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

CONTENTS

Annexes

NOTE:

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

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

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

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

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Malaysia Biogas Projects

Version: 04
Date: 14 December 2011

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

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1. General operating and implementing framework of PoA

The Malaysia Biogas Projects is a small-scale CDM Programme of Activities (hereafter referred to as "PoA") developed by GenPower Carbon Solutions Services (Malaysia) Sdn Bhd (GPCS) as a coordinating/managing entity and the proposed project activity will reduce the greenhouse gas (GHG) emissions from Palm Oil Mill Effluent (POME) treating systems by capturing the biogas produced instead of allowing it to escape into the atmosphere. Only small scale CDM projects will participate in this PoA. Each CPA will consist of an individual palm oil mill and the palm oil mill owner or project participant will sign an agreement with GPCS prior to being included in the PoA. GPCS will provide complete CDM service and technical support in terms of management and monitoring to the participating palm oil mills. This technical capacity provided by GPCS will ensure long-term sustainability of the project activity. GPCS has targeted approximately 20% of the total palm oil mills in Malaysia to be included in the PoA.

In Malaysia there are 410 mills in operation with a total annual processing capacity of 92.5 million tonnes of Fresh Fruit Bunch (FFB).[1] Most palm oil mills have opted for the open pond or lagoon system to treat POME as a current practice because this is the most common and least costly solution.[2] The anaerobic decay of organic matter inside the ponds or lagoons is accompanied by the production of methane, a highly potent GHG released in an uncontrolled manner to the atmosphere.

2. Policy/measure or stated goal of the PoA

The main objective of this PoA is to reduce a significant amount of GHG emissions from the palm oil mills in Malaysia. The PoA is aimed to recover the biogas from biogenic organic matter in POME which is released in the anaerobic process by introducing or substituting the current ponds with a biogas recovery system. This would result in a better POME treatment system in terms of performance, management and quality control. The PoA also helps to promote biogas utilization and renewable energy production in Malaysia from the palm oil industry.

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

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[1] "*Review of the Malaysian Oil Palm Industry 2008*." Malaysian Palm Oil Board (MPOB) and Ministry of Plantation Industries and Commodities, 2009.

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

The proposed PoA is a voluntary action by GPCS since the implementation of digesters is a voluntary action at every palm oil mill. There are no laws in Malaysia enforcing the capture of biogas at POME treatment systems and GPCS is not obliged by law to implement the PoA. GPCS also does not have any contractual obligation to implement the PoA. The targeted figure for the PoA of 20% of the total number of palm oil mills in Malaysia is also not mandatory.

The PoA also will support the sustainable development policies of Malaysia and bring direct benefits towards achieving sustainable development. Each CPA will bring direct and indirect sustainable development (social, economic and environmental) benefits as listed below:

Environmental criteria

- The reduction of GHG emissions by CH_4 destruction will improve the quality of the air resulting in the preservation of the climate.
- As solid parts are removed from wastewater, cleaner water will be discharged and this will reduce the risk of water contamination.
- Removal of the foul odor from existing treatment systems.
- Help to promote and support Malaysia's renewable energy programme with biogas utilization.

Economic criteria

- Provide more job opportunities especially for the community near the palm oil mill and the industrial sector involved both directly and indirectly.
- Technology transfer involved by working with several parties, including technology provider for the wastewater treatment system, sub-contractor, supplier and mill partners, to increase the efficiency of the project implementation. Thus the knowledge, expertise, technical and management skills will be enhanced and shared among the parties involved.
- Training will be provided to the local staff to execute and manage the projects in Malaysia, thus increasing the country's qualified manpower and knowledge.
- Improve the palm oil companies' way of doing business in a sustainable manner.
- The project will lead to an increase of the Gross Domestic Product (GDP) and will have a positive impact on the Malaysian annual GDP growth rate.

Social criteria

- Give knowledge and awareness to the people, especially in the local community, with respect to environment, climate change and renewable energy.
- Improve quality of life and environmental condition of the local community. This will lead to a more healthy population.
- Besides providing job opportunities, the project will also catalyze development of the nearby area, with palm oil mills normally located in rural areas.
- The increased job opportunity will reduce social disparity in society and thereby contribute to peace in the society.

The PoA will help Malaysia (generally) and the palm oil industry and local community (specifically) to achieve sustainable development, thus contributing to a better world.

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

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

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

GenPower Carbon Solutions Services (Malaysia) Sdn Bhd will act as a coordinating / managing entity for the PoA.

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

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

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

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A.4.1. Location of the programme of activities:

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The PoA will cover all states of Malaysia.

A.4.1.1. Host Party(ies):

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The host party for the project is Malaysia.

A.4.1.2. Physical/ Geographical boundary:

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The geographical boundary of the PoA will be within the country of Malaysia. The PoA can include all small-scale CDM programme activities (SSC-CPAs) utilizing the Methodology in states of Malaysia.

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

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

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The project activity will apply the AMS III.H. “Methane recovery in wastewater treatment” Version 15 methodology and subsequent versions under the type III project activities “Scope 13 – Waste Handling and Disposal”

A typical CPA will be an individual palm oil mill that will implement the project activity by installing a new treatment system with biogas recovery or installing a biogas recovery system for the existing anaerobic treatment system that currently emits biogas containing 60-65% methane[3] directly to the atmosphere. The Palm Oil Mill Effluent (POME) will be treated under controlled conditions mostly by a new enclosed digester before subsequently being treated further in the existing treatment system at the mill. In the project activity, each CPA is expected to install a state of the art technology which has better performance in terms of efficiency, reliability and quality than the existing system at the palm oil mill. It is expected that several technologies will be available to be considered for each CPA and each technology must comprise measures that recover biogas from biogenic organic matter in wastewater by means of one or a combination of methods based on AMS-III.H. methodology (version 15 and later).

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

Each SSC-CPA is expected to reduce up to 60,000 tCO2e of greenhouse gas annually from the Type III portion of the Project. Additional emission reductions may come from Type I activities at each project site.

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

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

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

1. The project must comprise measures that recover biogas from biogenic organic matter in wastewater by means of one, or a combination, of the following options:
   i. Substitution of aerobic wastewater or sludge treatment systems with anaerobic systems with biogas recovery and combustion.
   ii. Introduction of anaerobic sludge treatment system with biogas recovery and combustion to wastewater treatment plant without sludge treatment.
   iii. Introduction of biogas recovery and combustion to sludge treatment system.
   iv. Introduction of biogas recovery and combustion to an anaerobic wastewater treatment system such as anaerobic reactor, lagoon, septic tank or an on site industrial plant that does not collect biogas.
   v. Introduction of anaerobic wastewater treatment with biogas recovery and combustion, with or without anaerobic sludge treatment, to an untreated wastewater stream.
   vi. Introduction of sequential stage wastewater treatment with biogas recovery and combustion, with or without sludge treatment, to an anaerobic wastewater treatment system without biogas recovery (e.g. introduction of treatment in an anaerobic reactor with biogas recovery as a sequential treatment step for wastewater that is presently being treated in an anaerobic lagoon without methane recovery).
2. The project developer is required to utilize at least 10 percent of biogas for energy utilization.
3. The project has to fulfill Malaysia's National CDM criteria.
4. Each CPA must be approved by the managing entity prior to its incorporation into the PoA.
5. Each CPA must demonstrate in the CPA-DD that the project activity characteristics are defined in a way that precludes project activities to go beyond the limits:
   i. For type I: project participants shall provide proof that the installed capacity of the proposed project activity will not increase beyond 15 MW;
   ii. For type III: project participants shall provide an estimation of emission reductions by the project activity over the crediting period and proof that the emission reductions every year will not go beyond the limits of 60 ktCO2e/y over the entire crediting period.
6. Each CPA must demonstrate the project's additionality by applying "Non-binding best practise examples to demonstrate additionality for SSC project activities" or future updates. Each CPA also will have to demonstrate additionality based on the following criteria before inclusion in the PoA:

   i. Define credible possible alternative scenarios to the project activity. Ensure that the proposed CPA is not the only alternative amongst those considered that is in compliance with mandatory regulations.
   ii. Determine most relevant barrier in terms of investment analysis and barrier analysis to make sure the project activity is additional.
   iii. Either simple cost analysis, investment comparison analysis or benchmark analysis will be carried out to demonstrate the additionality of the project.

iv. The CPA participation is voluntary and there is no requirement or enforcement under existing national/state/local regulations to introduce or substitute the biogas recovery system.

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

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

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

The proposed PoA is a voluntary coordinated action from GPCS to promote the implementation of biogas technology with an option to utilize the captured methane as renewable energy.

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

In the absence of the PoA, the palm oil mills included in the PoA would continue to emit methane to the atmosphere. Malaysia is the second largest palm oil producer in the world and the palm oil producing capacity is increasing every year[4]. The Malaysian palm oil industry recorded a higher processing capacity in 2008 compare to 2007 by 12.1%[5]. In the Malaysian palm oil industry, the only regulation and requirement by Malaysian authority regarding POME treatment systems is the restriction to discharge the POME into the water stream or land; common practice is to use anaerobic open lagoons or ponds.[6]

Without the PoA to provide additional incentives, owners of palm oil mills will not implement the biogas recovery projects because there is no mandatory law to enforce such action in Malaysia. Most of the palm oil mills already comply with the discharge regulation enforced by the local Department of Environment. The incentives such as CDM revenue, energy cost savings and potential renewable energy revenue from the PoA are needed to make sure that the projects are viable and will attract the palm oil mill owners voluntarily participation.

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

Not Applicable

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

Not Applicable

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[4] "*Palm Oil - The Sustainable Oil*", A Report by World Growth, September 2009.
[5] "*Review of the Malaysian Oil Palm Industry 2008*." Malaysian Palm Oil Board (MPOB) and Ministry of Plantation Industries and Commodities, 2009.
[6] B.G. Yeoh "*A Technical and Economic Analysis of Heat and Power Generation from Biomethanation of Palm Oil Mill Effluent*." Electricity Supply Industry in Transition: Issues and Prospect for Asia 14-16 January 2004.

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

GPCS is the coordinating/managing entity of the management and monitoring plan. The operation program will be done by a project developer or technology provider for each CPA, which may include GPCS. Contractual arrangements will be signed with each participating palm oil mill, project developer/technology provider and GPCS.

A.4.4.1. Operational and management plan:

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

Every individual CPA will maintain a record keeping system as in applied Baseline and Monitoring Methodology and detailed in Section E below. GPCS as the managing entity will ensure that each CPA will maintain standard records documenting, will archive the monitoring data in a secure database and will keep the records during the entire crediting period and two years after for each CPA. Data (paper & electronic) will be transmitted semi-annually to GPCS who is responsible for the record keeping relating to production of the Monitoring Reports. GPCS will conduct a data audit and compliance with the Monitoring Plan at least 2 times per year for each CPA.

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

Prior to register a new CPA under the proposed PoA, GPCS, as the managing entity, will check the CPA and PoA databases in the UNFCCC website to ensure that a similar CPA has not been submitted for validation or registered. Currently, there is no PoA in validation or registered in Malaysia. The Designated National Authority of Malaysia also will be consulted prior to the inclusion of the CPA to confirm that the participating palm oil mill has not been registered either as a CDM project activity or as a CPA of another PoA. The individual CPA also has to issue an authorization letter to GPCS informing that they are aware of and have agreed that their activity is being subscribed to this proposed PoA and they are not registered either as a CDM project activity or as a CPA of another PoA.

Each CPA included in this PoA will have a unique identification number as a reference. To avoid double counting, each included CPA with its reference number will be linked with geographic coordinates marked by GPS for each specific fixed site location.

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

GPCS will follow the “Guidance for determining the occurrence of de-bundling under a Programme of Activities (PoA)” to ensure that the proposed CPA is not a de-bundled component of another CDM programme activity (CPA) or CDM project activity.

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

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

A.4.4.2. Monitoring plan:

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

Not Applicable

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

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

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

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

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The projects have not received and will not be seeking public funding from any Annex 1 countries.

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

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

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

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

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The length of the PoA is 28 years.

SECTION C. Environmental Analysis

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

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

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

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

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The project will not have any adverse environmental impacts, including transboundary impacts. In addition, the activity does not fall under those that require Environmental Impact Assessment (EIA) by the host country, Malaysia. Palm oil mills are discharging their treated POME either as Land Application or through the watercourse with the discharge licenses being approved by the local Department of Environment (DOE) under the Environmental Quality Regulations (1978) Palm Oil Effluent Discharge Standard. While the discharge limit may vary from state to state, the regulations do not specify the required treatment technologies. There is also no regulation on the GHG emissions from wastewater treatment operation for the palm oil mill. Each Palm Oil Mill will continue to be regulated according to its permit, as the activities of the PoA will not impact the final water discharge quality.

Rather than causing negative impacts to the environment, the project activity will provide the following environmental benefits:

- Reduction of methane emissions
- Improvement of POME treatment system
- Reduction of risk of water contamination
- Generation of green energy
- Reduction of fossil fuel usage
- Significant reduction of odor

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

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In accordance with Malaysian environmental regulations, Environmental Quality (Prescribed Activities Environmental Impact Assessment) Order 1987, an Environmental Impact Assessment (EIA) is not required for a typical CPA, included in the PoA. Each CPA will have to obtain a letter of exemption for the EIA assessment from Department of Environment.

SECTION D. Stakeholders' comments

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

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

Stakeholder consultation will be undertaken at the CPA level as to reach wider group of stakeholders due to the CPA geographical positions and different group of stakeholder affected. This is to ensure a full participation and consultation of local stakeholders for each CPA participating in the PoA. The PoA requires all relevant stakeholders have been consulted about the CPA through the local stakeholder meeting.

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

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

D.3. Summary of the comments received:

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

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

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

SECTION E. Application of a baseline and monitoring methodology

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

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

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The approved SSC baseline and monitoring methodology applied to a SSC-CPA included in this PoA is AMS-III.H. "Methane recovery in wastewater treatment" Version 15.

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

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

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Requirement for applicability of the methodology	Compliance of CPA with the given requirement	Reference
This methodology comprises measures that recover biogas from biogenic organic matter in wastewater by means of one, or a combination, of the following options: (a) Substitution of aerobic wastewater or sludge treatment systems with anaerobic systems with biogas recovery and combustion; (b) Introduction of anaerobic sludge treatment system with biogas recovery and combustion to a wastewater treatment plant without sludge treatment; (c) Introduction of biogas recovery and combustion to a sludge treatment system; (d) Introduction of biogas recovery and combustion to an anaerobic wastewater treatment system such as anaerobic reactor, lagoon, septic tank or an on site industrial plant; (e) Introduction of anaerobic wastewater treatment with biogas recovery and combustion, with or without anaerobic sludge treatment, to an untreated wastewater stream; (f) Introduction of a sequential stage of wastewater treatment with biogas recovery and combustion, with or without sludge treatment, to an anaerobic wastewater treatment system without biogas recovery (e.g. introduction of treatment in an anaerobic reactor with biogas recovery as a sequential treatment step for the wastewater that is presently being treated in an anaerobic lagoon without methane recovery).	The CPA to be implemented under this PoA will involve biogas recovery from biogenic organic matter in POME by means of one or a combination of the six options as in the Methodology. The activity will contribute in the avoidance of methane emissions to the atmosphere.	AMS – III.H./ Version 15 Paragraph 1
In cases where baseline system is anaerobic lagoon the methodology is applicable if: a) The lagoons are ponds with a depth greater than two meters, without aeration. The value for depth is obtained from engineering design documents, or through direct measurement, or by dividing the total volume by the surface area. If the lagoon filling level varies seasonally, the average of the highest and lowest levels may be taken; b) Ambient temperature above 15°C, at least during part of the year, on a monthly average basis; c) The minimum interval between two consecutive sludge removal events shall be 30 days.	Anaerobic open lagoon system is the common practice adopted by palm oil mills to treat the water because it is the least costly solution. GPCS will ensure that each CPA under this PoA complies with the methodological requirement regarding the anaerobic pond criteria.	AMS – III.H./ Version 15 Paragraph 2

The recovered biogas from the above measures may also be utilized for the following applications instead of combustion/flaring: (a) Thermal or electrical energy generation directly; (b) Thermal or electrical energy generation after bottling of upgraded biogas; or (c) Thermal or electrical energy generation after upgrading and distribution: (i) Upgrading and injection of biogas into a natural gas distribution grid with no significant transmission constraints; (ii) Upgrading and transportation of biogas via a dedicated piped network to a group of end users; or (d) Hydrogen production.	The CPA involves facilities to burn by flaring the biogas generated or utilize for renewable energy. CPA will have an option to utilize the biogas recovered for energy instead of flaring depending on each site specification and requirement. The Malaysian National CDM criteria require a project developer to utilize at least 10 percent of biogas for energy utilization.	AMS – III.H./ Version 15 Paragraph 3
If the recovered biogas is used for project activities covered under paragraph 3 (a), that component of the project activity can use a corresponding methodology under Type I.	One of the options in the CPA. GPCS will make sure that each CPA under this PoA complies with the methodological requirement.	AMS – III.H./ Version 15 Paragraph 4
If the recovered biogas is utilized for the production of hydrogen (project activities covered under paragraph 3 (d)), that component of the project activity shall use corresponding methodology AMS-III.O.	One of the options in the CPA. GPCS will make sure that each CPA under this PoA complies with the methodological requirement.	AMS – III.H./ Version 15 Paragraph 5
For project activities covered under paragraph 3 (b), if bottles with upgraded biogas are sold outside the project boundary, the end-use of the biogas shall be ensured via a contract between the bottled biogas vendor and the end-user. No emission reductions may be claimed from the displacement of fuels from the end use of bottled biogas in such situations. If however the end use of the bottled biogas is included in the project boundary and is monitored during the crediting period CO_2 emissions avoided by the displacement of fossil fuel can be claimed under the corresponding Type I methodology, e.g. AMS-I.C.	One of the options in the CPA. GPCS will make sure that each CPA under this PoA complies with the methodological requirement.	AMS – III.H./ Version 15 Paragraph 6
For project activities covered under paragraph 3 (c) (i), emission reductions from the displacement of the use of natural gas are eligible under this methodology, provided the geographical extent of the natural gas distribution grid is within the host country boundaries.	One of the options in the CPA. GPCS will make sure that each CPA under this PoA complies with the methodological requirement.	AMS – III.H./ Version 15 Paragraph 7

For project activities covered under paragraph 3 (c) (ii), emission reductions for the displacement of the use of fuels can be claimed following the provision in the corresponding Type I methodology, e.g. AMS-I.C.	One of the options in the CPA. GPCS will make sure that each CPA under this PoA complies with the methodological requirement.	AMS – III.H./ Version 15 Paragraph 8
For project activities covered under paragraph 3 (b) and (c), this methodology is applicable if the upgrade is done using one of the following technologies[7] such that the methane content of the upgraded biogas is in accordance with relevant national regulations (where these exist) or, in the absence of national regulations, a minimum of 96% (by volume). These conditions are necessary to ensure that the recovered biogas is completely destroyed through combustion in an end use: • Pressure Swing Adsorption; • Absorption with/without water circulation; • Absorption with water, with or without water recirculation (with or without recovery of methane emissions from discharge).	One of the options in the CPA. GPCS will make sure that each CPA under this PoA complies with the methodological requirement.	AMS – III.H./ Version 15 Paragraph 9
New facilities (Greenfield projects) and project activities involving a change of equipment resulting in a capacity addition of the wastewater or sludge treatment system compared to the designed capacity of the baseline treatment system are only eligible to apply this methodology if they comply with the relevant requirements in the General guidelines to SSC CDM methodologies. In addition the requirements for demonstrating the remaining lifetime of the equipment replaced, as described in the general guidelines shall be followed.	GPCS will make sure that each CPA under this PoA complies with the methodological requirement and follow the guidelines.	AMS – III.H./ Version 15 Paragraph 10
For project activities covered under paragraph 3 (b) and (c), additional guidance provided in Annex 1 shall be followed for the calculations, in addition to the procedures in the relevant sections below.	GPCS will make sure that each CPA under this PoA complies with the methodological requirement and follow the guidelines.	AMS – III.H./ Version 15 Paragraph 11
The location of the wastewater treatment plant as well as the source generating the wastewater shall be uniquely defined and described in the PDD.	The location of each CPA will be indentified by specific reference code, address, map and GPS coordinates. The wastewater generating source	AMS – III.H./ Version 15 Paragraph 12

[7] Please refer to annex 1 of the approved methodology AM0053/Version 01.1 regarding the description of these technologies.

	will be defined and described in the PDD and also shown in the baseline and project activity diagram.	
Measures are limited to those that result in aggregate emissions reductions of less than or equal to 60 kt CO_2 equivalent annually from all Type III components of the project activity.	This PoA only includes individual CPAs which will result in less than or equal to 60 kt CO_2 equivalent annually from all Type III components of the project activity.	AMS – III.H./ Version 15 Paragraph 13

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

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

Leakage emissions associated with CPAs will be accounted for in accordance with the requirements of the baseline and monitoring methodology.

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

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The PoA and consequently each CPA applies the simplified baseline methodology for selected small-scale CDM project activity AMS-III.H "Methane recovery in wastewater treatment" Version 15.

A baseline shall be established on a project-specific basis for each CPA. The baseline scenario will be investigated and identified during the feasibility study in the planning stage or before any project activity decision is confirmed. This will be done at the CPA level. The identified baseline must be in accordance with the procedures provided in the approved small scale baseline and monitoring methodology of AMS-III.H. The option taken must be consistent with mandatory applicable laws and regulations and not presented with investment or technical barriers in the baseline scenario.

The Small-Scale CDM Programme Activity Design Document (CDM-SSC-CPA-DD) will describe in detail the baseline for each CPA after the baseline scenario has been identified.

Historical records of at least one year prior to the project implementation shall be used for baseline data where this is available. This shall include for example the COD removal efficiency of the wastewater treatment systems, the amount of dry matter in sludge, power and electricity consumption per m^3 of wastewater treated, the amount of final sludge generated per tonne of COD treated, and all other parameters required for determination of baseline emissions.

If one year of historical data is not available:

(a) The parameters shall be determined by a measurement campaign in the baseline wastewater systems for at least 10 days. The measurements should be undertaken during a period that is representative for the typical operation conditions of the systems and ambient conditions of the site (temperature, etc). Average values from the measurement campaign shall be used and the result shall be multiplied by 0.89 to account for the uncertainty range (30% to 50%) associated with this approach as compared to one-year of historical data;

(b) In the case of Greenfield and capacity addition projects, one of the following procedures shall be used to determine the baseline emissions:

    (i) Value obtained from a measurement campaign in a comparable existing wastewater treatment plant i.e. having similar environmental and technological circumstances for example treating similar flow and same type of wastewater (domestic, industrial, etc.), located in the same host country and region. Average values from the measurement campaign shall be used and the result shall be multiplied by 0.89 to account for the uncertainty range (30% to 50%) associated with this approach;

    (ii) Value provided by the manufacturer/designer of a Greenfield wastewater treatment plant using the same technology, demonstrated to be conservative (less emitting), for example by choosing parameters from the top 20 per cent of the plants installed in the last five years designed for the same country/region to treat the same type and similar flow of wastewater as in the project activity.

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

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

(v) Methane emissions from the decay of the final sludge generated by the baseline treatment systems ($BE_{s,final,y}$).

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

The additionality of the programme could be demonstrated considering that there are no mandatory regulations and requirements to collect and burn the methane produced by the anaerobic activity of POME at palm oil mills. The environmental regulations establish only a restriction on discharging the POME into water or on land. The common practice in the palm oil industry in Malaysia is to use anaerobic lagoons and polishing aerobic lagoons in order to treat the POME up to a required level for discharge.

Investment is required to implement a biogas recovery and collection system with combustion of methane produced from POME. The possible return by generating energy for either electricity or heat, if applicable, is rather small. As the implementation cost of the project is too great compared to the current low tech lagoon/pond solution which has proved effective, these projects will only be implemented if revenue from CERs supplements any other income sources possible.[8,9,10]

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

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

>>
Each CPA included in this PoA is a small scale project activity. The Project's additionality will be demonstrated by applying the "Non-binding best practise examples to demonstrate additionality for SSC project activities" and "Guidelines for objective demonstration and assessment of barriers." The "Tool for the demonstration and assessment of additionality" can also be used to demonstrate additionality but is not mandatory. The additionality will be assessed and demonstrated at the CPA level.

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

a. Investment barrier

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

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

[10] United Nations Development Program, '*Generating Renewable Energy from Palm Oil Wastes*', August 2007.

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

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

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

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

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

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

Around 85% of palm oil mills are adopting anaerobic lagoon/pond systems and it is considered the prevailing practice for palm oil industry to treat POME[11]. The open anaerobic ponds system is an effective and low-tech solution that can easily meet the water discharge limits applicable to the palm oil industry. The existing system which consists of anaerobic/facultative/aerobic lagoons/ponds has been able to meet the current permitted discharge level of biological oxygen demand (BOD) set by the Department of Environment Malaysia. Only a few mills have reported the use and operation of a closed-tank anaerobic bioreactor equipped with a biogas recovery system because it is relatively new in Malaysia and not readily acceptable in the palm oil industry in Malaysia.[12]

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

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

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

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

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

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

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

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

E.6.1. Explanation of methodological choices, provided in the approved baseline and

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

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

monitoring methodology applied, selected for a typical SSC-CPA:

>>

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

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

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

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

>>

A. Calculation of Baseline Emissions.

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

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

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

Where:

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

shall be neglected

The tool and equations related to the baseline determination

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

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

Where:

$Q_{ww,i,y}$	Volume of wastewater treated in baseline wastewater treatment system *i* in year *y* (m^3)
$COD_{removed,i,y}$	Chemical oxygen demand removed by baseline treatment system *i* in year *y* (t/m^3), measured as the difference between inflow COD and the outflow COD in system *i*
$MCF_{ww,treatment,BL,i}$	Methane correction factor for baseline wastewater treatment systems *i*
i	Index for baseline wastewater treatment system
$B_{o,ww}$	Methane producing capacity of the wastewater
UF_{BL}	Model correction factor to account for model uncertainties
GWP_{CH4}	Global Warming Potential for methane

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

Where:

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

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

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

Where:

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

If the baseline wastewater treatment system is different from the treatment system in the project scenario, the sludge generation rate (amount of sludge generated per unit of COD removed) in the baseline may

differ significantly from that of the project scenario. Therefore, for these cases, the monitored values of the amount of sludge generated during the crediting period will be used to estimate the amount of sludge generated in the baseline, as follows:

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

Where:

$S_{l,PJ,y}$	Amount of dry matter in the sludge treated by the sludge treatment system *l* in year *y* in the project scenario (t)
SGR_{BL}	Sludge generation ratio of the wastewater treatment plant in the baseline scenario (t of dry matter in sludge / t COD removed). This ratio will be measured *ex ante* through representative measurement campaign, or using historical records of COD removal and sludge generation of at least one year prior to the project implementation as per paragraph 18 or 19 of AMS-III.H./Version 15
SGR_{PJ}	Sludge generation ratio of the wastewater treatment plant in the project scenario (t of dry matter in sludge / t COD removed). Calculated using the monitored values of COD removal and sludge generation in the project scenario

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

Where:

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

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

Where:

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

B. Calculation of Project Emissions.

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

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

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

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

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

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

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

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

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

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

Where:

PE_y	Project activity emissions in the year y (tCO_2e)
$PE_{power,y}$	Emissions from electricity or fuel consumption in the year y (tCO_2e)
$PE_{ww,treatment,y}$	Methane emissions from wastewater treatment systems affected by the project activity, and not equipped with biogas recovery, in year y (tCO_2e)
$PE_{s,treatment,y}$	Methane emissions from sludge treatment systems affected by the project activity, and not equipped with biogas recovery, in year y (tCO_2e)
$PE_{y,ww,discharge}$	Methane emissions from degradable organic carbon in treated wastewater in year y (tCO_2e)
$PE_{s,final,y}$	Methane emissions from anaerobic decay of the final sludge produced in year y (tCO_2e)
$PE_{fugitive,y}$	Methane emissions from biogas release in capture systems in year y (tCO_2e)
$PE_{flaring,y}$	Methane emissions due to incomplete flaring in year y as per the “Tool to determine project emissions from flaring gases containing methane”(tCO_2e)
$PE_{biomass,y}$	Methane emissions from biomass stored under anaerobic conditions. In case storage of biomass under anaerobic conditions takes place in the project and does not occur in the baseline, methane emissions due to anaerobic decay of this biomass shall be considered and be determined as per the procedure in the “Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site” (tCO_2e)

The tools and equations related to the Project Activity Emission determination

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

$$PE_{ww,treatment,y} = \sum_k (Q_{ww,k,y} * COD_{removed,PJ,k,y} * MCF_{ww,treatment,PJ,k}) * B_{o,ww} * UF_{PJ} * GWP_{CH4} \quad \textbf{(9)}$$

Where:

$Q_{ww,k,y}$	Volume of wastewater treated in project wastewater treatment system *k* in year *y* (m^3)
$COD_{removed,PJ,k,y}$	Chemical oxygen demand removed by project wastewater treatment system *k* in year *y* (t/m^3), measured as the difference between inflow COD and the outflow COD in system *k*
$MCF_{ww,treatment,PJ,k}$	Methane correction factor for project wastewater treatment system *k*
k	Index for project wastewater treatment system
$B_{o,ww}$	Methane producing capacity of the wastewater
UF_{PJ}	Model correction factor to account for model uncertainties
GWP_{CH4}	Global Warming Potential for methane

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

Where:

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

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

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

Where:

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

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

Where:

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

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

Where:

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

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

Where:

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

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

Where:

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

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

Where:

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

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

Where:

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

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

Where:

$S_{l,PJ,y}$	Amount of sludge treated in the project sludge treatment system *l* equipped with a biogas recovery system (on a dry basis) in year *y* (t)

$MCF_{s,treatment,PJ,l}$	Methane correction factor for the sludge treatment system equipped with biogas recovery equipment
UF_{PJ}	Model correction factor to account for model uncertainties

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

C. Leakage

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

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

D. Calculation of Emission Reduction.

For all scenarios in paragraph 1, i.e. 1 (a) to 1 (f),[13] emission reductions shall be estimated *ex ante* in the PDD using the equations provided in the baseline, project and leakage emissions sections above. Emission reductions shall be estimated *ex ante* as follows:

$$ER_{y,ex\,ante} = BE_{y,ex\,ante} - \left(PE_{y,ex\,ante} + LE_{y,ex\,ante}\right) \quad (19)$$

Where:

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

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

[13] AMS-III.H./Version 15, page 1.

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

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

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

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

Where:

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

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

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

Where:

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

For the cases listed in baseline scenario as:

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

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

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

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

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

In case (a) if the volumetric flow and the characteristic properties (e.g. COD) of the inflow and outflow of the wastewater are equivalent in the project and the baseline scenarios (i.e. the project and baseline systems have the same efficiency for COD removal for wastewater treatment), then the higher energy consumption and sludge generation in the baseline scenario are the only significant differences contributing to emission reductions in the project case. In this case, the emission reductions can be calculated as the difference between the historical energy consumption of the replaced unit and the recorded energy consumption of the new system, plus the difference in emissions from sludge treatment and/or disposal. Project emissions from fugitive emissions and incomplete flaring ($PE_{fugitive,y}$, $PE_{flaring,y}$) shall also be considered in the calculation of the emission reductions; however, the emissions from the wastewater outflow and sludge ($PE_{ww,discharge,y}$, $PE_{s,final,y}$) may be disregarded, if they are equivalent in the baseline and project scenarios.

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

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

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

Data / Parameter:	**$COD_{removed,i,y}$**
Data unit:	t COD/m^3
Description:	Chemical oxygen demand removed by baseline treatment system *i* in year *y* (t/m3), measured as the difference between inflow COD and outflow COD in system *i*
Source of data used:	Historical data or measurement campaign. For Greenfield and capacity addition projects: (i) The value obtained from measurement campaign of comparable existing wastewater plant (ii) The value provided by the manufacturer/designer of Greenfield wastewater treatment plant using the same

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

Data / Parameter:	**MCF** $_{ww, treatment,BL,i}$
Data unit:	Fraction
Description:	Methane correction factor for baseline wastewater treatment systems *i*
Source of data used:-	Table III.H.1, AMS III.H./Version 15
Value applied:	Will be based on type of wastewater system
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	

Data / Parameter:	$B_{o,ww}$
Data unit:	kg CH_4 per kg COD
Description:	Methane producing capacity of the wastewater
Source of data used:	IPCC value in AMS III.H./Version 15
Value applied:	0.25
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	The parameter will remain constant for the entire crediting period for each CPA

Data / Parameter:	UF_{BL}
Data unit:	Fraction
Description:	Model correction factor to account for model uncertainties
Source of data used:-	IPCC value in AMS III.H./Version 15
Value applied:	0.89
Justification of the choice of data or description of measurement methods and procedures actually applied :	To account for the uncertainty associated with calculation model
Any comment:	The parameter will remain constant for the entire crediting period for each CPA

Data / Parameter:	**GWP** $_{CH4}$
Data unit:	Fraction
Description:	Global Warming Potential for methane
Source of data used:-	IPCC value in AMS III.H./Version 15
Value applied:	21
Justification of the choice of data or description of measurement methods	In line with the requirement of the baseline monitoring methodology

and procedures actually applied :	
Any comment:	The parameter will remain constant for the entire crediting period for each CPA

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

Data / Parameter:	**DOC_s**
Data unit:	Fraction
Description:	Degradable organic content of the untreated sludge generated in the year *y* (dry basis)
Source of data used:	Default value in AMS III.H./Version 15
Value applied:	To be determined with respect to each CPA
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	Default values of 0.5 for domestic sludge and 0.257 for industrial sludge shall be used. The IPCC default values of 0.05 for domestic sludge (wet basis, considering a default dry matter content of 10 percent) or 0.09 for industrial sludge (wet basis, assuming dry matter content of 35 percent), were corrected for dry basis

Data / Parameter:	**$MCF_{s,treatment,BL,j}$**
Data unit:	Fraction
Description:	Methane correction factor for the baseline sludge treatment system *j*
Source of data used:-	Table III.H.1, AMS III.H./Version 15
Value applied:	Will be based on type of wastewater system

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

Data / Parameter:	**DOC_F**
Data unit:	Fraction
Description:	Fraction of degradable organic content dissimilated to biogas
Source of data used:	IPCC default value in AMS III.H./Version 15
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	The parameter will remain constant for the entire crediting period for each CPA

Data / Parameter:	**F**
Data unit:	Fraction
Description:	Fraction of CH_4 in biogas
Source of data used:	IPCC default value in AMS III.H./Version 15
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	The parameter will remain constant for the entire crediting period for each CPA

Data / Parameter:	**$EF_{composting}$**
Data unit:	t CH_4/t waste (sludge) treated
Description:	Emission factor for composting organic waste
Source of data used:	IPCC default value in AMS III.H./Version 15
Value applied:	0.01 (dry weight basis)
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	Emission factors can be based on facility/site-specific measurements, country specific values or IPCC default values (Table 4.1, chapter 4, Volume 5, 2006 IPCC Guidelines for National Greenhouse Gas Inventories)

Data / Parameter:	**$Q_{ww,y}$**
Data unit:	m^3
Description:	Volume of treated wastewater discharged in year *y*
Source of data used:	Historical data or measurement campaign. For Greenfield and capacity addition projects: (i) The value obtained from measurement campaign of comparable existing wastewater plant

	(ii) The value provided by the manufacturer/designer of Greenfield wastewater treatment plant using the same technology, demonstrated to be conservative
Value applied:	To be determined with respect to each CPA
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	

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

Data / Parameter:	**$MCF_{ww,BL,discharge}$**
Data unit:	Fraction
Description:	Methane correction factor based on discharge pathway in the baseline situation (e.g. into sea, river or lake) of the wastewater
Source of data used:	Table III.H.1, AMS III.H./Version 15
Value applied:	Will be based on type of discharge pathway system
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	

Data / Parameter:	**$S_{final,BL,y}$**
Data unit:	t
Description:	Amount of dry matter in the final sludge generated by the baseline wastewater treatment systems in year *y*
Source of data used:	Calculation, historical data or measurement campaign. For Greenfield and capacity addition projects: (i) The value obtained from measurement campaign of comparable existing wastewater plant (ii) The value provided by the manufacturer/designer of

	Greenfield wastewater treatment plant using the same technology, demonstrated to be .conservative
Value applied:	To be determined with respect to each CPA
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	If the baseline wastewater treatment system is different from the project system, it will be estimated using the monitored amount of dry matter in the final sludge generated by the project activity ($\mathbf{S}_{final,PJ,y}$) corrected for the sludge generation ratios of the project and baseline systems as per Equation 5

Data / Parameter:	$\mathbf{MCF}_{s, BL,final}$
Data unit:	Fraction
Description:	Methane correction factor of the disposal site that receives the final sludge in the baseline situation
Source of data used:-	Table III.H.1, AMS III.H./Version 15
Value applied:	Estimated as per the procedures described in the “Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site”
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	

2. **Data Parameters for calculating project emissions**

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

Data / Parameter:	$\mathbf{MCF}_{ww, treatment,PJ,k}$
Data unit:	Fraction
Description:	Methane correction factor for project wastewater treatment

	system *k*
Source of data used:-	Table III.H.1, AMS III.H./Version 15
Value applied:	Will be based on type of discharge pathway system
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	

Data / Parameter:	**$COD_{removed,PJ,k,y}$**
Data unit:	t COD/m^3
Description:	Chemical oxygen demand removed by project wastewater treatment system *k* in year *y*
Source of data used:	Measured as the difference between inflow COD and the outflow COD in system *k*
Value applied:	To be determined with respect to each CPA
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	

Data / Parameter:	**UF_{PJ}**
Data unit:	Fraction
Description:	Model correction factor to account for model uncertainties
Source of data used:-	IPCC value in AMS III.H./Version 15
Value applied:	1.12
Justification of the choice of data or description of measurement methods and procedures actually applied :	To account for the uncertainty associated with calculation model
Any comment:	The parameter will remain constant for the entire crediting period for each CPA

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

Data / Parameter:	**$MCF_{s, treatment,l}$**
Data unit:	Fraction
Description:	Methane correction factor for the project sludge treatment system *l*
Source of data used:-	Table III.H.1, AMS III.H./Version 15

Value applied:	Will be based on type of wastewater system
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	

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

Data / Parameter:	**MCF** $_{ww, PJ, discharge}$
Data unit:	Fraction
Description:	Methane correction factor based on the discharge pathway of the wastewater in the project scenario (e.g. into sea, river or lake)
Source of data used:-	Table III.H.1, AMS III.H./Version 15
Value applied:	Will be based on type of discharge pathway system
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	

Data / Parameter:	**MCF** $_{s, PJ, final}$
Data unit:	Fraction
Description:	Methane correction factor of the disposal site that receives the final sludge in the project scenario
Source of data used:-	Table III.H.1, AMS III.H./Version 15
Value applied:	Estimated as per the procedures described in the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site"
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	

Data / Parameter:	**S** $_{final,PJ,y}$
Data unit:	t
Description:	Amount of dry matter in final sludge generated by the project wastewater treatment system in year *y*
Source of data used:	Measured
Value applied:	To be determined with respect to each CPA

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

Data / Parameter:	**CFE** $_{ww}$
Data unit:	Fraction
Description:	Capture efficiency of the biogas recovery equipment in the wastewater treatment system
Source of data used:	Measured or used default value in AMS III.H./Version 15
Value applied:	To be determined with respect to each CPA
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	

Data / Parameter:	**MEP** $_{ww, treatment, y}$
Data unit:	t
Description:	Methane emission potential of wastewater treatment system equipped with biogas recovery system in year *y*
Source of data used:	Calculated as per Equation 15
Value applied:	To be determined with respect to each CPA
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	

Data / Parameter:	**CFE** $_{s}$
Data unit:	Fraction
Description:	Capture efficiency of the biogas recovery equipment in the sludge treatment system
Source of data used:	Default value in AMS III.H./Version 15
Value applied:	0.9
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	

Data / Parameter:	**MEP** $_{s, treatment, y}$
Data unit:	t
Description:	Methane emission potential of the sludge treatment system equipped with a biogas recovery system in year *y*
Source of data used:	Calculated as in Equation 17
Value applied:	To be determined with respect to each CPA
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology

Any comment:	

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

Data / Parameter:	**$MCF_{s, treatment,PJ,l}$**
Data unit:	Fraction
Description:	Methane correction factor for the sludge treatment system equipped with biogas recovery equipment
Source of data used:-	Table III.H.1, AMS III.H./Version 15
Value applied:	Will be based on type of discharge pathway system
Justification of the choice of data or description of measurement methods and procedures actually applied :	In line with the requirement of the baseline monitoring methodology
Any comment:	

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

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

Data / Parameter:	**D_{CH4}**

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

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

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

Data / Parameter:	$\mathbf{Q}_{ww,i,y}$
Data unit:	m^3
Description:	Volume of wastewater treated in baseline wastewater treatment system *i* in year *y*
Source of data to be used:	Measured during the project activity
Value of data applied for the purpose of calculating expected emission reductions in section E.6.	To be determined with respect to each CPA
Description of measurement methods and procedures to be applied:	The effluent inflow will be monitored continuously using flow meter
QA/QC procedures to be applied:	• The data will be measured directly • The data are monitored continuously (at least hourly measurements are taken) • Data are recorded and stored electronically in a data log file • The flow meter undergoes maintenance/calibration per manufacturer's specifications
Any comment:	Confidence and precision level of 90/10 shall be attained if the measurements are less than hourly

Data / Parameter:	$\mathbf{COD}_{ww,untreated,y}$
Data unit:	t COD/m^3
Description:	Chemical oxygen demand of untreated wastewater before the

	treatment system affected by the project activity
Source of data to be used:	Measured during the project activity
Value of data applied for the purpose of calculating expected emission reductions in section E.6.	To be determined with respect to each CPA
Description of measurement methods and procedures to be applied:	• The COD measurement will be onsite or by a third party laboratory • COD measurement must be according to national or international standard • The COD is measured through representative sampling
QA/QC procedures to be applied:	• Monthly measurement or shorter interval • COD reports are recorded manually and stored in a data log file • COD measurement cross checks are done at least once a year in an external laboratory to confirm onsite measurements • The COD measurement equipment undergoes maintenance/calibration per manufacturer's specifications • A trained and qualified person will be in charge of the COD measurement
Any comment:	Samples and measurements shall ensure a 90/10 confidence/ precision level

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

	precision level

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

Data / Parameter:	**$S_{l,PJ,y}$**
Data unit:	t
Description:	Amount of dry matter in the sludge treated by the sludge treatment system in the project activity
Source of data to be used:	Measured during the project activity
Value of data applied for the purpose of calculating expected emission reductions in section E.6.	To be determined with respect to each CPA
Description of measurement methods and procedures to be applied:	• Monitoring of 100% of the sludge amount through continuous or batch measurements and moisture content through representative sampling
QA/QC procedures to be applied:	• The volume (m^3) and density or direct weighing may be used to determine the sludge amount • Representative samples are taken to determine the moisture content to calculate the total sludge amount on dry basis • The weight measurement equipment undergoes maintenance/calibration per manufacturer's specifications
Any comment:	• Samples and measurements shall ensure a 90/10 confidence/precision level

	• If the methane emissions from anaerobic decay of the final sludge are to be neglected because the sludge is controlled, combusted, disposed of in a landfill with methane recovery, or used for soil application, then the end-use of the final sludge will be monitored during the crediting period • If the baseline emissions include the anaerobic decay of final sludge generated by the baseline treatment systems in a landfill without methane recovery, the baseline disposal site shall be clearly defined, and verified by the DOE

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

Data / Parameter:	**$BG_{burnt,y}$**
Data unit:	m^3
Description:	Biogas flared/combusted in year *y*
Source of data to be used:	Measured during the project activity
Value of data applied for the purpose	To be determined with respect to each CPA

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

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

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

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

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

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

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

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

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MONITORING PLAN

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

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

Specifically, the MP facilitates the following:

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

GPCS, as a managing entity, will make sure all individual CPAs will be verified based on the unique identification number as a reference to assure single counting of the PoA. The CPA with the reference

will be linked with geographic coordinates marked by GPS coordinate based on each specific fixed site location.

Monitoring obligations

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

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

Management and operational systems

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

Data handling

- Each CPA will develop and implement a protocol that establishes a transparent system for the collection, computation and storage of data, including adequate record keeping and data monitoring systems which will be fit for an independent auditing and verification process
- Every individual CPA will maintain its own monitoring system, data collection system and record keeping system
- GPCS as the managing entity will oversee and ensure that each CPA will maintain standard record documenting, archive the monitored data in a secure database and keep the records during the entire crediting period of each CPA and two years after the crediting period
- Data (paper & electronic) will be transmitted semi-annually to GPCS who is responsible for the compilation of the Monitoring Reports. GPCS will conduct a data audit and compliance review with the Monitoring Plan at least 2 times per year for each CPA

Quality assurance

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

Training

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

– Health and safety requirements also will be given priority

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

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

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The baseline study and monitoring methodology was completed on 8 August 2010 by:

Asrulnizam Bin Alias
CDM Project Engineer

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Annex 1

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<u>Annex 2</u>

INFORMATION REGARDING PUBLIC FUNDING

The projects have not received and will not be seeking public funding from Annex 1 countries.

<u>Annex 3</u>

BASELINE INFORMATION

No additional information.

<u>Annex 4</u>

MONITORING INFORMATION

No additional information.

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