PROGRAMME DESIGN DOCUMENT FORM FOR SMALL-SCALE CDM PROGRAMMES OF ACTIVITIES (F-CDM-SSC-PoA-DD) Version 02.0

PROGRAMME OF ACTIVITIES DESIGN DOCUMENT (PoA-DD)

PART I. Programme of activities (PoA)

SECTION A. General description of PoA

A.1. Title of the PoA

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Power generation using biogas from state-owned palm oil mills in the Republic of Indonesia

Version 04
Date: 12/02/2013

A.2. Purpose and general description of the PoA

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1. Policy/measure or stated goal of the PoA

Amidst projections of expansion in energy consumption, the Government of Indonesia has adopted a policy of limiting fossil fuel consumption and advancing development of new and renewable energies (Presidential Decree No.5/2006 National Energy Policy). It aims to obtain 17% of energy from such sources by 2020 (5% from biofuel, 5% from geothermal energy, 5% from other energies, i.e. biomass, nuclear, hydropower, solar power, wind power, and 2% from liquefied coal). In 2010, the government further raised this numerical target for the energy mix to 25% by 2025, and this policy is referred to as "Vision 25/25." As incentives for realizing this policy objective, the Ministry of Energy and Mineral Resources hiked the feed-in tariff in January 2012, and it also raised the purchase price for excess power generated from biogas to Ruphia 975 per kWh (No.4/2012).

This PoA is consistent with the said policy of the Government of Indonesia.

2. Framework for the implementation of the proposed PoA

The Project for Power Generation using Biogas from State-owned Palm Oil Mills in the Republic of Indonesia is a program CDM (PoA) which aims to collect biogas (methane gas) that is currently discharged into the atmosphere from existing lagoons at state-owned palm oil mills in the Republic of Indonesia, with a view to using it for generating electric power.

The CME is the PT. RISET PERKEBUNAN NUSANTARA.

In the standard CPA as prescribed in the PoA, a biogas collection system will be installed in existing lagoons, methane gas that is otherwise atmospherically discharged will be collected, and power will be generated using this biogas, thereby converting the methane gas into carbon dioxide. Moreover, through supplying the generated power to the local grid, it will be possible to reduce emissions of greenhouse gases. Concerning the biogas collection system, covers will be placed over part or all of the existing lagoons, blowers will be used to absorb the biogas generated under the covers, and the biogas will be sent to the biogas generator by pump.

The PT. RISET PERKEBUNAN NUSANTARA, which is the CME, will execute the following items in order to manage the CPA prescribed in this PoA.

- All information concerning the CPA will be consolidated in the PT. RISET PERKEBUNAN NUSANTARA once every year.
- Each CPA will be conferred with an identification number and will be managed based on serial numbers. Moreover, an electronic database will be prepared to manage the following items of

information concerning each CPA. Through managing the information of each CPA, debundling check will simultaneously be conducted.

- A standard format for recording monitoring data will be created and provided to each CPA implementer. The monitoring data will be stored in the CME's electronic database.
- In implementation of each CPA, support will be provided for selection of devices, contracting with the power company, preparation of verification and provision of technical guidance, etc. Moreover, when introducing or maintaining the equipment systems in each CPA, collaboration will be sought with the outsourcing company to ensure that the required specifications are met.
- Letters of intent will be signed with CPA implementers, guaranteeing that each CPA will be incorporated into the PoA (i.e. will not be registered with other PoA or as independent CDM projects), thereby avoiding double-counting.

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

The CME is the PT. RISET PERKEBUNAN NUSANTARA that is one of major research institute for Indonesian estate crops production and their utilization, and the PoA will be managed as a voluntary action. The PoA will be implemented with the aim of assisting new energy utilization plans in those countries where activities are not advancing as planned due to financial or technical problems. The PoA does not constitute a profit-making activity.

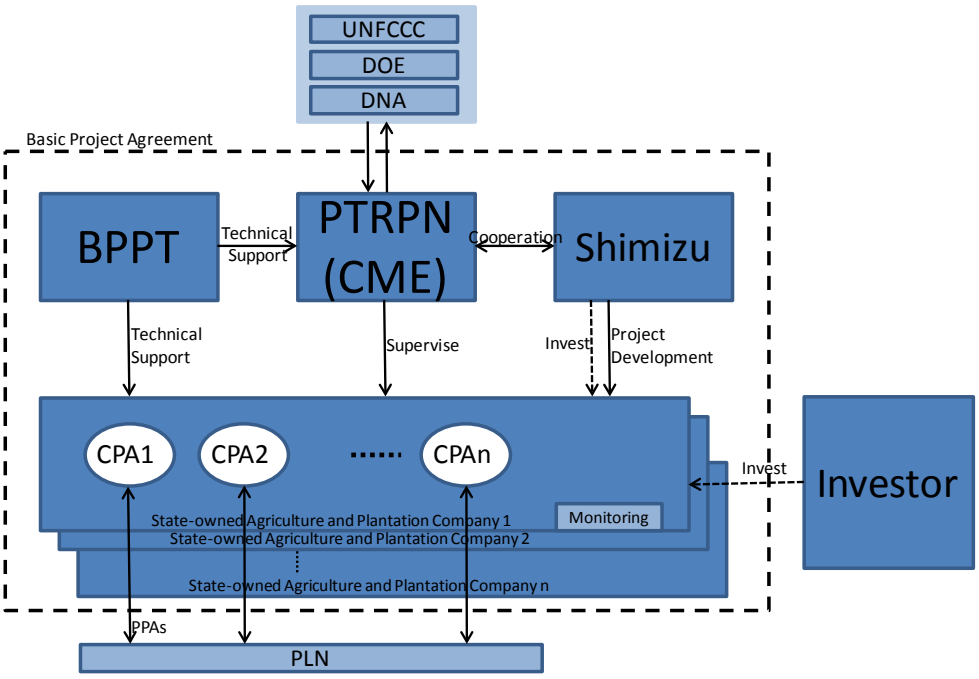

Figure 1 organization structure to implement PoA project

A.3. CMEs and participants of PoA

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Coordinating or managing entity of the PoA:

- PT. RISET PERKEBUNAN NUSANTARA

Project participants being registered in relation to the PoA:

- PT. RISET PERKEBUNAN NUSANTARA
- PTPSE/BPPT
- Shimizu Corporation

A.4. Party(ies)

Name of Party involved (host) indicates a host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Republic of Indonesia (host)	PT. RISET PERKEBUNAN NUSANTARA / Public	No
Republic of Indonesia (host)	Centre for Application and Assessment of Energy Resources Technology , Agency for the Assessment and Application of Technology (BPPT) / Public	No
Japan	Shimizu Corporation / Private	No

A.5. Physical/ Geographical boundary of the PoA

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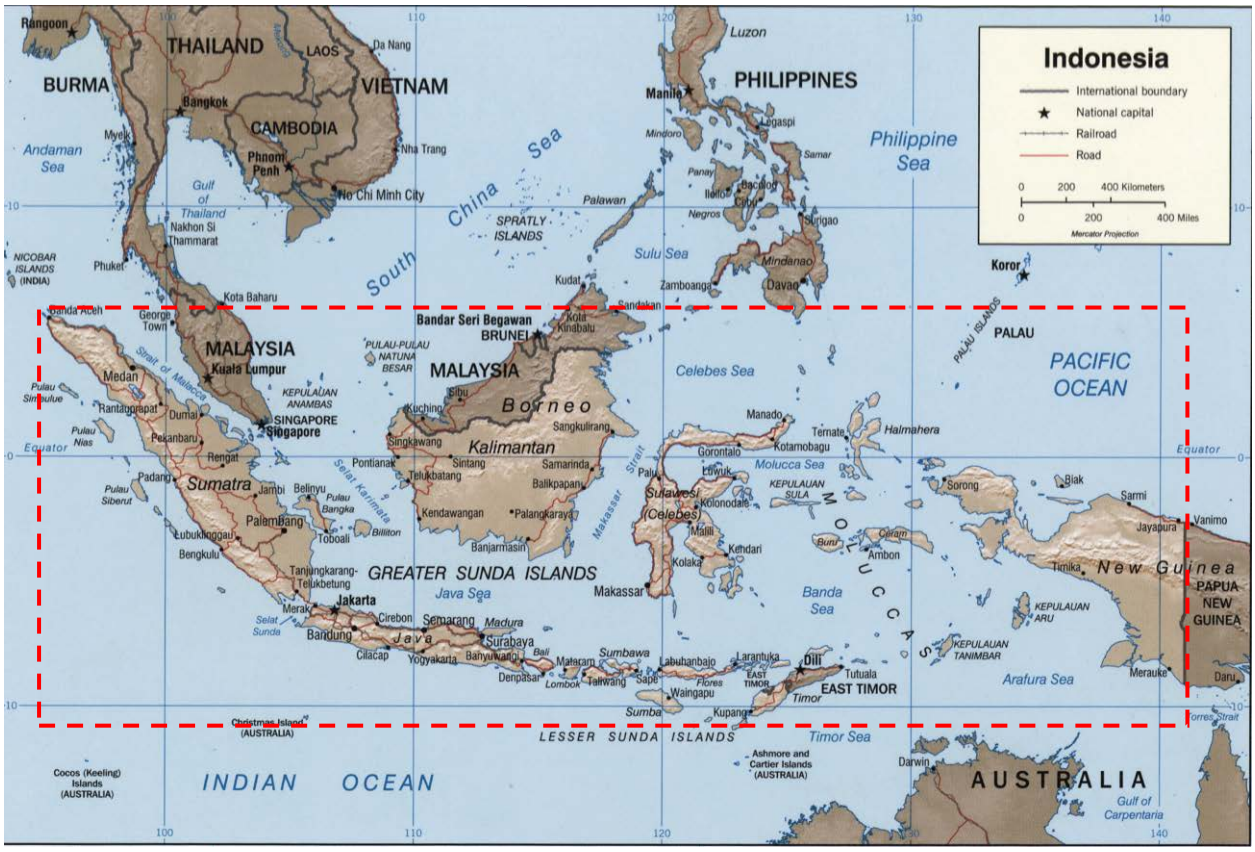
This PoA covers all of the Republic of Indonesia, which lies between latitudes 11°S and 6°N, and longitudes 95°E and 141°E. The location of all CPAs to be included in this PoA will be within these geographical coordinates.



A.6. Technologies/measures

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The generic CPA aims to install a biogas collection system in existing lagoons, collect biogas (methane gas) that is currently atmospherically discharged from existing lagoons in a state-owned palm oil mill, and generate power using this biogas, thereby converting the methane gas into carbon dioxide. Moreover, through supplying the generated power to the local grid, it will be possible to reduce emissions of greenhouse gases. Concerning the biogas collection system, covers will be placed over part or all of the existing lagoons, blowers will be used to absorb the biogas generated under the covers, and the biogas will be sent to the biogas generator by pump.

The technologies and/or measures to be employed and/or implemented by the CPAs in the PoA are as follows:

- Wastewater treatment technology
- Biogas collection technology
- Biogas power generation technology

A.7. Public funding of PoA

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The CME is the PT. RISET PERKEBUNAN NUSANTARA, and Indonesian public funding will be not introduced for the management work implemented by it.

SECTION B. Demonstration of additionality and development of eligibility criteria

B.1. Demonstration of additionality for PoA

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The PoA is the a voluntary action implemented as a policy of the PT. RISET PERKEBUNAN NUSANTARA. The government has compiled a new energy utilization plan, however, because it carries no binding force, it has so far not been implemented at any state-owned palm oil mill.

If this PoA is not introduced to mills, little progress can be made in biogas collection and power generation due to technical and financial factors, and there will be little hope of improvement in odor and other environmental factors.

According to “Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities”, When each CPA is a small-scale project, the additionality of each CPA shall be demonstrated in accordance with “Attachment A to Appendix B of the simplified modalities and procedures for small-scale CDM project activities”, and shall contain all the relevant requirements in the eligibility criteria (#6) about additionality.

The Attachment A to Appendix B stipulates the project participants to provide an explanation to show that the project activity would not have occurred anyway due to at least one of the following barriers:

(a) **Investment barrier**: a financially more viable alternative to the project activity would have led to higher emissions;
(b) **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 so would have led to higher emissions;
(c) **Barrier due to prevailing practice**: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions;
(d) **Other barriers**: without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

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

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The eligibility criteria for inclusion of a CPA in this PoA are outlined below:

No.	Eligibility criteria of the PoA:	Requirements for CPAs in the PoA	Confirmation (Proof)
1	The geographical boundary of the CPA including any time-induced boundary consistent with the geographical boundary set in the PoA	Each CPA shall be implemented within the territorial boundary of Republic of Indonesia. The project boundary shall involve the lagoons, the wastewater treatment systems, the biogas collection systems, the biogas power generation facilities, and the regional electricity grid.	Yes/No (The geographical location of the project site shall be specified in each CPA-DD)
2	Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations (e.g. programme logo)	A search of the CDM database on the UNFCCC website will be conducted by the CME prior to inclusion to ensure that each CPA-DD has not been registered as a single CDM project or another CPA. Moreover, if CME is not one of CPA implementers, CME and each CPA implementer conclude the letter which consent for CPA to contain in PoA, and not be registered as other PoA or CDM projects (refer to SECTION C of proposed PoA) .	Yes/No (The geographical coordinates of the project site to search of the database shall be specified in each CPA-DD. In addition, searching for other carbon market such as VCS, Gold standard, etc. is to be conducted.)
3	The specifications of technology/measure including the level and type of service, performance specifications including compliance with testing/certifications	Each CPA shall specify: a) a biogas collection system which covers the lagoon and collects the biogas will be used for the wastewater treatment of an anaerobic lagoon; and b) the gas engine generator and/or the enclosed type flare will be used for combustion of biogas collected from the anaerobic lagoon	Yes/No (The relevant information shall be specified in each CPA-DD)
4	Conditions to check the start date of the CPA through documentary evidence	The start date of the CPA shall be after the date of start of validation of the PoA.	Yes/No (The information proving the

			start date of each CPA was after the PoA start date shall be provided in each CPA-DD)
5	Conditions that ensure compliance with applicability and other requirements of single or multiple methodologies applied by CPAs	Each CPA shall apply the applicability of both AMS-III.H Ver. 16.0 and AMS-I.D Ver. 17.0 .	Yes/No (It shall be indicated in each CPA-DD that each CPA is applicable under AMS-III,H and AMS-I.D)
6	The conditions that ensure that CPAs meet the requirements pertaining to the demonstration of additionality	The additionality of each CPA shall be demonstrated in accordance with "Guidelines on the demonstration of additionality of small-scale project activities" Ver. 09.0. For details, it is shown below.	Yes/No (The additionality of each CPA shall be demonstrated in each CPA-DD)
7	The PoA-specific requirements stipulated by the CME including any conditions related to undertaking local stakeholder consultations and environmental impact analysis	The local stakeholder consultation and environmental impact analysis must be carried at the CPA level.	Yes/No (The details of the local stakeholder consultation and environmental impact analysis shall be provided in each CPA-DD)
8	Conditions to provide an affirmation that funding from Annex I parties, if any does not result in a diversion of official development assistance	In each CPA, there should be no public funding from Annex I parties.	Yes/No (The information about public funding from Annex I parties shall be provided in each CPA-DD)
9	Target group (e.g. domestic/commercial/industrial, rural/urban, grid-connected/off-grid) and distribution mechanisms	The target group of the PoA is State-owned Palm Oil Mills in the Republic of Indonesia.	Yes/No (The information of the project site shall be provided in each CPA-DD)
10	The requirements for the debundling check	Each CPA shall demonstrate that the project is not a debundling project. The debundling check is carried out when the CME manages the information on each CPA (refer to the section C of PART I of the PoA-DD).	Yes/No (It shall be indicated in each CPA-DD that each CPA will not a debundling project)

The criteria for additionality are as follows.

In order to meet Eligibility Criteria #6 the additionality of each CPA is demonstrated in accordance with "Guidelines on the demonstration of additionality of small-scale project activities".

The Guidelines on the demonstration of additionality of small-scale project activities stipulates the project participants to provide an explanation to show that the project activity would not have occurred anyway due to at least one of the following barriers:

(a) **Investment barrier**: a financially more viable alternative to the project activity would have led to higher emissions;
(b) **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 so would have led to higher emissions;
(c) **Barrier due to prevailing practice**: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions;
(d) **Other barriers**: without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

B.3. Application of methodologies

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The technology/measures of "Wastewater treatment system" and "Biogas collection technology" are applied to the "AMS-III.H. Methane recovery in wastewater treatment", and the technology/measures of "Biogas power generation technology are applied to the "AMS-I.D. Grid connected renewable electricity generation".

SECTION C. Management system

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The CME, the PT. RISET PERKEBUNAN NUSANTARA, has developed a management system covering all CPAs to be included in the PoA.
The relevant documents for the compliance of para 17 annex 3 of EB 65 has been provided to the DOE for validation.

(a) A clear definition of roles and responsibilities of personnel involved in the process of inclusion of CPAs, including a review of their competencies

The CME will include CME Head, PoA Operator, Technical Supporter and Document Controller. Each section has the following roles and responsibilities. PTPSE/BPPT will be in charge of implementing technical support to CME and each CPA for fulfilling each functions and obligations.

- CME Head
  - Registration of the PoA
  - Proper and timely validation of the PoA
  - Review of program compliance as per guidelines
  - Awareness creation and promotion of the PoA
  - Ensuring proper CPA operation and management as per required guidelines throughout the crediting period
- PoA Operator
  - Review of CPA compliance as per guidelines
  - Ensure verification of CPAs
  - Identification of CPA
  - Listing of eligible CPAs
  - Development of CPA-DD and PoA-DD
  - Validation and verification support to CPA implementer throughout the crediting period
  - Create a standard format for recording monitoring data, and provide it to each CPA implementer

  - Record keeping of monitoring parameters
- Technical Supporter
  - Support regarding selection of devices, contracting with the power company, preparation of verification and provision of technical guidance, etc.
  - Collaborate with the outsourcing company to ensure that the required specifications are met when introducing or maintaining the equipment systems in each CPA
  - Review and improvement suggestions of monitoring system and plan
  - Monitoring support to CPA implementers
- Document Controller
  - Collecting information and documentation of the CPA
  - Collection and scrutiny of all documents related to the eligibility criteria of CPA inclusion
  - Collection of necessary statutory approvals from CPA implementers
  - Preservation and management of a general document

(b) Records of arrangements for training and capacity development for personnel

The capacity building will focus on the following main areas:

- Management of the PoA:
  Members of the CME should be well equipped with basic knowledge of the CDM rules and guidelines. They should also acquire sufficient data to help them identify the types of projects which would be eligible under this PoA. They will be responsible for interaction with the UNFCCC on the transfer of credits and other matters.
- Supervising the Monitoring Plan:
  The CDM and Technical Experts will be responsible for setting and following a monitoring schedule. CPA implementers will be expected to keep record of monitoring parameters for the CPAs. The CDM Expert will be expected to follow all requests from DOEs and convey the necessary instructions to CPA implementers.
  Capacity building in this area will involve both CME experts as well as CPA implementers in order to follow the monitoring plan accurately until the issuance of credits for the length of the crediting period.
- Administration and record keeping:
  The CME will provide administrative support, particularly in keeping track of communication, monitoring records, and schedules, contractual agreements, sales dates for CERs, and related material.

(c) Procedures for technical review of inclusion of CPAs

The CME must have an onsite due diligence visit to the CPA location. They would also be able to inspect the physical boundaries of the CPA. Additional technical information regarding the description of the CPA could be obtained afterward from the responsible authorities or literature.

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

The CME will conclude letters of intent with CPA implementers, guaranteeing that each CPA will be incorporated into the PoA (i.e. will not be registered with other PoA or as independent CDM projects), thereby avoiding double-counting.
In each CPA that is based on this PoA, a monitoring plan will be compiled and verification of the greenhouse gas reduction effect will be conducted based on the amount of recovered gas, generated electric energy and project power consumption, etc.

Moreover, the CME will confirm the verified numerical information once every year and conduct checks to ensure that data are not double counted.

(e) Records and documentation control process for each CPA under the PoA

The CME will confer an identification number to each CPA and conduct management based on serial numbers. Moreover, it will prepare an electronic database to manage the following items of information concerning each CPA. Through managing the information of each CPA, it will simultaneously conduct debundling check.

- Name of CPA
- Implementer of CPA
- Location of CPA

The name of the mill of the project site of each CPA is included in the title of each CPA.

(f) Measures for continuous improvements of the PoA management system

Spot checks will be performed by the member of CME every year for the continuous development purpose. Training needs and requests for revision/deviation will be developed accordingly.

SECTION D. Duration of PoA

D.1. Start date of PoA

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31/05/2012, the date of publication of the PoA-DD for global stakeholder consultation.

D.2. Length of the PoA

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28 years

SECTION E. Environmental impacts

E.1. Level at which environmental analysis is undertaken

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Environmental Analysis is done at SSC-CPA level.

Since circumference environment is different at each site, environmental impact analysis should be undertaken at the CPA level.

E.2. Analysis of the environmental impacts

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N.A.

SECTION F. Local stakeholder comments

F.1. Solicitation of comments from local stakeholders

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Local stakeholder consultation is done at SSC-CPA level.

Since local stakeholders are different at each site, the local stakeholder consultation should be undertaken at the CPA level.

F.2. Summary of comments received

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N.A.

F.3. Report on consideration of comments received
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N.A.

SECTION G. Approval and authorization
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The letter of approval from Host Party involved was issued on 29/10/2012.

PART II. Generic component project activity (CPA)

SECTION A. General description of a generic CPA
A.1. Purpose and general description of generic CPAs
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A generic CPA aims to install a biogas collection system in existing lagoons, collect biogas (methane gas) that is currently atmospherically discharged from existing lagoons in a state-owned palm oil mill, and generate power using this biogas.

Even though the detailed technical characteristics might differ per CPA, the following general conditions will apply to all CPAs:

- The project site of each CPA is a state-owned palm oil mill. The name of the mill of the project site of each CPA is included in the title of each CPA. Title: PTPN VI Pinang Tinggi Mill POME Biogas Project in Jambi Province, Sumatera in Indonesia
- Palm oil mill effluents (POME) undergo phased anaerobic and aerobic treatment in the existing lagoons, the resulting low-concentration wastewater is discharge into rivers or used for sprinkling in plantations. There is no power generating equipment in existing wastewater treatment system (refer to figure 2).
- The sludge is applied as fertilizer in the palm plantations (field application). There is no sludge treatment system.
- In each CPA, the outline of a project system will be as follows (refer to figure 3).
    - A biogas collection system which covers the lagoon and collects the biogas is introduced and installed after the cooling and oxidation treatment pond. The expected COD removal rate of the system is about 80%.
    - The produced biogas is prevented from dispersing by HDPE sheet cover and is captured by the blower.
    - The gas will be used to generate power by mono-generation type gas engine. The generated power is supplied to the grid.
    - The enclosed type flare will be operated during trial operation of the reactor, regular inspections of the gas engine generator and for daily excess gas, in order to minimize dispersion of methane gas into the atmosphere.

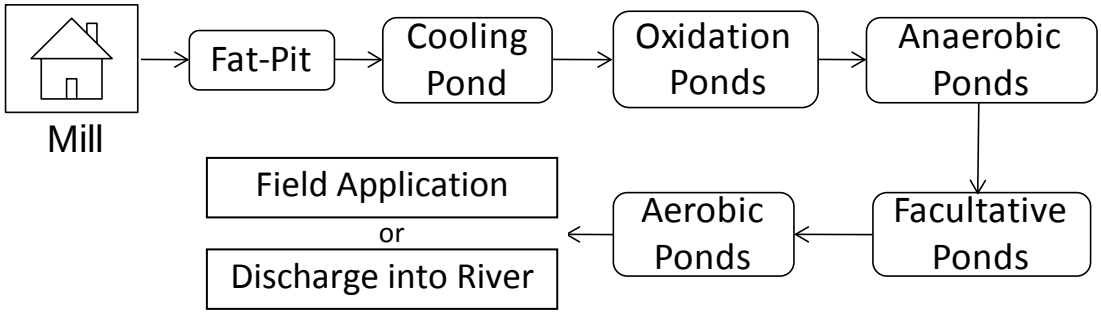
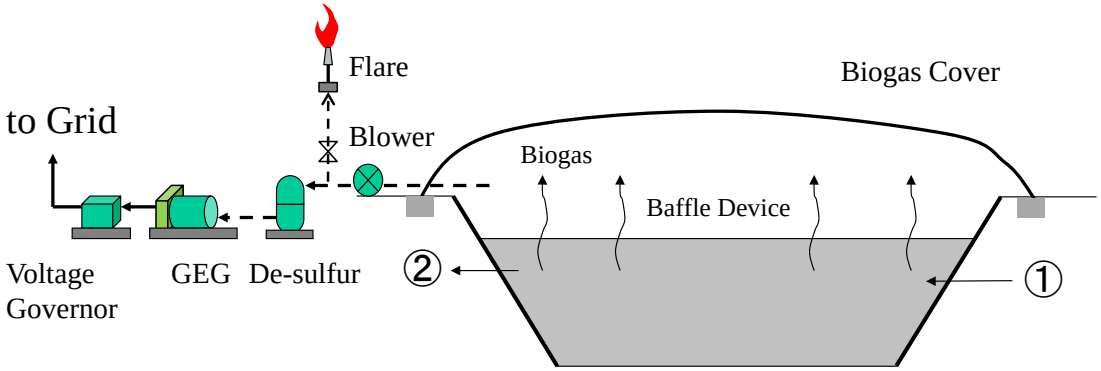


Figure 2 existing POME treatment lagoon system



①: POMEin after Cooling&Oxidation treatment
②: POMEout into Open Lagoon System existing

Figure 3 Scheme of Project Activities

SECTION B. Application of a baseline and monitoring methodology

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

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Methodology

AMS-III.H. Methane recovery in wastewater treatment --- Version 16

AMS-I.D. Grid connected renewable electricity generation --- Version 17

Tool

Version 2 of the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"

Version 1 of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption"

Version 1 of the "Tool to determine project emissions from flaring gases containing methane"

Version 3.0.0 of the "Tool to calculate the emission factor for an electricity system"

B.2. Application of methodology(ies)

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The following table shows the applicability condition in the AMS-III.H methodology.

Reference	Applicability condition	Generic CPA
AMS-III.H, para 1	This methodology comprises measures that recover biogas from biogenic organic matter in wastewater by means of one, or a combination, of the following options: (a) Substitution of aerobic wastewater or sludge treatment systems with anaerobic systems with biogas recovery and combustion; (b) Introduction of anaerobic sludge treatment system with biogas recovery and combustion to a wastewater treatment plant without sludge treatment; (c) Introduction of biogas recovery and combustion to a sludge treatment system; (d) Introduction of biogas recovery and combustion to an anaerobic wastewater treatment system such as anaerobic reactor, lagoon, septic tank or an on-site industrial plant; (e) Introduction of anaerobic wastewater treatment with biogas recovery and combustion, with or without anaerobic sludge treatment, to an untreated 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).	<u>Applicable:</u> A generic CPA is applicable under paragraph 1(f). A biogas collection system is installed in open lagoons of a state-owned palm oil mill, and the collected biogas is used to generate power. A generic CPA installs the system of biogas recovery and combustion by biogas power generation system at an existing open lagoon system.
AMS-III.H, para 2	In cases where baseline system is anaerobic lagoon the methodology is applicable if: (a) The lagoons are ponds with a depth greater than two meters, without aeration. The value for depth is obtained from engineering design documents, or through direct measurement, or by dividing the surface area by the total volume. If the lagoon filling level varies seasonally, the average of the highest and lowest levels may be taken; (b) Ambient temperature above 15°C, at least during part of the year, on a monthly average basis; (c) The minimum interval between two consecutive sludge removal events shall be 30 days.	<u>Applicable:</u> (a) The lagoons of the baseline system are ponds with a depth greater than two meters, without aeration equipment. The lagoon filling level doesn't vary seasonally. Please refer to each CPA-DD. (b) Ambient temperature around project site is higher than 15°C throughout the year. Please refer to each CPA-DD. (c) The interval between two consecutive sludge removal events is 30 days or more. Please refer to each CPA-DD.

Reference	Applicability condition	Generic CPA
AMS-III.H, para 3	The recovered biogas from the above measures may also be utilised for the following applications instead of combustion/flaring: (a) Thermal or electrical energy generation directly; (b) Thermal or mechanical, electrical energy generation after bottling of upgraded biogas, in this case additional guidance provided in Annex 1 shall be followed; or (c) Thermal or mechanical, electrical energy generation after upgrading and distribution, in this case additional guidance provided in Annex 1 shall be followed: (i) Upgrading and injection of biogas into a natural gas distribution grid with no significant transmission constraints; (ii) Upgrading and transportation of biogas via a dedicated piped network to a group of end users; or (iii) Upgrading and transportation of biogas (e.g. by trucks) to distribution points for end users. (d) Hydrogen production; (e) Use as fuel in transportation applications after upgrading.	Applicable: A generic CPA is applicable under paragraph 3(a). The recovered biogas is directly used as electrical energy generation directly.
AMS-III.H, para 4	If the recovered biogas is used for project activities covered under paragraph 3 (a), that component of the project activity can use a corresponding methodology under Type I.	Applicable: The component of a generic CPA uses AMS-I.D.
AMS-III.H, para 5	For project activities covered under paragraph 3(b), if bottles with upgraded biogas are sold outside the project boundary, the end-use of biogas shall be ensured via a contract between the bottled biogas vendor and the end-user. No emission reductions may be claimed from the displacement of fuels from the end use of bottled biogas in such situations. If however the end use of the bottled biogas is included in the project boundary and is monitored during the crediting period CO_2 emissions avoided by the displacement of fossil fuel can be claimed under the corresponding Type I methodology, e.g. AMS-I.C "Thermal energy production with or without electricity".	Not applicable: A generic CPA is applicable under paragraph 3(a).
AMS-III.H, para 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.	Not applicable: A generic CPA is applicable under paragraph 3(a).
AMS-III.H, para 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.	Not applicable: A generic CPA is applicable under paragraph 3(a).

Reference	Applicability condition	Generic CPA
AMS-III.H, para 8	In particular, for the case of 3(b) and 3(c) (iii), the physical leakage during storage and transportation of upgraded biogas, as well as the emission from fossil fuel consumed by vehicles for transporting biogas shall be considered. Relevant procedures in paragraph 11 of Annex 1 of AMS-III.H "Methane recovery in wastewater treatment" shall be followed in this regard.	Not applicable: A generic CPA is applicable under paragraph 3(a).
AMS-III.H, para 9	For project activities covered under paragraph 3(b) and 3(c), this methodology is applicable if the upgraded methane content of biogas is in accordance with relevant national regulations (where these exist) or, in the absence of national regulations, a minimum of 96% (by volume).	Not applicable: A generic CPA is applicable under paragraph 3(a).
AMS-III.H, para 10	If the recovered biogas is utilized for the production of hydrogen (project activities covered under paragraph 3(d)), that component of the project activity shall use the corresponding methodology AMS-III.O "Hydrogen production using methane extracted from biogas".	Not applicable: A generic CPA is applicable under paragraph 3(a).
AMS-III.H, para 11	If the recovered biogas is used for project activities covered under paragraph 3(e), that component of the project activity shall use corresponding methodology AMS-III.AQ "Introduction of Bio-CNG in road transportation".	Not applicable: A generic CPA is applicable under paragraph 3(a).
AMS-III.H, para 12	New facilities (Greenfield projects) and project activities involving a change of equipment resulting in a capacity addition of the wastewater or sludge treatment system compared to the designed capacity of the baseline treatment system are only eligible to apply this methodology if they comply with the relevant requirements in the "General guidelines to SSC CDM methodologies". In addition the requirements for demonstrating the remaining lifetime of the equipment replaced, as described in the general guidelines shall be followed.	Not applicable: A generic CPA is not a Greenfield project and does not involve a change of equipment resulting in a capacity addition to the wastewater compared to the designed capacity of the baseline treatment system.
AMS-III.H, para 13	The location of the wastewater treatment plant as well as the source generating the wastewater shall be uniquely defined and described in the PDD.	Applicable: The mill is the only source generating the wastewater. Please refer to each CPA-DD.
AMS-III.H, para 14	Measures are limited to those that result in aggregate emissions reductions of less than or equal to 60 kt CO_2 equivalent annually from all type III components of the project activity.	Applicable: The emission reductions in each CPA are no greater than 60,000t CO_2 per year. Please refer to each CPA-DD.

A generic CPA is thus applicable under AMS-III.H and this methodology can be applied.

The flowing table shows the applicability condition in the AMS-I.D. methodology.

Reference	Applicability condition	Generic CPA
AMS-I.D, para1	This methodology comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass: (a) Supplying electricity to a national or a regional grid; or (b) Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	Applicable: A generic CPA will supply renewable biomass energy (electricity generated using methane gas) to the regional grid.
AMS-I.D, para2	Illustration of respective situations under which each of the methodology (i.e. AMS-I.D, AMS-I.F and AMS-I.A) applies is included in Table 2.	Applicable: As was indicated in paragraph 1, a generic CPA entails supply to the local power grid and is applicable under AMS-I.D rather than AMS-I.F or AMS-I.A.
AMS-I.D, para3	This methodology is applicable to project activities that (a) Install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant); (b) Involve a capacity addition; (c) Involve a retrofit of (an) existing plant(s); or (d) Involve a replacement of (an) existing plant(s).	Applicable: There is no power generating equipment in the wastewater treatment system, and a new generator will be introduced. Therefore, a generic CPA applies to (a).
AMS-I.D, para4	Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: · The project activity is implemented in an existing reservoir with no change in the volume of reservoir; · The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the project emissions section, is greater than 4 W/m^2; · The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the project emissions section, is greater than 4 W/m^2	Not applicable: A generic CPA does not entail hydroelectric generation.
AMS-I.D, para5	If the new unit has both renewable and non-renewable components (e.g. a wind /diesel unit), the eligibility limit of 15 MW for a small-scale CDM project activity applies only to the renewable component. If the new unit co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15 MW.	Not applicable: It is scheduled to use an independent unit that utilizes renewable energy in a generic CPA. There are no plans to combine this with combustion of fossil fuels. The total generating capacity of the unit will be no more than 15 MW. Please refer to each CPA-DD.
AMS-I.D, para6	Combined heat and power (co-generation) systems are not eligible under this category.	Not applicable: In a generic CPA, co-generation systems will not be installed.

Reference	Applicability condition	Generic CPA
AMS-I.D, para7	In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.	Applicable: In a generic CPA the additional unit capacity will not exceed 15 MW and will be physically distinct from the existing units. Please refer to each CPA-DD.
AMS-I.D, para8	In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.	Not applicable: A generic CPA does not involve retrofit or replacement.

A generic CPA is thus applicable under AMS-I.D. and this methodology can be applied.

The following table shows the applicability condition in the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"

Reference	Applicability condition	Generic CPA
Scope and applicability	This tool provides procedures to calculate project and/or leakage CO_2 emissions from the combustion of fossil fuels. It can be used in cases where CO_2 emissions from fossil fuel combustion is calculated based on the quantity of fuel combusted and its properties. Methodologies using this tool should specify for which combustion processes j this tool is being applied.	Applicable: This tool is used in order to calculate project CO_2 emissions from the combustion of fossil fuels based on the quantity of fuel combusted and its properties.

A generic CPA is thus applicable under this tool and this tool can be applied.

The following table shows the applicability condition in the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption"

Reference	Applicability condition	Generic CPA
Scope and applicability Para 1	This tool provides procedures to estimate the baseline, project and/or leakage emissions associated with the consumption of electricity. The tool may, for example, be used in methodologies where auxiliary electricity is consumed in the project and/or the baseline scenario. The tool can also be applied in situations where electricity is only consumed in the baseline or in the project or as leakage source.	Applicable: This tool is used in order to estimate project emissions associated with the consumption of electricity.
Scope and applicability Para 2	The tool provides several options to project participants. These options aim to provide flexibility to project participants, while ensuring that the estimation of emission reductions is conservative. Some options provide more rough estimates of the emission reductions is conservative default values or conservative simplifications, whereas other options provide more accurate estimates but require more accurate project or	Applicable: An option suitable for a project is adopted.

Reference	Applicability condition	Generic CPA
	country specific data.	
Scope and applicability Para 3	Methodologies which refer to this tool should: (a) Specify clearly which sources of project, baseline and leakage electricity consumption should be calculated with this tool; (b) Provide the necessary procedures, equations and monitoring provisions to determine the quantity of electricity that is consumed by each identified source; and (c) Provide the necessary procedures to determine the most likely baseline scenario for each source of baseline electricity consumption.	Applicable: It is specified in AMS-III.H. that this tool should be used.
Scope and applicability Para 4	The tool is only applicable if one out of the following three scenarios applies to the sources of electricity consumption: Scenario A: Electricity consumption from the grid. The electricity is purchased from the grid only. Either no captive power plant is installed at the site of electricity consumption or, if any on-site captive power plant exits, it is not operating or it can physically not provide electricity to the source of electricity consumption. Scenario B: Electricity consumption from (an) off-grid fossil fuel fired captive power plant(s). One or more fossil fuel fired captive power plants are installed at the site of the electricity consumption source and supply the source with electricity. The captive power plant(s) is/are not connected to the electricity grid. Scenario C: Electricity consumption from the grid and (a) fossil fuel fired captive power plant(s). One or more fossil fuel captive power plants operate at the site of the electricity consumption source. The captive power plant(s) can provide electricity to the electricity consumption source. The captive power plant(s) is/are also connected to the electricity grid. Hence, the electricity consumption source can be provided with electricity from the captive power plant(s) and the grid.	Applicable: A generic CPA is applicable under Scenario A. In a generic CPA, electricity from the grid is only consumed, and no captive power plant is installed at the site of electricity consumption.
Scope and applicability Para 5	The tool is not applicable in cases where captive renewable power generation technologies are installed to provide electricity in the project activity, in the baseline scenario or to sources of leakage. The tool only accounts for CO_2 emissions.	Not Applicable: No captive renewable power generation technologies are installed in a generic CPA.

A generic CPA is thus applicable under this tool and this tool can be applied.

The following table shows the applicability condition in the “Tool to determine project emissions from flaring gases containing methane”

Reference	Applicability condition	Generic CPA
Scope and applicability	This tool is applicable under the following conditions: • The residual gas stream to be flared contains no other combustible gases than methane, carbon monoxide and hydrogen; • The residual gas stream to be flared shall be obtained from decomposition of organic material (through landfills, bio-digesters or anaerobic lagoons, among others) or from gases vented in coal mines (coal mine methane and coal bed methane).	Applicable: In a generic CPA, the biogas to be flared is captured from a bio-digester. The main contents of biogas are CH_4, N_2O and H_2, and no other combustible gas than methane, carbon monoxide and hydrogen is contained in biogas.

A generic CPA is thus applicable under this tool and this tool can be applied.

The following table shows the applicability criteria in the "Tool to calculate the emission factor for an electricity system"

Reference	Applicability condition	Generic CPA
Scope and applicability Para 1	This methodological tool determines the CO_2 emission factor for the displacement of electricity generated by power plants in an electricity system, by calculating the "combined margin" emission factor (CM) of the electricity system. The CM is the result of a weighted average of two emission factors pertaining to the electricity system: the "operating margin" (OM) and the "build margin" (BM). The operating margin is the emission factor that refers to the group of existing power plants whose current electricity generation would be affected by the proposed CDM project activity. The build margin is the emission factor that refers to the group of prospective power plants whose construction and future operation would be affected by the proposed CDM project activity.	Applicable: This tool is used to determine the CO_2 emission factor for the displacement of electricity generated by power plants in an electricity system.
Scope and applicability Para 2	This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity, i.e. where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).	Applicable: Electricity generated in a generic CPA is supplied to a grid. This tool is used to estimate the OM, BM and CM of a grid.
Scope and applicability Para 3	Under this tool, the emission factor for the project electricity system can be calculated either for grid power plants only or, as an option, can include off-grid power plants. In the latter case, the conditions specified in "Annex 2 - Procedures related to off-grid power generation" should be met. Namely, the total capacity of off-grid power plants (in MW) should be at least 10% of the total capacity of grid power plants in the electricity system; or the total	Applicable: A grid connected to in a generic CPA is the local grid that includes no off-grid power plant.

Reference	Applicability condition	Generic CPA
	electricity generation by off-grid power plants (in MWh) should be at least 10% of the total electricity generation by grid power plants in the electricity system; and that factors which negatively affect the reliability and stability of the grid are primarily due to constraints in generation and not to other aspects such as transmission capacity.	
Scope and applicability Para 4	Note that this tool is also referred to in the "Tool to calculate project emissions from electricity consumption" for the purpose of calculating project and leakage emissions in case where a project activity consumes electricity from the grid or results in increase of consumption of electricity from the grid outside the project boundary.	Not applicable: A generic CPA does not consume electricity from the grid and not result in increase of consumption of electricity from the grid outside the project boundary.
Scope and applicability Para 5	In case of CDM projects the tool is not applicable if the project electricity system is located partially or totally in an Annex I country.	Not applicable: The project electricity system is not located in an Annex I country.

A generic CPA is thus applicable under this tool and this tool can be applied.

B.3. Sources and GHGs

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The following project boundary will apply to all CPAs:

According to AMS-III.H., the project boundary is the physical, geographical site where the wastewater and sludge treatment takes place, in the baseline and project situations. It covers all facilities affected by the project activity including sites where processing, transportation and application or disposal of waste products as well as biogas takes place.

According to AMS-I.D., the project boundary is the spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to.

The project boundary is as indicated in Figure 4.

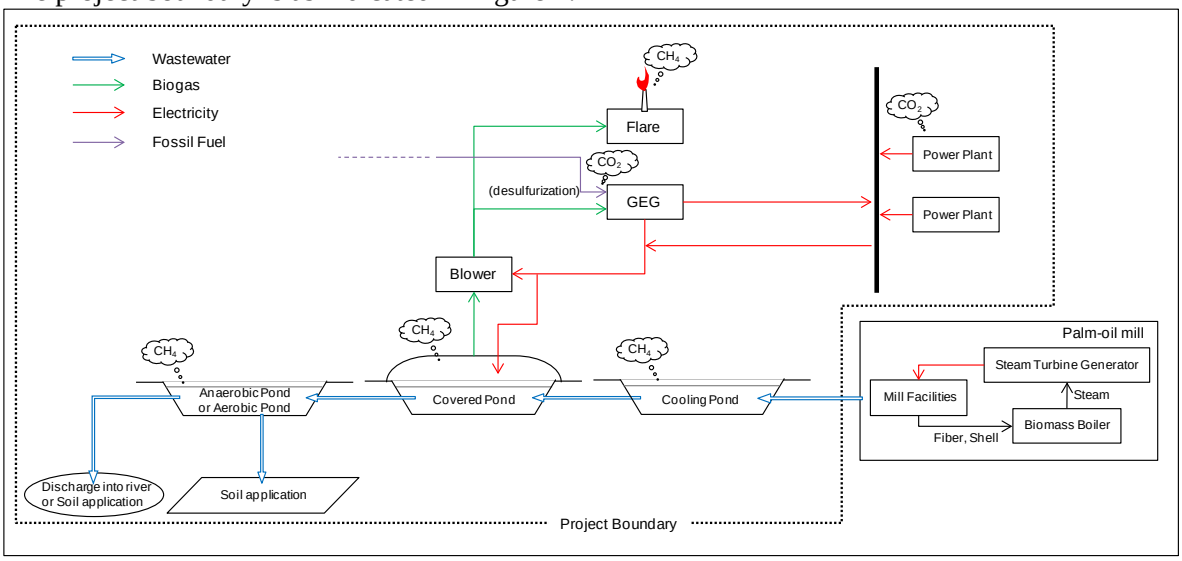

Figure 4 Project boundary

The following table indicates the generation sources and gases included in the project boundary.

	Source	Gas	Included?	Justification / Explanation
Baseline	Wastewater treatment process	CH_4	Included	Emissions from the existing open lagoon wastewater treatment system
		CH_4	Excluded	In this project, treated wastewater will use for field application, therefore there is no emissions from degradable organic carbon in discharged into river.
		N_2O	Excluded	Excluded for simplification. This is conservative
		CO_2	Excluded	CO_2 emissions from the decomposition of organic waste are not account for
	Electricity consumption / generation	CO_2	Included	Emissions from consumption of grid electricity substituted by the power generated from biogas in the project
		CH_4	Excluded	Excluded for simplification. This is conservative
		N_2O	Excluded	Excluded for simplification. This is conservative
Project Activity	Wastewater treatment process	CH_4	Included	Emissions from non-collected parts; Emissions from biogas release capture system; Emissions due to incomplete flaring system
		CH_4	Excluded	In this project, treated wastewater will use for field application, therefore there is no emissions from degradable organic carbon in discharged into river.
		CO_2	Excluded	CO_2 emissions from the decomposition of organic waste are not account for
		N_2O	Excluded	Excluded due to the project is not involved land application of sludge
	Electricity consumption / generation	CO_2	Included	Electricity from grid is consumed to operate the project activity, emissions shall be included.
		CO_2	Included	At the time of starting of a gas engine, diesel is used. Emissions from consumption of diesel shall be included.
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small

B.4. Description of baseline scenario

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Baseline is determined by using methodology AMS-III.H. & AMS-I.D.

<u>Baseline determination for wastewater treatment</u>

Indonesia does not have any legal system for obliging palm oil mills to collect biogas discharged from lagoons and sludge. Accordingly, if each CPA is not implemented, biogas collection equipment will not be installed in the future. Therefore, the baseline scenario for the wastewater treatment process would be the utilisation of open lagoons.

Baseline determination for electricity generation

Some mills have biomass boilers and generating equipment for combusting (utilizing) shells and fibers, and power is mainly used for operating the plant equipment and lighting, while steam is used for steaming and drying FFB. There is no prospect of production quantities, power consumption or calorific value increasing greatly from now on.

Moreover, Indonesia does not have any legal system for obliging palm oil mills to install generating equipment that uses renewable energy. Accordingly, if each CPA is not implemented, methane gas power generation equipment will not be installed in the future.

According to paragraph 10 of AMS-I.D, the baseline scenario is the electricity delivered to the grid by each CPA would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources into the grid.

The baseline emission factor of electricity from a grid is determined in line with paragraph 12 (a) of AMS-I.D., i.e. a combined margin(CM), consisting of the combination of operating margin (OM) and build margin (BM), according to the procedures prescribed in the "Tool to calculate the emission factor for an electricity system".

Thus, the electricity displacement component of each CPA will displace the electricity that would have been supplied by the connecting grid in the region. Therefore, the baseline emission factor of the local grid connected to in each CPA will be used the value* published by DNA of Republic of Indonesia is applied (January 19, 2009).

**Reference*
http://pasarkarbon.dnpi.go.id/web/index.php/dnacdm/read/14/faktor-emisi-jaringan-listrik-sumatera-dan-jamali-2008.html

B.5. Demonstration of eligibility for a generic CPA

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The following table shows the eligibility criteria for CPAs.

No.	Eligibility criteria of the PoA:	Requirements for CPAs in the PoA	Confirmation (Proof)
1	The geographical boundary of the CPA including any time-induced boundary consistent with the geographical boundary set in the PoA	Each CPA shall be implemented within the territorial boundary of Republic of Indonesia. The project boundary shall involve the lagoons, the wastewater treatment systems, the biogas collection systems, the biogas power generation facilities, and the regional electricity grid.	Yes/No (The geographical location of the project site shall be specified in each CPA-DD)
2	Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations (e.g. programme logo)	A search of the CDM database on the UNFCCC website will be conducted by the CME prior to inclusion to ensure that each CPA-DD has not been registered as a single CDM project or another CPA. Moreover, if CME is not one	Yes/No (The geographical coordinates of the project site to search of the database shall be specified in each CPA-DD. In addition, searching for other carbon market such as VCS, Gold

		of CPA implementers, CME and each CPA implementer conclude the letter which consent for CPA to contain in PoA, and not be registered as other PoA or CDM projects (refer to SECTION C of proposed PoA) .	standard, etc. is to be conducted.)
3	The specifications of technology/measure including the level and type of service, performance specifications including compliance with testing/certifications	Each CPA shall specify: a) a biogas collection system which covers the lagoon and collects the biogas will be used for the wastewater treatment of an anaerobic lagoon; and b) the gas engine generator and/or the enclosed type flare will be used for combustion of biogas collected from the anaerobic lagoon	Yes/No (The relevant information shall be specified in each CPA-DD)
4	Conditions to check the start date of the CPA through documentary evidence	The start date of the CPA shall be after the date of start of validation of the PoA.	Yes/No (The information proving the start date of each CPA was after the PoA start date shall be provided in each CPA-DD)
5	Conditions that ensure compliance with applicability and other requirements of single or multiple methodologies applied by CPAs	Each CPA shall apply the applicability of both AMS-III.H Ver. 16.0 and AMS-I.D Ver. 17.0.	Yes/No (It shall be indicated in each CPA-DD that each CPA is applicable under AMS-III,H and AMS-I.D)
6	The conditions that ensure that CPAs meet the requirements pertaining to the demonstration of additionality	The additionality of each CPA shall be demonstrated in accordance with "Guidelines on the demonstration of additionality of small-scale project activities" Ver. 09.0. For details, it is shown below.	Yes/No (The additionality of each CPA shall be demonstrated in each CPA-DD)
7	The PoA-specific requirements stipulated by the CME including any conditions related to undertaking local stakeholder consultations and environmental impact analysis	The local stakeholder consultation and environmental impact analysis must be carried at the CPA level.	Yes/No (The details of the local stakeholder consultation and environmental impact analysis shall be provided in each CPA-DD)
8	Conditions to provide an	In each CPA, there should be	Yes/No

	affirmation that funding from Annex I parties, if any does not result in a diversion of official development assistance	no public funding from Annex I parties.	(The information about public funding from Annex I parties shall be provided in each CPA-DD)
9	Target group (e.g. domestic/commercial/industrial, rural/urban, grid-connected/off-grid) and distribution mechanisms	The target group of the PoA is State-owned Palm Oil Mills in the Republic of Indonesia.	Yes/No (The information of the project site shall be provided in each CPA-DD)
10	The requirements for the debundling check	Each CPA shall demonstrate that the project is not a debundling project. The debundling check is carried out when the CME manages the information on each CPA (refer to the section C of PART I of the PoA-DD).	Yes/No (It shall be indicated in each CPA-DD that each CPA will not a debundling project)

The criteria for additionality are as follows.

In order to meet Eligibility Criteria #6 the additionality of each CPA is demonstrated in accordance with "Guidelines on the demonstration of additionality of small-scale project activities".

The Guidelines on the demonstration of additionality of small-scale project activities stipulates the project participants to provide an explanation to show that the project activity would not have occurred anyway due to at least one of the following barriers:

(a) **Investment barrier**: a financially more viable alternative to the project activity would have led to higher emissions;
(b) **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 so would have led to higher emissions;
(c) **Barrier due to prevailing practice**: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions;
(d) **Other barriers**: without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

(The demonstration of additionality of each CPA will be indicated here.)

B.6. Estimation of emission reductions of a generic CPA
B.6.1. Explanation of methodological choices
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The following explanation of methodological choices will apply to all CPAs:

Wastewater treatment

Baseline

Baseline emissions are calculated by equation (1), which applies the equation (1) of AMS-III.H/Version 16.

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

Where:

$BE_{wastewater,y}$	Baseline emissions in year *y* (tCO_2e)
$BE_{power,y}$	Baseline emissions from electricity or fuel consumption in year *y* (tCO_2e)
$BE_{ww,treatment,y}$	Baseline emissions of the wastewater treatment systems affected by the project activity in year *y* (tCO_2e)
$BE_{s,treatment,y}$	Baseline emissions of the sludge treatment systems affected by the project activity in year *y* (tCO_2e)
$BE_{ww,discharge,y}$	Baseline methane emissions from degradable organic carbon in treated wastewater discharged into sea/river/lake in year *y* (tCO_2e).
$BE_{s,final,y}$	Baseline methane emissions from anaerobic decay of the final sludge produced in year *y* (tCO_2e).

a) Baseline emissions from electricity or fuel consumption

No electricity is required to operate baseline wastewater treatment system in the project boundary of baseline scenario, and sludge treatment system and fuel consumption has no change between Baseline and Project Activity. Therefore the emissions are neglected.

b) Baseline emissions of the wastewater treatment systems affected by the project activity

$BE_{ww,treatment,y}$ is demonstrated by the following equation (2), which applies the equation (2) of AMS-III.H/Version 16.

$$BE_{ww,treatment,y}= \Sigma_i(Q_{ww,i,y}\times COD_{inflow,i,y}\times \eta_{COD,BL,i}\times MCF_{ww,treatment,BL,i}) \times B_{o,ww}\times UF_{BL}\times GWP_{CH4} \quad (2)$$

Where:

$Q_{ww,i,y}$	Volume of wastewater treated in baseline wastewater treatment system *i* inyear *y* (m^3)
$COD_{inflow,i,y}$	Chemical oxygen demand of the wastewater inflow to the baseline treatment system *i* in year *y*(t/m^3)
$\eta_{COD,BL,i}$	COD removal efficiency of the baseline treatment system *i*
$MCF_{ww,treatment,BL}$	Methane correction factor for baseline wastewater treatment systems (MCF values as per Table III.H.1 : Anaerobic deep lagoon (depth more than 2 m) 0.8)
i	Index for baseline wastewater treatment system
$B_{o,ww}$	Methane producing capacity of the wastewater (IPCC value of 0.25 kg CH_4/kg COD)
UF_{BL}	Model correction factor to account for model uncertainties (0.89)
GWP_{CH4}	Global Warming Potential for methane (value of 25)

c) Baseline emissions of the sludge treatment systems affected by the project activity

No sludge treatment system occurred in the baseline scenario. Therefore the emissions are neglected.

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

$BE_{ww,discharge,y}$ is demonstrated by the following equation (3), which applies the equation (6) of AMS-III.H/Version 16. However, the emissions are neglected when the resulting low-concentration wastewater is discharge into rivers or used for sprinkling in plantations.

$$BE_{ww,discharge,y} = Q_{ww,y} \times COD_{ww,discharge,BL,y} \times MCF_{ww,discharge,BL} \times B_{o,ww} \times UF_{BL} \times GWP_{CH4} \quad (3)$$

Where:

$Q_{ww,y}$	Volume of treated wastewater discharged in year *y* (m^3)
$COD_{ww,discharge,BL,y}$	Chemical oxygen demand of treated wastewater discharged into sea, river or lake in the baseline situation in year *y*(t/m^3)
$MCF_{ww,discharge,BL}$	Methane correction factor based on discharge pathway in the baseline situation (e.g. into sea, river or lake) of the wastewater (MCF values as per Table III.H.1 : Discharge of wastewater to sea, river or lake 0.1)

e) Baseline methane emissions from anaerobic decay of the final sludge produced

The final sludge is used for soil application. Therefore the emissions are neglected.

Project Activity Emissions

Project activity emissions of AMS-III.H are calculated by equation (4), which applies the equation (8) of AMS-III.H/Version 16.

$$PE_{wastewater,y}=\{PE_{power,y}+PE_{ww,treatment,y}+PE_{s,treatment,y}+PE_{ww,discharge\ ,\ y} +PE_{s,final,y}+PE_{fugitive,y}+PE_{biomass,y}+PE_{flaring,y}\} \quad (4)$$

Where:

$PE_{wastewater,y}$	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).
$PE_{ww,discharge,y}$	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)
$PE_{biomass,y}$	Methane emissions from biomass stored under anaerobic conditions (tCO_2e)
$PE_{flaring,y}$	Methane emissions due to incomplete flaring in year *y* (tCO_2e)

a) Emissions from electricity or fuel consumption

$PE_{power,y}$ is calculated based on scenario A of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" and option B of the "tool to calculate project or leakage CO_2 emissions from fossil fuel combustion". $PE_{power,y}$ is demonstrated by the following equation (5), which applies "$PE_{power,y}$" of Para 29 of AMS-III.H/Version 16.

$$PE_{power,y}=EC_{PJ,grid,y}\times EF_{EL,grid,y}\times(1+TDL_{grid,y})+FC_{diesel,y}\times NCV_{diesel,y}\times EF_{CO2,diesel,y} \quad (5)$$

Where:

$EC_{PJ,grid,y}$	Quantity of electricity consumed by the project electricity consumption from the grid in year y (MWh/y)
$EF_{EL,grid,y}$	Emission factor for electricity generation from the grid in year y (tCO_2/MWh) $=EF_{grid,CM,y}$ of the "Tool to calculate the emission factor for an electricity system".
$TDL_{grid,y}$	Average technical transmission and distribution losses for providing electricity to from the grid in year y
$FC_{diesel,y}$	Quantity of diesel combusted in year y (ton)
$NCV_{diesel,y}$	Weighted average net calorific value of diesel in year y (GJ/ton)

$EF_{CO2,diesel,y}$	Weighted average CO_2 emission factor of diesel in year y (tCO_2/GJ)

b) Methane emissions from wastewater treatment systems affected by the project activity, and not equipped with biogas recovery

$PE_{ww,treatment,y}$ is demonstrated by the following equation (6), which applies "$PE_{ww,treatment,y}$" of Para 29 of AMS-III.H/Version 16.

$$PE_{ww,treatment,y}=\Sigma_k(Q_{ww,k,y}\times COD_{inflow,k,y}\times\eta_{COD,PJ,k}\times MCF_{ww,treatment,PJ,k})\times B_{o,ww}\times UF_{PJ}\times GWP_{CH4} \quad (6)$$

Where:

$Q_{ww,k,y}$	Volume of wastewater treated in project wastewater treatment system *k* in year *y* (m^3)
$COD_{inflow,k,y}$	Chemical oxygen demand of the wastewater inflow to the project treatment system *k* in year *y*(t/m^3)
$\eta_{COD,PJ,k}$	COD removal efficiency of the project wastewater treatment system *k* in year *y* (t/m^3)
$MCF_{ww,treatment,PJ,k}$	Methane correction factor for project wastewater treatment systems *k* (MCF values as per Table III.H.1 : Anaerobic deep lagoon (depth more than 2 m) 0.8)
k	Index for project wastewater treatment system
$B_{o,ww}$	Methane producing capacity of the wastewater (IPCC value of 0.25 kg CH_4/kg COD)
UF_{PJ}	Model correction factor to account for model uncertainties (1.12)
GWP_{CH4}	Global Warming Potential for methane (value of 25)

c) Methane emissions from sludge treatment systems affected by the project activity, and not equipped with biogas recovery

No sludge treatment system occurred in a generic CPA. Therefore the emissions are neglected.

d) Methane emissions from degradable organic carbon in treated wastewater

$PE_{ww,discharge,y}$ is demonstrated by the following equation (7), which applies "$PE_{ww,discharge,y}$" of Para 29 of AMS-III.H/Version 16.

$$PE_{ww,discharge,y} = Q_{ww,y} \times COD_{ww,discharge,PJ,y} \times MCF_{ww,discharge,PJ} \times B_{o,ww} \times UF_{PJ} \times GWP_{CH4} \quad (7)$$

Where:

$Q_{ww,y}$	Volume of treated wastewater discharged in year *y* (m^3)
$COD_{ww,discharge,PJ,y}$	Chemical oxygen demand of treated wastewater discharged into sea, river or lake in the project scenario in year *y*(t/m^3)
$MCF_{ww,discharge,PJ}$	Methane correction factor based on discharge pathway in the project scenario (e.g. into sea, river or lake) of the wastewater (MCF values as per Table III.H.1 : Discharge of wastewater to sea, river or lake 0.1)

e) Methane emissions from anaerobic decay of the final sludge produced

The final sludge in a generic CPA will be used for soil application. Therefore the emissions are neglected.

f) Methane emissions from biogas release in capture systems

$PE_{fugitive,\ y}$ is demonstrated by the following equation (8), which applies the equation (9) of AMS-III.H/Version 16.

$$PE_{fugitive,y}=PE_{fugitive,ww,y}+PE_{fugitive,s,y} \quad (8)$$

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)

Moreover, since methane gas will not be recovered from sludge in a generic CPA, $PE_{fugitive,s,y}$ can be omitted, equation (8) can be modified to (8)'.

$$PE_{fugitive,y}=PE_{fugitive,ww,y} \quad (8)'$$

Also, $PE_{fugitive,ww,y}$is demonstrated by the following equation (9), which applies the equation (10) of AMS-III.H/Version 16.

$$PE_{fugitive,ww,y}=(1-CFE_{ww}) \times MEP_{ww,treatment,y} \times GWP_{CH4} \quad \mathbf{(9)}$$

Where:

CFE_{ww}	Capture efficiency of the biogas recovery equipment in the wastewater treatment systems (a default value of 0.9 shall be used)
$MEP_{ww,treatment,y}$	Methane emission potential of wastewater treatment systems equipped with biogas recovery system in year *y* (t)

$MEP_{ww,treatment,y}$ is demonstrated by the following equation (10), which applies the equation (11) of AMS-III.H/Version 16.

$$MEP_{ww,treatment,y}=Q_{ww,y} \times B_{o,ww} \times UF_{PJ} \times \sum_k (COD_{removed,PJ,k,y} \times MCF_{ww,treatment,PJ,k}) \quad (10)$$

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 (MCF values as per Table III.H.1)

g) Methane emissions from biomass stored under anaerobic conditions

No biomass will be stored under anaerobic conditions in a generic CPA. Therefore the emissions are neglected.

h) Methane emissions due to incomplete flaring

$PE_{flaring,y}$ is demonstrated by the following equation (11), which applies the equation (15) of the Methodological "Tool to determine project emissions from flaring gases containing methane (EB28 Annex 13)".

$$PE_{flare,y}=\Sigma_{(h=1\sim8760)} TM_{RG,h} \times (1-\eta_{flare,h}) \times GWP_{CH4} / 1000 \quad (11)$$

Where:

$PE_{flare,y}$	Project emissions from flaring of the residual gas stream in year *y* (tCO_2e) $= PE_{flaring,y}$
$TM_{RG,h}$	Mass flow rate of methane in the residual gas in the hour *h* ($kgCH_4/h$)
$\eta_{flare,h}$	Flare efficiency in hour *h*

$TM_{RG,h}$ is demonstrated by the following equation (12), which applies the equation (13) of the

Methodological "Tool to determine project emissions from flaring gases containing methane (EB28 Annex 13)".

$$TM_{RG,h} = FV_{RG,h} \times fv_{CH4,RG,h} \times \rho_{CH4} \quad (12)$$

Where:

$FV_{RG,h}$	Volumetric flow rate of the residual gas in dry basis at normal conditions in hour h (m^3/h)
$fv_{CH4,RG,h}$	Volumetric fraction of methane in the residual gas on dry basis in hour h (-)
ρ_{CH4}	Density of methane at normal conditions (0.716) ($kgCH_4/m^3CH_4$)

Leakage

It is explained that "If the technology is using equipment transferred from another activity, leakage effects at the site of the other activity are be considered and estimated" in AMS-III.H..

There is no equipment transferring in this project, so that leakage does not need to be considered.

Emission Reduction (Ex-ante)

According to AMS-III.H., emission reduction of ex-ante is calculated by equation (13), which applies the equation (14) of AMS-III.H/Version 16.

$$ER_{wastewater,y,ex\text{-}ante}=BE_{wastewater,y,ex\text{-}ante}-(PE_{wastewater,y,ex\text{-}ante}+LE_{wastewater,y,ex\text{-}ante}) \quad (13)$$

Where:

$ER_{wastewater,y,ex\text{-}ante}$	*Ex-ante* emission reduction in year *y* (tCO_2e)
$BE_{wastewater,y,ex\text{-}ante}$	*Ex-ante* baseline emissions in year *y* (tCO_2e)
$PE_{wastewater,y,ex\text{-}ante}$	*Ex-ante* project emissions in year *y* (tCO_2e)
$LE_{wastewater,y,ex\text{-}ante}$	*Ex-ante* leakage emissions in year *y* (tCO_2e)

As explained, $LE_{wastewater,y,ex\text{-}ante}$ can be skipped and equation (13) can be modified as equation (13)'.

$$ER_{wastewater,y,ex\text{-}ante}=BE_{wastewater,y,ex\text{-}ante}-PE_{wastewater,y,ex\text{-}ante} \quad (13)'$$

Emission Reduction (Ex-post)

Emission Reductions of ex-post are calculated by equation (14), which applies the equation (15) of AMS-III.H/Version 16.

- The amount of biogas recovered and fuelled or flared (MD_y) during the crediting period, that monitored ex-post
- Ex-post calculated baseline, project and leakage emissions based on actual monitored data for the project activity

$$ER_{wastewater,y,ex\text{-}post}=min((BE_{wastewater,y,ex\text{-}post}-PE_{wastewater,y,ex\text{-}post}-LE_{wastewater,y,ex\text{-}post}),$$
$$(MD_y-PE_{power,y}-PE_{biomass,y}-LE_{wastewater,y,ex\text{-}post})) \quad (14)$$

Where:

$ER_{wastewater,y,ex\text{-}post}$	*Ex-post* emission reduction in year *y* (tCO_2e)
$BE_{wastewater,y,ex\text{-}post}$	Baseline emissions calculated as per equation (1)' using ex-post monitored values (tCO_2e)
$PE_{wastewater,y,ex\text{-}post}$	Project emissions calculated as per equation (3)' using ex-post monitored values

	(tCO_2e)
$LE_{wastewater,y,ex\text{-}post}$	Leakage emissions (tCO_2e)
MD_y	Methane captured and destroyed/gainfully used by the project activity in the year *y* (tCO_2e)

As explained, $LE_{wastewater,y,ex\text{-}post}$, $PE_{biomass,y}$ can be skipped and equation (14) can be modified as equation (14)'.

$$ER_{wastewater,y,ex\text{-}post}=min((BE_{wastewater,y,ex\text{-}post}-PE_{wastewater,y,ex\text{-}post}), MD_y-PE_{power,y}) \quad (14)'$$

MD_y is demonstrated by the following equation (15), which applies the equation (16) of AMS-III.H/Version 16.

$$MD_y=BG_{burnt,y}\times w_{CH4,y}\times \rho_{CH4}\times FE\times GWP_{CH4} \quad (15)$$

Where:

$BG_{burnt,\,y}$	Quantity of biogas fed into electricity generator in the year *y* (m^3)
$w_{CH4,y}$	Methane content of the biogas in the year *y*
FE	The flare efficiency

In a generic CPA, biogas which consist of collected methane is used by gas engine generator and the remaining biogas is burned in flare, $BG_{burnt,y}$ is divided $BG_{burnt,GEG,y}$ and $BG_{burnt,flare,y}$, the equation (15) can be modified as equation (15)'.

$$MD_y=(BG_{burnt,GEG,y}\times w_{CH4,y}\times \rho_{CH4}\times GWP_{CH4})+(BG_{burnt,flare,y}\times w_{CH4,y}\times \rho_{CH4}\times FE\times GWP_{CH4}) \quad (15)'$$

Where:

$BG_{burnt,GEG,y}$	Quantity of biogas fed into electricity generator in the year *y* (m^3)
$BG_{burnt,flare,y}$	Quantity of biogas fed to the flare in the year *y* (m^3)

<u>Electricity generation</u>

Baseline

Baseline emissions are calculated by the following equation (16), which applies the equation (1) of AMS-I.D/Version 17.

$$BE_{electricity,y} = EG_{BL,y} \times EF_{CO2,grid,y} \quad (16)$$

Where:

$BE_{electricity,y}$	Baseline emissions of the electricity which would have been produced by power plants connected to the grid in absence of the project activity in year y (tCO_2e).
$EG_{BL,y}$	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y (MWh)
$EF_{CO2,grid,y}$	CO_2 emission factor of the grid in year y (tCO_2/MWh)

Emission factor

The electricity baseline is determined in line with paragraph 12 (a) of AMS-I.D., i.e. a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM), according to the

procedures prescribed in the "Tool to calculate the emission factor for an electricity system", Version 3.0.0, in the following 6 steps.

Step 1: Identify the relevant electric power systems
The spatial extent of the proposed project boundary includes the project site and all power plants connected physically to the electricity system, where the project is connected to.

Step 2: Choose whether to include off-grid power plants in the project electricity system (optional)
Project participants may choose between the following two options to calculate the operating margin and build margin emission factor:
Option I: Only grid power plants are included in the calculation.
Option II: Both grid power plants and off-grid power plants are included in the calculation.

Option I is used in emission factor calculation due to the project activity is connected with the grid and assume the off grid power plant is not significantly gives impact for emission factor calculation.

Step 3: Select a method to determine the operating margin (OM)
The tool provides four methods for calculating operating margin emission factor $EF_{grid,OM,y}$, namely **simple OM** method, **simple adjusted OM** method, **dispatch data analysis OM** method and **average OM** method. OM is calculated ex-ante, according to the simple OM method.

Step 4: Calculate the operating margin emission factor according to the selected method
The simple OM emission factor is calculated as generation-weighted average CO_2 emission per unit net electricity generation (tCO_2e/MWh) of all generating power plants serving the system, not including low-cost / must-run power plants.

Step 5: Calculate the build margin (BM) emission factor ($EF_{grid,BM,y}$)
Project participants can choose between the following two options:
Option 1: For the first crediting period, calculate the build margin emission factor *ex-ante* based on the most recent information available on units already built for sample group *m* at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.
Option 2: For the first crediting period, the build margin emission factor shall be updated annually, *ex-post*, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated ex ante, as described in Option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

Option 1 is used in emission factor calculation.

Step 6: Calculate the combined margin emissions factor
The combined margin emission factor (baseline emission factor) in year *y*, $EF_{grid,CM,y}$ is the weighted average of the operating margin emission factor ($EF_{grid,OM,y}$) and the build margin emission factor ($EF_{grid,OM,y}$). The value of $EF_{grid,CM,y}$ will remain the same during the crediting period.

Therefore, the baseline emission factor of the value, published by DNA of Republic of Indonesia is applied.

Project Activity Emissions

According to Para 20 of AMS-I.D/Version 17, project activity emissions are "0".

$$PE_{electricity,y} = 0 \quad (17)$$

Leakage

It is explained that "If the energy generating equipment is transferred from another activity, is to be considered" in Para 22 of AMS-I.D/Version 17.

There is no equipment transferring in this project, so that leakage does not need to be considered.

Emission Reduction

Emission Reductions are calculated by equation (18), which applies the equation (10) of AMS-I.D/Version 17.

$$ER_{electricity,y} = BE_{electricity,y} - PE_{electricity,y} - LE_{electricity,y} \quad (18)$$

Where:

$ER_{electricity,y}$	Emission reduction in year *y* (tCO_2e)
$BE_{electricity,y}$	Baseline emissions in year *y*, calculated as per equation (12) (tCO_2e)
$PE_{electricity,y}$	Project emissions in year *y* (tCO_2e)
$LE_{electricity,y}$	Leakage emissions in year *y* (tCO_2e)

As explained, $PE_{electricity,y}$ and $LE_{electricity,y}$ can be skipped and equation (18) can be modified as equation (18)'.

$$ER_{electricity,y} = BE_{electricity,y} \quad (18)'$$

<u>Total Emission Reduction</u>

Total emission reductions are calculated by the following equation (19).

$$ER_{total,y} = ER_{wastewater,y} + ER_{electricity,y} \quad (19)$$

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

(Copy this table for each data and parameter.)

Data / Parameter	$\eta_{COD,BL,B1}$
Unit	-
Description	COD removal efficiency of the baseline treatment system (B1)
Source of data	Measurement by project participant
Value(s) applied	0.7805 This value is different by each CPA. The value applied here is a temporary value used as a sample of ex-ante calculation in the section B.6.3.
Choice of data or Measurement methods and procedures	If one year of historical data will be not available, according to paragraph 27 of AMS-III.H.ver16, 10 days measurement campaign will be implemented. The CODs of inflow and outflow of baseline wastewater treatment system are measured, and the COD removal efficiency is calculated.
Purpose of data	Calculation of baseline emissions
Additional comment	N/A

Data / Parameter	$MCF_{ww,treatment,BL,B1}$
Unit	-
Description	Methane correction factor for baseline wastewater treatment system (B1)
Source of data	Table III.H.1 of AMS-III.H. Methane recovery in wastewater treatment --- Version 16
Value(s) applied	0.8
Choice of data or Measurement methods and procedures	The depth of lagoon of baseline wastewater treatment system is more than 2m, so that the value of Anaerobic deep lagoon (depth more than 2 meters) from Table III.H.1 is applied.
Purpose of data	Calculation of baseline emissions
Additional comment	N/A

Data / Parameter	$MCF_{ww,discharge,BL}$
Unit	-
Description	Methane correction factor based on discharge pathway of the wastewater in the baseline situation
Source of data	Table III.H.1 of AMS-III.H. Methane recovery in wastewater treatment --- Version 16
Value(s) applied	0.1
Choice of data or Measurement methods and procedures	The value for discharge of wastewater to sea, river or lake from Table III.H.1 is used.
Purpose of data	Calculation of baseline emissions
Additional comment	N/A

Data / Parameter	$COD_{ww,discharge,BL,y}$
Unit	t/m^3
Description	Chemical oxygen demand of treated wastewater discharged into sea, river or lake in the baseline situation in the year y
Source of data	Measurement by project participant
Value(s) applied	0.00452 This value is different by each CPA. The value applied here is a temporary value used as a sample of ex-ante calculation in the section B.6.3.
Choice of data or Measurement methods and procedures	If one year of historical data will be not available, according to paragraph 27 of AMS-III.H.ver16, 10 days measurement campaign will be implemented. The CODs of inflow and outflow of baseline wastewater treatment system are measured, and the COD removal efficiency is calculated.
Purpose of data	Calculation of baseline emissions
Additional comment	N/A

Data / Parameter	$B_{o,ww}$
Unit	kg -CH_4/kg-COD
Description	Methane producing capacity of the wastewater
Source of data	Para 20 of AMS-III.H. Methane recovery in wastewater treatment --- Version 16
Value(s) applied	0.25
Choice of data or Measurement methods and procedures	Default value
Purpose of data	Calculation of baseline emissions
Additional comment	N/A

Data / Parameter	UF_{BL}
Unit	-
Description	Model correction factor to account for model uncertainties
Source of data	Para 20 of AMS-III.H. Methane recovery in wastewater treatment --- Version 16
Value(s) applied	0.89
Choice of data or Measurement methods and procedures	Default value
Purpose of data	Calculation of baseline emissions
Additional comment	N/A

Data / Parameter	GWP_{CH4}
Unit	-
Description	Global Warming Potential for methane
Source of data	Para 20 of AMS-III.H. Methane recovery in wastewater treatment --- Version 16
Value(s) applied	25
Choice of data or Measurement methods and procedures	Default value
Purpose of data	Calculation of baseline emissions and project emissions
Additional comment	N/A

Data / Parameter	$EF_{grid,CM,y}$
Unit	tCO_2/MWh
Description	Combined margin emission factor for grid electricity (Sumatra, Republic of Indonesia)
Source of data	Calculated by the Department of Energy and Natural Resources to the DNA of Republic of Indonesia
Value(s) applied	0.743 With a local grid connected by each CPA, this value is different. The value applied here is a temporary value used as a sample of ex-ante calculation in the section B.6.3.
Choice of data or Measurement methods and procedures	Calculated as per the “Tool to calculate the emission factor of an electricity system”.
Purpose of data	Calculation of project emissions
Additional comment	N/A

Data / Parameter	$TDL_{grid,y}$
Unit	-
Description	Average technical transmission and distribution losses for providing electricity to from the grid
Source of data	“Data and parameters monitored” of “Tool to calculate baseline, project and/or leakage emissions from electricity consumption”
Value(s) applied	20%
Choice of data or Measurement methods and procedures	Default value
Purpose of data	Calculation of project emissions
Additional comment	N/A

Data / Parameter	$MCF_{ww,treatment,PJ,P1}$
Unit	-
Description	Methane correction factor for the project wastewater treatment system 1 (P1) equipped with biogas recovery equipment
Source of data	Table III.H.1 of AMS-III.H. Methane recovery in wastewater treatment --- Version 16
Value(s) applied	0.8
Choice of data or Measurement methods and procedures	The depth of lagoon is operated more than 2m, the value of Anaerobic deep lagoon (depth more than 2 meters) from Table III.H.1 is applied.
Purpose of data	Calculation of project emissions
Additional comment	N/A

Data / Parameter	$MCF_{ww,treatment,PJ,P2}$
Unit	-
Description	Methane correction factor for the project wastewater treatment system 2 (P2) equipped with biogas recovery equipment
Source of data	Table III.H.1 of AMS-III.H. Methane recovery in wastewater treatment --- Version 16
Value(s) applied	0.8
Choice of data or Measurement methods and procedures	The depth of lagoon is operated more than 2m, the value of Anaerobic deep lagoon (depth more than 2 meters) from Table III.H.1 is applied.
Purpose of data	Calculation of project emissions
Additional comment	N/A

Data / Parameter	$MCF_{ww,discharge,PJ}$
Unit	-
Description	Methane correction factor based on discharge pathway of the wastewater in the project scenario
Source of data	Table III.H.1 of AMS-III.H. Methane recovery in wastewater treatment --- Version 16
Value(s) applied	0.1
Choice of data or Measurement methods and procedures	The value for discharge of wastewater to sea, river or lake from Table III.H.1 is used.
Purpose of data	Calculation of project emissions
Additional comment	N/A

Data / Parameter	UF_{PJ}
Unit	-
Description	Model correction factor to account for model uncertainties
Source of data	Para 29 of AMS-III.H. Methane recovery in wastewater treatment --- Version 16
Value(s) applied	1.12
Choice of data or Measurement methods and procedures	Default value
Purpose of data	Calculation of project emissions
Additional comment	N/A

Data / Parameter	CFE_{ww}
Unit	-
Description	Capture efficiency of the biogas recovery equipment in the wastewater treatment systems
Source of data	Para 30 of AMS-III.H. Methane recovery in wastewater treatment --- Version 16
Value(s) applied	0.9
Choice of data or Measurement methods and procedures	Default value
Purpose of data	Calculation of project emissions
Additional comment	N/A

Data / Parameter	ρ_{CH4}
Unit	$kgCH_4/m^3CH_4$
Description	Density of methane at normal conditions
Source of data	Table 1 of “Tool to determine project emissions from flaring gases containing methane”
Value(s) applied	0.716
Choice of data or Measurement methods and procedures	Default value
Purpose of data	Calculation of project emissions
Additional comment	N/A

Data / Parameter	$EF_{CO2,grid,y}$
Unit	tCO_2/MWh
Description	Emission factor for grid electricity
Source of data	Calculated by the Department of Energy and Natural Resources to the DNA of Republic of Indonesia
Value(s) applied	0.743 With a local grid connected by each CPA, this value is different. The value applied here is a temporary value used as a sample of ex-ante calculation in the section B.6.3.
Choice of data or Measurement methods and procedures	Calculated as per the "Tool to calculate the emission factor of an electricity system".
Purpose of data	Calculation of project emissions
Additional comment	N/A

B.6.3. Ex-ante calculations of emission reductions

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In this section, a sample of ex-ante calculations is shown.

The outline of a baseline system is as in Figure 5, and the outline of a project system is as in Figure 6.

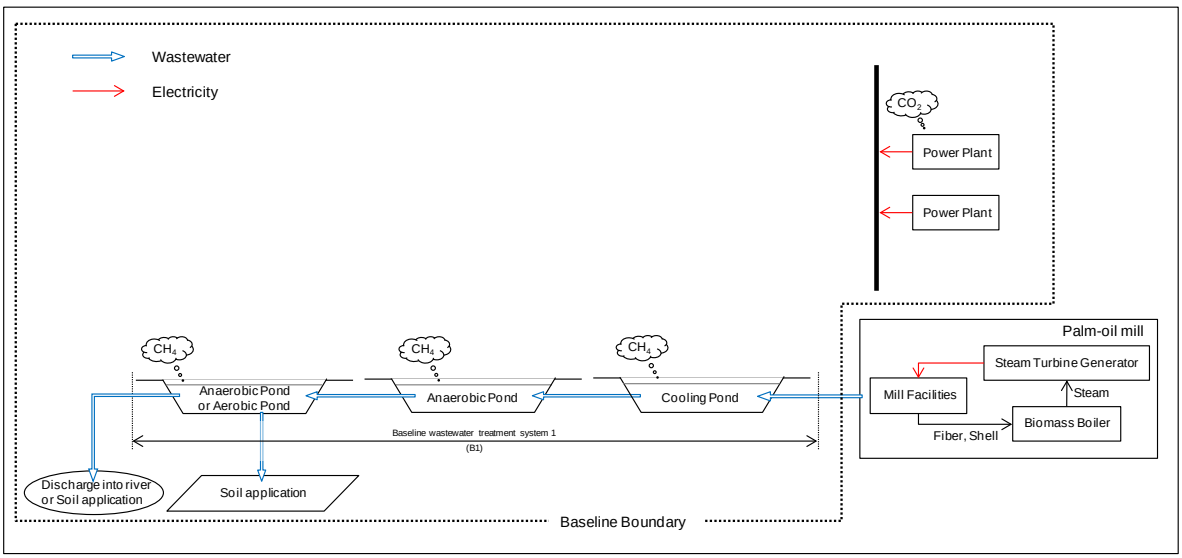

Figure 5 Baseline system

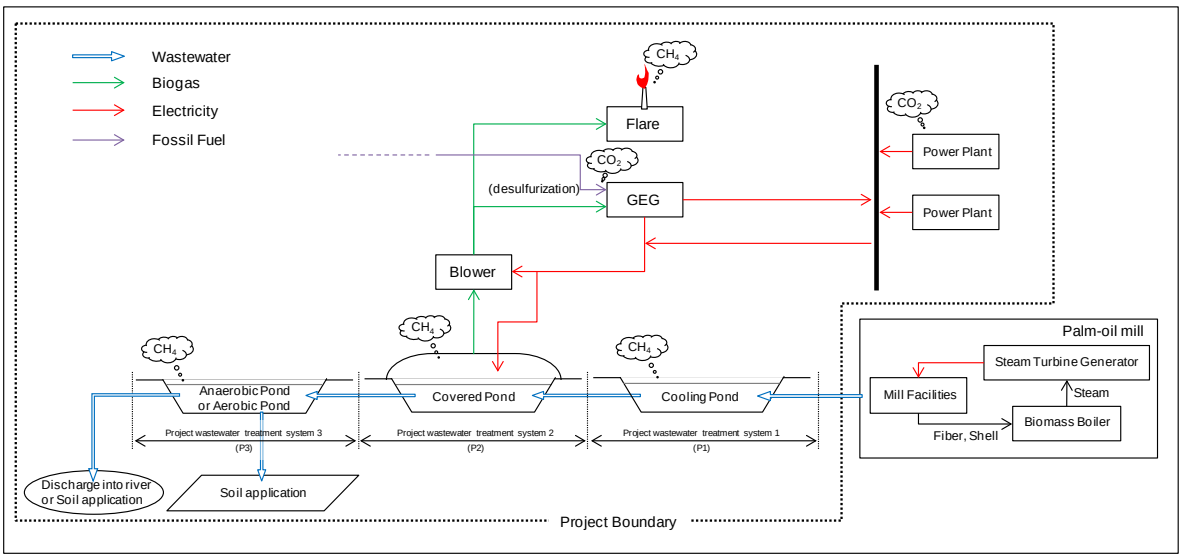

Figure 6 Project system

<u>Wastewater treatment</u>

Baseline

<u>a) Baseline emissions from electricity or fuel consumption</u>

The emissions are neglected for the reason explained in the same item of the section B.6.1.

<u>b) Baseline emissions of the wastewater treatment systems affected by the project activity</u>

In the baseline wastewater treatment system, since the scope from exit of wastewater from the mill to just before field application is viewed as an integrated system.

$$BE_{ww,treatment,y} = \Sigma_i(Q_{ww,i,y} \times COD_{inflow,i,y} \times \eta_{COD,BL,i} \times MCF_{ww,treatment,BL,i}) \times B_{o,ww} \times UF_{BL} \times GWP_{CH4} \quad (2)$$
$$= Q_{ww,B1,y} \times COD_{inflow,B1,y} \times \eta_{COD,BL,B1} \times MCF_{ww,treatment,BL,B1}) \times B_{o,ww} \times UF_{BL} \times GWP_{CH4}$$

$Q_{ww,B1,y}$	Volume of wastewater treated in baseline wastewater treatment system (B1) in year *y* (m^3)	**xxxx**
$COD_{inflow,B1,y}$	Chemical oxygen demand of the wastewater inflow to the baseline treatment system (B1) in year *y*(t/m^3)	**xxxx**
$\eta_{COD,BL,B1}$	COD removal efficiency of the baseline treatment system (B1)	**xxxx**
$MCF_{ww,treatment,BL,B1}$	Methane correction factor for baseline wastewater treatment system (B1) (MCF values as per Table III.H.1 : Anaerobic deep lagoon (depth more than 2 m) 0.8)	0.8
$B_{o,ww}$	Methane producing capacity of the wastewater (IPCC value of 0.25 kg CH_4/kg COD)	0.25
UF_{BL}	Model correction factor to account for model uncertainties (0.89)	0.89
GWP_{CH4}	Global Warming Potential for methane (value of 25)	25

<u>c) Baseline emissions of the sludge treatment systems affected by the project activity</u>

The emissions are neglected for the reason explained in the same item of the section B.6.1.

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

$$BE_{ww,discharge,y} = Q_{ww,y} \times COD_{ww,discharge,BL,y} \times MCF_{ww,discharge,BL} \times B_{o,ww} \times UF_{BL} \times GWP_{CH4} \quad (3)$$

$Q_{ww,y}$	Volume of treated wastewater discharged in year *y* (m^3)	**xxxx**
$COD_{ww,discharge,BL,y}$	Chemical oxygen demand of treated wastewater discharged into sea, river or lake in the baseline situation in year *y*(t/m^3)	**xxxx**
$MCF_{ww,discharge,BL}$	Methane correction factor based on discharge pathway in the baseline situation (e.g. into sea, river or lake) of the wastewater (MCF values as per Table III.H.1 : Discharge of wastewater to sea, river or lake 0.1)	0.1
$B_{o,ww}$	Methane producing capacity of the wastewater (IPCC value of 0.25 kg CH_4 /kg COD)	0.25
UF_{BL}	Model correction factor to account for model uncertainties (0.89)	0.89
GWP_{CH4}	Global Warming Potential for methane (value of 25)	25

e) Baseline methane emissions from anaerobic decay of the final sludge produced

The emissions are neglected for the reason explained in the same item of the section B.6.1.

Total baseline emissions under wastewater treatment

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

Project Activity Emissions

a) Emissions from electricity or fuel consumption

$$PE_{power,y}=EC_{PJ,grid,y}\times EF_{EL,grid,y}\times(1+TDL_{grid,y})+FC_{diesel,y}\times NCV_{diesel,y}\times EF_{CO2,diesel,y} \quad (5)$$

$EC_{PJ,grid,y}$	Quantity of electricity consumed by the project electricity consumption from the grid in year y (MWh/y)	**xxxx**
$EF_{EL,grid,y}$	Emission factor for electricity generation from the grid in year y (tCO_2/MWh)	**xxxx**
$TDL_{grid,y}$	Average technical transmission and distribution losses for providing electricity to from the grid in year y	20%
$FC_{diesel,y}$	Quantity of diesel combusted in year y (ton)	**xxxx**
$NCV_{diesel,y}$	Weighted average net calorific value of diesel in year y (GJ/ton)	**xxxx**
$EF_{CO2,diesel,y}$	Weighted average CO_2 emission factor of diesel in year y (tCO_2/GJ)	**xxxx**

b) Methane emissions from wastewater treatment systems affected by the project activity, and not equipped with biogas recovery

$$PE_{ww,treatment,y}=\Sigma_k(Q_{ww,k,y}\times COD_{inflow,k,y}\times\eta_{COD,PJ,k}\times MCF_{ww,treatment,PJ,k})\times B_{o,ww}\times UF_{PJ}\times GWP_{CH4} \quad (6)$$

$$=(Q_{ww,P1,y}\times COD_{inflow,P1,y}\times\eta_{COD,PJ,P1}\times MCF_{ww,treatment,PJ,P1} + Q_{ww,P3,y}\times COD_{inflow,P3,y}\times\eta_{COD,PJ,P3}\times MCF_{ww,treatment,PJ,P3})\times B_{o,ww}\times UF_{PJ}\times GWP_{CH4}$$

$Q_{ww,P1,y}$	Volume of wastewater treated in project wastewater treatment system 1 *(P1)* in year *y* (m^3)	**xxxx**
$COD_{inflow,P1,y}$	Chemical oxygen demand of the wastewater inflow to the project treatment system 1 *(P1)* in year *y*(t/m^3)	**xxxx**

$\eta_{COD,PJ,P1}$	COD removal efficiency of the project wastewater treatment system 1 *(P1)* in year *y* (t/m^3)	**xxxx**
$MCF_{ww,treatment,PJ,P1}$	Methane correction factor for project wastewater treatment system 1 *(P1)* (MCF values as per Table III.H.1 : Anaerobic deep lagoon (depth more than 2 m) 0.8)	0.8
$Q_{ww,P3,y}$	Volume of wastewater treated in project wastewater treatment system 3 *(P3)* in year *y* (m^3)	**xxxx**
$COD_{inflow,P3,y}$	Chemical oxygen demand of the wastewater inflow to the project treatment system 3 *(P3)* in year *y*(t/m^3)	**xxxx**
$\eta_{COD,PJ,P3}$	COD removal efficiency of the project wastewater treatment system 3 *(P3)* in year *y* (t/m^3)	**xxxx**
$MCF_{ww,treatment,PJ,P3}$	Methane correction factor for project wastewater treatment system 3 *(P3)* (MCF values as per Table III.H.1 : Anaerobic deep lagoon (depth more than 2 m) 0.8)	0.8
$B_{o,ww}$	Methane producing capacity of the wastewater (IPCC value of 0.25 kg CH_4/kg COD)	0.25
UF_{PJ}	Model correction factor to account for model uncertainties (1.12)	1.12
GWP_{CH4}	Global Warming Potential for methane (value of 25)	25

c) Methane emissions from sludge treatment systems affected by the project activity, and not equipped with biogas recovery

The emissions are neglected for the reason explained in the same item of the section B.6.1.

d) Methane emissions from degradable organic carbon in treated wastewater

$$PE_{ww,discharge,y} = Q_{ww,y} \times COD_{ww,discharge,PJ,y} \times MCF_{ww,discharge,PJ} \times B_{o,ww} \times UF_{PJ} \times GWP_{CH4} \quad (7)$$

$Q_{ww,y}$	Volume of treated wastewater discharged in year *y* (m^3)	**xxxx**
$COD_{ww,discharge,PJ,y}$	Chemical oxygen demand of treated wastewater discharged into sea, river or lake in the project scenario in year *y*(t/m^3)	**xxxx**
$MCF_{ww,discharge,PJ}$	Methane correction factor based on discharge pathway in the project scenario (e.g. into sea, river or lake) of the wastewater (MCF values as per Table III.H.1 : Discharge of wastewater to sea, river or lake 0.1)	0.1
$B_{o,ww}$	Methane producing capacity of the wastewater (IPCC value of 0.25 kg CH_4/kg COD)	0.25
UF_{PJ}	Model correction factor to account for model uncertainties (1.12)	1.12
GWP_{CH4}	Global Warming Potential for methane (value of 25)	25

e) Methane emissions from anaerobic decay of the final sludge produced

The emissions are neglected for the reason explained in the same item of the section B.6.1.

f) Methane emissions from biogas release in capture systems

$$MEP_{ww,treatment,y}=Q_{ww,y}\times B_{o,ww}\times UF_{PJ}\times \sum_k (COD_{removed,PJ,k,y}\times MCF_{ww,treatment,PJ,k}) \quad (10)$$
$$=Q_{ww,y}\times B_{o,ww}\times UF_{PJ}\times COD_{removed,PJ,P2,y}\times MCF_{ww,treatment,PJ,P2})$$

$Q_{ww,y}$	Volume of treated wastewater discharged in year *y* (m^3)	**xxxx**
$B_{o,ww}$	Methane producing capacity of the wastewater (IPCC value of 0.25 kg	0.25

	CH_4/kg COD)	
UF_{PJ}	Model correction factor to account for model uncertainties (1.12)	1.12
$COD_{removed,PJ,P2,y}$	The chemical oxygen demand removed by the treatment system 2 *(P2)* of the project activity equipped with biogas recovery in the year *y* (t/m^3)	**xxxx**
$MCF_{ww,treatment,PJ,P2}$	Methane correction factor for the project wastewater treatment system 2 *(P2)* equipped with biogas recovery equipment (MCF values as per Table III.H.1)	0.8

$$PE_{fugitive,y}=PE_{fugitive,ww,y} \quad (8)'$$
$$=(1-CFE_{ww}) \times MEP_{ww,treatment,y} \times GWP_{CH4} \quad (9)$$

CFE_{ww}	Capture efficiency of the biogas recovery equipment in the wastewater treatment systems (a default value of 0.9 shall be used)	0.9
GWP_{CH4}	Global Warming Potential for methane (value of 25)	25

g) Methane emissions from biomass stored under anaerobic conditions

The emissions are neglected for the reason explained in the same item of the section B.6.1.

h) Methane emissions due to incomplete flaring

$$TM_{RG,h} = FV_{RG,h} \times fv_{CH4,RG,h} \times \rho_{CH4} \quad (12)$$

$FV_{RG,h}$	Volumetric flow rate of the residual gas in dry basis at normal conditions in hour h (m^3/h)	**xxxx**
$fv_{CH4,RG,h}$	Volumetric fraction of methane in the residual gas on dry basis in hour h (-)	**xxxx**
ρ_{CH4}	Density of methane at normal conditions (0.716) ($kgCH_4/m^3CH_4$)	0.716

$$PE_{flaring,y} = PE_{flare,y}$$
$$=\Sigma_{(h=1\sim8760)} TM_{RG,h} \times (1-\eta_{flare,h}) \times GWP_{CH4} / 1000 \quad (11)$$

$\eta_{flare,h}$	Flare efficiency in hour *h*	0.9
GWP_{CH4}	Global Warming Potential for methane (value of 25)	25

Total project emissions under wastewater treatment

$$PE_{wastewater,y}=\{PE_{power,y}+PE_{ww,treatment,y}+PE_{s,treatment,y}+PE_{ww,discharge,y}$$
$$+PE_{s,final,y}+PE_{fugitive,y}+PE_{biomass,y}+PE_{flaring,y}\} \quad (4)$$

Emission Reduction (Ex-ante)

$$ER_{wastewater,y,ex\text{-}ante}=BE_{wastewater,y,ex\text{-}ante}-PE_{wastewater,y,ex\text{-}ante} \quad (13)'$$

Electricity generation

Baseline

In ex-ante calculation, $BG_{burnt,GEG,y}$ is calculated by the equation (20) which modified the equation (10). The methane emission potential calculated by the equation (10) is rectified with recovery efficiency and

operation days, and volume conversion is carried out.

$$BG_{burnt,GEG,y} = CFE_{ww} \times Q_{ww,y} \times B_{o,ww} \times UF_{PJ} \times (COD_{removed,PJ,P2,y} \times MCF_{ww,treatment,PJ,P2}) \times \text{“annual operating days”} / 365 / \rho_{CH4} \times 1000 \quad (20)$$

CFE_{ww}	Capture efficiency of the biogas recovery equipment in the wastewater treatment systems (a default value of 0.9 shall be used)	0.9
$Q_{ww,y}$	Volume of treated wastewater discharged in year *y* (m^3)	**xxxx**
$B_{o,ww}$	Methane producing capacity of the wastewater (IPCC value of 0.25 kg CH_4/kg COD)	0.25
UF_{PJ}	Model correction factor to account for model uncertainties (1.12)	1.12
$COD_{removed,PJ,P2,y}$	The chemical oxygen demand removed by the treatment system 2 *(P2)* of the project activity equipped with biogas recovery in the year *y* (t/m^3)	**xxxx**
$MCF_{ww,treatment,PJ,P2}$	Methane correction factor for the project wastewater treatment system 2 *(P2)* equipped with biogas recovery equipment (MCF values as per Table III.H.1)	0.8
“annual operating days” (-)		**xxxx**
ρ_{CH4}	Density of methane at normal conditions (0.716) ($kgCH_4/m^3CH_4$)	0.716

In ex-ante calculation, $EG_{BL,y}$ is calculated by the equation (21). Internal consumption of GEG and electricity consumption in the facility are deducted by the quantity of electricity generation calculated by amount of methane, lower heating value of methane and power generation efficiency.

$$EG_{BL,y} = BG_{burnt,GEG,y} \times \text{“LHV of Methane”} / \text{“unit conversion”} / 1000 \times \text{“power generation efficiency”} \times (1 - \text{“Internal consumption of GEG”}) - \text{“Electricity (GEG to water treatment system)”} \quad (21)$$

$BG_{burnt,GEG,y}$	The volume of biogas which is burnt by gas engine generator (m^3)	**xxxx**
“LHV of Methane” ($kcal/m^3$)		8,560
“unit conversion” (kcal/kWh)		860
“power generation efficiency” (-)		**xxxx**
“Internal consumption of GEG” (-)		**xxxx**
“Electricity (GEG to water treatment system)” (MWh)		**xxxx**

$$BE_{electricity,y} = EG_{BL,y} \times EF_{CO2,grid,y} \quad (16)$$

$EG_{BL,y}$	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y (MWh)	**xxxx**
$EF_{CO2,grid,y}$	CO2 emission factor of the grid in year y (tCO_2/MWh)	**xxxx**

Emission Reduction

$$ER_{electricity,y} = BE_{electricity,y} \quad (18)'$$

Sample of ex-ante calculation

B.6.3 of "V. Specific guidelines" of "Guidelines for completing the programme design document form for small-scale CDM programmes of activities (EB66 Annex13)" has the description "Provide a sample calculation for each equation used, substituting the values used in the equations".
According to this description, a sample calculation is provided here.

The specific conditions set up for the sample of ex-ante calculation are as follows. This is the same as the calculation of CPA, the title of the CPA is "PTPN VI Pinang Tinggi Mill POME Biogas Project in Jambi Province, Sumatera in Indonesia", submitted simultaneously with this PoA.

- The resulting low-concentration wastewater is discharge into rivers.
- The gas engine of the power generation capacity of 1,050 kW and 40% of power generation efficiency is planned to install.
- The days of operation of a gas engine are 313 days in one year.
- The enclosed type flare is planned to install.
- The other values used in the equations are contained in the table in section B.6.2 and section B.7.1.

Wastewater treatment

Baseline

a) Baseline emissions from electricity or fuel consumption

The emissions are neglected for the reason explained in the same item of the section B.6.1.

b) Baseline emissions of the wastewater treatment systems affected by the project activity

In the baseline wastewater treatment system, since the scope from exit of wastewater from the mill to just before field application is viewed as an integrated system.

$$BE_{ww,treatment,y} = \Sigma_i(Q_{ww,i,y} \times COD_{inflow,i,y} \times \eta_{COD,BL,i} \times MCF_{ww,treatment,BL,i}) \times B_{o,ww} \times UF_{BL} \times GWP_{CH4} \quad (2)$$
$$= Q_{ww,B1,y} \times COD_{inflow,B1,y} \times \eta_{COD,BL,B1} \times MCF_{ww,treatment,BL,B1}) \times B_{o,ww} \times UF_{BL} \times GWP_{CH4}$$
$$= 181{,}567 \times 0.04142 \times 0.7805 \times 0.8 \times 0.25 \times 0.89 \times 25$$
$$= 26{,}120$$

$Q_{ww,B1,y}$	Volume of wastewater treated in baseline wastewater treatment system (B1) in year *y* (m^3)	181,567
$COD_{inflow,B1,y}$	Chemical oxygen demand of the wastewater inflow to the baseline treatment system (B1) in year *y*(t/m^3)	0.04142
$\eta_{COD,BL,B1}$	COD removal efficiency of the baseline treatment system (B1)	0.7805
$MCF_{ww,treatment,BL,B1}$	Methane correction factor for baseline wastewater treatment system (B1) (MCF values as per Table III.H.1 : Anaerobic deep lagoon (depth more than 2 m) 0.8)	0.8
$B_{o,ww}$	Methane producing capacity of the wastewater (IPCC value of 0.25 kg CH_4/kg COD)	0.25
UF_{BL}	Model correction factor to account for model uncertainties (0.89)	0.89
GWP_{CH4}	Global Warming Potential for methane (value of 25)	25

c) Baseline emissions of the sludge treatment systems affected by the project activity

The emissions are neglected for the reason explained in the same item of the section B.6.1.

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

$$BE_{ww,discharge,y} = Q_{ww,y} \times COD_{ww,discharge,BL,y} \times MCF_{ww,discharge,BL} \times B_{o,ww} \times UF_{BL} \times GWP_{CH4} \quad (3)$$
$$= 181{,}567 \times 0.00452 \times 0.1 \times 0.25 \times 0.89 \times 25$$
$$= 457$$

$Q_{ww,y}$	Volume of treated wastewater discharged in year *y* (m^3)	181,567
$COD_{ww,discharge,BL,y}$	Chemical oxygen demand of treated wastewater discharged into sea, river or lake in the baseline situation in year *y*(t/m^3)	0.00452
$MCF_{ww,discharge,BL}$	Methane correction factor based on discharge pathway in the baseline situation (e.g. into sea, river or lake) of the wastewater (MCF values as per Table III.H.1 : Discharge of wastewater to sea, river or lake 0.1)	0.1
$B_{o,ww}$	Methane producing capacity of the wastewater (IPCC value of 0.25 kg CH_4 /kg COD)	0.25
UF_{BL}	Model correction factor to account for model uncertainties (0.89)	0.89
GWP_{CH4}	Global Warming Potential for methane (value of 25)	25

e) Baseline methane emissions from anaerobic decay of the final sludge produced

The emissions are neglected for the reason explained in the same item of the section B.6.1.

Total baseline emissions under wastewater treatment

$$BE_{wastewater,y} = \{BE_{power,y}+BE_{ww,treatment,y}+BE_{s,treatment,y}+BE_{ww,discharge,y}+BE_{s,final,y}\} \quad (1)$$
$$= 0+26{,}120+0+457+0$$
$$= 26{,}577$$

Project Activity Emissions

a) Emissions from electricity or fuel consumption

$$PE_{power,y}=EC_{PJ,grid,y}\times EF_{EL,grid,y}\times(1+TDL_{grid,y})+FC_{diesel,y}\times NCV_{diesel,y}\times EF_{CO2,diesel,y} \quad (5)$$
$$=18\times0.743\times1.2+22\times42.7\times0.0741$$
$$=86$$

$EC_{PJ,grid,y}$	Quantity of electricity consumed by the project electricity consumption from the grid in year y (MWh/y)	18
$EF_{EL,grid,y}$	Emission factor for electricity generation from the grid in year y (tCO_2/MWh)	0.743
$TDL_{grid,y}$	Average technical transmission and distribution losses for providing electricity to from the grid in year y	20%
$FC_{diesel,y}$	Quantity of diesel combusted in year y (ton)	22
$NCV_{diesel,y}$	Weighted average net calorific value of diesel in year y (GJ/ton)	42.7
$EF_{CO2,diesel,y}$	Weighted average CO_2 emission factor of diesel in year y (tCO_2/GJ)	0.0741

b) Methane emissions from wastewater treatment systems affected by the project activity, and not equipped with biogas recovery

$$PE_{ww,treatment,y}=\Sigma_k(Q_{ww,k,y}\times COD_{inflow,k,y}\times\eta_{COD,PJ,k}\times MCF_{ww,treatment,PJ,k})\times B_{o,ww}\times UF_{PJ}\times GWP_{CH4} \quad (6)$$
$$=(Q_{ww,P1,y}\times COD_{inflow,P1,y}\times\eta_{COD,PJ,P1}\times MCF_{ww,treatment,PJ,P1}$$
$$+Q_{ww,P3,y}\times COD_{inflow,P3,y}\times\eta_{COD,PJ,P3}\times MCF_{ww,treatment,PJ,P3})\times B_{o,ww}\times UF_{PJ}\times GWP_{CH4}$$

=(181,567×0.04142×0.1300×0.8+181,567×0.00721×0.2950×0.8) ×0.25×1.12×25
=5,475+2,163
=7,638

$Q_{ww,P1,y}$	Volume of wastewater treated in project wastewater treatment system 1 *(P1)* in year *y* (m^3)	181,567
$COD_{inflow,P1,y}$	Chemical oxygen demand of the wastewater inflow to the project treatment system 1 *(P1)* in year *y*(t/m^3)	0.04142
$\eta_{COD,PJ,P1}$	COD removal efficiency of the project wastewater treatment system 1 *(P1)* in year *y* (t/m^3)	0.1300
$MCF_{ww,treatment,PJ,P1}$	Methane correction factor for project wastewater treatment system 1 *(P1)* (MCF values as per Table III.H.1 : Anaerobic deep lagoon (depth more than 2 m) 0.8)	0.8
$Q_{ww,P3,y}$	Volume of wastewater treated in project wastewater treatment system 3 *(P3)* in year *y* (m^3)	156,100
$COD_{inflow,P3,y}$	Chemical oxygen demand of the wastewater inflow to the project treatment system 3 *(P3)* in year *y*(t/m^3)	0.00721
$\eta_{COD,PJ,P3}$	COD removal efficiency of the project wastewater treatment system 3 *(P3)* in year *y* (t/m^3)	0.2950
$MCF_{ww,treatment,PJ,P3}$	Methane correction factor for project wastewater treatment system 3 *(P3)* (MCF values as per Table III.H.1 : Anaerobic deep lagoon (depth more than 2 m) 0.8)	0.8
$B_{o,ww}$	Methane producing capacity of the wastewater (IPCC value of 0.25 kg CH_4/kg COD)	0.25
UF_{PJ}	Model correction factor to account for model uncertainties (1.12)	1.12
GWP_{CH4}	Global Warming Potential for methane (value of 25)	25

c) Methane emissions from sludge treatment systems affected by the project activity, and not equipped with biogas recovery

The emissions are neglected for the reason explained in the same item of the section B.6.1.

d) Methane emissions from degradable organic carbon in treated wastewater

$$PE_{ww,discharge,y} = Q_{ww,y} \times COD_{ww,discharge,PJ,y} \times MCF_{ww,discharge,PJ} \times B_{o,ww} \times UF_{PJ} \times GWP_{CH4} \quad (7)$$

=181,567×0.00508×0.1×0.25×1.12×25
=646

$Q_{ww,y}$	Volume of treated wastewater discharged in year *y* (m^3)	181,567
$COD_{ww,discharge,PJ,y}$	Chemical oxygen demand of treated wastewater discharged into sea, river or lake in the project scenario in year *y*(t/m^3)	0.00508
$MCF_{ww,discharge,PJ}$	Methane correction factor based on discharge pathway in the project scenario (e.g. into sea, river or lake) of the wastewater (MCF values as per Table III.H.1 : Discharge of wastewater to sea, river or lake 0.1)	0.1
$B_{o,ww}$	Methane producing capacity of the wastewater (IPCC value of 0.25 kg CH_4/kg COD)	0.25
UF_{PJ}	Model correction factor to account for model uncertainties (1.12)	1.12
GWP_{CH4}	Global Warming Potential for methane (value of 25)	25

e) Methane emissions from anaerobic decay of the final sludge produced

The emissions are neglected for the reason explained in the same item of the section B.6.1.

f) Methane emissions from biogas release in capture systems

$$MEP_{ww,treatment,y}=Q_{ww,y}\times B_{o,ww}\times UF_{PJ}\times\sum_k(COD_{removed,PJ,k,y}\times MCF_{ww,treatment,PJ,k}) \quad (10)$$
$$=Q_{ww,y}\times B_{o,ww}\times UF_{PJ}\times COD_{removed,PJ,P2,y}\times MCF_{ww,treatment,PJ,P2})$$
$$=181{,}567\times 0.25\times 1.12\times(0.02882\times 0.8)$$
$$=1{,}172$$

$Q_{ww,y}$	Volume of treated wastewater discharged in year *y* (m^3)	181,567
$B_{o,ww}$	Methane producing capacity of the wastewater (IPCC value of 0.25 kg CH_4/kg COD)	0.25
UF_{PJ}	Model correction factor to account for model uncertainties (1.12)	1.12
$COD_{removed,PJ,P2,y}$	The chemical oxygen demand removed by the treatment system 2 *(P2)* of the project activity equipped with biogas recovery in the year *y* (t/m^3)	0.02882
$MCF_{ww,treatment,PJ,P2}$	Methane correction factor for the project wastewater treatment system 2 *(P2)* equipped with biogas recovery equipment (MCF values as per Table III.H.1)	0.8

$$PE_{fugitive,y}=PE_{fugitive,ww,y} \quad (8)'$$
$$=(1-CFE_{ww})\times MEP_{ww,treatment,y}\times GWP_{CH4} \quad (9)$$
$$=(1-0.9)\times 1{,}172\times 25$$
$$=2{,}930$$

CFE_{ww}	Capture efficiency of the biogas recovery equipment in the wastewater treatment systems (a default value of 0.9 shall be used)	0.9
GWP_{CH4}	Global Warming Potential for methane (value of 25)	25

g) Methane emissions from biomass stored under anaerobic conditions

The emissions are neglected for the reason explained in the same item of the section B.6.1.

h) Methane emissions due to incomplete flaring

$$TM_{RG,h} = FV_{RG,h}\times fv_{CH4,RG,h}\times \rho_{CH4} \quad (12)$$
$$=23.962\times 0.716$$
$$=17.157$$

$FV_{RG,h}$	Volumetric flow rate of the residual gas in dry basis at normal conditions in hour h (m^3/h)	23.962 (The volume value of methane)
$fv_{CH4,RG,h}$	Volumetric fraction of methane in the residual gas on dry basis in hour h (-)	
ρ_{CH4}	Density of methane at normal conditions (0.716) ($kgCH_4/m^3CH_4$)	0.716

$$PE_{flaring,y} = PE_{flare,y}$$
$$=\Sigma_{(h=1\sim 8760)}TM_{RG,h}\times(1-\eta_{flare,h})\times GWP_{CH4}/1000 \quad (11)$$
$$=8{,}760\times 17.157\times(1-0.9)\times 25/1000$$
$$=376$$

$\eta_{flare,h}$	Flare efficiency in hour *h*	0.9
GWP_{CH4}	Global Warming Potential for methane (value of 25)	25

Total project emissions under wastewater treatment

$$PE_{wastewater,y}=\{PE_{power,y}+PE_{ww,treatment,y}+PE_{s,treatment,y}+PE_{ww,discharge,y}+PE_{s,final,y}+PE_{fugitive,y}+PE_{biomass,y}+PE_{flaring,y}\} \quad (4)$$

$$=86+7,638+0+646+0+2,930+0+376$$

$$=11,676$$

Emission Reduction (Ex-ante)

$$ER_{wastewater,y,ex\text{-}ante}=BE_{wastewater,y,ex\text{-}ante}-PE_{wastewater,y,ex\text{-}ante} \quad (13)'$$

$$=26,577-11,676$$

$$=14,901$$

Electricity generation

Baseline

$$BG_{burnt,GEG,y} = CFE_{ww} \times Q_{ww,y} \times B_{o,ww} \times UF_{PJ} \times (COD_{removed,PJ,P2,y} \times MCF_{ww,treatment,PJ,P2}) \times \text{“annual operating days”} / 365 / \rho_{CH4} \times 1000 \quad (20)$$

$$= 0.9\times181,567\times0.25\times1.12\times(0.02882\times0.8)\times313/365/0.716\times1000$$

$$=1,263,455$$

CFE_{ww}	Capture efficiency of the biogas recovery equipment in the wastewater treatment systems (a default value of 0.9 shall be used)	0.9
$Q_{ww,y}$	Volume of treated wastewater discharged in year *y* (m^3)	181,567
$B_{o,ww}$	Methane producing capacity of the wastewater (IPCC value of 0.25 kg CH_4/kg COD)	0.25
UF_{PJ}	Model correction factor to account for model uncertainties (1.12)	1.12
$COD_{removed,PJ,P2,y}$	The chemical oxygen demand removed by the treatment system 2 *(P2)* of the project activity equipped with biogas recovery in the year *y* (t/m^3)	0.02882
$MCF_{ww,treatment,PJ,P2}$	Methane correction factor for the project wastewater treatment system 2 *(P2)* equipped with biogas recovery equipment (MCF values as per Table III.H.1)	0.8
“annual operating days” (-)		313
ρ_{CH4}	Density of methane at normal conditions (0.716) ($kgCH_4/m^3CH_4$)	0.716

$$EG_{BL,y} = BG_{burnt,GEG,y} \times \text{“LHV of Methane”} / \text{“unit conversion”} / 1000 \times \text{“power generation efficiency”} \times (1-\text{“Internal consumption of GEG”}) - \text{“Electricity (GEG to water treatment system)”} \quad (21)$$

$$=1,263,455 \times 8,560 / 860 /1,000 \times 0.4 \times (1-0.05) - 108$$

$$=4,671$$

$BG_{burnt,GEG,y}$	The volume of biogas which is burnt by gas engine generator (m^3)	1,263,455
“LHV of Methane” ($kcal/m^3$)		8,560
“unit conversion” (kcal/kWh)		860
“power generation efficiency” (-)		0.4

“Internal consumption of GEG” (-)	0.05
“Electricity (GEG to water treatment system)” (MWh)	108

$$BE_{electricity,y} = EG_{BL,y} \times EF_{CO2,grid,y} \quad (16)$$
$$=4,671\times0.743$$
$$=3,471$$

$EG_{BL,y}$	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y (MWh)	4,671
$EF_{CO2,grid,y}$	CO2 emission factor of the grid in year y (tCO_2/MWh)	0.743

Emission Reduction

$$ER_{electricity,y}=BE_{electricity,y} \quad (18)'$$
$$=3,471$$

<u>Total Emission Reduction</u>

$$ER_{total}=ER_{wastewater,y}+ ER_{electricity,y} \quad (19)$$

	BE_y (tCO_2e)	PE_y (tCO_2e)	LE_y (tCO_2e)	ER_y (tCO_2e)
Wastewater treatment	26,577	11,676	0	14,901
Electricity generation	3,471	0	0	3,471
Total	30,048	11,676	0	18,372

B.7. Application of the monitoring methodology and description of the monitoring plan
B.7.1. Data and parameters to be monitored by each generic CPA

The value indicated in the cell of "Value(s) applied" is a temporary value used as a sample of ex-ante calculation in the section B.6.3.

(Copy this table for each data and parameter)

Data / Parameter	$EC_{PJ,grid,y}$
Unit	MWh/y
Description	Quantity of electricity consumed by the project electricity consumption from the grid in year y
Source of data	On-site measurement by project participant
Value(s) applied	18 This value is different by each CPA. The value applied here is a temporary value used as a sample of ex-ante calculation in the section B.6.3.
Measurement methods and procedures	Measurements are undertaken using energy meters. Calibration will be undertaken as prescribed in the relevant paragraph of "General guidelines to SSC CDM Methodologies". Measurement results will be cross checked with records for purchased electricity (e.g. receipts).
Monitoring frequency	Continuous monitoring, hourly measurement and at least monthly recording.
QA/QC procedures	Measurement results shall be cross checked with records for sold electricity (e.g. invoices/receipts). Measuring equipment will be certified to national or IEC standards and calibrated according to the national standards and reference points or IEC standards and recalibrated at appropriate intervals according to manufacturer specifications, but at least three years.
Purpose of data	Calculation of project emissions
Additional comments	N/A

Data / Parameter	$FC_{diesel,y}$
Unit	ton
Description	The amount of diesel used in year y
Source of data	On-site measurement by project participant
Value(s) applied	22 This value is different by each CPA. The value applied here is a temporary value used as a sample of ex-ante calculation in the section B.6.3.
Measurement methods and procedures	Use mass or Volume meters.
Monitoring frequency	Daily recording the amount of diesel used.
QA/QC procedures	The consumption quantities of diesel will be cross-checked with available purchase invoices from the use records.
Purpose of data	Calculation of project emissions
Additional comments	N/A

Data / Parameter	$NCV_{diesel,y}$
Unit	GJ/tonne
Description	Weighted average net calorific value of diesel in year y
Source of data	The following data sources will be used if the relevant conditions apply: a) Value provided by the fuel supplier in invoices b) Measurements by the project participants c) Regional or national default values d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories. If a) is not available, b), c) or d) will be used.
Value(s) applied	42.7 This value is different by each CPA. The value applied here is a temporary value used as a sample of ex-ante calculation in the section B.6.3.
Measurement methods and procedures	For a) and b): Measurements will be undertaken in line with national or international fuel standards
Monitoring frequency	For a) and b): The NCV should be obtained for each fuel delivery, from which weighted average annual values will be calculated For c):Review appropriateness of the values annually For d): Any future revision of the IPCC Guidelines will be taken into account
QA/QC procedures	Verify if the values under a), b) and c) are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines. If the values fall below this range collect additional information from the testing laboratory to justify the outcome or conduct additional measurements. The laboratories in a), b) or c) will have ISO17025 accreditation or justify that they can comply with similar quality standards.
Purpose of data	Calculation of project emissions
Additional comments	N/A

Data / Parameter	$EF_{CO2,diesel,y}$
Unit	tCO_2/GJ
Description	Weighted average CO_2 emission factor of diesel in year y
Source of data	The following data sources may be used if the relevant conditions apply: a) Values provided by the fuel supplier in invoices b) Measurements by the project participants c) Regional or national default values d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of the 2006 IPCC Guidelines on National GHG Inventories If a) is not available, b), c) or d) will be used.
Value(s) applied	0.0741 This value is different by each CPA. The value applied here is a temporary value used as a sample of ex-ante calculation in the section B.6.3.
Measurement methods and procedures	For a) and b): Measurements will be undertaken in line with national or international fuel standards.
Monitoring frequency	For a) and b): The CO_2 emission factor will be obtained for each fuel delivery, from which weighted average annual values will be calculated For c): Review appropriateness of the values annually For d): Any future revision of the IPCC Guidelines will be taken into account
QA/QC procedures	For a): If the fuel supplier does provide the NCV value and the CO_2 emission factor on the invoice and these two values are based on measurements for this specific fuel, this CO_2 factor will be used. If another source for the CO_2 emission factor is used or no CO_2 emission factor is provided, option b), c) or d) will be used.
Purpose of data	Calculation of project emissions
Additional comments	N/A

Data / Parameter	$Q_{ww,B1,y}$
Unit	m^3/year
Description	The flow of wastewater (POME) that is treated in baseline wastewater treatment system (B1) during the year y
Source of data	On-site measurement by project participant
Value(s) applied	181,567 This value is different by each CPA. The value applied here is a temporary value used as a sample of ex-ante calculation in the section B.6.3.
Measurement methods and procedures	Measurements are undertaken using Volumetric flow meters
Monitoring frequency	Monitored continuously (at least hourly measurements are undertaken, if less, confidence/precision level of 90/10 shall be attained)
QA/QC procedures	Measuring equipment will be certified to national or IEC standards and calibrated according to the national standards and reference points or IEC standards and recalibrated at appropriate intervals according to manufacturer specifications, but at least three years.
Purpose of data	Calculation of baseline emissions
Additional comments	N/A

Data / Parameter	$Q_{ww,P1,y}$
Unit	m³/year
Description	The flow of wastewater (POME) that is treated in project wastewater treatment system 1 (P1) during the year y
Source of data	On-site measurement by project participant
Value(s) applied	181,567 This value is different by each CPA. The value applied here is a temporary value used as a sample of ex-ante calculation in the section B.6.3.
Measurement methods and procedures	Measurements are undertaken using Volumetric flow meters. The value of $Q_{ww,P1,y}$ is equal to the value of $Q_{ww,B1,y}$
Monitoring frequency	Monitored continuously (at least hourly measurements are undertaken, if less, confidence/precision level of 90/10 shall be attained)
QA/QC procedures	Measuring equipment will be certified to national or IEC standards and calibrated according to the national standards and reference points or IEC standards and recalibrated at appropriate intervals according to manufacturer specifications, but at least three years.
Purpose of data	Calculation of baseline emissions
Additional comments	N/A

Data / Parameter	$Q_{ww,P3,y}$
Unit	m³/year
Description	The flow of wastewater (POME) that is treated in project wastewater treatment system 3 (P3) during the year y
Source of data	On-site measurement by project participant
Value(s) applied	181,567 This value is different by each CPA. The value applied here is a temporary value used as a sample of ex-ante calculation in the section B.6.3.
Measurement methods and procedures	Measurements are undertaken using Volumetric flow meters. The value of $Q_{ww,P3,y}$ is equal to the value of $Q_{ww,B1,y}$
Monitoring frequency	Monitored continuously (at least hourly measurements are undertaken, if less, confidence/precision level of 90/10 shall be attained)
QA/QC procedures	Measuring equipment will be certified to national or IEC standards and calibrated according to the national standards and reference points or IEC standards and recalibrated at appropriate intervals according to manufacturer specifications, but at least three years.
Purpose of data	Calculation of baseline emissions
Additional comments	N/A

Data / Parameter	$Q_{ww,y}$
Unit	m³/year
Description	The flow of treated wastewater discharged in year y
Source of data	On-site measurement by project participant
Value(s) applied	181,567 This value is different by each CPA. The value applied here is a temporary value used as a sample of ex-ante calculation in the section B.6.3.
Measurement methods and procedures	Measurements are undertaken using Volumetric flow meters. The value of $Q_{ww,y}$ is equal to the value of $Q_{ww,B1,y}$
Monitoring frequency	Monitored continuously (at least hourly measurements are undertaken, if less, confidence/precision level of 90/10 shall be attained)
QA/QC procedures	Measuring equipment will be certified to national or IEC standards and calibrated according to the national standards and reference points or IEC standards and recalibrated at appropriate intervals according to manufacturer specifications, but at least three years.
Purpose of data	Calculation of baseline emissions
Additional comments	N/A

Data / Parameter	$COD_{ww,untreated,y}$
Unit	t COD/m³
Description	The chemical oxygen demand of the wastewater before the treatment system affected by the project activity
Source of data	On-site measurement by participant
Value(s) applied	0.04142 This value is different by each CPA. The value applied here is a temporary value used as a sample of ex-ante calculation in the section B.6.3.
Measurement methods and procedures	Measure the COD according to national or international standards. COD is measured through representative sampling.
Monitoring frequency	Samples and measurements shall ensure a 90/10 confidence/precision level
QA/QC procedures	Analysis of the COD of the wastewater will be conducted by the certificated laboratory.
Purpose of data	Calculation of baseline emissions and project emission
Additional comments	This value is used for the value of $COD_{inflow,B1,y}$ and $COD_{inflow,P1,y}$. $COD_{inflow,B1,y} = COD_{ww,untreated,y}$ $COD_{inflow,P1,y} = COD_{ww,untreated,y}$

Data / Parameter	$COD_{ww,treated,P1,y}$
Unit	t COD/m³
Description	The chemical oxygen demand of the wastewater after the treatment system 1 (P1) affected by the project activity
Source of data	On-site measurement by participant
Value(s) applied	0.03603 This value is different by each CPA. The value applied here is a temporary value used as a sample of ex-ante calculation in the section B.6.3.
Measurement methods and procedures	Measure the COD according to national or international standards. COD is measured through representative sampling.
Monitoring frequency	Samples and measurements shall ensure a 90/10 confidence/precision level
QA/QC procedures	Analysis of the COD of the wastewater will be conducted by the certificated laboratory.
Purpose of data	Calculation of project emission
Additional comments	This value is used for the calculation of $\eta_{COD,PJ,P1}$ and $COD_{removed,PJ,P2,y}$. $\eta_{COD,PJ,P1}=(COD_{ww,untreated,y} - COD_{ww,treated,P1,y})/ COD_{ww,untreated,y}$ $COD_{removed,PJ,P2,y}= COD_{ww,treated,P1,,y} - COD_{ww,treated,P2,y}$

Data / Parameter	$COD_{ww,treated,P2,y}$
Unit	t COD/m³
Description	The chemical oxygen demand of the wastewater after the treatment system 2 (P2) affected by the project activity
Source of data	On-site measurement by participant
Value(s) applied	0.00721 This value is different by each CPA. The value applied here is a temporary value used as a sample of ex-ante calculation in the section B.6.3.
Measurement methods and procedures	Measure the COD according to national or international standards. COD is measured through representative sampling.
Monitoring frequency	Samples and measurements shall ensure a 90/10 confidence/precision level
QA/QC procedures	Analysis of the COD of the wastewater will be conducted by the certificated laboratory.
Purpose of data	Calculation of project emission
Additional comments	This value is used for the value of $COD_{inflow,P3,y}$ and the calculation of $COD_{removed,PJ,P2,y}$. $COD_{inflow,P3,y}= COD_{ww,treated,P2,y}$ $COD_{removed,PJ,P2,y}= COD_{ww,treated,P1,,y} - COD_{ww,treated,P2,y}$

Data / Parameter	$COD_{ww,discharge,PJ,y}$
Unit	t COD/m³
Description	The chemical oxygen demand of the wastewater after the treatment system 3 (P3) affected by the project activity
Source of data	On-site measurement by participant
Value(s) applied	0.00508 This value is different by each CPA. The value applied here is a temporary value used as a sample of ex-ante calculation in the section B.6.3.
Measurement methods and procedures	Measure the COD according to national or international standards. COD is measured through representative sampling.
Monitoring frequency	Samples and measurements shall ensure a 90/10confidence/precision level
QA/QC procedures	Analysis of the COD of the wastewater will be conducted by the certificated laboratory.
Purpose of data	Calculation of baseline emission and project emission
Additional comments	This value is also used for the calculation of $\eta_{COD,PJ,P3}$. $\eta_{COD,PJ,P3}=(COD_{ww,treated,P2,y} - COD_{ww,discharge,PJ,y})/ COD_{ww,treated,P2,y}$

Data / Parameter	$BG_{burnt,GEG,y}$
Unit	m³
Description	The volume of biogas which is burnt by gas engine generator
Source of data	On-site measurement by project participant
Value(s) applied	1,263,455 This value is different by each CPA. The value applied here is a temporary value used as a sample of ex-ante calculation in the section B.6.3.
Measurement methods and procedures	Measured continuously by flow meters
Monitoring frequency	Monitored continuously (at least hourly measurements are undertaken, if less, confidence/precision level of 90/10 shall be attained)
QA/QC procedures	Measuring equipment will be certified to national or IEC standards and calibrated according to the national standards and reference points or IEC standards and recalibrated at appropriate intervals according to manufacturer specifications, but at least three years.
Purpose of data	Calculation of project emission
Additional comments	N/A

Data / Parameter	$BG_{burnt,flare,y}$
Unit	m^3
Description	The volume of biogas which is burnt by flare system
Source of data	On-site measurement by project participant
Value(s) applied	-
Measurement methods and procedures	Measured continuously by flow meters $FV_{RG,h}$ and $BG_{burnt,flare,y}$ are measured with the same flow meter. $BG_{burnt,flare,y}$ is an integrated value of $FV_{RG,h}$.
Monitoring frequency	Monitored continuously (at least hourly measurements are undertaken, if less, confidence/precision level of 90/10 shall be attained)
QA/QC procedures	Measuring equipment will be certified to national or IEC standards and calibrated according to the national standards and reference points or IEC standards and recalibrated at appropriate intervals according to manufacturer specifications, but at least three years.
Purpose of data	Calculation of project emission
Additional comments	N/A

Data / Parameter	$FV_{RG,h}$
Unit	m^3/h
Description	Volumetric flow rate of residual gas in dry basis at normal conditions in hour h
Source of data	Measurements by project participants using a flow mater
Value(s) applied	23.962 (The volume value of methane) This value is different by each CPA. The value applied here is a temporary value used as a sample of ex-ante calculation in the section B.6.3.
Measurement methods and procedures	Ensure that the same basis (dry or wet) is considered for this measurement and the measurement of volumetric fraction of all components in the residual gas ($fv_{CH4,h}$) when the residual gas temperature exceed 60 ^oC. $FV_{RG,h}$ and $BG_{burnt,flare,y}$ are measured with the same flow meter. $BG_{burnt,flare,y}$ is an integrated value of $FV_{RG,h}$.
Monitoring frequency	Continuously. Values to be averaged hourly or at a shorter time interval
QA/QC procedures	Flow meters to be periodically calibrated according to the manufacturer's recommendation.
Purpose of data	Calculation of project emission
Additional comments	N/A

Data / Parameter	$fv_{CH4,h}$
Unit	-
Description	Volumetric fraction of methane in the residual gas in the residual gas in the hour h
Source of data	Measurements by project participants using a continuous gas analyser
Value(s) applied	-
Measurement methods and procedures	Ensure that the same basis (dry or wet) is considered for the this measurement and the measurement of the volumetric flow rate of the residual gas ($FV_{RG,h}$) when the residual gas temperature exceeds 60 ^{o}C. $fv_{CH4,h}$ and $w_{CH4,y}$ are measured with the same gas analyser. $w_{CH4,y}$ is the average value of $fv_{CH4,h}$.
Monitoring frequency	Continuously. Values to be averaged hourly or at a shorter time interval
QA/QC procedures	Analysers must be periodically calibrated according to the manufacturer's recommendation. A zero check and a typical value check should be performed by comparison with a standard certified gas.
Purpose of data	Calculation of project emission
Additional comments	As a simplified approach, project participants will only measure the methane content of the residual gas and consider the remaining part as N_2.

Data / Parameter	$w_{CH4,y}$
Unit	-
Description	Methane content in biogas
Source of data	On-site measurement by project participant
Value(s) applied	-
Measurement methods and procedures	Measured by Methane fraction meter (gas quality analyzer). $fv_{CH4,h}$ and $w_{CH4,y}$ are measured with the same gas analyser. $w_{CH4,y}$ is the average value of $fv_{CH4,h}$.
Monitoring frequency	Periodical measurement Confidence/precision level of 90/10 shall be attained.
QA/QC procedures	Analysers must be periodically calibrated according to the manufacturer's recommendation. A zero check and a typical value check should be performed by comparison with a standard certified gas.
Purpose of data	Calculation of project emission
Additional comments	As a simplified approach, project participants will only measure the methane content of the residual gas and consider the remaining part as N_2.

Data / Parameter	$T_{BG,y}$
Unit	^{o}C
Description	Temperature of the biogas
Source of data	On-site measurement by project participant
Value(s) applied	-
Measurement methods and procedures	Measured by Thermo meter. 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.
Monitoring frequency	Measured at the same time when methane content in biogas ($w_{CH4,y}$) is measured.
QA/QC procedures	Measuring equipment will be certified to national or IEC standards and calibrated according to the national standards and reference points or IEC standards and recalibrated at appropriate intervals according to manufacturer specifications, but at least three years.
Purpose of data	Calculation of project emission
Additional comments	N/A

Data / Parameter	$P_{BG,y}$
Unit	Pa
Description	Pressure of the biogas
Source of data	On-site measurement by project participant
Value(s) applied	-
Measurement methods and procedures	Measured by Pressure gauge. 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.
Monitoring frequency	Measured at the same time when methane content in biogas ($w_{CH4,y}$) is measured.
QA/QC procedures	Measuring equipment will be certified to national or IEC standards and calibrated according to the national standards and reference points or IEC standards and recalibrated at appropriate intervals according to manufacturer specifications, but at least three years.
Purpose of data	Calculation of project emission
Additional comments	N/A

Data / Parameter	$T_{flare,h}$
Unit	^{o}C
Description	Temperature in the exhaust gas of the flare
Source of data	on-site measurement by project participant
Value(s) applied	-
Measurement methods and procedures	Measured the temperature of the exaust gas stream in flare by a type N thermocouple. A temperature above 500 ^{o}C indicates that a significant amount of gases are still being burnt and that the flare is operating.
Monitoring frequency	Continuously
QA/QC procedures	Thermocouple should be replaced or calibrated every year.
Purpose of data	Calculation of project emission
Additional comments	An excessively high temperature at the sampling point (above 700 ^{o}C) may be an indication that the flare is not being adequately operated or that a its capacity is not adequate to the actual flow.

Data / Parameter	***Other flare operation parameters***
Unit	-
Description	This should include all data and parameters that are required to monitor whether the flare operates within the range of operating conditions according to the manufacturer's specifications.
Source of data	Measurements by project participants
Value(s) applied	-
Measurement methods and procedures	Monitor whether the flare operates within the range of operating conditions according to the manufacturer's specifications.
Monitoring frequency	Continuously
QA/QC procedures	Electronically archive all data will collect as part of monitoring for a period of two years from the end of the crediting period.
Purpose of data	Calculation of project emission
Additional comments	Only applicable in case of use of a default value.

Data / Parameter	$\eta_{flare,h}$
Unit	-
Description	The flare efficiency
Source of data	"Tool to determine project emissions from flaring gases containing methane"
Value(s) applied	0.9
Measurement methods and procedures	According to a measurement result of $T_{flare,h}$ and "Other flare operation parameters", $\eta_{flare,h}$ is chosen from default value shown in the "Tool to determine project emissions from flaring gases containing methane".
Monitoring frequency	Continuously
QA/QC procedures	Electronically archive all data will collect as part of monitoring for a period of two years from the end of the crediting period.
Purpose of data	Calculation of project emission
Additional comments	N/A

Data / Parameter	*FE*
Unit	%
Description	The flare efficiency
Source of data	Calculated
Value(s) applied	90% (0.9)
Measurement methods and procedures	As per the "Tool to determine project emissions from flaring gases containing Methane". The value of *FE* is annual average value of $\eta_{flare,h}$.
Monitoring frequency	Continuously
QA/QC procedures	Electronically archive all data will collect as part of monitoring for a period of two years from the end of the crediting period.
Purpose of data	Calculation of project emission
Additional comments	N/A

Data / Parameter	$EG_{BL,y}$
Unit	MWh
Description	Quantity of net electricity supplied to the grid in year *y*
Source of data	on-site measurement by project participant
Value(s) applied	4,671 This value is different by each CPA. The value applied here is a temporary value used as a sample of ex-ante calculation in the section B.6.3.
Measurement methods and procedures	Measurements are undertaken using energy meters.
Monitoring frequency	Continuous monitoring, hourly measurement and at least monthly recording.
QA/QC procedures	Measurement results shall be cross checked with records for sold electricity (e.g. invoices/receipts). Measuring equipment will be certified to national or IEC standards and calibrated according to the national standards and reference points or IEC standards and recalibrated at appropriate intervals according to manufacturer specifications, but at least three years.
Purpose of data	Calculation of project emission
Additional comments	N/A

Data / Parameter	***the end-use of the final sludge***
Unit	kg or tonne
Description	Final sludge in the project activity that is to be used in soil application
Source of data	Log book of sludge disposal
Value(s) applied	-
Measurement methods and procedures	Final sludge in the project activity shall come from digester. Final sludge shall be used in soil application. Final sludge taken and disposal for soil application shall be recorded in a log book. Amount of final sludge, disposal time and location shall be recorded
Monitoring frequency	Continuously
QA/QC procedures	Electronically archive all data will collect as part of monitoring for a period of two years from the end of the crediting period.
Purpose of data	Calculation of project emission
Additional comments	N/A

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

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The following monitoring plan will apply to all CPAs:

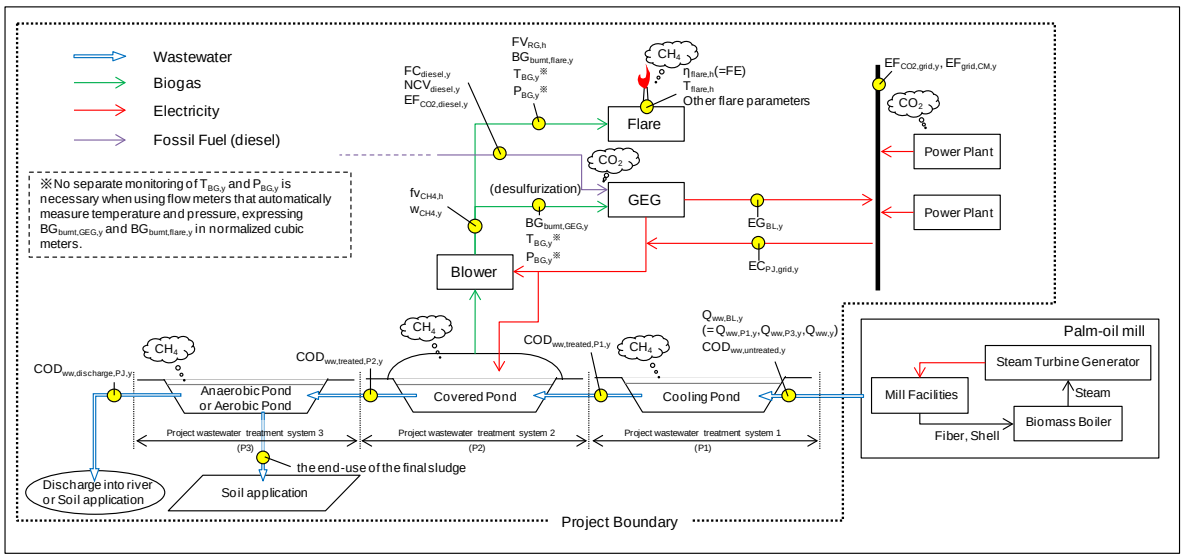

Figure 7 monitoring plan

In the project, quality control and quality assurance shall be carried out by the following methods.

- The project implementing organization will consist of operating personnel and management.
- Management will prepare written procedures for operating facilities.
- Written procedures, containing daily work contents, periodic maintenance methods and judgment criteria, etc., will be compiled according to appropriate formats.
- Management will check reports from operating personnel and determine there are no problems according to the procedures. If problems are found in such checks, management will implement the appropriate countermeasures with appropriate timing.
- Management will everyday file and store reports from operating personnel according to the procedures.
- In the event of accidents (including the unforeseen release of GHG), management will ascertain the causes, implement and instruct countermeasures to the operating personnel.
- In cases of emergency (including the unforeseen release of GHG), operating personnel will take stopgap measures and implement countermeasures according to instructions from management.
- Measuring instruments will be periodically and appropriately calibrated according to the procedures. Calibration timing and methods will be in accordance with “the monitoring plan”.
- Measured data will be disclosed and open to public comment. Received comments and the steps taken in response to them will also be disclosed.
- Measured data will also be subject to audit by government agencies in the host country.
- Measuring equipment will be certified to national or IEC standards and calibrated according to the national standards and reference points or IEC standards and recalibrated at appropriate intervals according to manufacturer specifications, but at least once in three years.

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

Organization	PT. RISET PERKEBUNAN NUSANTARA
Street/P.O. Box	Jl. Salak 1 A
Building	-
City	Bogor
State/Region	-
Postcode	16151
Country	Republic of Indonesia
Telephone	+62-251-833-3089
Fax	+62-251-831-5985
E-mail	-
Website	-
Contact person	-
Title	Director
Salutation	Dr. Ir.
Last name	Wibawa
Middle name	-
First name	Gede
Department	Research for Development
Mobile	-
Direct fax	-
Direct tel.	-
Personal e-mail	gedewibawa@yahoo.co.id

Organization	Centre for Application and Assessment of Energy Resources Technology , Agency for the Assessment and Application of Technology (BPPT)
Street/P.O. Box	Jl. M.H. Thamrin no.8
Building	BPPT building 2nd, 22nd flr.
City	Jakarta
State/Region	-
Postcode	10340
Country	Republic of Indonesia
Telephone	+62-21-316-9860
Fax	+62-21-316-9867
E-mail	-
Website	-
Contact person	-
Title	Researcher
Salutation	Dr.
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Middle name	-
First name	Irhan
Department	-
Mobile	-
Direct fax	-
Direct tel.	-
Personal e-mail	-

Organization	Shimizu Corporation
Street/P.O. Box	No. 16-1, Shibaura 2-chome
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Postcode	104-8370
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Telephone	+81-3-3561-1111
Fax	-
E-mail	-
Website	http://www.shimz.co.jp
Contact person	-
Title	General Manager
Salutation	Mr.
Last name	Kurita
Middle name	-
First name	Hiroyuki
Department	GHG Project Department
Mobile	-
Direct fax	+81-3-3561-8519
Direct tel.	+81-3-3561-4310
Personal e-mail	kurita@shimz.co.jp

Appendix 2: Affirmation regarding public funding

The project will not utilize any official funding from Annex I countries.

Appendix 3: Application of methodology(ies)

N.A.

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

N.A.

Appendix 5: Further background information on the monitoring plan

N.A.

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History of the document

Version	Date	Nature of revision(s)
02.0	EB 66 13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the programme design document form for small-scale CDM programmes of activities" (EB 66, Annex 13).
01	EB33, Annex43 27 July 2007	Initial adoption.
Decision Class: Regulatory **Document Type:** Form **Business Function:** Registration		