b: Organic removal ratio (ORR) method

The organic removal ratio method measures the reduction of chemical oxygen demand (COD) in a wastewater between its entry into and exit from the treatment system (the open lagoon). The organic removal ratio is a project specific factor expressing the fraction of COD that is degraded in the open lagoon (i.e. between the entry and exit points).

Losses of COD in a lagoon system occur through three main routes:

- Anaerobic decomposition (and consequently methane emissions);
- Oxidative decomposition, either aerobic at the pond surface, or through chemical oxidation where there is a presence of an oxidizing product, such as sulphate from sulphuric acid (SO_4^{2-} from H_2SO_4);
- Sedimentation of certain suspended materials that can be lost through other routes, and settle to the lagoon bottom, remaining on a more or less permanent basis.

The organic removal ratio method acknowledges these different losses of COD. Baseline methane emissions from anaerobic treatment of the wastewater in open lagoons (Scenario 1) are estimated based on a mass balance of the organic matter, as follows:

$$BE_{CH4,y} = GWP_{CH4} \times B_o \times \left(COD_{BL,y} - COD_{aerobic,BL} - COD_{OX,BL,y} - COD_{sedim,BL,y}\right)$$

Where:

$BE_{CH4,y}$	=	Methane emissions from anaerobic treatment of the wastewater in open lagoons (Scenario 1) in the absence of the project activity in year *y* (tCO_2e/yr)
GWP_{CH4}	=	Global Warming Potential of methane valid for the commitment period (tCO_2e/tCH_4)
B_o	=	Maximum methane producing capacity, expressing the maximum amount of CH_4 that can be produced from a given quantity of chemical oxygen demand ($tCH_4/tCOD$)
$COD_{BL,y}$	=	Quantity of chemical oxygen demand that would be treated in open lagoons (Scenario 1) in the absence of the project activity in year *y* (t COD/yr)
$COD_{aerobic,BL}$	=	Annual quantity of chemical oxygen demand that would degrade aerobically in the lagoon (t COD/yr)
$COD_{OX,BL,y}$	=	Annual quantity of chemical oxygen demand that would be chemically oxidised through sulphate in the wastewater in year *y* (t COD/yr)
$COD_{sedim,BL,y}$	=	Amount of chemical oxygen demand lost through sedimentation in the lagoon before the start of the project activity (t COD/yr)

$COD_{BL,y}$ is determined as per the methane conversion factor method.

Determination of $COD_{aerobic,BL}$

$COD_{aerobic,BL}$ is calculated based on the surface of the lagoon or sludge pit and a default value for the amount of COD per hectare that degrades under aerobic conditions, as follows:

$$COD_{aerobic,BL} = A \times f_{COD,aerobic}$$

Where:

$COD_{aerobic,BL}$	=	Annual quantity of chemical oxygen demand that would degrade aerobically in the lagoon (t COD/yr)
A	=	Surface of the lagoon (ha)

$f_{COD,aerobic}$ = Quantity of chemical oxygen demand degraded to CO_2 under aerobic conditions per surface area of the lagoon (t COD/ha yr)

Determination of $COD_{OX,BL,y}$

The determination of this parameter is relevant if the wastewater contains chemical substances that chemically oxidize organic matter in the wastewater. The most likely chemical substance that may be present is the sulphate ion (SO_4^{2-}) from use in the process of sulphuric acid. Project participants should identify which chemical substances are relevant for the wastewater. The concentration of these chemical substances is monitored and the reduction in chemical oxygen demand due to the chemical oxidation of organic matter is then determined as follows:

$$COD_{OX,BL,y} = F_{PJ,y} \times \sum_{s} w_{s,y} \times R_s \times 0.001 \text{ with}$$

$$F_{PJ,y} = \sum_{m} F_{PJ,dig,m}$$

Where:

$COD_{OX,BL,y}$ = Annual quantity of chemical oxygen demand that would be chemically oxidised through sulphate in the wastewater in year *y* (t COD/yr)
$F_{PJ,y}$ = Quantity of wastewater treated in the digester in year *y* (m³/yr)
$w_{s,y}$ = Average concentration of chemical oxidative substance *s* in the wastewater treated in the digester in year *y* (kg/m³)
R_s = Specific reduction in chemical oxygen demand by substance *s* (t COD/t substance)
S = Substances in the wastewater that can chemically oxidize organic matter
$F_{PJ,dig,m}$ = Quantity of wastewater that is treated in the anaerobic digester in the project activity in month *m*

Determination of $COD_{sedim,BL,y}$

To estimate $COD_{sedim,BL,y}$ the Chemical Oxygen Demand that is lost through sedimentation, the first step is to characterise the type of organic waste material in order to determine the likelihood of any sedimentation actually taking place. In addition, the conditions in the existing lagoon system must also be assessed to determine the lagoon dynamics in relation to mixing. Those lagoons so identified as highly anaerobically active have the characteristic to keep all the material that would sediment in a state of permanent suspension, this material is then anaerobically degraded. Where such characteristics of sedimentation are identified, the fraction of Chemical Oxygen Demand lost to sedimentation is determined by monitoring the rate of COD entering the pond system and the rate at which pond depth alters over time. Then, a relationship between pond depth and sedimentation can be established.

Pond Based Sedimentation Determination

Daily pond sedimentation rates vary in a seasonally operated industry. There are no hard average numbers for the dynamic deposition rate to be expected. Project proponents should determine whether the wastewater contains material that is likely to sediment, and assess whether the pond dynamics are such that such sedimentation will occur. Where these conditions occur, an analysis must be carried out as to the rate of this sedimentation. Having verified these conditions, project proponents should measure the net annual effect of the COD deposition into the sediment of individual ponds at long time intervals because the pond sediment sludge amount accumulates gradually over the years. This is often shown by

the historic evidence of gradually shrinking working volumes of the treatment pond(s) in question.

Approach to determine the net annual COD sedimentation in wastewater treatment ponds

A GPS grid of at least 20 sampling points/pond will be put over each pond that is monitored. The distance of the GPS points from the pond bank needs to be at least 2 m. Twice a year (start of season and end of season) the following protocol will be performed:

(a) At each sampling time, determine pond water level height at all four corners of the pond by theodolite against an absolute height reference, ideally a concrete wall (accuracy > + / - 5 mm);

(b) Using an immersible turbidimeter mounted on a calibrated depth probe chain measure the sediment surface height relative to the water surface at the points indicated by the GPS grid;

Note: Gas masks/face shields need to be worn for this task due to the risk of H_2S poisoning and high temperatures. There is also a high fire risk on the pond surface. Thus under no circumstances can flammable items, cellphones or other equipment that could trigger a spark be brought onto the pond surface. This instruction must be obeyed at all times.

With a rowing boat determine at each GPS point the relative pond water column depth relative to the absolute height reference determined under (a). Calculate the relative increase/decrease in the average sediment height of the pond system twice/year, i.e. at the beginning and the end of a season determining the change in between seasons by calculation.

(c) Obtain a 10 cm diam x 40 cm core of the sediment layer at each GPS point with a core sampler (4 " plastic pipe). Combine the 0-20 cm layer cores and the 20-40 cm layer cores for all 20 points into a large drum. Mix the combined 0-20 cm (fraction A) and 20-40 cm samples (fraction B) with a metal or plastic rod. Take four random sub-samples of each of the two combined samples to determine VSS, TSS and COD. Carry out the sediment composition analysis in an experienced laboratory such as Waste Solutions Ltd, Analytical Laboratory;

(d) Calculate the mean+ / - SD for COD, VSS, TSS of each group. Perform a test of statistical significance of any observed changes (t-test, paired) by comparing the paired pre-season / pre-season and paired post-season / post-season samples for two consecutive years. Any real COD accumulation / deposition trend (if real) must be visible in the paired pre-season / pre-season and paired post-season / post-season time points. The net COD deposition relative for the methane abatement balance in a season is determined by comparing the net sediment mass (COD, VSS, TSS) in the pond at the beginning of a new season with the previously measured pre-existing net deposition at the beginning of the previous season. It is assumed that the net sediment COD deposition by sedimentation in a steady state situation has the composition of the sediment material of the B-fraction because the B-fraction is the actual accumulating stable end product in the pond sediment;

(e) The amount of accumulated sediment COD / pond deposited every year is then determined as follows.

- Determine B-fraction COD content (g COD/g sediment; wet basis);
- Calculate the net accumulated COD in pond (Mg/pond/year) as:

Accumulated COD = [area (m^2) x increase (m/year)] x sediment density x COD content B-fraction (gCOD/gwet).

The equations above will be applied on a case by case basis and documented in the CPA-DD.

Step 2: Baseline emissions from generation and/or consumption of electricity

In this step, baseline emissions from the following sources are estimated:

- Baseline emissions from consumption of electricity associated with the treatment of wastewater (Scenario 1);
- If electricity is generated with biogas from a new anaerobic digester under the project activity: baseline emissions from the generation of electricity in the grid (E2) and/or with a captive fossil fuel fired power plant (E1) in the absence of the electricity generation with biogas.

Baseline emissions from the generation and / or consumption of electricity are calculated as follows:

$$BE_{EL,y} = \left(EC_{BL} + EG_{PJ,y}\right) \times EF_{BL,EL,y}$$

Where:

$BE_{EL,y}$ = CO_2 emissions associated with electricity generation that is displaced by the project activity and/or electricity consumption in the absence of the project activity in year *y* (tCO_2/yr)

EC_{BL} = Annual quantity of electricity that would be consumed in the absence of the project activity for the treatment of the wastewater (Scenario 1) (MWh/yr)

$EG_{PJ,y}$ = Net quantity of electricity generated in year *y* with biogas from the new anaerobic biodigester (MWh/yr)

$EF_{BL,EL,y}$ = Baseline emission factor for electricity generated and / or consumed in the absence of the project activity in year *y* (tCO_2/MWh)

The determination of $EF_{BL,EL,y}$ depends on the baseline scenario and the configuration at the project site.

The grid emission factor should be used ($EF_{BL,EL,y} = EF_{grid,y}$) if the baseline scenario for displacement of electricity generated with biogas from the anaerobic digester is E2 or, in the case that no electricity is generated at the project site, if no captive fossil fuel fired power plant is operating at the project site in year *y*. In all other cases, the lower emission factor between the grid emission factor and the emission factor of the captive power plant should be used as a conservative simplification,[6] as follows:

$$EF_{BL,EL,y} = MIN\left(EF_{grid,y}; EF_{BL,EL,captive}\right)$$

Where:

$EF_{BL,EL,y}$ = Baseline emission factor for electricity generated and/or consumed in the absence of the project activity in year *y* (tCO_2/MWh)

$EF_{grid,y}$ = Grid emission factor in year *y* (tCO_2/MWh)

$EF_{BL,EL,captive}$ = Emission factor of electricity generated by the captive power plant that would have been used in the absence of the project activity (tCO_2/MWh)

[6] This conservative simplification has been made because it is depends on the exact configuration of the project activity to which extent electricity is displaced in the captive fossil fuel fired power plant and/or the grid.

The emission factor of the captive power plant ($EF_{BL,EL,captive}$) may be determined using one of the following options:

- In case of diesel generators: use the value the default emission factor for a diesel generator of 0.8 tCO_2/MWh;
- Calculate $EF_{BL,EL,captive}$ as follows:

$$EF_{BL,EL,captive} = \frac{EF_{CO2,FF,captive}}{\eta_{EL,captive}} \times 3.6$$

Where:

$EF_{BL,EL,captive}$	=	Emission factor of electricity generated by the captive power plant that would have been used in the absence of the project activity (tCO_2/MWh)
$EF_{CO2,FF,captive}$	=	CO_2 emission factor of the fossil fuel type used in the captive power plant (tCO_2 /GJ)
$\eta_{EL,captive}$	=	Efficiency of electricity generation of the fossil fuel fired captive power plant
3.6	=	Unit conversion factor from GJ to MWh

Calculating Grid Emission Factor

The Grid Emissions Factor $EF_{grid,y} = EF_{grid,CM,y}$ will be calculated according to the *Tool to calculate the emission factor for an electricity system*, Version 2.2.1, EB63, Annex 19. The emissions factor $EF_{grid,CM,y}$ will be calculated using the *ex ante* option at the validation stage. The latest combined margin published by the DNA of Thailand should be used to calculate emission reductions throughout the first crediting period. The stepwise approach to calculating the $EF_{grid,CM,y}$ shall be applied as follows:

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

STEP 1: Identify the relevant electricity systems

For the purpose of determining the electricity emission factor, the project electricity system is defined as the electricity transmission system of Thailand which is a single system connected by transmission lines throughout the country and owned by the Electricity Generating Authority of Thailand (EGAT).

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

The inclusion of off-grid power plants is an optional step. For the purpose of the Thailand grid, Option I is applied and only grid power plants are included in the calculation.

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

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods, which are described under Step 4:
(a) Simple OM; or
(b) Simple adjusted OM; or
(c) Dispatch data analysis OM; or
(d) Average OM.

The simple OM method (option a) can be used if low-cost/must-run resources (LC/MR) constitute less than 50% of total grid generation in the average of the five most recent years. In Thailand, LC/MR plants currently constitute less than 10% and therefore for the current crediting period (option b) Simple OM will be applied.

STEP 4: Calculate the operating margin emission factor according to the selected method
The simple OM may be calculated by one of the following two options:
Option A: Based on the net electricity generation and a CO2 emission factor of each power unit; or
Option B - Calculation based on total fuel consumption and electricity generation of the system

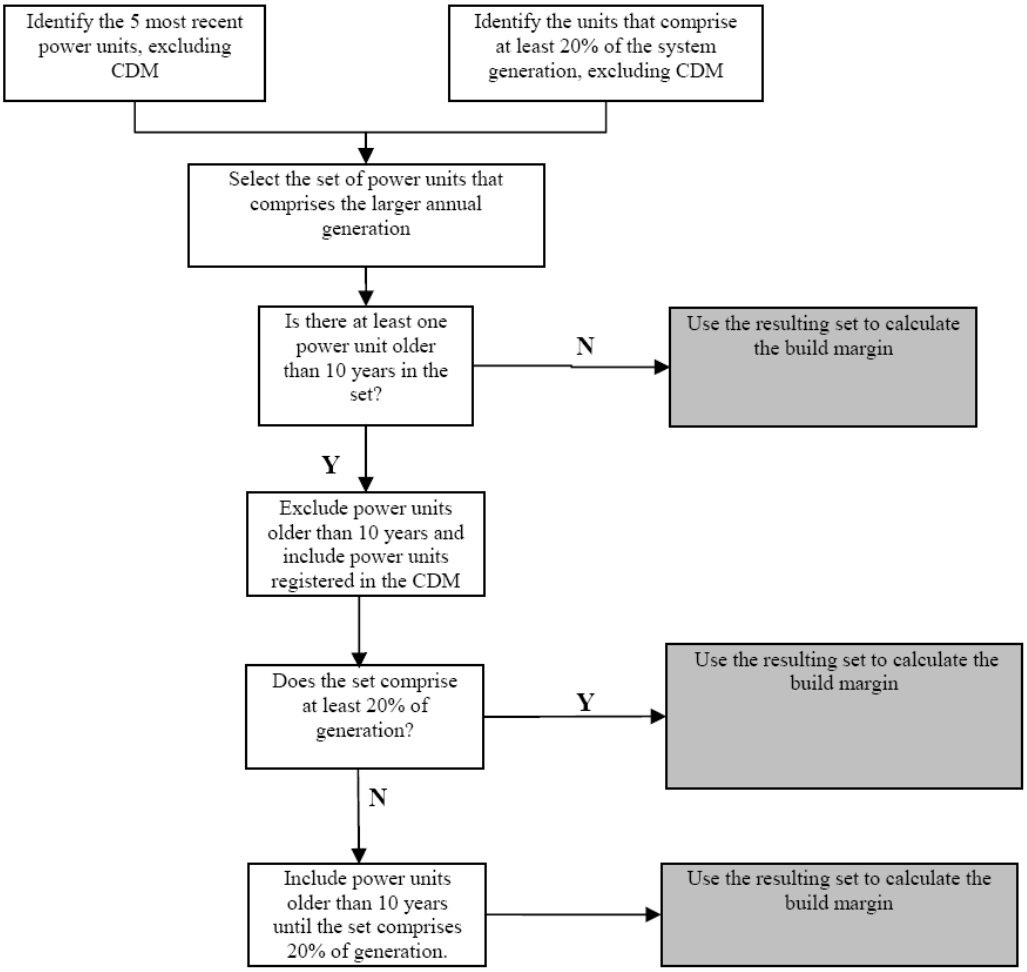
Currently Option B is applied in Thailand because:
(a) the net electricity generation and CO2 emission factor of each power unit is not available; and
(b) only renewable power generation was considered as LC/MR and the quantity of electricity supplied to the grid by these sources is available and
(c) off-grid power plants are not included in the calculation (ie Option I of Step 2 was chosen).
If any of these factors, then Option A must be applied following the steps in the Tool.

The simple OM emission factor for Option B is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/units.

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \cdot NCV_{i,y} \cdot EF_{CO2,i,y}}{EG_y}$$

where,
$EF_{grid,OMsimple,y}$ = Simple operating margin CO_2 emission factor in year y (tCO_2/MWh)
$FC_{i,y}$ = Amount of fossil fuel type i consumed in the project electricity system in year y (mass or volume unit)
$NCV_{i,y}$ = Net calorific value of fossil fuel type i in year y (GJ/mass or volume unit)
$EF_{CO2,i,y}$ = CO_2 emission factor of fossil fuel type i in year y (tCO_2y/GJ)
EG_y = Net electricity generated & delivered to the grid by all power sources serving the system, not including LC/MR power plants/units in year y (MWh)
i = All fossil fuel types combusted in power sources in the project electricity system in year y
y = The three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option)

STEP 5: Calculate the build margin (BM) emission factor
The build margin emissions factor is the generation-weighted average emission factor (tCO_2/MWh) of a sample group of power units, during the most recent year *y* for which power generation data is available, The Sample group of power units *m* used to calculate the build margin should be determined via the procedure outlined in the Tool and summarised in the following diagram:



The build margin emissions factor is the generation-weighted average emission factor (tCO2/MWh) of all power units *m* during the most recent year *y* for which electricity generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_{m} EG_{m,y} \cdot EF_{EL,m,y}}{\sum_{m} EG_{m,y}}$$

Where the CO_2 emissions factor of each power unit is calculated as per the simple OM emission factor method, and the other terms are as follows:

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EG_{m,y}$ = Net electricity generated and delivered to the grid by power plant/unit m in year y (MWh)
$EF_{EL,m,y}$ = CO_2 emission factor of power unit m in year y (tCO_2/MWh)
m = Power units included in the build margin
y = The most recent historical year for which power generation data is available

STEP 6: Calculate the combined margin (CM) emissions factor

The combined margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM}$$

where:

$EF_{grid,BM,y}$ = Build margin CO_2 emissions factor in year y (tCO_2/MWh)
$EF_{grid,OM,y}$ = Operating margin CO_2 emissions factor in year y (tCO_2/MWh)
w_{OM} = Weighting of operating margin emissions factor (%)
w_{BM} = Weighting of build margin emissions factor (%)

The weightings for the first crediting period are applied as $w_{OM} = 0.5$ and $w_{BM} = 0.5$.

The equations above will be applied on a case by case basis and documented in the CPA-DD.

Step 3: Baseline emissions from the generation of heat

This step is applicable if the biogas captured from the new anaerobic digester is utilized in the project scenario for heat generation. If the baseline Scenarios H1 or H3 apply, $BE_{HG,y} = 0$.[7] If Scenario H2 applies, fossil fuels from the generation of heat in boilers are displaced and baseline emissions are calculated as follows:

$$BE_{HG,y} = \frac{HG_{PJ,y} \times EF_{CO2,FF,boiler}}{\eta_{BL,boiler}}$$

Where:

$BE_{HG,y}$ = CO_2 emissions associated with fossil fuel combustion for heating equipment that is displaced by the project in year *y* (tCO_2/yr)
$HG_{PJ,y}$ = Net quantity of heat generated in year *y* with biogas from the new anaerobic digester (GJ)
$EF_{CO2,FF,boiler}$ = CO_2 emission factor of the fossil fuel type used in the boiler for heat generation in the absence of the project activity (tCO_2/GJ)
$\eta_{BL,boiler}$ = Efficiency of the boiler that would be used for heat generation in the absence of the project activity

The equation above will be applied on a case by case basis and documented in the CPA-DD.

Project emissions

Emissions attributed to the project activity depend on which scenario in Table 1 (of ACM0014) applies and the configuration of the project activity. If solid materials are treated in a digester system in a Scenario 1 type projects, project emissions shall be included and calculated the same way as project emissions of the treatment of wastewater.

[7] In case of cogeneration in the absence of the project activity (H1), the emission reductions from using the biogas in a cogeneration plant are already reflected in Step 2.

(i) Methane emissions from the open lagoons or dewatering process (applicable if residual from the anaerobic digester, after treatment, under the project activity, is directed to either open lagoons or to a dewatering facility);

In the case of project activities that introduce an anaerobic digester for the treatment of wastewater, solid materials or sludge:

(ii) Physical leakage of methane from the digester system;

(iii) Methane emissions from flaring (applicable if biogas from the digester is flared);

In the case of project activities that introduce a treatment of sludge or land application of wastewater:

(iv) Methane and nitrous oxide emissions from land application of sludge (if applicable);

In the case of project activities where wastewater is dewatered and directed to land application:

(v) Methane and nitrous oxide emissions from land application of wastewater;

In the case of project activities that consume electricity or heat under the project activity:

(vi) CO_2 emissions from consumption of electricity and or fossil fuels in the project activity.

Project participants should document and justify in the CDM-PDD which emission sources are applicable in the context of their project activity. Project emissions are calculated as follows:

$$PE_y = PE_{CH4,effluent,y} + PE_{CH4,digest,y} + PE_{flare,y} + PE_{sludge,LA,y} + PE_{ww,LA,y} + PE_{EC,y} + PE_{FC,y}$$

Where:

PE_y	=	Project emissions in year *y* (tCO_2e/yr)
$PE_{CH4,effluent,y}$	=	Project emissions from treatment of wastewater effluent from the anaerobic digester in year *y* (tCO_2e/yr)
$PE_{CH4,digest,y}$	=	Project emissions from physical leakage of methane from the anaerobic digester in year *y* (tCO_2e/yr)
$PE_{flare,y}$	=	Project emissions from flaring of biogas generated in the anaerobic digester in year *y* (tCO_2e/yr)[8]
$PE_{sludge,LA,y}$	=	Project emissions from land application of sludge in year *y* (tCO_2e/yr)
$PE_{ww,LA,y}$	=	Project emissions from land application of wastewater in year *y* (tCO_2e/yr)
$PE_{EC,y}$	=	Project emissions from electricity consumption in year *y* (tCO_2e/yr)
$PE_{FC,y}$	=	Project emissions from fossil fuel consumption in year *y* (tCO_2e/yr)

(i) Project methane emissions from effluent from the digester

This emission source is only applicable if a new digester is installed under the project activity and if the effluent from this digester is directed to open lagoons or a dewatering facility (see Scenario 1 in Table 1 of the Applicability conditions).

A significant amount of the COD load is usually degraded in the new anaerobic digester and open lagoons can be expected to operate under largely aerobic conditions. However, due to the uncertainty

[8] The parameters used to determine the project emissions from flaring of the residual gas stream in year *y* should be monitored as per the: “Tool to determine project emissions from flaring gases containing methane”.

regarding the exact extent of aerobic/anaerobic degradation after project implementation, the calculation of any CH_4 emissions is conservatively carried out in the same way as for the baseline, using either the methane conversion factor method or the organic removal ratio method. The same method as for the baseline emissions shall be applied.

Methane conversion factor method

Project methane emissions from treatment of the effluent from the digester are estimated as follows:

$$PE_{CH4,effluent,y} = GWP_{CH4} \times MCF_{PJ,y} \times B_o \times \left(COD_{PJ,effl,dig,y} - COD_{PJ,effl,lag,y}\right) \text{ with}$$

$$COD_{PJ,effl,dig,y} = \sum_{m=1}^{12} F_{PJ,effl,dig,m} \times w_{COD,effl,dig,m} \text{ and}$$

$$COD_{PJ,effl,lag,y} = \sum_{m=1}^{12} F_{PJ,effl,lag,m} \times w_{COD,effl,lag,m}$$

Where:

$PE_{CH4,effluent,y}$	=	Project emissions from treatment of wastewater effluent from the anaerobic digester in year *y* (tCO_2e/yr)
GWP_{CH4}	=	Global Warming Potential of methane valid for the commitment period (tCO_2e/tCH_4)
$MCF_{PJ,y}$	=	Project methane conversion factor (fraction) in year *y*, representing the fraction of ($COD_{PJ,effluent,y}$ x B_o) that degrades to CH_4
B_o	=	Maximum methane producing capacity, expressing the maximum amount of CH_4 that can be produced from a given quantity of chemical oxygen demand ($tCH_4/tCOD$)
$COD_{PJ,effl,dig,y}$	=	Quantity of chemical oxygen demand in the effluent from the digester in year *y* (tCOD/yr)
$COD_{PJ,effl,lag,y}$	=	Quantity of chemical oxygen demand in the effluent of the open lagoon or dewatering facility in which the effluent from the digester is treated in year *y* (tCOD/yr)
$F_{PJ,effl,dig,m}$	=	Quantity of effluent from the digester in month *m* (m^3/month)
$w_{COD,effl,dig,m}$	=	Average chemical oxygen demand in the effluent from the digester in month *m* (t COD/m^3)
$F_{PJ,effl,lag,m}$	=	Quantity of effluent from the open lagoon or dewatering facility in which the effluent from the digester is treated in month *m* (m^3/month)
$w_{COD,effl,lag,m}$	=	Average chemical oxygen demand in the effluent from the open lagoon or dewatering facility in which the effluent from the digester is treated in month *m* (t COD/m^3)

The quantity of methane generated from COD disposed to the open lagoon or in dewatering facility is calculated as follows:

$$MCF_{PJ,y} = f_d \times f_{PJ,T,y}$$

Where:

$MCF_{PJ,y}$ = Project methane conversion factor (fraction) in year *y*, representing the fraction of ($COD_{PJ,effluent,y}$ x B_o) that degrades to CH_4

f_d = Factor expressing the influence of the depth of the lagoon or dewatering facility on methane generation

$f_{PJ,T,y}$ = Factor expression the influence of the temperature on the methane generation under the project activity in year *y*

The factor $f_{T,PJ,y}$ is calculated, as under baseline emissions, with the help of a monthly stock change model which aims at assessing how much COD degrades in each month, as follows:

$$COD_{PJ,available,m} = \left(COD_{PJ,effl,dig,m} - COD_{PJ,effl,lag,m}\right) + (1 - f_{T,m}) \times COD_{PJ,available,m-1} \quad \text{with}$$

$$COD_{PJ,effl,dig,m} = F_{PJ,effl,dig,m} \times w_{COD,effl,dig,m} \quad \text{and}$$

$$COD_{PJ,effl,lag,m} = F_{PJ,effl,lag,m} \times w_{COD,effl,lag,m}$$

Where:

$COD_{PJ,available,m}$ = Quantity of chemical oxygen demand available for degradation in the open lagoon or dewatering facility under the project activity in month *m* (t COD/month)

$COD_{PJ,effl,dig,m}$ = Quantity of chemical oxygen demand in the effluent from the digester in month *m* (tCOD/month)

$COD_{PJ,effl,lag,m}$ = Quantity of chemical oxygen demand in the effluent of the open lagoon or dewatering facility in which the effluent from the digester is treated in month *m* (tCOD/month)

$F_{PJ,effl,dig,m}$ = Quantity of effluent from the digester in month *m* (m^3/month)

$w_{COD,effl,dig,m}$ = Average chemical oxygen demand in the effluent from the digester in month *m* (t COD/m^3)

$F_{PJ,effl,lag,m}$ = Quantity of effluent from the open lagoon or dewatering facility in which the effluent from the digester is treated in month *m* (m^3/month)

$w_{COD,effl,lag,m}$ = Average chemical oxygen demand in the effluent from the open lagoon or dewatering facility in which the effluent from the digester is treated in month *m* (t COD/m^3)

$f_{T,m}$ = Factor expressing the influence of the temperature on the methane generation in month *m*

m = Months of year *y* of the crediting period

As for the baseline emissions, the carry-over calculations are limited to a maximum of one year. In case the residence time in the open lagoon or the dewatering facility is less than one year, carry-on calculations are limited to the period where the wastewater remains in the lagoon or dewatering facility. Project participants should provide evidence of the typical residence time of the organic matter in the lagoon or the dewatering facility.

The monthly factor to account for the influence of the temperature on methane generation is calculated as per the equation for $f_{T,m}$ above.

Based on the monthly values $f_{T,m}$ the annual value $f_{T,PJ,y}$ is calculated as follows:

$$f_{PJ,T,y} = \frac{\sum_{m=1}^{12} f_{T,m} \times COD_{PJ,avaialble,m}}{\sum_{m=1}^{12} \left(COD_{PJ,effl,dig,m} - COD_{PJ,effl,lag,m}\right)}$$

Where:

$f_{PJ,T,y}$	=	Factor expressing the influence of the temperature on the methane generation under the project activity in year *y*
$f_{T,m}$	=	Factor expressing the influence of the temperature on the methane generation in month *m*
$COD_{PJ,available,m}$	=	Quantity of chemical oxygen demand available for degradation in the open lagoon or dewatering facility under the project activity in month *m* (t COD/month)
$COD_{PJ,effl,dig,m}$	=	Quantity of chemical oxygen demand in the effluent from the digester in month *m* (tCOD/month)
$COD_{PJ,effl,lag,m}$	=	Quantity of chemical oxygen demand in the effluent of the open lagoon or dewatering facility in which the effluent from the digester is treated in month *m* (tCOD/month)
M	=	Months of year *y* of the crediting period

Organic removal ratio method

As for baseline emissions, methane emissions from anaerobic treatment of the effluent from the digester are estimated based on a mass balance of the organic matter, as follows:

$$PE_{CH4,effluent,y} = GWP_{CH4} \times B_o \times \left(COD_{PJ,effl,dig,y} - COD_{PJ,aerobic} - COD_{PJ,OX,y} - COD_{PJ,sedim,y} - COD_{PJ,effl,lag,y}\right)$$

Where:

$PE_{CH4,effluent,y}$	=	Project emissions from treatment of wastewater effluent from the anaerobic digester in year *y* (tCO_2e/yr)
GWP_{CH4}	=	Global Warming Potential of methane valid for the commitment period (tCO_2e/tCH_4)
B_o	=	Maximum methane producing capacity, expressing the maximum amount of CH_4 that can be produced from a given quantity of chemical oxygen demand ($tCH_4/tCOD$)
$COD_{PJ,effl,dig,y}$	=	Quantity of chemical oxygen demand in the effluent from the digester in year *y* (t COD/yr)
$COD_{PJ,aerobic}$	=	Annual quantity of chemical oxygen demand that degrades aerobically in the lagoon under the project activity (t COD/yr)
$COD_{PJ,OX,y}$	=	Annual quantity of chemical oxygen demand that is chemically oxidised through oxidizing substances in the effluent from the digester in year *y* (t COD/yr)
$COD_{PJ,sedim,y}$	=	Amount of chemical oxygen demand lost through sedimentation in the lagoon under the project activity (t COD/yr)
$COD_{PJ,effl,lag,y}$	=	Quantity of chemical oxygen demand in the effluent of the open lagoon or dewatering facility in which the effluent from the digester is treated in year *y* (t COD/yr)

$COD_{PJ,effl,dig,y}$ and $COD_{PJ,effl,lag,y}$ are determined as for the equivalent equations for baseline emissions. $COD_{PJ,aerobic}$ is determined as for the equivalent equation under baseline emissions. $COD_{sedim,PJ,y}$ is

determined following the same procedure for $COD_{sedim,BL,y}$, $COD_{PJ,OX,y}$ is determined, as under baseline emissions, as follows:

$$COD_{PJ,OX,y} = \sum_{m}^{12} F_{PJ,effl,dig,m} \times \sum_{s} w_{s,effl,y} \times R_s \times 0.001$$

Where:

$COD_{PJ,OX,y}$	=	Annual quantity of chemical oxygen demand that is chemically oxidised through oxidizing substances in the effluent from the digester in year *y* (t COD/yr)
$F_{PJ,effl,dig,m}$	=	Quantity of effluent from the digester in month *m* (m³/month)
$w_{s,effl,y}$	=	Average concentration of chemical oxidative substance *s* in the effluent from the digester in year *y* (kg/m³)
R_s	=	Specific reduction in chemical oxygen demand by substance *s* (t COD/t substance)
S	=	Substances in the effluent of the digester that can chemically oxidize organic matter

(ii) Project emissions related to physical leakage from the digester

This emission source is only applicable if the project activity includes the construction of a new anaerobic digester. The emissions directly associated with the operation of digesters involve the physical leakage of methane from the digester system. Methane emissions from the new digester are calculated as follows:

$$PE_{CH4,digest,y} = F_{biogas,y} \times FL_{biogas,digest} \times w_{CH4,biogas,y} \times GWP_{CH4} \times 0.001$$

where:

$PE_{CH4,digest,y}$	=	Project emissions from physical leakage of methane from the anaerobic digester (tCO_2e / yr)
$F_{biogas,y}$	=	Amount of biogas collected in the outlet of the new digester in year *y* (m^3/yr)
$FL_{biogas,digest}$	=	Fraction of biogas that leaks from the digester (m³ biogas leaked/m³ biogas produced)
$w_{CH4,biogas,y}$	=	Concentration of methane in the biogas in the outlet of the new digester (kg CH_4/m³)
GWP_{CH4}	=	Global Warming Potential of methane valid for the commitment period (tCO_2e/tCH_4)

(iii) Methane emissions from flaring

Project methane emissions due to incomplete flaring

Methane emissions that occur due to incomplete flaring will be calculated as per the "Tool to determine project emissions from flaring gases containing methane", Version 1, EB28, Annex 13. If an open flare is installed, the flare efficiency cannot be measured in a reliable manner (i.e. external air will be mixed and will dilute the remaining methane) and a default value of 50% is to be used provided that it can be demonstrated that the flare is operational. The flare efficiency in the hour h ($\eta_{flare,h}$) is:

- 0% if the flame is not detected for more than 20 minutes during the hour h.
- 50%, if the flare is detected for more than 20 minutes during the hour h.

If an enclosed flare is used, the temperature in the exhaust gas of the flare is measured to determine whether the flare is operating or not, and in accordance with section II of the Tool, option (a) will be used to determine the flare efficiency of the enclosed flare as follows:

(a) To 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) must be performed. If in a specific hour any of the parameters are out of the limit manufacturer's specifications, a 50% default value for the flare efficiency should be used for the calculations for this 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 shall be assumed that during that hour the flare efficiency is zero. As such, manufacturer's specification for the operation of the flare and the required data and procedures to monitor these specifications are documented in section B.7.

The default value for flare efficiency will be used therefore steps 3 and 4 of the flare Tool are not applicable. As a simplified approach, project participants may only measure the volumetric fraction of methane and consider the difference to 100% as being nitrogen and the corresponding calculations on steps 1 and 2 are also not required. As such, the flare emissions are calculated with Steps 5-7 as follows:

The methane mass flow rate in the flare gas stream is calculated using Step 5 of the Tool as follows:

$TM_{RG,h} = FV_{RG,h} \times fv_{CH4,RG,h} \times \rho_{CH4,n}$

where,

$TM_{RG,h}$ = Mass flow rate of methane in the residual gas in hour *h* (kg/h)

$FV_{RG,h}$ = Volumetric flow rate of the residual gas in dry basis at normal conditions in hour *h* (m^3/h)

$fv_{CH4,RG,h}$ = Volumetric fraction of methane in the residual gas on dry basis in hour h (NB: this corresponds to $fv_{iRG,h}$ where *i* refers to methane)

$\rho_{CH4,n}$ = Density of methane at normal conditions (0.716 kg/m3)

As stated above, the default efficiency factor has been selected for the flare. In accordance with Step 6 of the Tool, the determination of hourly flare efficiency depends on the operation of flare and the type of flare used. In the case where the default value for flare efficiency is applied to enclosed flares, the flare efficiency in hour *h* ($\eta_{flare,h}$) is:

- 0% if the temperature in the exhaust of the flare (T_{flare}) is below 500 °C for more than 20 minutes during the hour *h*.
- 50% if the temperature in the exhaust gas of the flare (T_{flare}) is above 500 °C for more than 40 minutes during the hour *h*, but manufacturer's specifications on proper operation of the flare are not met at any point in time during the hour *h*.
- 90% if the temperature in the exhaust gas of the flare (T_{flare}) is above 500 °C for more than 40 minutes during the hour *h* and the manufacturer's specifications on proper operation of the flare are met continuously during the hour *h*.

In case of **open flares**, the flare efficiency in hour *h* ($\eta_{flare,h}$) is:

- 0% if the flame is not detected for more than 20 minutes during the hour *h*.
- 50%, if the flare is detected for more than 20 minutes during the hour *h*.

Project emissions from flaring are calculated using step 7 of the Tool, as the sum of emissions from each hour *h*, based on the methane flow rate in the residual gas ($TM_{RG,h}$) and the flare efficiency during each hour *h* ($\eta_{flare,h}$) as follows:

$PE_{flare,y}$ = $\Sigma^{8760}_{h=1} TM_{RG,h}$ x (1 - $\eta_{flare,h}$) x GWP_{CH4}/ 1000
where,
$PE_{flare,y}$ = Project emissions from flaring of the residual gas stream in year y (tCO_2e)
$TM_{RG,h}$ = Mass flow rate of methane in the residual gas in hour h (kg/h)
$\eta_{flare,h}$ = Flare efficiency in hour h
GWP_{CH4} = Global Warming Potential of methane valid for the commitment period (tCO_2e/tCH_4)

(iv) Project emissions from land application of sludge

This emission source is only applicable if under the project activity sludge is applied on lands. For conservativeness, an MCF of 0.05 is to be used to estimate possible methane emissions from the land application treatment process to account for any possible anaerobic pockets. These emissions are to be estimated from the following equations:

$$PE_{sludge,LA,y} = COD_{sludge,LA,y} \times B_o \times MCF_{sludge,LA} \times GWP_{CH4} + N_{sludge,LA,y} \times EF_{N2O,LA,sludge} \times GWP_{N2O}$$

with

$$COD_{sludge,LA,y} = \sum_{m=1}^{12} S_{LA,m} \times w_{sludge,COD,LA,m} \quad \text{and}$$

$$N_{sludge,LA,y} = \sum_{m=1}^{12} S_{LA,m} \times w_{N,sludge,m}$$

Where:
$PE_{sludge,LA,y}$ = Project emissions from land application of sludge in year y (tCO_2e/yr)
$COD_{sludge,LA,y}$ = Chemical oxygen demand (COD) of the sludge applied to land after the dewatering process in year y (tCOD/yr)
B_o = Maximum methane producing capacity, expressing the maximum amount of CH_4 that can be produced from a given quantity of chemical oxygen demand (tCH_4/tCOD)
$MCF_{sludge,LA}$ = Methane conversion factor for the application of sludge to lands
GWP_{CH4} = Global Warming Potential of methane valid for the applicable commitment period (tCO_2e/tCH_4)
$w_{sludge,COD,LA,m}$ = Average chemical oxygen demand in the sludge applied to land after the dewatering process in month m (t COD/t sludge)
$S_{LA,m}$ = Amount of sludge applied to land in month m (t sludge/month)
$N_{sludge,LA,y}$ = Amount of nitrogen in the sludge applied to land in year y (t N/yr)
$w_{N,sludge,m}$ = Mass fraction of nitrogen in the sludge applied to land in month m (t N/t sludge)
$EF_{N2O,LA,sludge}$ = N_2O emission factor for nitrogen from sludge applied to land (t N_2O/t N)
GWP_{N2O} = Global Warming Potential of nitrous dioxide (tCO_2e/tN_2O)

(v) Project emissions from land application of wastewater

This emission source is only applicable if under the project activity wastewater is dewatered and directed to land application. For conservativeness, an MCF of 0.05 is to be used to estimate possible methane

emissions from the land application treatment process to account for any possible anaerobic pockets. These emissions are to be estimated from the following equations:

$$\mathrm{PE}_{\mathrm{ww,LA,y}} = COD_{ww,LA,y} \times B_o \times MCF_{ww,LA} \times GWP_{CH4} + N_{ww,LA,y} \times EF_{N2O,LA,ww} \times \mathrm{GWP}_{\mathrm{N2O}}$$

with

$$\mathrm{COD}_{\mathrm{ww,LA,y}} = \sum_{m=1}^{12} \mathrm{DWW}_{\mathrm{LA,m}} \times \mathrm{w}_{\mathrm{ww,COD,LA,m}} \quad \text{and}$$

$$\mathrm{N}_{\mathrm{ww,LA,y}} = \sum_{m=1}^{12} \mathrm{DWW}_{\mathrm{LA,m}} \times \mathrm{w}_{\mathrm{N,ww,m}}$$

Where:

$PE_{ww,LA,y}$	=	Project emissions from land application of dewatered wastewater in year *y* (tCO_2e/yr)
$COD_{ww,LA,y}$	=	Chemical oxygen demand (COD) of the wastewater applied to land after the dewatering process in year *y* (tCOD/yr)
B_o	=	Maximum methane producing capacity, expressing the maximum amount of CH_4 that can be produced from a given quantity of chemical oxygen demand ($tCH_4/tCOD$)
$MCF_{ww,LA}$	=	Methane conversion factor for the application of wastewater to lands
GWP_{CH4}	=	Global Warming Potential of methane valid for the applicable commitment period (tCO_2e/tCH_4)
$W_{ww,COD,LA,m}$	=	Average chemical oxygen demand in the dewatered wastewater in month *m* (t COD/t dewatered wastewater)
$DWW_{LA,m}$	=	Amount of dewatered wastewater applied to land in month *m* (t/month)
$N_{ww,LA,y}$	=	Amount of nitrogen in wastewater applied to land in year *y* (t N/yr)
$w_{N,ww,m}$	=	Mass fraction of nitrogen in the wastewater applied to land in month *m* (t N/t dewatered wastewater)
$EF_{N2O,LA,ww}$	=	N_2O emission factor for nitrogen from wastewater applied to land (t N_2O/t N)
GWP_{N2O}	=	Global Warming Potential of nitrous dioxide (tCO_2e/tN_2O)

(vi) Project emissions from electricity consumption and combustion of fossil fuels in the project

This emission source includes CO_2 emissions from the consumption of electricity or combustion of fossil fuels for the operation of the project activity. This may, for example, include the operation of pumps. CPA's included in this PoA will not combust fossil fuels. Hence, equations for fossil fuel combustion are omitted.

If electricity is generated with biogas under the project activity, the electricity consumption for the operation of the project activity should be subtracted from the total on-site electricity generation with biogas in calculating $EG_{PJ,y}$ (i.e. $EG_{PJ,y}$ only includes the *net* electricity generation resulting from the project activity). Otherwise, the latest approved version of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" Version 1, EB39, Annex 7 should be applied to calculate project emissions from electricity consumption ($PE_{EC,y}$).

Scenario A, electricity consumption from the grid will apply whereby no captive power plant is installed at the site of electricity consumption or, if any onsite captive power plant exits, it is not operating or it can physically not provide electricity to the source of electricity consumption.

Project, baseline and leakage emissions from consumption of electricity are calculated based on the quantity of electricity consumed, an emission factor for electricity generation and a factor to account for transmission losses, as follows:

$$PE_{EC,y} = \sum_{j} EC_{PJ,j,y} \times EF_{EL,j,y} \times (1 + TDL_{j,y})$$

Under Scenario A where the electricity consumption is from the grid, thereby the source, j is the electricity grid.

$EC_{PJ,j,y}$	=	Quantity of electricity consumed by the project electricity consumption sourced from the grid (MWh/yr)
$EF_{EL,j,y}$	=	Emission factor for electricity generation sourced from the grid in year y (tCO2/MWh). This is calculated following the “Tool to calculate the emission factor for an electricity system”, Version 2.2.1, EB63 outlined previously
$TDL_{j,y}$	=	Average technical transmission and distribution losses for providing electricity to source j in year y, applying the default value of 20%

The equations above will be applied on a case by case basis and documented in the CPA-DD.

Leakage

Leakage emissions are only calculated for Scenario 1 type projects that include the treatment of solid materials in the digester in the project activity, and identified baseline scenario for the treatment of solid materials in the “Procedure for the identification of the most plausible baseline scenario” is SM2: The solid materials are used as animal fodder.

In such case, the potential source of leakage emission is the CO_2 emissions related to the production of additional animal fodder (or feed) that would be required in the project scenario due to the diversion of solid materials that were used as animal fodder in the baseline scenario, as a result of the project activity.

For this purpose, project participants shall assess the supply situation for the types of solid materials (suitable for animal fodder) in the region. Project participants may, however, rule out the leakage emissions, if they demonstrate that the use of the solid materials in the project activity does not result in CO_2 emissions elsewhere for the production of additional animal fodder, by one of the options below:

L_1: Demonstrate that there is an abundant surplus of the solid materials in the region of the project activity which are not utilized. For this purpose, demonstrate that the quantity of available solid materials in the region is at least 25% larger than the quantity that is utilized for animal fodder;

L_2: Demonstrate that suppliers of the solid materials in the region of the project activity are not able to sell all of their solid materials. For this purpose, project participants shall demonstrate that both project entity as well as a representative sample of producers of the same type of solid materials in the region, had a surplus of these solid materials (e.g. at the end of the period during which solid materials are sold), which they could not sell and which is not utilized.

When project participants wish to use approaches L1 or L2 to rule out leakage emissions, they shall clearly define the geographical boundary of the region and document it in the CDM-PDD. In defining the geographical boundary of the region, project participants should take the usual distances for animal fodder transports into account, i.e. if animal fodder is transported up to 50 km, the region may cover a radius of 50 km around the project activity. In any case, the region should cover a radius around the project activity of at least 20 km but not more than 200 km.

If project participants are not able to rule out the leakage emissions using one of the approaches above, a leakage penalty shall be applied. This leakage penalty shall be calculated for each year *y* as follows:

$$\mathrm{LE_y} = \sum_k EF_{CO2,k,LE} \times SM_{PJ,k,y} \times \mathrm{NCV_k} \quad \text{and}$$

$$EF_{CO2,k,LE} = \sum_i f_i \times \mathrm{EF_i}$$

Where:

LE_y	=	Leakage emissions during the year *y* (tCO2/yr)
$EF_{CO2,k,LE}$	=	CO2 emission factor of production of animal fodder that is used to replace the solid materials type *k* (tCO2/GJ)
$SM_{PJ,k,y}$	=	Quantity of solid materials type *k* that are displaced as animal fodder as a result of the project activity during the year *y* (tons of dry matter)
K	=	Types of solid materials for which leakage effects could not be ruled out with one of the approaches L1 or L2 above
NCV_k	=	Net calorific value of the solid materials type *k* (GJ/ton)
f_i	=	Fraction of total calorific value of animal feed type *i,* compared to the total calorific value of all animal feed, which is used to replace the solid materials (%)
EF_i	=	Specific production emission factor of type of animal feed *i* which is used to replace the solid materials (tCO2/GJ)
I	=	Types of different animal feeds which are used to replace the solid materials

Alternatively, given the potential complexity of the above procedure, the leakage penalty may be calculated by applying a simple yet conservative alternative:

$$\mathrm{LE_y} = \sum_k SM_{PJ,k,y} \times \mathrm{D}$$

Where:

LE_y	=	Leakage emissions during the year *y* (tCO2/yr)
$SM_{PJ,k,y}$	=	Quantity of solid materials type *k* that are displaced as animal fodder as a result of the project activity during the year *y* (tons of dry matter)
D	=	Default value of 1 tCO_2 / ton of dry matter

Note that the default value can only be used in case the production of animal fodder in the region does not have an impact on deforestation. In case deforestation is likely to occur, this needs be included and a region specific emission factor for animal fodder production needs to be estimated according to formula 32 of the methodology.

Emissions Reductions

Emission reductions for any given year of the crediting period are calculated by subtracting project emissions from baseline emissions.

- $ER_y = BE_y - PE_y - LE_y$

Where:

ER_y	=	Emissions reductions of the project activity in year *y* (tCO_2e/year)
BE_y	=	Baseline emissions in year *y* (tCO_2e/year)
PE_y	=	Project emissions in year *y* (tCO_2e/year)
LE_y	=	Leakage emissions in year *y* (tCO_2e/year)

In addition, the CPA-DD shall contain information regarding greenhouse gas emissions occurring within the proposed CPA project activity boundary as a result of the implementation of the proposed CPA which are expected to contribute more than 1% of the overall expected average annual emissions reductions, which are not addressed by the applied methodology.

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

All or some of the following data and parameters may be applicable to each relevant CPA.

Data / Parameter:	$COD_{out,x}$ $COD_{in,x}$
Data unit:	ton COD/unit of time (year, month)
Description:	COD of the effluent in the period x COD directed to the open lagoons (Scenario 1) in the period x
Source of data used:	For existing plants: one year of historical data. If no data is available the COD inflow to and effluent from the lagoon or sludge pit during a measurement campaign of at least 10 days. For Greenfield projects: use the design COD inflow for COD in and the design effluent COD flow for COD out corresponding to the design features of the lagoon system identified in the procedure for the selection of the baseline scenario. The measurements should be undertaken during a period that is representative for the typical operation conditions of the plant and ambient conditions of the site (temperature, etc). The average COD_{in} and COD_{out} values from the measurement campaign shall be used and the result shall be multiplied by 0.89 to account for the uncertainty range (of 30% to 50%) associated with this approach as compared to one-year historical data
Value applied:	To be determined individually for each CPA
Justification of the choice of data or description of measurement methods and procedures	In line with the requirements of the baseline methodology

actually applied :	
Any comment:	x = Representative historical reference period (at least one year). Fixed *ex-ante*.

Data / Parameter:	B_o
Data unit:	$tCH_4/tCOD$
Description:	Maximum methane producing capacity, expressing the maximum amount of CH_4 that can be produced from a given quantity of chemical oxygen demand (COD)
Source of data used:	2006 IPCC Guidelines
Value applied:	No measurement procedures. The default IPCC value for B_o is 0.25 kg CH_4/kg COD. If the methodology is used for wastewater containing materials not akin to simple sugars, a CH_4 emissions factor different from 0.21 $tCH_4/tCOD$ has to be estimated and applied
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirements of the baseline methodology
Any comment:	Taking into account the uncertainty of this estimate, project participants should use a value of 0.21 kg CH_4/kg COD as a conservative assumption for B_o Fixed *ex-ante*.

Data / Parameter:	f_d
Data unit:	-
Description:	Factor expressing the influence of the depth of the lagoon or sludge pit on methane generation
Source of data used:	Default values prescribed in the baseline methodology
Value applied:	Apply the following values for the corresponding average depth of the open lagoon: Depth > 5 m: 70% Depth 1 – 5 m: 50% Depth < 1 m: 0%
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirements of the baseline methodology
Any comment:	Applicable to the methane conversion factor method. In the case of ~~projects~~ activities implemented in Greenfield facilities where the baseline is a new to be built anaerobic lagoon, use the depth as defined in the baseline lagoon design in the section "Identification of alternative scenarios" Fixed *ex-ante*.

Data / Parameter:	$f_{COD,aerobic}$
Data unit:	t COD/ha yr

Description:	Quantity of chemical oxygen demand degraded to CO_2 under aerobic conditions per surface area of the lagoon
Source of data used:	Default values prescribed in the baseline methodology
Value applied:	Suggested value: 92.7 t COD / ha yr (= 254 kg COD/ha day)
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirements of the baseline methodology
Any comment:	Applicable to the organic removal ratio method Fixed *ex-ante*.

Data / Parameter:	D
Data unit:	M
Description:	Average depth of the lagoon
Source of data used:	For existing plants: Conduct measurements For project activities implemented in Greenfield facilities: As per the baseline lagoon design as identified in Step 1 of the section “Procedure for the identification of the most plausible baseline scenario Identification of alternative scenarios”
Value applied:	To be determined individually for each CPA
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirements of the baseline methodology
Any comment:	Fixed *ex-ante*. Determine the average depths of the whole lagoon under normal operating conditions.

Data / Parameter:	EC_{BL}
Data unit:	MWh/yr
Description:	Annual quantity of electricity that would be consumed in the absence of the project activity for the treatment of the wastewater (Scenario 1)
Source of data used:	In case of existing plants: Historical records of the average electricity during the most recent three years prior to the implementation of the project activity; In case of project activities implemented in Greenfield facilities: according to the baseline lagoon design as identified in Step 1 of the section "Procedure for the identification of the most plausible baseline scenario" Historical records must correspond to measurements whereby electricity meters undergo maintenance/calibration subject to appropriate industry standards. The accuracy of the meter readings will be verified by receipts issued by the purchasing power company. Uncertainty of the meters to be obtained from the manufacturers
Value applied:	To be determined individually for each CPA
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirements of the baseline methodology
Any comment:	Only relevant if electricity emissions are included in the baseline. Fixed *ex-ante*.

Data / Parameter:	$EF_{grid,y}$ $EF_{BL,EL,y}$
Data unit:	tCO_2/MWh
Description:	Grid emission factor in year *y* ;Baseline emission factor for electricity generated and/or consumed in the absence of the project activity in year *y* (tCO_2/MWh)
Source of data used:	Calculated in accordance with the latest approved version of the "Tool to calculate the emission factor for an electricity system", Version 2.2.1, EB63
Value applied:	To be determined individually for each CPA
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirements of the baseline methodology
Any comment:	Fixed *ex-ante*.

Data / Parameter:	$EF_{CO2,FF,captive}$ $EF_{CO2,FF,boiler}$
Data unit:	tCO2/GJ
Description:	CO_2 emission factor of the fossil fuel type used in the captive power plant; CO_2 emission factor of the fossil fuel type used in the boiler for heat generation in the absence of the project activity
Source of data used:	Actual measured or local data is to be used. If not available, regional data should be used and, in its absence, IPCC defaults can be used from the most recent version of IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	To be determined individually for each CPA
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirements of the baseline methodology
Any comment:	Only relevant if baseline emissions from captive power (electricity/heat) sources are calculated. If the measurement results differ significantly from previous measurements or other relevant data sources, conduct additional measurements. Double-checked against IPCC defaults (for consistency) if data is local or regional Fixed *ex-ante*.

Data / Parameter:	$\eta_{EL,captive}$ $\eta_{BL,boiler}$
Data unit:	%
Description:	Efficiency of the fossil fuel fired captive power plant; Efficiency of the boiler that would be used for heat generation in the absence of the project activity
Source of data used:	Depending on which option is chosen, the source will be either of the following: • Measured efficiency prior to project implementation; • Measured efficiency during monitoring; • Manufacturer nameplate data for efficiency of the existing equipment
Value applied:	To be determined individually for each CPA
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirements of the baseline methodology
Any comment:	Only relevant if baseline emissions from captive power (electricity/heat) sources are calculated. Fixed *ex-ante*.

Data / Parameter:	$FL_{biogas,digest}$
Data unit:	m³ biogas leaked/m³ biogas produced
Description:	Fraction of biogas that leaks from the digester
Source of data used:	IPCC (2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 5, Chapter 4, Page 4.4)
Value applied:	Use default leak factor of 0.05 m³ biogas leaked/m³ biogas produced
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirements of the baseline methodology
Any comment:	Where project participants wish to use lower values of physical leakage, they should request for revision of the methodology with the procedure to monitor the methane leak from the digester Fixed *ex-ante*.

Data / Parameter:	$EF_{N2O,LA,sludge}$
Data unit:	t N_2O/t N
Description:	N_2O emission factor for nitrogen from sludge applied to land
Source of data used:	Stehfest, E. and Bouwman, A.F. N_2O and NO emission from agricultural fields and soils under natural vegetation: summarizing available measurement data and modelling of global annual emissions. Nutr. Cycl. 29 Agroecosyst., in press. The average emission factor used is 0.01 kg N_2O-N / kg N (= 0.016 kg N_2O / kg N)
Value applied:	0.016
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirements of the baseline methodology
Any comment:	Applicable if sludge is applied on lands under the project activity Fixed *ex-ante*.

Data / Parameter:	$EF_{N2O,LA,ww}$
Data unit:	t N_2O/t N
Description:	N_2O emission factor for nitrogen from wastewater applied to land
Source of data used:	Stehfest, E. and Bouwman, A.F. N_2O and NO emission from agricultural fields and soils under natural vegetation: summarizing available measurement data and modelling of global annual emissions. Nutr. Cycl. 29 Agroecosyst., in press. The average emission factor used is 0.01 kg N_2O-N / kg N (= 0.016 kg N_2O / kg N)
Value applied:	Value to be applied: 0.016
Justification of the choice of data or description of	In line with the requirements of the baseline methodology

measurement methods and procedures actually applied :	
Any comment:	Applicable if sludge is applied on lands under the project activity Fixed *ex-ante*.

Data / Parameter:	$MCF_{sludge,LA}$
Data unit:	-
Description:	Methane conversion factor for the application of sludge to lands
Source of data used:	In line with the requirements of the baseline methodology
Value applied:	Value to be applied 0.05
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirements of the baseline methodology
Any comment:	Applicable if sludge is applied on lands under the project activity Fixed *ex-ante*.

Data / Parameter:	$MCF_{ww,LA}$
Data unit:	-
Description:	Methane conversion factor for the application of wastewater to lands
Source of data used:	In line with the requirements of the baseline methodology
Value applied:	Value to be applied 0.05
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirements of the baseline methodology
Any comment:	Fixed *ex-ante*.

Data / Parameter:	GWPCH4
Data unit:	tCO2e/tCH4
Description:	Global warming potential for CH4
Source of data used:	IPCC
Value applied:	Default to be applied: 21 for the first commitment period
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirements of the baseline methodology
Any comment:	Shall be updated according to any future COP/MOP decisions

Data / Parameter:	GWPN2O
Data unit:	$tCO2e/tN_2O$
Description:	Global warming potential for N_2O
Source of data used:	IPCC
Value applied:	Default to be applied: 296 for the first commitment period
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirements of the baseline methodology
Any comment:	Shall be updated according to any future COP/MOP decisions

Data / Parameter:	Rs
Data unit:	t COD/t substance
Description:	Specific reduction in chemical oxygen demand by substance *s*
Source of data used:	The most conservative default value from review of published literature
Value applied:	To be determined individually for each CPA
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirements of the baseline methodology
Any comment:	Substance is very likely to be SO4 Fixed *ex-ante*.

Data / Parameter:	A
Data unit:	Unit of area (ha)
Description:	Surface of the lagoon
Source of data used:	Actual measurements in case of existing lagoons. In case of project activities implemented in Greenfield facilities: According to the baseline lagoon design as identified in Step 1 of the section "Procedure for the identification of the most plausible baseline scenario"
Value applied:	To be determined individually for each CPA
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirements of the baseline methodology
Any comment:	Fixed *ex-ante*.

Data / Parameter:	EF_i
Data unit:	tCO2/GJ

Description:	Specific production emission factor of type of animal feed which is used to replace the solid materials
Source of data used:	Use relevant emission factors based on lifecycle analysis studies, for type *i* of animal feed used to replace the solid materials (e.g. from scientific literature, industry sources or manufacturers). Alternatively, identify average lifecycle emissions per animal feed produced (e.g. calculations based on national/international statistics or estimated by external research institutes or national agencies responsible for GHG inventory)
Value applied:	To be determined individually for each CPA, if applicable
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirements of the baseline methodology
Any comment:	Applicable if leakage occurs due to displacement of animal fodder. In case the production of animal fodder in the region has an impact on deforestation, emissions associated with the deforestation need to be included in the estimations

Data / Parameter:	f_i
Data unit:	Fraction GJ/GJ (%)
Description:	Fraction of animal feed type *i* compared to the total mix of animal feed which is used to replace the solid materials on dry basis
Source of data used:	Interviews with existing customers of solid materials type *k* and/or regional/national market statistics on animal feed use, which can be statistically significant (representative sampling with 95% confidence interval)
Value applied:	To be determined individually for each CPA, if applicable
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirements of the baseline methodology
Any comment:	Applicable if leakage occurs due to displacement of animal fodder. In case of variation in the data, apply a conservative approach (i.e. the largest fraction for the most GHG intensive animal fodder etc.)

Data / Parameter:	NCV_k
Data unit:	GJ/ton of dry matter
Description:	Net calorific value of the solid materials type *k*
Source of data used:	Measurements shall be carried out at qualified laboratories and according to relevant national or international standards. Measure the NCV based on dry matter
Value applied:	To be determined individually for each CPA, if applicable
Justification of the choice of data or description of	In line with the requirements of the baseline methodology

measurement methods and procedures actually applied :	
Any comment:	Applicable if leakage occurs due to displacement of animal fodder

Data / Parameter:	TDLj,y
Data unit:	-
Description:	Average technical transmission and distribution losses for providing electricity to source *j*,
Source of data used:	Tool to calculate baseline, project and/or leakage emissions from electricity consumption,Version 01, EB39
Value applied:	20%
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default value provided in Tool for project electricity consumption sources.
Any comment:	

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

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

All or some of the following data and parameters may be applicable to the relevant CPA:

Data / Parameter:	$F_{PJ,dig,m}$
Data unit:	m³/month
Description:	Quantity of wastewater that is treated in the anaerobic digester in the project activity in month *m*
Source of data to be used:	Measured and calculated
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Will be defined for each individual CPA and described in the CPA-DD.
Description of measurement methods and procedures to be applied:	Parameter monitored continuously using flow meters but aggregated annually for calculations
QA/QC procedures to be applied:	The equipment will be calibrated in accordance with manufacturer's requirements or once per year if no guidelines are provided by the manufacturer. Equipment will be calibrated prior to or during installation. Additional QA/QC procedures may be defined for each individual CPA and described in the CPA-DD.
Any comment:	In case of Scenario 1, if the solid materials are also treated in the baseline and project scenario, the $F_{PJ,dig,m}$ does not account the amount of solid materials treated or separated from the wastewater stream in the anaerobic digester, if applicable

	$w_{COD,dig,m}$
Data unit:	t COD/m³
Description:	Average chemical oxygen demand in the wastewater that is treated in the anaerobic digester in the project activity in month *m*
Source of data to be used:	Measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Measure the COD according to national or international standards
Description of measurement methods and procedures to be applied:	Regularly, calculate average monthly and annual values
QA/QC procedures to be applied:	The equipment will be calibrated in accordance with manufacturer's requirements or once per year if no guidelines are provided by the manufacturer. Equipment will be calibrated prior to or during installation. Additional QA/QC procedures may be defined for each individual CPA and described in the CPA-DD.
Any comment:	In case of Scenario 1, if the solid materials are also treated in the baseline and project scenario, the $w_{COD,dig,m}$ is not calculated for the solid materials treated or separated from the wastewater stream in the anaerobic digester, if applicable

Data / Parameter:	$w_{S,y}$
Data unit:	Kg/m³
Description:	Average concentration of chemical oxidative substance s in the wastewater treated in the digester in year *y*
Source of data to be used:	Measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Measure the COD according to national or international standards

Description of measurement methods and procedures to be applied:	Regularly, calculate average monthly and annual values
QA/QC procedures to be applied:	The equipment will be calibrated in accordance with manufacturer's requirements or once per year if no guidelines are provided by the manufacturer. Equipment will be calibrated prior to or during installation. Additional QA/QC procedures may be defined for each individual CPA and described in the CPA-DD.
Any comment:	Organic removal ratio (baseline emissions) Applicable if chemical oxidative substance are present in the wastewater

Data / Parameter:	$T_{2,m}$
Data unit:	K
Description:	Average temperature at the project site in month *m*
Source of data to be used:	National or regional weather statistics
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Will be defined for each individual CPA and described in the CPA-DD.
Description of measurement methods and procedures to be applied:	Continuously, aggregated in monthly average values
QA/QC procedures to be applied:	-
Any comment:	Applicable for the methane conversion factor method

Data / Parameter:	**$EG_{PJ,y}$**
Data unit:	MWh
Description:	Net quantity of electricity generated in year y with biogas from the new anaerobic biodigester (Net electricity sold to the grid)
Source of data to be used:	Measured with electricity meters
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Will be defined for each individual CPA and described in the CPA-DD.
Description of measurement methods and procedures to be applied:	Measured continuously with an electricity meter and monitored daily. The meter will measure electricity sold to the grid and represent net electricity sold to the grid.
QA/QC procedures to be applied:	The meters will be calibrated as per the manufacturer's recommendation or once per year. As a backup, in case the meters for net electricity fail, the net electricity will be calculated as Gross generation (monitored by internal meters); minus electricity consumed by the Auxiliary load of the biogas plant.
Any comment:	The net electricity sold to the grid will be cross checked against invoices from the power company. Biogas generated from solid materials is to be separately monitored in order to discount the part of renewable electricity generation from $EG_{PJ,y}$ caused by digestion of solid materials. Total net exported heat/power shall be multiplied with a ratio $R_{biogas,SM,y}$ in order to determine only the relevant amount of baseline heat/power emissions for calculation of emission reductions, where: $R_{biogas,SM,y} = \frac{F_{biogas,y} \times w_{CH4,biogas,y} - F_{biogas,SM,y} \times w_{CH4,biogas,SM,y}}{F_{biogas,y} \times w_{CH4,biogas,y}}$

Data / Parameter:	$HG_{PJ,y}$
Data unit:	GJ/year
Description:	Net quantity of heat generated in year *y* with biogas from the new anaerobic digester
Source of data to be used:	Measured from the heat received by the heated process; else: Calculated on the basis of measurement of the volume of biogas captured and used for heat generation multiplied by the methane content of the gas, CV methane, and the efficiency of the boiler during the project (i.e. with biogas)
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Will be defined for each individual CPA and described in the CPA-DD.

Description of measurement methods and procedures to be applied:	Monitored daily
QA/QC procedures to be applied:	The equipment will be calibrated in accordance with manufacturer's requirements or once per year if no guidelines are provided by the manufacturer. Equipment will be calibrated prior to or during installation. Additional QA/QC procedures may be defined for each individual CPA and described in the CPA-DD.
Any comment:	Biogas generated from solid materials is to be separately monitored in order to discount the part of heat generated from $HG_{PJ,y}$, caused by digestion of solid materials. Total net exported heat/power shall be multiplied with a ratio $R_{biogas,SM,y}$ in order to determine only the relevant amount of baseline heat/power emissions for calculation of emission reductions, where: $R_{biogas,SM,y} = \frac{F_{biogas,y} \times w_{CH4,biogas,y} - F_{biogas,SM,y} \times w_{CH4,biogas,SM,y}}{F_{biogas,y} \times w_{CH4,biogas,y}}$

Data / Parameter:	$F_{PJ,effl,dig,m}$ $F_{PJ,effl,lag,m}$
Data unit:	m³/month
Description:	Quantity of effluent from the digester in month *m;* Quantity of effluent from the open lagoon or dewatering facility in which the effluent from the digester is treated in month *m*
Source of data to be used:	Measured
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Will be defined for each individual CPA and described in the CPA-DD.
Description of measurement methods and procedures to be applied:	Parameter monitored continuously but aggregated monthly for calculations
QA/QC procedures to be applied:	The equipment will be calibrated in accordance with manufacturer's requirements or once per year if no guidelines are provided by the manufacturer. Equipment will be calibrated prior to or during installation. Additional QA/QC procedures may be defined for each individual CPA and described in the CPA-DD.
Any comment:	*m* = Months of year *y* of the crediting period

Data / Parameter:	$S_{LA,m}$ $DWW_{LA,m}$

Data unit:	t/month
Description:	Amount of sludge applied to land in month *m* Amount of dewatered wastewater applied to land in month *m*
Source of data to be used:	Measured
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Will be defined for each individual CPA and described in the CPA-DD.
Description of measurement methods and procedures to be applied:	Parameter monitored continuously but aggregated monthly for calculations
QA/QC procedures to be applied:	Will be defined for each individual CPA and described in the CPA-DD.
Any comment:	

Data / Parameter:	$w_{COD,effl,dig,m}$ $w_{COD,effl,lag,m}$
Data unit:	t COD/m³
Description:	Average chemical oxygen demand in the effluent from the digester in month *m* Average chemical oxygen demand in the effluent from the open lagoon or dewatering facility in which the effluent from the digester is treated in month *m*
Source of data to be used:	Measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Measure the COD according to national or international standards
Description of measurement methods and procedures to be applied:	Sampled and tested regularly, calculate average monthly and annual values
QA/QC procedures to be applied:	The equipment will be calibrated in accordance with manufacturer's requirements or once per year if no guidelines are provided by the manufacturer. Equipment will be calibrated prior to or during installation. Additional QA/QC procedures may be defined for each individual CPA and described in the CPA-DD.
Any comment:	-

Data / Parameter:	$w_{sludge,COD,LA,m}$
Data unit:	t COD/t sludge
Description:	Average chemical oxygen demand in the sludge applied to land after the dewatering process in month *m*
Source of data to be used:	Measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Measure the COD according to national or international standards
Description of measurement methods and procedures to be applied:	Sampled and tested regularly, calculate average monthly and annual values
QA/QC procedures to be applied:	The equipment will be calibrated in accordance with manufacturer's requirements, or once per year if no guidelines are provided by the manufacturer. Equipment will be calibrated prior to or during installation. Additional QA/QC procedures may be defined for each individual CPA and described in the CPA-DD.
Any comment:	-

Data / Parameter:	$w_{ww,COD,LA,m}$
Data unit:	t COD/t dewatered wastewater
Description:	Average chemical oxygen demand in the dewatered wastewater in month *m*
Source of data to be used:	Measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Measure the COD according to national or international standards
Description of measurement methods and procedures to be applied:	sampled and tested regularly, calculate average monthly and annual values
QA/QC procedures to be applied:	The equipment will be calibrated in accordance with manufacturer's requirements or once per year if no guidelines are provided by the manufacturer. Equipment will be calibrated prior to or during installation. Additional QA/QC procedures may be defined for each individual CPA and described in the CPA-DD.
Any comment:	-

Data / Parameter:	$w_{S,effl,y}$
Data unit:	Kg/m³
Description:	Average concentration of chemical oxidative substance *s* in the effluent from the digester in year *y*
Source of data to be used:	Measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Measure according to national or international standards
Description of measurement methods and procedures to be applied:	Regularly, calculate average monthly and annual values
QA/QC procedures to be applied:	The equipment will be calibrated in accordance with manufacturer's requirements or once per year if no guidelines are provided by the manufacturer. Equipment will be calibrated prior to or during installation. Additional QA/QC procedures may be defined for each individual CPA and described in the CPA-DD.
Any comment:	Organic removal ratio method

Data / Parameter:	$w_{N,sludge,m}$
Data unit:	t N/t sludge
Description:	Mass fraction of nitrogen in the sludge applied to land in month *m*
Source of data to be used:	Measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Measured according to national or international standards
Description of measurement methods and procedures to be applied:	Measured regularly, calculate average monthly
QA/QC procedures to be applied:	The equipment will be calibrated in accordance with manufacturer's requirements or once per year if no guidelines are provided by the manufacturer. Equipment will be calibrated prior to or during installation. Additional QA/QC procedures may be defined for each individual CPA and described in the CPA-DD.

Any comment:	-

Data / Parameter:	$w_{N,ww,m}$
Data unit:	t N/t dewatered wastewater
Description:	Mass fraction of nitrogen in the wastewater applied to land in month *m*
Source of data to be used:	Measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Measured according to national or international standards
Description of measurement methods and procedures to be applied:	Regularly, calculate average monthly
QA/QC procedures to be applied:	The equipment will be calibrated in accordance with manufacturer's requirements or once per year if no guidelines are provided by the manufacturer. Equipment will be calibrated prior to or during installation. Additional QA/QC procedures may be defined for each individual CPA and described in the CPA-DD.
Any comment:	-

Data / Parameter:	$SM_{PJ,k,y}$
Data unit:	tons of dry matter
Description:	Quantity of solid materials type *k* during the year *y*
Source of data to be used:	On-site measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Use weight meters and adjust for the moisture content in order to determine the quantity of dry matter
Description of measurement methods and procedures to be applied:	Measured daily, calculate monthly and annual values
QA/QC procedures to be applied:	Meters will undergo maintenance/calibration subject to appropriate industry standards. The frequency of calibration and control procedures would be different for each application. The equipment will be calibrated in accordance with manufacturer's requirements or once per year if no guidelines are provided by the manufacturer. Equipment will be calibrated prior to or during installation.

	Additional QA/QC procedures may be defined for each individual CPA and described in the CPA-DD.
Any comment:	Applicable if leakage occurs due to displacement of animal fodder

Data / Parameter:	$F_{biogas,y}$
Data unit:	m^3/yr
Description:	Total amount of biogas collected in the outlet of the new digester in year *y*
Source of data to be used:	Measured
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Will be defined for each individual CPA and described in the CPA-DD.
Description of measurement methods and procedures to be applied:	Parameter monitored continuously but aggregated annually for calculations
QA/QC procedures to be applied:	Flow meters will undergo maintenance/calibration subject to appropriate industry standards. The frequency of calibration and control procedures would be different for each application. This maintenance/calibration practice should be clearly stated in the CPA-DD.
Any comment:	Applied to estimate emissions associated with physical leakage from the digester. When biogas is generated from solid materials in a Scenario 1 project, this is to be separately monitored as $F_{biogas,SM,y}$ but included in the total amount of biogas monitored for the purpose of determining physical leakage and flaring emissions

Data / Parameter:	$F_{biogas,SM,y}$
Data unit:	m^3/yr
Description:	Amount of biogas collected in the outlet of the new digester that is generating biogas from solid materials only in year *y*
Source of data to be used:	Measured
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Will be defined for each individual CPA and described in the CPA-DD.
Description of measurement methods and	Parameter monitored continuously but aggregated annually for calculations

procedures to be applied:	
QA/QC procedures to be applied:	Flow meters will undergo maintenance/calibration subject to appropriate industry standards. The frequency of calibration and control procedures would be different for each application. This maintenance/calibration practice should be clearly stated in the CPA-DD.
Any comment:	Only applicable for Scenario 1 type projects that include digestion of solid materials in the project scenario. Biogas generated from solid materials is to be separately monitored in order to discount the part of exported heat/power caused by digestion of solid materials. Total net exported heat/power shall be multiplied with a ratio $R_{biogas,SM,y}$ in order to determine only the relevant amount of baseline heat/power emissions for calculation of emission reductions, where: $R_{biogas,SM,y} = \frac{F_{biogas,y} \times w_{CH4,biogas,y} - F_{biogas,SM,y} \times w_{CH4,biogas,SM,y}}{F_{biogas,y} \times w_{CH4,biogas,y}}$

Data / Parameter:	$w_{CH4,biogas,y}$
Data unit:	kg CH_4 / m³
Description:	Concentration of methane in the total biogas supply in the outlet of the new digester
Source of data to be used:	Measured
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Will be defined for each individual CPA and described in the CPA-DD.
Description of measurement methods and procedures to be applied:	Either with continuous analyser or alternatively with periodical measurement at 95% confidence level
QA/QC procedures to be applied:	The equipment will be calibrated in accordance with manufacturer's requirements or once per year if no guidelines are provided by the manufacturer. Equipment will be calibrated prior to or during installation. Additional QA/QC procedures may be defined for each individual CPA and described in the CPA-DD. The project proponents shall define the error for different levels of measurement frequency in the CPA-DD. The level of accuracy will be deducted from average concentration of measurement.
Any comment:	-

Data / Parameter:	$w_{CH4,biogas,SM,y}$
Data unit:	kg CH_4 / m³
Description:	Concentration of methane in the biogas in the outlet of the new digester that is

	generating biogas from solid materials only, in year *y*
Source of data to be used:	Measured
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Will be defined for each individual CPA and described in the CPA-DD.
Description of measurement methods and procedures to be applied:	Either with continuous analyser or alternatively with periodical measurement at 95% confidence level
QA/QC procedures to be applied:	The equipment will be calibrated in accordance with manufacturer's requirements or once per year if no guidelines are provided by the manufacturer. Equipment will be calibrated prior to or during installation. Additional QA/QC procedures may be defined for each individual CPA and described in the CPA-DD. The error for different levels of measurement frequency shall be defined. The level of accuracy will be deducted from average concentration of measurement
Any comment:	Used to determine $R_{biogas,SM,y}$ in order to discount the heat/power generated by the solid materials. Although biogas created from the solid materials can be expected to be similar to biogas generated from the wastewater in terms of methane content, monitoring the methane content of the biogas of the solid materials is used to correct for any methane concentration fluctuations

Data / Parameter:	$COD_{,PJ,sedim,y}$
Data unit:	t COD/yr
Description:	Amount of chemical oxygen demand lost through sedimentation in the lagoon or sludge pit under the project activity
Source of data to be used:	Measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Will be defined for each individual CPA and described in the CPA-DD.
Description of measurement methods and procedures to be applied:	Sampling procedures described in section E.6.2
QA/QC procedures to be applied:	The COD will be tested by an external accredited laboratory.
Any comment:	-

Data / Parameter:	$\mathbf{FV_{RG,h}}$
Data unit:	Nm^3/hr
Description:	Biogas sent to flare, (Volumetric flow rate of the residual gas in dry basis at normal conditions in the hour *h*.)
Source of data to be used:	Measured with a flow meter.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Will be defined for each individual CPA and described in the CPA-DD.
Description of measurement methods and procedures to be applied:	Measured continuously and averaged hourly. Ensure that it is measured on the same basis (wet or dry) as the volumetric fraction.
QA/QC procedures to be applied:	The equipment will be calibrated in accordance with manufacturer's requirements or once per year if no guidelines are provided by the manufacturer. Equipment will be calibrated prior to or during installation. Additional QA/QC procedures may be defined for each individual CPA and described in the CPA-DD.
Any comment:	-

Data / Parameter:	$\mathbf{fv_{i,h}}$

Data unit:	
Description:	Volumetric fraction of component i in the residual gas in the hour *h* where *i* = CH_4
Source of data to be used:	Measured continuously with a gas analyser.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Will be defined for each individual CPA and described in the CPA-DD.
Description of measurement methods and procedures to be applied:	Continuously using a gas analyser. Values to be averaged hourly or at a shorter time interval. Ensure that the same basis (dry or wet) is considered for this measurement and the measurement of the volumetric flow rate of the residual gas ($FV_{RG,h}$) when the residual gas temperature exceeds 60 ºC
QA/QC procedures to be applied:	The equipment will be calibrated in accordance with manufacturer's requirements, or once per year if no guidelines are provided by the manufacturer. A zero check and a typical value check should be performed by comparison with a standard certified gas. Equipment will be calibrated prior to or during installation. Additional QA/QC procedures may be defined for each individual CPA and described in the CPA-DD.
Any comment:	As a simplified approach only the concentration of methane is measured and the remaining part is considered as N_2

Data / Parameter:	**Other flare operation parameters – Flame detector**
Data unit:	On/Off or numeric value indicating On/Off
Description:	Detection unit
Source of data to be used:	Measured
Value of data applied for the purpose of calculating expected emission reductions in section B.5	The Sensor will be linked to the data logger linked up to an alarm. If the flame goes out, the shift leader/process operator will immediately attend and re-ignite the flame. If the flame is not re-ignited within 20mins, then the emission from that hour will not be included.
Description of measurement methods and procedures to be applied:	Continuously.
QA/QC procedures to be applied:	The detector will be calibrated by the manufacturer and checked on a quarterly basis to ensure that it is operational and functioning correctly.

Any comment:	Used for open flare, as per "Tool to determine project emissions from flaring gases containing Methane", Version 1.0, EB28. Used to demonstrate that the flare is operational (e.g. through a flame detection system reporting electronically on continuous basis)). If the flare is not operational for more than 20 mins the default value to be adopted for flare efficiency is 0%. This parameter is only relevant for open flares. In case of enclosed flared, the parameter T_{flare} is used to indicate that the flare is operating.

Data / Parameter:	T_{flare}
Data unit:	°C
Description:	Temperature in the exhaust gas of the flare
Source of data to be used:	Measurements by project participants
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Measure the temperature of the exhaust gas stream in the flare by a Type N thermocouple. A temperature above 500 ºC indicates that a significant amount of gases are still being burnt and that the flare is operating.
Description of measurement methods and procedures to be applied:	Continuously.
QA/QC procedures to be applied:	Thermocouples should be replaced or calibrated every year.
Any comment:	Used for default efficiency for enclosed flare. 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 / Parameter:	**Flare efficiency**
Data unit:	%
Description:	Flare efficiency of the flare
Source of data to be used:	"Tool to determine project emissions from flaring gases containing methane"
Value of data applied for the purpose of calculating expected emission reductions in section B.5	If the project has an enclosed flare, the 90% default value from the "Tool to determine project emissions from flaring gases containing methane" may be applied. If the project has an open flare, the 50% default value from the "Tool to determine project emissions from flaring gases containing methane" may be applied.
Description of measurement methods and procedures to be applied:	Use of the default factor for enclosed flare or open flare.
QA/QC procedures	

to be applied:	
Any comment:	

Data / Parameter:	$E_{CPJ,j,y}$
Data unit:	MWh
Description:	Quantity of electricity consumed by the project electricity consumption sourced from the grid.
Source of data to be used:	Tool to calculate baseline, project and/or leakage emissions from electricity consumption, Version 1, EB39
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Will be defined for each individual CPA and described in the CPA-DD.
Description of measurement methods and procedures to be applied:	Monitored continuously using electricity meters
QA/QC procedures to be applied:	The equipment will be calibrated in accordance with manufacturer's requirements or once per year if no guidelines are provided by the manufacturer. Equipment will be calibrated prior to or during installation. Additional QA/QC procedures may be defined for each individual CPA and described in the CPA-DD.
Any comment:	

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

A monitoring plan will implemented for each individual CPA by the operator of the project.

Data Monitored Sources
Section E.7.1 describes the data and parameters that may be monitored for each CPA. Data for each parameter will be monitored at a frequency described in the relevant table of section E.7.1. The main equipment used for monitoring is:

- Wastewater flow meters
- Biogas flow meters
- Gas analyser for measuring the methane content in biogas
- Flame detector Temperature sensor for flare monitoring
- Electricity meters (if applicable to the CPA)
- COD laboratory test results.

- Operational logbook of sludge removal events

Monitoring Procedures
Monitoring data will be recorded/downloaded monthly and stored electronically in a database. Any problems with the monitoring equipment will be noted in an operation and maintenance log and entered into the database. Monitoring reports will be produced at a frequency determined by the implementer containing the monthly monitoring data files and details of any equipment faults and/or loss of data. The monitoring report will be submitted to the project participants for review and acceptance.

Monitoring Period
The CPA implementer will select a suitable monitoring period on a case by case basis for the purpose of preparing monitoring reports for verification.

Data Storage
All records will be retained for at least two years after the end of the crediting period during which the data was recorded. All electronic monitoring data will be stored in spreadsheets. Documents and Records will be stored on TBECs server and with the necessary infrastructure for managing document security, access and version control. All records will be retained for at least two years after the end of the crediting period during which the data was recorded. All electronic data will be backed up electronically on a secondary storage device.

Emergency Procedures
If only partial data are available, the monitoring report will be finalized by either make the most conservative assumption theoretically possible or by raising a request for deviation prior to submitting request for issuance, if appropriate. If the calibration requirements of the monitoring plan are not met, the “Guidelines for assessing compliance with the calibration frequency requirements” (Version 01.0 EB52) will be applied.

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

Date of Completion: 05/12/2011
Responsible Person: Paul Corletto

Annex 1

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

Organization:	Thai Biogas Energy Company Limited (TBEC)
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Represented by:	
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The PoA will not use any Overseas Development Aid from Annex 1 countries.

Annex 3

BASELINE INFORMATION

This section is intentionally left blank.

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Annex 4

MONITORING INFORMATION

This section is intentionally left blank.