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

CONTENTS

Annexes

NOTE:

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

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

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

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

South East Asia Biogas Programme of Activities

Version 7
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A.2. Description of the small-scale programme of activities (PoA):

1. General operating and implementing framework of PoA

The "South East Asia Biogas Programme of Activities", later on referred to as the "SEA Biogas PoA", seeks to introduce less greenhouse gas (GHG) intensive forms of wastewater treatment in agro-industrial operations in South East Asia.

The Small Scale Programme Activities, SSC-CPAs to be introduced under the SEA Biogas PoA will enable the biogas, which is generated in wastewater treatment processes, to be captured and used as fuel to generate electricity for export to a grid. Any excess recovered methane gas will be combusted/destroyed in a flare.

In the absence of the SEA Biogas PoA, the current practice of anaerobic lagoon treatment, and thus the methane it emits, would continue.

The SEA Biogas PoA will be launched in the Republic of Indonesia, and in due course of time, rolled out to enable the introduction of similar measures in the agro-industrial sector in other host countries within South East Asia, which covers Burma, Brunei, Cambodia, East Timor, Indonesia, Malaysia, Laos, Philippines, Singapore, Thailand and Vietnam. Wastewater treatment installations in the agro-industrial sector in Indonesia, such as those used in the palm oil industry, constitute a significant source of GHG emissions. In Indonesia, however, there are no regulations that require the biogas resulting from wastewater treatment systems to be captured and destroyed. Biogas generated in wastewater treatment systems can be used for generating power, which can then be exported to a grid. In 2002 the Indonesian government, through the Department of Energy and Mineral Resources, issued a ministerial decree that obliges the State-Owned Electricity Company (referred to as PT. PLN) to purchase electricity generated from renewable energy sources with an installed capacity lower than 1 MW[1]. This was further extended in 2006 to include plants with an installed capacity between 1 MW to 10 MW.[2]

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[1] The Minister of Energy and Mineral Resources Decree No. 1122 K issued in 2002 about Guidance on the development of Small-Scattered Scale Electric Power Plant

(http://www.esdm.go.id/prokum/kepmen/2002/kepmen-1122-2002.pdf, retrieved on August 19, 2010).

[2] The Minister of Energy and Mineral Resources Regulation No. 02 issued in 2006 about The Development of Medium Scale Renewable Energy Power Plants (http://www.esdm.go.id/prokum/permen/2006/permen-esdm-02-2006.pdf, retrieved on August 19, 2010).

However, the feed-in tariff [3] awarded to such projects has not proven high enough to encourage entities other than PT. PLN to invest in developing Renewable Energy (RE) projects. A new regulation issued in 2009[4] established a feed-in tariff that must be offered by PT. PLN to Independent Power Producers (IPPs) of renewable energy. The regulation has so far not succeeded in increasing the investment in RE projects[5]. Consequently, agro-industrial businesses have neither the need to recover this gas to destroy it by flaring nor a sufficiently strong incentive to recover it and use it as a fuel for generating power for export to a grid.

The Clean Development Mechanism (CDM) under a programmatic framework offers the possibility to introduce small scale biogas recovery technologies on a wide scale by providing the incentive, in the form of CDM revenue, which is needed to overcome the investment barriers that such projects face and by putting in place a framework that reduces the transaction costs associated with generation of this much needed revenue stream.

PT. Biogas Program International/PT. BPI (referred later on as the Coordinating/Managing Entity or CME) will coordinate the SEA Biogas PoA. PT. BPI will work closely with South Pole Carbon Assets Management Ltd. (referred later on as SP) and the developer of the biogas power plant (referred later on as CPA implementer) and/or the owner of the agro-industrial facility (if not the same as the implementer). The CPA implementer is the entity that shall be responsible for the monitoring plan of the project activity—assisted by CME—and shall sign the contractual provision with the CME.

Each CDM programme activity (CPA) is expected to reduce up to 60,000 tCO2e of GHGs annually for the type III portion of the project. Additional emission reductions will come from type 1 (renewable energy projects) and shall also be below the SSC threshold of type 1[6] activities at each project site. A CPA such as the first CPA included in this PoA may be expected to achieve average emissions reductions of 19,270 tCO2e annually as a result of the methane recovery from the wastewater treatment plant and electricity that is displaced from the grid.

2. Policy/measure or stated goal of the PoA

The SEA Biogas PoA is a voluntary effort driven and coordinated by PT. Biogas Program International. It aims to introduce measures and technologies that recover biogas from biogenic organic matter in wastewater and use this gas as a fuel to generate Renewable Electricity for export to a grid and flare any biogas recovered in excess. In doing so, the PoA will also displace CO_2 emissions from the combustion of fossil fuel in grid-connected power plants.

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[3] Based on Decree No. 1122 K issued in 2002 and Regulation No. 02 issued in 2006, feed-in tariff price is 0.6 x electricity base price provided by PT. PLN for low-tension voltage grid and 0.8 x electricity base price provided by PT. PLN for medium-tension voltage grid.

[4] The Minister of Energy and Mineral Resources Regulation No. 31 issued in 2009 about The Electricity Purchasing Price by PT. PLN from Small and Medium Scale Renewable Energy Power Plants or excess electric power (http://www.esdm.go.id/prokum/permen/2009/Permen%20ESDM%2031%202009.pdf, retrieved on September 01, 2010).

[5] Statistik PLN 2010

[6] The proposed project activity will not exceed 15 MW (or an appropriate equivalent)

The SEA Biogas PoA shall set up a platform for the widespread introduction of the aforementioned GHG mitigation measures in agro-industrial wastewater treatment facilities, initially in Indonesia and later in wastewater treatment installations in the agro-industrial sectors in other host countries in South East Asia.

To reach this goal, the SEA Biogas PoA will enable a suite of services to be provided; with the purpose of overcoming the barriers that prevent the introduction of the proposed measures in wastewater treatment facilities in agro-industrial installations. PT. Biogas Program International (the Coordinating/Managing Entity) shall provide the following services:

- Raise awareness among operators (and thus potential CPA implementers) of wastewater treatment installations in the agro-industrial sector on the impact that such operations have on climate change and how the biogas that results from these operations can be recovered and used to generate electricity for export to a grid in order to prevent the release of methane, a highly potent GHG gas to the atmosphere.

- Raise awareness as to how carbon finance can help overcome the barriers that prevent the uptake of the proposed measures, what processes and steps need to be followed in order to access such incentives and the suite of services that are provided by the Coordinating /Managing Entity under the SEA Biogas PoA. The purpose is to assist potential third party SSC-CPA implementers by introducing such measures in wastewater treatment facilities in the agro-industry and ensure that they obtain the carbon revenues from the GHG emissions reductions that they achieve. To this end, the Coordinating/Managing Entity will conduct CDM awareness workshops / sessions and undertake capacity building for program implementation partners as and when required.

- Streamlined and Standardized CDM Carbon Management services for SSC-CPA implementers and project hosts. To this end the Coordinating/Managing Entity will coordinate the inclusion of the CPAs in the PoA and support the effective commercialization of Certified Emission Reductions (CERs). It shall provide CDM monitoring and verification services to all CPAs, and ensure that proper Monitoring & Verification (M&V) systems and procedures are in place and followed, and that any process improvements that result from the ongoing review of the effectiveness of the monitoring and reporting plans be replicated across the CPAs in the PoA were viable. This, in turn, is expected to help build up confidence in the market, that the proposed measures offer a sound economic opportunity to potential implementers in the agro-industrial sector to reduce GHG from wastewater treatment operations and encourage participation in the SEA Biogas PoA.

- The CME anticipates that each SSC-CPA implementer will face challenges and barriers at some stage of the SSC-CPA project cycle, besides the main upfront one which is the investment barrier. The ability of a SSC-CPA implementer to address these challenges successfully will depend on the implementer’s capabilities to manage and implement the various tasks that need to be undertaken and fulfill the responsibilities associated with the implementation of the introduced GHG mitigation measures under a CDM PoA, as well as the operation, maintenance and management of the biogas systems to be installed. Therefore, the CME will provide, or facilitate as appropriate, other services on an as needed basis in order to support the design and effective implementation of the GHG mitigation measures promoted under the SEA Biogas PoA. Such additional services and support (beyond those strictly related to the CDM project cycle) may include, but are not

limited to the following:

- o Access to Finance (debt and equity)
- o Access to biogas recovery and power generation technology suppliers
- o Support/Provision of monitoring system and data management solutions
- o Access to proven biogas metering and instrumentation equipment and services providers, etc.
- o Access to Renewable Energy and IPP project developers, as well as specialized companies to which the operation, maintenance and management of the biogas recovery plant, power plant and flare may be outsourced to
- o Over time additional services will be added in response to the SSC-CPA implementers needs.

The SEA Biogas PoA will contribute to the sustainable development in the host countries in which it is rolled out.

Contribution to Sustainable Development in Indonesia

The SEA Biogas PoA will contribute to the sustainable development of Indonesia and its agro-industry, as discussed below in terms of Indonesia's Sustainable Development Criteria[7].

Environmental sustainability

- The SEA Biogas PoA will encourage the recovery of biogas and its conditioning as required, to produce a high-value gas for electricity generation that can be exported to a grid. In so doing the PoA reduces the amount of methane that would have otherwise been released to the atmosphere as a result of organic matter decomposition during the wastewater treatment process.

- The SEA Biogas PoA will also contribute to reducing odors which would have been generated using only open anaerobic lagoon treatment; thus minimizing pollution to the environment;

- The SEA Biogas PoA will contribute to diversifying the sources of grid-connected electricity generation. In so doing, it will reduce GHGs and other pollutant emissions that would have otherwise have been produced from grid-connected-fossil-fuel-fired power plants.

Economic sustainability

- The implementation of Renewable Independent Power Production SSC-CPAs will stimulate local investment in renewable based IPP.

- The SEA Biogas PoA enables Indonesia to diversify the sources of energy used for electricity generation, thus helping to meet a growing energy demand in a way that

[7] Indonesian DNA website, http://pasarkarbon.dnpi.go.id/web/index.php/dnacdm/cat/5/sustainable-development-criteria-.html.

reduces the dependence on diesel and coal-supplied electricity generation for future generations.

Social sustainability

- The SEA Biogas PoA creates employment opportunities in the area where the SSC-CPAs are built. It thus generates income for local communities during the construction phase of SSC-CPA. The SEA Biogas PoA also generates employment opportunities and enables skills and capabilities to be developed during the operational stage of the project (operation of biogas recovery plant, biogas conditioning, operation of biogas fired power generation equipment, export to a grid, operation of flaring systems). These skills and capabilities can, in turn, be used for the development of other clean energy and GHG mitigation projects.

  Thus, by building up a market for the provision of low carbon wastewater treatment solutions and related services in the agro-industrial sector in Indonesia, the SEA Biogas PoA will contribute to create employment opportunities in construction, operation, maintenance and management of such plants[8].

Technology sustainability

- Each CPA will act as a clean technology demonstration project and is expected to further encourage other industries in the agro-industrial sector to explore the viability of implementing similar measures at their sites.

- Each CPA will provide an opportunity for local people to acquire know-how and gain the experience needed to ensure optimal maintenance and operation of state-of-the-art biogas recovery plant, and in the conditioning and use of this gas as a fuel for power generation for the production of electricity for export to a grid.

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

The SEA Biogas PoA is a voluntary action being coordinated by PT. Biogas Program International. There are no mandatory laws or regulations in place in Indonesia that require wastewater treatment facilities in the country to capture the biogas that is produced and to destroy or use it for any purpose. Moreover, no mandatory laws or regulations exist requiring the Coordinating/Managing Entity or any other party to develop such a programme in Indonesia.

There are no economic reasons for businesses in this sector to implement the type of measures which the SEA Biogas PoA aims to promote. Moreover it is also anticipated there maybe also other barriers that prevent a broader uptake of such type of projects under CDM, which although deemed additional are likely to face a number of challenges before they can be implemented under the CDM. Such additional barriers, which the PoA may need to eliminate or lower in order to achieve the goal of widespread introduction of less GHG intensive forms of wastewater treatment,

[8] The employment creation will be detailed at CPA level.

include but are not limited to:

- Limited awareness to the CDM and how it works
- Limited access to debt and equity finance
- Uncertainty surrounding the amount of resource (biogas) available to generate power
- Lack of prior experience with the use of the biogas as a fuel, its properties and the level of gas conditioning that is required to be able to use it as a fuel to run power generation equipment
- Lack of experience with the various technologies involved, reliability, and operation and maintenance costs when running on biogas, and perceived risks
- Limited commercial experience with grid-connected renewable power production

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

PT. Biogas Program International will be the Coordinating/Managing Entity[9] for the CDM programme activities under the Programme of Activities (PoA) in Indonesia (and later in other countries in South East Asia) and will communicate with the CDM Executive Board.

Name of Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Republic of Indonesia (host)	PT. Biogas Program International	No
Switzerland	South Pole Carbon Asset Management Ltd.	No
Netherlands	E.ON Carbon Sourcing GmbH	No

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

A.4.1. Location of the programme of activities:

The SEA Biogas PoA covers the geographical region of Indonesia.

The boundary of the SEA Biogas PoA shall be amended post registration of the PoA to include other South East Asia countries subject to the conditions presented in Annex 26 of the EB 60 to this effect being met.

A.4.1.1. Host Party(ies):

[9] The Coordinating/Managing Entity shall be a project participant authorized by all participating host country DNAs involved and identified in the modalities of communication as the entity which communicates with the Executive Board, including on matters relating to the distribution of CERs.

Republic of Indonesia.

Other South East Asia host parties shall be added after registration of the PoA subject to the conditions stipulated in Annex 26 of EB 60 to this effect being met.

A.4.1.2. Physical/ Geographical boundary:

>> Definition of the boundary for the PoA in terms of a geographical area (e.g. municipality, region within a country, country or several countries) within which small–scale CDM programme activities (SSC-CPAs) included in the PoA will be implemented, taking into consideration to the requirement that all applicable national and/or sectoral policies and regulation of each host country within that chosen boundary.

The proposed SEA Biogas PoA will be launched in the Republic of Indonesia. CPAs will be implemented between the latitude of 6.0000° N to 11.0000° S and the longitude of 97.0000° E to 141.0000° E. A map indicating the location of the starting Geographical Boundary of the PoA is given below.

Figure 1: **The map of Indonesia**

In due course the SEA Biogas PoA will be rolled out across other host countries in South East Asia. Thus the boundary of the SEA Biogas PoA will be amended post registration of the PoA to cover Burma, Brunei, Cambodia, East Timor, Malaysia, Laos, Philippines, Singapore, Thailand and Vietnam, subject to the conditions presented in Annex 26 of the EB 60 to this effect being met.

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

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

The SEA Biogas PoA aims to introduce biogas recovery processes whereby the recovered biogas is used as a fuel to generate electricity for export to a regional or national grid, and any recovered, excess gas is combusted in a flare to prevent the release of methane to the atmosphere.

The Palm Oil Sector in SEA countries is one sector that constitutes a good example of an agro-industrial setting in which such measures can be introduced to existing wastewater treatment facilities under the SEA Biogas PoA.

In a typical wastewater treatment installation in the agro-industrial sector in Indonesia, such as Palm Oil Mill for example, the processing of Fresh Fruit Bunches (FFB) of palm into Crude Palm Oil (CPO) will generate solid and liquid wastes.

The liquid waste, as other organic bearing effluents produced in other agro-industries, cannot be discharged directly into rivers due to its high organic content. Currently, Palm Oil Mills in Indonesia, and in fact other countries in South East Asia, generally treat the liquid waste in open ponds (lagoons) in several stages before discharging it into the waters[10]. The decomposition of organic matter in the liquid waste present in the ponds will result in the release of GHGs that are harmful to the environment. These gases include a mixture of methane (CH_4), a particularly potent GHG, and carbon dioxide (CO_2).

A typical CPA will introduce a new treatment system (digester) with biogas recovery, and electricity generated will be exported to the grid. Most SSC CPAs, will introduce a sequential stage of wastewater treatment with biogas recovery and combustion with or without sludge treatment to an existing anaerobic wastewater treatment system without biogas recovery (i.e. a measure covered under Option 1 (f) of AMS-III.H Version 16. The typical COD removal is expected to be in the range of 90-96 per cent.

There are a number of technologies that can be used to capture the biogas that is generated in wastewater treatment facilities in the agro-industry such as, but not limited to: Anaerobic Sequencing Batch Reactor (ASBR) ponds, Upflow Anaerobic Sludge Blanket (UASB) reactor, covered lagoon system, etc. Biogas can in turn be used as a fuel to run, for instance, internal combustion (IC) engine generator sets to produce electricity for export to a grid.

The recovered biogas, however, usually contains significant levels of H_2S (hydrogen sulfide) and moisture, which can cause damage to the engines. Hence, the recovered gas may have to be first conditioned to ensure the levels of H_2S, humidity and temperature do not exceed the levels set by the equipment manufacturers.

Each SSC-CPA is expected to reduce up to 60,000 tCO2e of methane annually from the type III portion of the project. Additional emission reductions will come from type I activities at each project site and it is expected that this will lead to further emission reductions of around 6,000 tCO2e annually.

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

[10] One of the example is wastewater treatment at PTPN I Tanjung Seumantoh, Nanggroe Aceh Darussalam province Indonesia

Below are criteria to be applied to every SSC- CPA that is to be included in the PoA. The criteria used for assessing and demonstrating additionality of a SSC-CPA in which the biogas is recovered and used for generating power for export to a grid, with any recovered biogas in excess is combusted in a flare in order to destroy the methane contained in it, shall be described in greater detail in sections A.4.3 and E.5.1 of the present document.

Any SSC-CPA to be included in the proposed PoA must:

1. Have a start date which is not prior to the date at which the CDM-PoA-DD was first published for Global Stakeholder Consultation on 11 August 2011. The start date CPA can be sourced from the contract which has been signed for the equipment (in case available); can also be checked during physical site visit for projects where construction has not yet started.
2. Demonstrate that its geographical boundary is consistent with the geographical boundary set in the PoA-DD. The location (coordinate or village/town/district/province) of the project activity as per AMS-III.H and AMS-I.D shall meet the geographical boundary set in the PoA. A map to assess that the location of project activity lies within the geographical boundary set in the PoA will be provided and presented in CPA-DD.
3. Demonstrate that the methane recovery component shall not exceed 60 ktCO2e/yr and that the output capacity of the electricity production component does not exceed 15 MW and does comply with the applicability criteria of AMS-III.H version 16 and AMS-1.D version 17. The project must comprise measures that recover biogas from biogenic matter in wastewater as per AMS-III.H version 16. The electricity generated by the project activity shall be exported to the grid to be in line with AMS-I.D. The crosschecking refers to the section E.2 of PoA-DD. All requirements listed in section E.2 are to be met.
4. Be implemented at a site where at the time of validation of the CPA there are neither any mandatory requirements in place, nor under discussion by the relevant regulatory authorities in the host country, that prohibit or limit in any way the amount of greenhouse gases that result from waste water treatment facilities from being released into the atmosphere. This can be verified by reviewing the regulation on effluent quality standard for industrial activity or any other relevant document
5. Have entered a cooperation agreement between the CPA implementer with the Coordinating/Managing Entity or CME (PT. Biogas Program International), authorizing the CME to include the CPA to participate in the PoA and therefore ceding the carbon rights to CME. Compliance with this eligibility criteria can be confirmed by means of the ERPA or contract with the CME.
6. Employ new biogas recovery equipment and new power plant. Sources of information that can be reviewed to confirm compliance with this eligibility criteria include but are not limited to proposals and data from vendors of equipment, feasibility studies and the contract with the technology provider.
7. Demonstrate that this project activity shall not lead to double counting of Emission Reductions by confirming that this project activity shall not be a part of any of the below mentioned category post approval of the project activity under CDM (1) standalone CDM project activity, (2) Bundled CDM project activity, (3) Another registered PoA. Compliance with this criteria can be confirmed by reviewing and assessing the information contained in the record keeping system and by applying the provisions in the Section A.4.4.1 of PoA-DD.
8. Demonstrate compliance with the EB 54 Annex 13 “Guidelines on assessment of de-bundling for SSC project activities”. The CPA is considered as debundled if both conditions (a) and (b) below are satisfied:

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

Compliance with this eligibility criteria can be assessed and confirmed by analysing the information that is to be provided in the record keeping system and by following the procedure described in Section A.4.4.1 of PoA-DD.

9. Have a crediting period that does not exceed the duration of the PoA. It can be crosschecked from the start date of the crediting period of the PoA and the length of the crediting period of the SSC-CPA.
10. Undertake a local stakeholder consultation. It can be sourced from the minutes of stakeholders meeting.
11. In the event that it receives public funding, clearly describe this in the SSC-CPA-DD and provide an affirmation indicating that such funding does not result in a diversion of Official Development Assistance (ODA). It can be sourced from the confirmation of non-ODA letter.
12. If being implemented at a site where there is an existing wastewater treatment facility, demonstrate that the IRR of the proposed CPA (without CDM revenues) shall be below its benchmark and that the sensitivity analysis confirms this conclusion. Compliance with such eligibility criterion can be confirmed by reviewing the information and data used for assessing and demonstrating additionality of SSC-CPA as described as per section A.4.3 and E.5.1 of PoA-DD and presented in the CPA's corresponding CPA-DD.
13. If being implemented at a site where there is a plan to increase the wastewater treatment capacity, or where no wastewater treatment facilities exist, the CPA shall be deemed additional, if as according to EB 61 Annex 21 and Attachment A of Appendix B of 4/CMP.1 Annex II it can be shown that the project activity would otherwise not have been implemented due to the existence of an investment barrier, and that therefore a financially more viable alternative to the project activity would have led to higher emissions. Compliance with such eligibility criterion can be confirmed by reviewing the information and data used for assessing and demonstrating additionality of SSC-CPA as described as per section A.4.3 and E.5.1 of PoA-DD and presented in the CPA's corresponding CPA-DD.

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

Common practice in wastewater treatment facilities in the agro-industrial sector in Indonesia, as well as in other South East Asia countries, involves releasing all the methane resulting from the decomposition of organic matter in wastewater treatment facilities to the atmosphere. This prevalent practice is compliant with the relevant regulations in the host country (ies).

A SSC-CPA developed under the SEA Biogas PoA enables this practice to be changed by overcoming the barriers that hinder the introduction of measures that capture the biogas and use it as fuel for power generation in a grid-connected power plant, and combusting any surplus recovered biogas in a flare.

The following information presents the demonstration of additionality of the PoA as a whole:

(i) The proposed PoA is a voluntary coordinated action

The proposed PoA is a voluntary action undertaken by South Pole Carbon Asset Management and E.ON Carbon Sourcing GmbH as a vehicle to overcome barriers to the widespread introduction of less GHG intensive forms of wastewater treatment across the agro-industrial sector in Indonesia, and South East Asia in general. Both entities have and continue to invest and allocate resources to the design and implementation the proposed programme as a CDM Programme of Activities. As part of these efforts, PT. Biogas Program International, a commercial entity, has been tasked with the purpose of coordinating the implementation of the PoA.

There are no mandatory laws or regulations in the Geographical Boundary, i.e. Indonesia, stipulating that biogas resulting from the decomposition of organic waste that is present in agro-industrial liquid effluent needs to be captured and destroyed or utilised in any manner. There are also no similar programmes in place that aim to achieve such an objective.

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

In the absence of the proposed PoA, the referred voluntary coordinated action will not be implemented. The construction of biogas recovery facilities for the sole purpose of recovering biogas and combusting it in a flare to prevent the release of methane to the atmosphere requires substantial investment in equipment and civil works, as well as ongoing operation and maintenance costs that cannot be recovered. Moreover, using this same recovered gas to generate power involves a significant additional investment to be made in power generation as well as in the electrical equipment needed to connect the power plant to a grid in order to export the power that is produced. Although, in this case, additional revenues are generated from the sale of electricity, these have not proven to be sufficient to enable such projects to be implemented in the geographical boundary of Indonesia.

Without the additional revenue stream that the CDM can provide it is expected that such projects will not be economically viable.

Hence, there is either no incentive or at best, very little incentive for any investor to pursue such measures in the absence of the CDM. Neither is there any incentive for South Pole Carbon Asset Management Ltd. and E.ON Carbon Sourcing GmbH to absorb the upfront costs associated with the design and development of such a programme under the CDM aimed at introducing the aforementioned GHG mitigation measures on a much wider scale, across Indonesia and other countries in South East Asia, if such measures are per se, not economically attractive in the absence of the CDM.

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

Not applicable, the SEA Biogas PoA is not implementing any mandatory policies/regulations in the selected geographical boundary.

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

Not applicable because there is no mandatory policy/regulation in the host country(ies) that enforces the measures which the PoA promotes to be implemented.

Assessment and demonstration of additionality of a SSC-CPA

The additionality of SSC-CPAs where the objective of the project is the generation of electricity from recovered biogas for export to a grid shall be assessed and demonstrated at the CPA level by showing that such SSC-CPA cannot be implemented in the absence of this PoA because of investment barriers as detailed in section E.5.2 of this SSC-PoA-DD.

Recovering the biogas that results in wastewater treatment installations in agro-industrial operations and generating power from it for export to the grid faces similar investment barriers as those encountered by projects that aim to reduce the amount of methane released to the atmosphere by combusting it in a flare. However under this project setup, the sale of electricity to a grid generates a revenue stream which needs to be considered when assessing the additionality of the SSC-CPA.

Nevertheless, to date, within the geographical boundary of Indonesia the feed-in tariff which would be awarded to such projects has yet to prove sufficient to stimulate the introduction of biogas to power projects in the country[11]. Nevertheless, it cannot be ascertained that the generation of electricity for export to the grid may not prove an economically viable option in particular circumstances at some point in the future.

Hence, demonstrating additionality at the CPA level is deemed to be more appropriate than demonstrating the additionality at the PoA level. In fact, the demonstration of investment barriers will guarantee that every SSC-CPA considered for inclusion in the PoA at any point in time in future would not have occurred in the absence of the CDM.

As per paragraph 73 of the 47th EB meeting report "additionality is to be demonstrated either at the PoA level or at CPA level" and as prescribed in the Simplified modalities and procedures of small scale project activities, additionality shall be demonstrated as per Attachment A to Appendix B of 4/CMP.1 Annex II. Hence, the Project Proponents choose to demonstrate the additionality at CPA level by showing that the SSC-CPAs cannot be implemented in the absence of this PoA because of investment barriers, as described in greater detail in section E.5.2 of this SSC-PoA-DD.

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

A.4.4.1. Operational and management plan:

[11] Statistik PLN 2010

The proposed PoA involves implementing and managing a number of operational activities in order to roll out the programme and to ensure that those CPAs that are included, are implemented and operated in accordance with the criteria and terms set out in the present PoA-DD and the corresponding SSC-CPA-DD.

The CME anticipates that the implementation of the proposed GHG mitigation measures and their ongoing operation will not be trouble free. Throughout the project cycle SSC-CPA implementers are bound to face obstacles beyond the investment barrier that they will have to overcome in order to implement the project and be able to obtain the expected carbon revenue stream that drives implementers to implement this project under the CDM. These obstacles may include, for instance, the inability to raise capital and or debt, as well as a range of risks that potential SSC-CPA implementers may perceive in relation to the technologies involved, the production of electricity from biogas and its export to a grid and the overall process through which the emission reductions that they achieve as a result of implementing a project translate into a revenue stream that makes investing in such projects a business worthy of pursuit.

Hence the underlying programme needs to be capable of addressing such issues where and when they arise, and provide or facilitate the provision of solutions to them. For example, there may be situations in which the implementer does not have the capabilities to manage the construction of the project, operate the power plant, manage the commercial aspects of selling power to a grid, or have the necessary staff or infrastructure needed to implement certain elements of the monitoring plan.

The extent to which the SEA Biogas PoA can be rolled out and achieve its goal of widespread introduction of the proposed measures, therefore, depends on being able to include CPAs in the programme and enable them to be built. This hinges on the ability to deploy solutions to address problems such as the ones mentioned above that PT. Biogas Program International expects CPA implementers to encounter, and to do so through a streamlined and standardised approach in order to reduce both the associated CDM and non – CDM transaction and project implementation costs.

In doing so, the implementation of specific elements of the underlying programme (the non CDM project cycle elements) may be outsourced to third party specialists that have the required capabilities, are active in the host country market, and are able to assist in developing or delivering solutions in a cost effective manner.

Such an approach aims to maximise the number of implemented SSC-CPAs included in the PoA. It provides for a win-win situation by building on the strengths of different stakeholders and potential partners present in the market in which the SSC-CPAs are to be implemented, and aligning the interest of these players to achieve the PoA's objective: the successful implementation of the Small Scale CPAs on a wide scale.

It is the responsibility of the CME to review the programme's performance in this respect on an ongoing basis, identify areas where it might be improved, develop required solutions, implement and monitor the effectiveness of solutions, and ensure that the programme is operated in line with the Operational and Management Plan described in the PoA-DD. To this aim, the management plan shall ensure that the required CDM systems are kept in place and that CDM PoA related procedures are followed.

The following table describes key functions to be performed and the entities responsible for the PoA's implementation in Indonesia. Additional local entities may be involved in rolling out the

PoA in other host countries in South East Asia. More specifically, local entities may be involved in the implementation of non CDM project cycle related tasks (i.e. excluding CPA eligibility criteria compliance, CPA –DD documentation preparation, CPA Monitoring report, amongst other CDM project cycle tasks) related to the day-to-day operation of the PoA.

Table 1: Key operational roles and Management Responsibilities – Republic of Indonesia

Entity	Management Responsibilities and Arrangements
PT. Biogas Program International	• Promote the PoA to potential CPA implementers: - Awareness raising and opportunity assessment - Identification of barriers to uptake of proposed measures - CPA Eligibility Criteria compliance check - Emissions reductions and carbon revenue estimation - CPA documentation development - Coordination of Validation and inclusion of the CPA in the SEA Biogas PoA • Support CPA implementer during project design and implementation - Define roles and responsibilities of the parties in the development and operation of the CPA - Conduct gap analysis to establish assistance that the CPA implementer may require to build and operate the project under the CDM - Assist the CPA implementer in closing this gap • Periodic collection and review of CPA monitoring data • Preparation of monitoring reports for emission reduction verification • Coordinate and manage CPA Verification • Review CPA overall project (technologies) and monitoring system performance: - Identify opportunities to improve specification, selection, installation, commissioning, operation and maintenance of underlying project (biogas recovery, conditioning, transport, power generation) - Identify opportunities to improve specification, selection, installation, commissioning and calibration of measuring equipment, as well as overall, monitoring system and plan performance - Disseminate lessons learned and good practice across the SSC-CPAs under the PoA (develop and share good practices) and assist in incorporating them to existing CPAs as well as ensuring they are considered at the design stage of new CPA • Review SEA Biogas PoA's Performance • Identify opportunities to improve the programme's operation, propose improvement actions and monitor effectiveness of improvement measures adopted
SSC-CPA implementer	• Undertake Feasibility Study • Implement biogas plant project activity (construction, daily operation,

	and maintenance of biogas recovery and power plant) • Implementation of the SSC-CPA monitoring plan as described in the CPA-DD The SSC-CPA implementer is free to make arrangements to outsource certain tasks to Third Party Service providers (e.g. technology suppliers, IPP companies, etc), but is ultimately responsible for ensuring the correct implementation of such tasks, particularly those related to the implementation of monitoring plan contained in the relevant CPA-DD.

The following figure illustrates the key entities and stakeholders that are involved in the PoA and who they interact with.

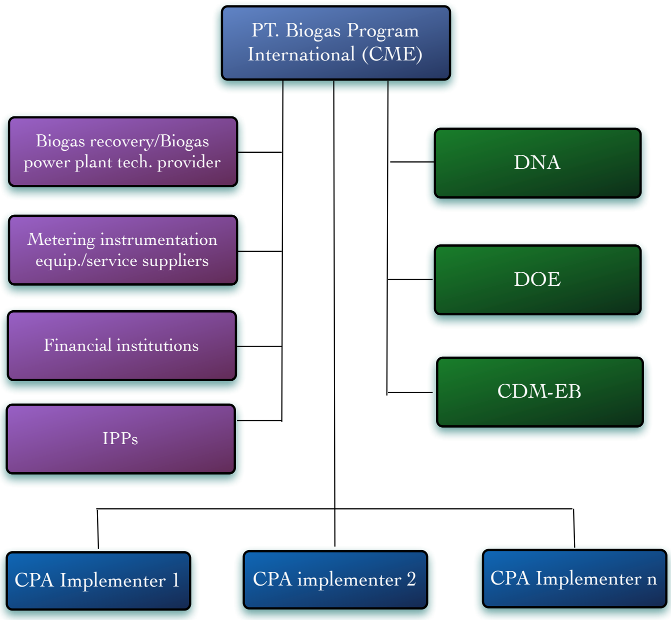

Figure 2. Organizational chart

In addition to the above management tasks, PT. Biogas Program International will implement the following Monitoring Plan for the Programme of Activities to ensure proper management and oversight of the proposed PoA under the CDM.

Monitoring Plan for Programme of Activities (PoA)

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

In order to unambiguously identify each biogas recovery facility participating in the SEA Biogas PoA a serial numbering system will be implemented that uniquely identifies it through numbers for the SSC- CPA (i.e. SSC CPA title - CPA number 001). This serial numbering system will be used to record baseline and monitoring data using a MS Excel database. In this way the PoA Coordinating/Managing entity will be able to track the emission reductions of each biogas facility over the full duration of the crediting period.

Each SSC-CPA will follow the record keeping and monitoring requirements stipulated in AMS

III.H version 16 and AMS I.D version 17 as required. In summary, PT. Biogas Program International will record and document SSC-CPA detail information as follows:

- Name of the SSC-CPA and its project capacity
- The name of CPA implementer and project details of each participating SSC-CPA
- The geographical coordinates of each SSC-CPA (GPS coordinates of new wastewater treatment plant or information on village/district/town)
- The record of technical specification of each biogas recovery and power plant participating in the SSC-CPA

PT. Biogas Program International will be responsible for the management of records and data associated with each CPA. The MS Excel database will be updated manually using the data supplied by the participating SSC-CPAs. It will form the basis for the verification of CPAs and be available for inspection by the DOE at any point in time.

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

The database described above will be used to perform a double accounting check. Every new CPA will be compared to the already existing database and the list of project activities that are under validation or registered at the UNFCCC. Moreover as shown below, the project implementers will be made aware of the double accounting principle and will certify that the proposed CPA is not registered under the Clean Development Mechanism of the UNFCCC or any voluntary scheme.

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

The de-bundling check will be performed pursuant to the Guidance for determining the occurrence of debundling under a Programme of Activities, given in the *Guidelines on Assessment of Debundling for SSC Project Activities* issued on the EB's 54th meeting, Annex 13.

The CPA is considered as de-bundled if both conditions (a) and (b) below are satisfied:

a. Has the same activity implementer as the proposed small scale CPA or has a coordinating or managing entity, which also manages a large scale PoA of the same technology/measure, and;

b. The boundary is within 1 km of the boundary of the proposed small-scale CPA at the closest point.

The database described above will be used to perform the de-bundling check. Every new SSC-CPA will be compared to the already existing database and the list of project activities under-validation or registered at the UNFCCC. Moreover as shown below, the project implementers will be made aware of the de-bundling rules and will certify that the proposed SSC-CPA is not a de-bundled part of a larger project.

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

In order to avoid double accounting and to ensure that the operators of the SSC-CPA are aware of and have agreed that their activity is being subscribed to the PoA the implementing entity of a SSC-CPA shall enter into a contractual arrangement with the Coordinating Entity including respective provisions that:

- The SSC-CPA has not been and will not be registered as a single CDM project activity nor as a CPA under another PoA (The implementing entity certifies that the CPA is not registered under the Clean Development Mechanism of the UNFCCC or any voluntary scheme).
- The implementing entity is aware that the SSC-CPA will be subscribed to the present PoA.
- The implementing entity cedes its rights to claim and own emission reductions under the Clean Development Mechanism of the UNFCCC or any voluntary scheme to the managing entity of the present PoA.

Using the unique identifier for each participating biogas facility, the PoA Coordinating/Managing Entity will confirm that a facility has not already been registered or entered validation as a CDM project activity or as a CPA of another PoA. Should such a case occur then the coordinating entity will not proceed with inclusion of the corresponding CPA in the PoA.

A.4.4.2. Monitoring plan:

Monitoring Plan – Republic of Indonesia

Each CPA is to be verified individually. A monitoring plan for each CPA will be developed in accordance with the applied baseline and monitoring methodology at the CPA level as per section E.7 of this PoA DD.

The CME will submit CPAs for verification by the DOE pursuant to the sequence described below:

1- The coordinating entity will continuously update the list of all SSC-CPAs under the PoA.
2- The coordinating entity will collate the monitoring information for all SSC-CPAs and prepare a monitoring report for each SSC-CPA.
3- The DOE will perform assessments of the SSC-CPAs.
4- The DOE will compute total verified emissions reductions by the PoA

The approach followed by the CME can be summarised in the following steps:

1- Maintenance of a list of choice of verification options to be applied to each CPA
The coordinating entity will develop and continuously update a list of SSC-CPAs. This will clearly and uniquely identify each CPA and give further important information to build the basis in order to compile a monitoring report, such as the crediting period start date of each CPA

2- Collection of monitored parameters and elaboration of the monitoring report
A monitoring report shall be prepared for each CPA in accordance to its corresponding monitoring plan as presented in its SSC-CPA-DD. Each report shall provide the value for emission reductions achieved by the SSC-CPA during the monitoring period consistent with the requirements of this SSC-PoA-DD and the corresponding SSC-CPA-DD.

The monitoring plan for parameters included in section E.7.1 will be implemented for each SSC-CPA with assistance from the Coordinating/Managing Entity as follows:

- CPA implementer will implement each SSC-CPA individually and monitor and record all parameters included in section E.7.1. The CPA Implementer may delegate this function to a third party, but retains responsibility for this task and the submission of this information to the Coordinating/Managing Entity.
- The Coordinating/Managing Entity will provide guidance to the SSC-CPA implementer on how monitoring should be conducted and data should be collected in regards to emission reductions calculation.
- The SSC-CPA implementer will provide data on monitored parameters included in section E.7.1 to the Coordinating/Managing Entity.
- The Coordinating/Managing Entity will document and store all data for parameters included in section E.7.1 provided by CPA implementers, in an electronic database, while primary data will be stored by CPA implementer.
- The Coordinating/Managing Entity reviews relevant monitoring documents, prepares the monitoring reports of the SSC-CPAs, and all documents related to monitoring shall be made available to the DOE, including each SSC-CPA individual monitoring report. The Coordinating/Managing Entity may conduct audits at any time to ensure that the procedures laid down in the CPA's monitoring plan are properly adhered to.

3- Assessment of the CPAs

The DOE performs a desk review of the monitoring information of all CPAs and performs on-site assessments as per procedures determined by the latest CDM Validation and Verification Standard.

At the end of the assessment, the Coordinating/Managing Entity shall provide an updated monitoring report elaborated in light of the DOE findings.

4-Computation of total emission reductions achieved by the PoA

The DOE approves the final monitoring reports provided by the CME and certifies that (i) the list and type of data collected and provided within the monitoring reports is consistent with the monitoring plan of each SSC-CPA (ii) ERs are estimated as described in this PoA-DD and the respective CPA-DD and are not miscalculated.

It shall be noted that:

a) The period of time over which the ERs are computed shall be the same as for that for which the ERs have been monitored and verified for.

b) For the first monitoring period, each CPA can have a different crediting-period start date, but the end of the monitoring period shall be equal for each CPA.

c) The following monitoring periods for the CPAs will be done at the same time. The end date of the last monitoring period of a crediting period may also be different for each CPA and shall be clearly indicated in the Monitoring Report.

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

The SEA Biogas PoA does not receive any public funding. Any public funding that may be provided to individual SSC-CPAs will be described in the corresponding SSC-CPA-DD. In case public funding is received for a SSC-CPA an affirmation will be provided that such funding does not result in a diversion of Official Development Assistance (ODA).

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

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

01/09/2012 or the date of registration, whichever is later

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

28 years

SECTION C. Environmental Analysis

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

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

The SEA Biogas PoA introduces the construction and operation of biogas recovery and destruction or utilization facilities in wastewater treatment facilities located in agro-industrial installations. Due to the site specificity of each SSC-CPA, the Environmental Analysis will be conducted at CPA level (see Section C.3).

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

The documentation of the analysis of environmental impacts, including trans-boundary impacts, will be conducted at CPA level.

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

Republic of Indonesia

As SSC-CPA activities to be introduced in Indonesia at existing water treatment facilities are considered continuous improvements in existing environmental management practices, national policies in place at the date of registration of the SEA Biogas PoA, for biogas power plants less than or equal to 10 MW, do not require Environmental Impact Assessments (EIA)[12] to be carried out.

Other South East Asia Host Country (ies) requirements shall be included post registration of the present PoA-DD as required.

SECTION D. Stakeholders' comments

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

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

Stakeholder consultation will take place at CPA level. Local stakeholders are the ones that are directly and indirectly mostly impacted by the SEA Biogas PoA. Local Stakeholder consultation not only offers local stakeholders an opportunity to raise any concerns they may have about the project but also provides a means whereby such concerns may be addressed by the developer.

It also poses as an opportunity to raise awareness amongst local communities and other stakeholders to the underlying objective of the SEA Biogas PoA, and discuss the benefits that accrue to them at local, regional and national levels.

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

Comments from local stakeholders will be invited at CPA level.

D.3. Summary of the comments received:

Summary of comments from local stakeholders will be provided at the CPA level.

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

Not applicable. Comments from local stakeholders will be invited at CPA level.

SECTION E. Application of a baseline and monitoring methodology

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

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

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

All SSC-CPAs shall apply the following approved SSC baseline and monitoring methodologies[13]

Methane avoidance component:

The approved CDM small-scale baseline and monitoring methodology AMS III.H "Methane Recovery in Wastewater Treatment" (Version 16) is applied to the methane avoidance component of the SSC-CPA.

Electricity generation component:

As specified in AMS III.H Version 16, paragraph 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".

Therefore, the approved CDM small-scale baseline and monitoring methodology AMS I.D "Grid connected renewable electricity generation" (Version 17) is applied to the electricity generation component of the SSC-CPA.

All CPAs under the SEA Biogas PoA will apply both methodologies of AMS-III.H and AMS-I.D.

In addition to the above, the following Methodological Tools are referred:

- Tool to calculate the emission factor for an electricity system, Version 02.2.1
- Tool to determine project emissions from flaring gases containing methane, Version 01.
- Tool to calculate baseline, project and/or leakage emissions from electricity consumption, Version 01.
- Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion, Version 02
- Emissions from solid waste disposal sites, version 06.0.1
- Tool to determine the remaining lifetime of equipment, version 01

For more information on both methodologies and tools, please refer to the link:
http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html

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

For the Methane recovery component

AMS III.H version 16 and AMS I.D Version 17 are applicable to the SSC-CPAs that the PoA aims to introduce for the following reasons:

[13] The EB at its 56th meeting approved the combination of any one of the Type III methodologies where activities lead to the generation of methane, such as AMS – III.H with any one of the Type 1 methodologies for utilising the methane generated for the generation of renewable energy, e.g. AMS – I.D.

Technology/measure under AMS III.H version 16"Methane recovery in Wastewater Treatment"	*Compliance of SSC-CPAs with the given applicability condition*
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;[14] **(e)** Introduction of anaerobic wastewater treatment with biogas recovery and combustion, with or without anaerobic sludge treatment, to an untreated wastewater stream; **(f)** Introduction of a sequential stage of wastewater treatment with biogas recovery and combustion, with or without sludge treatment, to an anaerobic wastewater treatment system without biogas recovery (e.g. introduction of treatment in an anaerobic reactor with biogas recovery as a sequential treatment step for the wastewater that is presently being treated in an anaerobic lagoon without methane recovery).	The measures to be introduced as part of the SEA Biogas PoA include any of those identified in point 1 of AMS III.H version 16 with the exception of option 1 (b) and 1 (c). The SEA Biogas PoA does not introduce biogas recovery systems to existing or new sludge treatment systems. However, any sludge treatment system affected by the project activity that may exist on-site (not being part of CDM project activity), such sludge treatment system will not be included in the baseline emission calculation (for conservative estimate). Compliance with this criteria shall be assessed based on site visit and project description, obtained from e.g. FSR, technology supplier, etc.
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	In cases where the baseline wastewater treatment system is based on anaerobic lagoons, these requirements shall be fulfilled by the SSC–CPA. Compliance with this criteria to be determined based or derived from e.g. waste water treatment system diagrams, site

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

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.	measurements, wastewater system design documents, etc.
3. The recovered biogas from the above measures may also be utilised for the following applications instead of combustion/flaring: (a) Thermal or mechanical,[15] electrical energy generation directly; (b) Thermal or mechanical, electrical energy generation after bottling of upgraded 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.	The SSC-CPA may include the use of recovered biogas for electrical generation as per application (a). Other applications (b) through (e) are not included under the PoA. Compliance with this applicability condition can be assessed by reviewing the project's proposed design, FSR, equipment or technology supplier's information.
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.	All SSC-CPAs recover biogas and use it for generating power for export to a grid; thus all SSC-CPAs shall apply AMS I.D version 17 for the power generation component of the SSC-CPA. Compliance with this applicability condition can be assessed e.g. from the FSR, system design drawings, technology supplier or manufacture's information.
5. For project activities covered under paragraph 3 (b), if bottles with upgraded biogas are sold outside the project boundary, the end-use of the	Not relevant. The SEA Biogas PoA does not promote type b) applications described in paragraph 3 of AMS III H Version 16.

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

biogas shall be ensured via a contract between the bottled biogas vendor and the end-user. No emission reductions may be claimed from the displacement of fuels from the end use of bottled biogas in such situations. If however the end use of the bottled biogas is included in the project boundary and is monitored during the crediting period CO2 emissions avoided by the displacement of fossil fuel can be claimed under the corresponding Type I methodology, e.g. AMS-I.C "Thermal energy production with or without electricity".	Compliance with this applicability condition can be assessed e.g. from the FSR, system design drawings, technology supplier or manufacture's information.
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 relevant. The SEA Biogas PoA does not promote type c) applications described in paragraph 3 of AMS III H Version 16. Compliance with this applicability condition can be assessed e.g. from the FSR, system design drawings, technology supplier or manufacture's information.
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 relevant. The SEA Biogas PoA does not promote c) applications described in paragraph 3 of AMS III H Version 16. Compliance with this applicability condition can be assessed e.g. from the FSR, system design drawings, technology supplier or manufacture's information.
8. In particular, for the case of 3 (b) and (c) (iii), the physical leakage during storage and transportation of upgraded biogas, as well as the emissions from fossil fuel consumed by vehicles for transporting biogas shall be considered. Relevant procedures in paragraph 11 of Annex 1 of AMS-III.H "Methane recovery in wastewater treatment" shall be followed in this regard.	Not relevant. The SEA Biogas PoA does not promote c) applications described in paragraph 3 of AMS III H Version 16. Compliance with this applicability condition can be assessed e.g. from the FSR, system design drawings, technology supplier or manufacture's information.
9. For project activities covered under paragraph 3 (b) and (c), this methodology is applicable if the upgraded methane content of the biogas is in accordance with relevant national regulations (where these exist) or, in the absence of national regulations, a minimum of 96% (by volume).	Not relevant. The SEA Biogas PoA does not promote c) applications described in paragraph 3 of AMS III H Version 16. Compliance with this applicability condition can be assessed e.g. from the FSR, system design drawings, technology supplier or manufacture's information.
10. If the recovered biogas is utilized for the production of hydrogen (project activities recovered 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 relevant. The SEA Biogas PoA does not promote projects in which the biogas is utilised for hydrogen production. Compliance with this applicability condition can be assessed e.g. from the FSR, system design drawings, technology supplier or manufacture's information.
11. If the recovered biogas is used for project	Not relevant. The SEA Biogas PoA does

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 promote activities that use recovered biogas as fuel in transportation. Compliance with this applicability condition can be assessed e.g. from the FSR, system design drawings, technology supplier or manufacturer’s information.
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.	The SEA Biogas PoA may introduce measures that may be considered as Greenfield projects (where no wastewater treatment systems exist prior to the project activity), and/or project activities involving a change of equipment resulting in a capacity addition of the wastewater compared to the designed capacity of baseline treatment system. In such cases such measures shall comply with the “General guidelines to SSC CDM methodologies version 16 and PoA-DD section E.4. In addition the requirements concerning the demonstration of the remaining lifetime of the replaced equipment, as described in the Tool to determine the remaining lifetime of equipment, version 01 at CPA inclusion stage should be followed. Compliance with this applicability condition can be assessed e.g. from the FSR, system design drawings, technology supplier or manufacture’s information and actual site visit.
13. The location of the wastewater treatment plant as well as the source generating the wastewater shall be uniquely defined and described in the PDD.	The location of the wastewater treatment plant as well as the source generating the wastewater shall be uniquely defined and described in the section A.4.1.2 of SSC-CPA-DD. Compliance with this applicability condition can be assessed by assessing the description given in section A.4.1.2
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.	The emissions reductions from the Methane recovery component of each SSC-CPA shall be less than or equal to 60 kt CO2 equivalent per year.

For Grid connected power generation component

The applicability conditions stated in AMS I.D Version 17 and how the SSC-CPA that are to be included under the PoA fulfil such criteria are described below:

Technology/measure under AMS I.D version 17 “Grid Connected Renewable Electricity	*Compliance of SSC-CPAs with the given applicability condition*

Generation"	
1. This category 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; (b) supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling	The SEA Biogas PoA promotes Measures in which recovered biogas is used for generating electricity for export to a national or a regional grid. Hence SSC CPAs shall be in compliance with 1 (a). Compliance with this applicability condition can be assessed by reviewing the emissions reductions calculations presented as part of the CPA-DD submission to the DOE.
2. Illustration of respective situations under which each of the methodology (i.e. AMS-I.D, AMS-I.F and AMS-I.A[16]) applies in included in Table 2	The SEA Biogas PoA promotes Measures in which recovered biogas is used for generating electricity for export to a national or a regional grid. Thus it is applicable to the methodology of AMS-I.D. Compliance with this applicability condition can be assessed e.g. from feasibility study, technology supplier or manufacturer's information, as proof of the intention to produce power for export to a grid.
3. 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[17]; (c) involve a retrofit[18] of (an) existing plant(s); or (d) involve a replacement[19] of (an) existing plant(s).	The SEA Biogas PoA promotes measures 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. Compliance with this applicability condition can be assessed e.g. from the FSR, system design drawings, technology supplier or manufacturer's information, as proof of the intention to produce power for export to a grid, in conjunction with visit to

[16] AMS-I.D "Grid connected renewable electricity generation", AMS-I.F "Renewable electricity generation for captive use and mini-grid" and AMS-I.A "Electricity generation by the user".

[17] A capacity addition is an increase in the installed power generation capacity of an existing power plant through: (i) the installation of a new power plant besides the existing power plant/units, or (ii) the installation of new power units, additional to the existing power plant/units. The existing power plant/units continue to operate after the implementation of the project activity.

[18] Retrofit (or Rehabilitation or Refurbishment). It involves an investment to repair or modify an existing power plant/unit, with the purpose to increase the efficiency, performance or power generation capacity of the plant, without adding new power plants or units, or to resume the operation of closed (mothballed) power plants. A retrofit restores the installed power generation capacity to or above its original level. Retrofits shall only include measures that involve capital investments and not regular maintenance or housekeeping measures.

[19] Replacement. It involves investment in a new power plant or unit that replaces one or several existing unit(s) at the existing power plant. The installed capacity of the new plant or unit is equal to or higher than the plant or unit that was replaced.

	the actual site.
4. Hydro power plants with reservoirs[20] 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[21], 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.	The SEA Biogas PoA does not promote Hydro Power plant. Compliance with this applicability condition can be assessed e.g. from the FSR, system design drawings, technology supplier or manufacturer's description of the project.
5. 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[22], the capacity of the entire unit shall not exceed the limit of 15 MW.	The new power plants may co-fire fossil fuel. In such case, the combined capacity of the entire unit shall not exceed of 15 MW. Compliance with this applicability condition can be assessed e.g. from the FSR, technology supplier or manufacturer's information.
6. Combined heat and power (co-generation) systems are not eligible under this category.	The SEA Biogas PoA does not promote CHP. Compliance with this applicability condition can be assessed e.g. from the FSR, system design drawings, technology supplier or manufacturer's information.
7. 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[23] from the existing units	The SEA Biogas PoA does not include the project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility. Compliance with this applicability condition can be assessed e.g. from the FSR, system design drawings, technology

[20] Replacement. It involves investment in a new power plant or unit that replaces one or several existing unit(s) at the existing power plant. The installed capacity of the new plant or unit is equal to or higher than the plant or unit that was replaced

[21] A reservoir is to be considered as an "existing reservoir" if it has been in operation for at least three years before the implementation of the project activity.

[22] A co-fired system uses both fossil and renewable fuels, for example the simultaneous combustion of both biomass residues and fossil fuels in a single boiler. Fossil fuel may be used during a period of time when the biomass is not available and due justifications are provided.

[23] Physically distinct units are those that are capable of generating electricity without the operation of existing units, and that do not directly affect the mechanical, thermal, or electrical characteristics of the existing facility. For example, the addition of a steam turbine to an existing combustion turbine to create a combined cycle unit would not be considered "physically distinct".

	supplier or manufacturer's information describing the technology and source of energy used to generate power.
8. 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.	The SEA Biogas PoA does not include the retrofit or replacement. Compliance with this applicability condition can be assessed e.g. from the FSR, technology supplier or manufacturer's information.

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

According to AMS III .H. Version 16, the project boundary is the physical, geographical site where the wastewater 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 of waste products as well as biogas takes place.

Implementation of the project activity at a wastewater treatment system will affect certain sections of the treatment systems while others may remain unaffected. The treatment systems not affected by the SSC-CPA, i.e. sections operating in the project scenario under the same operational conditions as in the baseline scenario (e.g. wastewater inflow and COD content, temperature, retention time, etc.), shall be described in the SSC-CPA-DD, but emissions from those sections do not have to be accounted for in the baseline and project emission calculations (since the same emissions would occur in both baseline and project scenarios)[24]. The assessment and identification of the systems affected by the SSC-CPA will be undertaken *ex ante*, and the SSC-CPA-DD Section B.4 shall justify the exclusion of sections or components of the system and the applicable formulae are included in Section B.5.2. The treatment systems (lagoons, reactors, digesters, etc.) that will be covered and/or equipped with biogas recovery by the project activity, but continue to operate with the same quality of feed inflow, volume (retention time), and temperature (heating) as in the baseline scenario, may be considered as not affected i.e. the methane generation potential[25] remains unaltered.

The gases and sources to be included in a SSC-CPA are presented in Table 2.

Table 2 - Summary of Gases and Sources included in the SSC-CPA Boundary AMS III.H Version 16

	Source	Gas	Included?	Justification / Explanation
Baseline	Wastewater treatment process	CO_2	No	CO_2 emissions from the decomposition of organic waste are not accounted.
		CH_4	Yes	The treatment of wastewater under the baseline scenario which consist of : **(i)** Emission from the baseline wastewater treatment system affected by the project activity

[24] As per EB 22, annex 2 "Guidance regarding methodological issues" section E.

[25] The covering of lagoons and the installation of biogas recovery equipment may result in changes in the operational conditions (such as temperature, COD removal, etc.) of an anaerobic treatment system. These changes are considered small and hence not accounted for under this methodology.

				(ii) Emission from degradable organic carbon in treated wastewater discharged **(iii)** Emission from anaerobic decay of the final sludge produced by the baseline wastewater treatment system. *If the sludge is controlled combusted, disposed in a landfill with biogas recovery, or used for soil application in baseline scenario, this term shall be neglected. Methane emissions resulting from baseline sludge treatment systems that are affected by the project activity are not taken into account for the purpose of simplicity and conservativeness in the determination of baseline emissions.*
		N_2O	No	Excluded for simplification and conservativeness.
	Electricity and/or fossil fuel consumption	CO_2	Yes	Where applicable emission from the electricity consumption that would have been consumed in the absence of the project activity and which would have been supplied from grid or fossil fuel based captive power plant.
		CH_4	No	Excluded for simplification and conservativeness.
		N_2O	No	Excluded for simplification and conservativeness.
Project Activity	Wastewater treatment processes	CO_2	No	CO_2 emissions from the decomposition of organic waste are not accounted.
		CH_4	Yes	The treatment of wastewater under the project scenario which consist of : (i) Emission from wastewater treatment system affected by the project (ii) Emission from sludge treatment system affected by the project activity, and not equipped with biogas recovery (iii) Emission from degradable organic carbon in treated wastewater discharged (iv) Emission from anaerobic decay of the final sludge produced in year *y*. Applicable only if the sludge is not controlled combusted, not disposed in a landfill with biogas recovery, or not used for soil application in aerobic conditions in the project activity. (v) Emission from biogas release in capture system (vi) Emission due to inco*m*plete flaring system (vii) Emission from biomass stored under anaerobic conditions.
		N_2O	No	Excluded for simplification and conservativeness
	Electricity from on-site electricity use	CO_2	Yes	Electricity consumed by the project activity if provided by the biogas power plant shall be considered to have a zero emission factor. If electricity from grid and/or from fossil fuel captive power plant is consumed to run the project activity, these emissions source shall be included.

		CH_4	No	Excluded for simplification. This emission source is assumed to be very small
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small

As per AMS I.D. Version 17, the spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the SSC-CPA power plant is connected to.

Table 3 **- Summary of Gases and Sources included in the SSC-CPA Boundary AMS I.D Version 17**

Source		Gas	Included?	Justification/Explanation
Baseline	Generation of electricity by grid connected plants	CO_2	Yes	According to AMS I.D only CO2 emission from electricity generation should be accounted
		CH_4	No	According to AMS I.D./Version 17
		N_2O	No	According to AMS I.D./Version 17
Project Activity	Electricity consumption in the project activity	CO_2	Yes	According to AMS I.D./Version 17, only if fossil fuels are used is the SSC CPA.
		CH_4	No	According to AMS I.D./Version 17
		N_2O	No	According to AMS I.D./Version 17
	On-site fossil fuel consumption	CO2	Yes	Where applicable, and in accordance with AMS I.D./Version 17

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

The SEA Biogas PoA aims to promote the widespread adoption of less GHG intensive forms of wastewater treatment. Although anaerobic based lagoons are the most common systems applied in the industry, there are forms of wastewater treatment systems as well, in which the release of methane to the atmosphere also takes place. Thus there are different baseline technologies that may be encountered across the agro-industrial sector as the SEA Biogas PoA is rolled out. Similarly there are different technologies available to capture the biogas that can be produced, and the PoA does not want to restrict the technologies that are deployed under it. It aims to facilitate the technology that is most suited to the individual CPA circumstances, and therefore the baseline scenario is identified and described for each CPA in its corresponding CPA-DD.

The SEA Biogas PoA covers options 1(a), 1(d), 1(e) and 1(f) described in paragraph 1 in AMS III H Version 16, with the exception of any measure that also seeks to introduce biogas recovery systems to a sludge treatment system (either existent or new). The SEA Biogas PoA covers two major categories of baseline scenario:

a. The continuation of the operation of the existing wastewater treatment facilities and the release of the biogas generated to atmosphere

b. The expansion of an existing wastewater treatment capacity or the installation of a new water treatment at a site where no waste water treatment exists prior to the proposed SSC CPA

Hence although, the most common baseline scenario for wastewater treatment system in the Republic of Indonesia is anaerobic lagoon based systems, be it at existing agro-industrial sites or new sites, due to their relatively low capital and running costs, the baseline scenario for a CPA will be CPA specific, as discussed below.

Methane recovery in waste water treatment and grid connected renewable electricity generation

For SSC-CPAs that aim to recover the biogas and use it to generate power for export to a grid, and where any excess biogas is combusted in a flare to avoid the release of methane to the atmosphere the baseline scenario comprises the baseline of each of the two components of the SSC-CPA:

For the methane recovery in wastewater treatment component of the SSC-CPA:

Two SSC-CPA cases are described:

A) The proposed SSC-CPA is developed at an existing wastewater treatment facility:

The baseline scenario is the continued operation of the existing wastewater treatment facility and the release of the methane generated to the atmosphere.

B) The expansion of an existing wastewater treatment capacity or the installation of a new water treatment at a site where no wastewater treatment exists prior.

As per approved methodology of AMS-III.H Version 16, paragraph 12, New facilities (Greenfield Projects) and project activities involving a change in equipment resulting in a capacity addition of the wastewater treatment system compared to the design 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 accordance to paragraph 19 of the referred guidelines, Greenfield SSC-CPAs may use Type III small scale methodology provided that they can demonstrate that the most plausible baseline scenario for the project activity is the baseline provided in the respective Type III small-scale methodology.

Similarly, in accordance to paragraph 21 of the referred guidelines, SSC-CPAs involving capacity increase may use a Type III SSC methodology provided that they can demonstrate that the most plausible baseline scenario for the additional (incremental) capacity is the baseline provided in the respective.

According to the General Guidelines to SSC CDM methodologies, Version 17, the baseline scenario for such SSC-CPAs shall be that which results from applying the stepwise assessment prescribed in paragraph 19:

Step 1:
Identify the various alternatives available to the project proponent that deliver comparable level of service including the proposed project activity undertaken without being registered as a CDM project activity.

Step 2:
List the alternatives identified per Step 1 in compliance with the local regulations (if any of the identified baseline is not in compliance with the local regulations, then exclude the same from further consideration).

Step 3:
Eliminate and rank the alternatives identified in Step 2 taking into account barrier tests specified in Attachment A to Appendix B of the simplified modalities and procedures of SSC CDM.

Step 4:
If only one alternative remains that is:

- Not the proposed project activity undertaken without being registered as a CDM project activity; and
- Corresponds to one of the baseline scenarios provided in the methodology, then the project activity is eligible under the methodology.

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

The resulting baseline scenario for such SSC-CPAs must be consistent with AMS III H in order to be able to include such SSC-CPAs in the SEA Biogas PoA.

In any of the above two cases, the following baseline wastewater treatment options catered for under AMS III.H Version 16 paragraph 1, and which are considered under the SEA Biogas PoA are:

(a) Aerobic wastewater system
(b) Anaerobic wastewater treatment system such as anaerobic reactor, lagoon, septic tank or an on site industrial plant
(c) An untreated wastewater stream
(d) Anaerobic wastewater treatment system without biogas recovery

If the baseline wastewater treatment facility is an anaerobic lagoon, then the following conditions must be satisfied for the continued operation of such facility to be considered the baseline scenario for the purpose of applying AMS III H Version 16:

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 is above 15°C, at least during part of the year, on a monthly average basis.
c) The minimum interval between two consecutive sludge removal shall be 30 days.

For the grid connected renewable electricity generation component:

As per AMS I.D. Version 17, the baseline scenario is that the electricity that is delivered to the grid by the project activity 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 emissions are the product of electrical energy baseline expressed in MWh of electricity produced by the SSC-CPA's renewable generating unit multiplied by the grid emission factor.

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

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

As discussed in Section A.4.3 the additionality for a typical SSC-CPA in which biogas is recovered and used to generate electricity for export to a grid, and in which any excess recovered biogas that is available is combusted in a flare is demonstrated at the CPA level, by means of the use of Attachment A to Appendix B of the Simplified Modalities and Procedures for Small Scale CDM Project Activity.

The recovery of biogas and its destruction in a flare to reduce the amount of methane released to the atmosphere as a result of wastewater treatment as well as the recovery of biogas from such facilities to generate electricity for export to the grid faces a number of barriers, of which the investment barrier constitutes the largest obstacle that those who wish to implement such projects need to overcome.

SSC-CPA implemented at a site where there is an existing waste water treatment facility

The continuation of the existing practice in the agro-industry in countries in South East Asia such as the Republic of Indonesia is such that the biogas resulting from wastewater treatment is released to the atmosphere. This practice requires little if any investment at all, as well minimal expenditure to maintain such treatment facilities operational.

For example, in agro-industrial subsectors such as the Palm Oil Industry, the organic material bearing effluent is commonly treated using anaerobic lagoons. Continuation of this practice would result in minimal ongoing costs to the owner of the wastewater treatment facility, and would not require any additional capital investment nor additional operating and maintenance expenses to keep such facilities in operation beyond those in which they normally incur in.

On the other hand, the construction of a biogas recovery system in which the recovered gas is used to generate electricity for export to a grid will require substantial investment in equipment, land preparation and construction of the concrete floor, as well as ongoing expenditure to cover operation and maintenance associated with running the gas recovery installation, power plant and the flare. The source of revenue for the proposed measures in the SEA Biogas PoA is the sale of power to the grid. If the revenues generated from the export of power to the grid do not offer the desired returns the investor will not invest in such a project. If such an investment is not made, the electricity that the CPA could generate would have been generated by grid connected power plants.

The SEA Biogas PoA is a small scale CDM programme of activities and Investment analysis is chosen for the demonstration of additionality of the CPAs. Steps taken to conduct the investment analysis are as follows:

(a) identify the financial indicator/economic indicator (IRR)
(b) calculation and comparison of financial indicators (benchmark)
(c) conduct the sensitivity analysis

Therefore the financial viability of the development and operation EB 62 annex 5, version 5.0 of the Guidelines for the Assessment of Investment Analysis, project IRR (without CDM revenues) will be compared with a benchmark rate for investment returns available to the SSC-CPA implementer. The appropriate benchmark for a Project IRR is either the local Commercial Lending rate or Weighted Average of Capital Cost (WACC).

In so doing the economic indicator chosen to assess additionality may be either the Project Pre-Tax IRR or the Project Post-tax IRR. Taxation should only be included as an expense in the IRR calculation in cases where a post tax benchmark is used for comparison. The calculation of the indicator shall be determined based on the approach and data and taking into account information corresponding to the Host Country where the SSC-CPA is implemented as appropriate.

Project Pre Tax IRR calculation

The project Pre Tax IRR, if chosen to be financial indicator, will be determined based on information, data and economic parameters provided by the CPA implementer that were available at the timing of the investment decision. This list of parameters includes:

Table 4: Parameters for project IRR calculation

PROJECT DATA		
	Unit	**Comments**
Technical lifetime	Year	Estimation of technical lifetime can be justified based on the information of registered project, (if applicable) confirmation of project lifespan from technology provider
Start date	DD/MM/YYYY	Typical start date of a CPA can be the date on which contracts have been signed for equipment for project activity
Investment decision date	DD/MM/YYYY	Can be sourced from e.g. board decision, loan agreement, main equipment purchasing contract
Construction start date	Year	Can be sourced from e.g. constructor quotation, Feasibility Study, Project Status Report, civil work contract
Date project starts operating	Year	Can be sourced from e.g. Commissioning Recommendation Certificate and Commissioning Certificate, commissioning plan
FINANCIAL PARAMETERS		
	Unit	**Comments**
Total amount of electricity sold to the grid	kWh/y	Can be sourced from Feasibility Study
Electricity price	Currency unit/kWh	As per contract with electricity buyer when available. To be determined at CPA level. If PPA is not available at the time investment decision, the electricity price as per regulation is taken
Inflation rate	% per year	If not otherwise specified, annual change in consumer price index at date of investment decision is used. It can be

		sourced from the Central Bureau statistic or any relevant evidences
Exchange Rate	Foreign currency unit/applied currency unit	As per the time the investment decision is made. In Indonesia, it can be source from the central bank of Indonesia
COSTS AND EQUIPMENT		
	Unit	**Comments**
Total investment	Currency unit	If the construction is expected to take place over several years, a yearly breakdown of investments can be provided. The value can be sourced from feasibility study.
(Other revenues)	Currency unit	
Operation & Maintenance cost	Currency unit /year	Can be sourced from e.g. FS together with calculation approach of such costs (nr. employees times salary) and yearly costs of equipment replacement as per technology provider.
(Other operating expenditure)	Currency unit /year	
Insurance	% of Capex p.a.	Can be sourced from e.g. insurance quotation/contract
Tax	%	Can be sourced from Tax law. In Indonesia it can be referred to tax law no. 36 year 2008. This parameter is applicable for post-tax IRR calculation.
Depreciation	%	Can be sourced from tax law. In Indonesia it can be referred to tax law no. 36 year 2008. This parameter is applicable for post-tax IRR calculation

In Indonesia for example, US$ and IDR are sometimes applied in financial projections. When conducting the analysis, all foreign currencies may be converted into the local currency, in this specific case, IDR, using the average exchange rate during the twelve months preceding the date of the investment decision.

Post Tax IRR, if chosen as the indicator, shall follow EB 62 annex 5, version 5.0 of the Guidelines for the Assessment of Investment Analysis.

As per guidance 5, EB 62 annex 5, Depreciation, and other non-cash items related to the project activity, which have been deducted in estimating gross profit on which tax is calculated, should be added back to net profits for the purpose of calculating the financial indicator (e.g. IRR, NPV). Taxation should only be included as an expense in the IRR/NPV calculation in cases where the benchmark or other financial indicator is intended for post-tax comparisons.

According to guidance 11, EB 62 annex 5, due to the impact of loan interest on income tax calculation it is recommended that when a project IRR is calculated to demonstrate additionality a pre-tax benchmark is applied. In cases where a post-tax benchmark is applied, actual interest payable is taken into account in the calculation of income tax.

Benchmark calculation

As per guidance 19 of Annex 5, EB 62, if the proposed baseline scenario leaves the project participant no other choice than to make an investment to supply the same (or substitute) products or services, a benchmark analysis is not appropriate and an investment comparison analysis shall

be used. If the alternative to the project activity is the supply of electricity from a grid this is not to be considered an investment and a benchmark approach is considered appropriate.

Biogas capture and utilisation projects are typically financed using a combination of loan and equity financing. The benchmark chosen may therefore be the Commercial Lending Rate or the country-specific Weighted Average Cost of Capital (WACC).

The WACC is defined as the average return expected across the different types of capital that finance a given project. For the purpose of this PoA the WACC may be determined for each SSC-CPA by using the following rules:

- All financial information used for the benchmark determination will be sourced from independently verifiable sources

- The cost of equity may be determined using the capital asset pricing model (CAPM).

The WACC will be calculated as follows:[26]

$$WACC = CD \times \%Debt + CE \times \%Equity$$

Depending on whether the comparison is to be done on a Post Tax or Pre Tax basis, the WACC may be determined as follows:

$$WACC(post - tax) = CD \times (1 - T) \times \%Debt + CE \times \%Equity$$

The cost of equity (CE) may be determined based on the capital asset pricing model (CAPM):

$$CE = RFR + \beta \cdot (RP) + SP$$

Where:

$$\beta = \beta unlevered \times (1 + (1 - T) \times D / E)$$

The WACC (pre-tax) can in turn be determined by:

$$WACC(pre - tax) = WACC(post - tax) / (1 - T)$$

Table 5 provides the parameters and sources from which their values may be drawn from in order to determine the WACC.

Table 5: Parameters for calculation of WACC benchmark

Parameters	Description	Source and explanation

[26] Velez-Pareja, Ignacio and Tham, Joseph, "A Note on the Weighted Average Cost of Capital WACC" (August 7, 2005). Available at SSRN: http://ssrn.com/abstract=254587.

RFR	Risk Free Rate in a mature equity market	Lowest rate between the host country and government bond and U.S. long –term government bond. U.S. long-term government bond is considered as risk free instrument. Bond rate is taken as the 6 month average prior to the investment decision and for a duration equal to the technical lifetime of the project activity Source: http://www.treasury.gov/resource-center/data-chart-center/interest-rates/Pages/TextView.aspx?data=yieldYear&year=2010
ß *unlevered*	Beta (unlevered)	Total Beta (*Unlevered*) from Damadoran (Stern University) for the relevant industrial sector; most recent year data before the investment decision was made. It reflects a firm's total exposure to risk rather than just the market risk component. It is a function of the market beta and the portion of the total risk that is market risk. These betas might provide better estimates of costs of equity for undiversified owners of businesses. http://pages.stern.nyu.edu/~adamodar/ "Total Beta by industry sector"
RP	Total Risk Premium	The Total Risk Premium includes an Equity Risk Premium and a Country Risk Premium. The reason behind this premium stems from the risk-return trade off, in which a higher rate of return is required to entice investors to take on riskier investments. http://pages.stern.nyu.edu/~adamodar/ "Risk Premium for other Markets"
SP	Size Premium.	Size premium is an investor's risk incurred when investing in a small project. Betas are generally calculated based on data for large corporations. However companies of different sizes face different levels of risk. The smaller the company the fewer the sources of capital and investors require additional returns to compensate for the lower marketability of shares. According to Ibbotson Associates' statistics for 2009 [27]for the New York Stock exchange reveals that risk premium increases as the size of a company reduces: The equity risk premium of the largest 10% of companies is -0.36% (i.e. the firms in the largest 10% have an equity risk premium that is 0.36% below average). The smallest 10% of companies (up to 128 million USD) have an equity risk premium of 5.81%. The usual way of accounting for this risk premium is to add this to the Cost of Equity (CE), as given in the equation for CE above. The Size risk premium can be sourced from the "*Ibbotson SBBI valuation yearbook"* published by Morningstar Inc

[27] Ibbotson SBBI 2009 Valuation Yearbook, Chapter 7, page 96

		The PP may apply the SP in cases where project CAPEX is less than 100 million USD
CD	Cost of Debt	Interest rate of loan by commercial bank for investment. The cost of debt can be assumed as the commercial lending rate in the host country or the yield of a 10 year bond issued by the government of the host country or, if this is not available, the bond with the maturity which is closest to 10 years. As per EB61 Annex 13, Para 16.) If the WACC is based on parameters that are standard in the market, the cost of debt can be taken as the cost of financing in the capital markets, e.g. the host country commercial lending rate in the host country The value of cost of debt can be sourced from Central Bank e.g. Central Bank of Indonesia or any other relevant evidence
%Debt	% of finance from debt	Based on the finance structure of the project. If debt/equity finance structure is not yet available, 50% debt may be assumed as per EB 62, Annex 5, Para 17, 18
%Equity	% of finance from equity	Based on the finance structure of the project. If debt/equity finance structure is not yet available, 50% equity may be assumed As per EB 62, Annex 5, Para 17, 18
D/E	Debt to Equity ratio	Calculation
CE	Cost of Equity, i.e. Average expected return on equity	Calculated as per CAPM
T	Tax rate	Tax regulation. e.g. In Indonesia tax rate could be sourced from tax law no.36/2008
Date of performing financial analysis	DD/MM/YYYY	Can be sourced from the date of the investment decision

If over the course of the lifetime of the PoA, a parameter or the source of its value becomes unavailable or is replaced by a more relevant parameter and/or source, then this parameter and/or sources will be revised accordingly prior to acceptance from the DOE.

Sensitivity analysis

As specified in the excel spreadsheet to be supplied to the DOE upon submission of a CPA-DD, a sensitivity analysis will be conducted on variables that constitute more than 20% of either the total project costs or the total project revenues, and shall include the following variables: (1) total investment; (2) O&M, (3) Revenues (Electricity Production and power tariff). As per Guidance 21 of the Guidelines on the assessment of investment analysis Version 05[28], as general point of departure variations in the sensitivity analysis should at least cover a range of +10% and -10%, unless it is deemed inappropriate in the context of the specific SSC-CPA's circumstances.

[28] EB 62 Annex 5 "Guidelines on the assessment of investment analysis"

The full results of each sensitivity analysis will be reported in the respective SSC-CPA-DD using the following format:

Table 6: Framework for reporting results of sensitivity analysis

Factor	**Variation**		
	-10% (or less if appropriate)	0%	10% (or more if appropriate)
Total investment			
O&M Cost			
Revenues			
Benchmark			

If the IRR in the sensitivity analysis exceeds the benchmark while altering one of the four parameters, the CPA implementers shall provide evidence that this scenario is unlikely to occur. If no sufficient proof is provided, the CPA will be considered non-additional. Otherwise the CPA shall be deemed additional.

SSC-CPAs implemented at sites where there is a planned capacity expansion or Greenfield SSC-CPAs

SSC-CPAs that seek to recover biogas from a waste water treatment installation whose capacity is to be increased as a part of capacity expansion plan or where no waste water treatment installation currently exists (Greenfield) shall demonstrate its additionality as per EB 61 Annex 21 paragraph 5 and Attachment A of Appendix B of 4/CMP.1 Annex II by showing that the proposed project would otherwise not have been implemented due to the existence of an investment barrier, i.e. that a financially more viable alternative to the project activity would have led to higher emissions.

When undertaking such assessment, it shall be noted that CPAs which involve a wastewater treatment capacity increase or that involve the construction of a wastewater treatment facility where biogas is to be recovered for the purpose of generating power for export to the grid must demonstrate first that the most plausible baseline scenario is in line with that of AMS III.H Version 16. This shall be determined by following the stepwise approach prescribed in paragraph 19 of EB 61 Annex 21.

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

1.0 As per EB 55, Annex 38, paragraph 7 the start date of any SSC-CPA to be included in the SEA Biogas PoA is not prior to the commencement of validation of the programme of activities, i.e. the date on which the CDM-POA-DD was first published for Global Stakeholder consultation.

2.0 SSC-CPAs that seek to recover biogas from existing wastewater treatment installations and use this gas to generate power for export to a grid, and combust any remaining biogas that is recovered in a flare, in order to prevent the release of methane to the atmosphere shall apply the criteria given in E.5.1 section and may employ the sources of data indicated above to determine the value of the benchmark upon which to compare the IRR of the CPA. If the IRR of the project is found below the Benchmark and the sensitivity analysis confirms this conclusion, the CPA is additional.

3.0 SSC-CPAs that seek to recover biogas and generate power for export to a grid at wastewater treatment facilities where there is a plan to increase the wastewater treatment capacity, or SSC-CPAs that aim to recover biogas and generate power for export to a grid at a site where no wastewater treatment facilities exist shall be deemed additional if as according to EB 61 Annex 21 and Attachment A of Appendix B of 4/CMP.1 Annex II it can be shown that the project activity would otherwise not have been implemented due to the existence of an investment barrier, i.e. that a financially more viable alternative to the project activity would have led to higher emissions.

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

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

The emission reductions achieved by the proposed CPA are calculated according to the approved methodology AMS III.H "methane recovery in wastewater treatment" version 16 and AMS I.D "Grid connected renewable electricity generation" version 17.
As per AMS III.H version 16, where the baseline system is based on anaerobic lagoons, the following conditions must be met in order to apply this methodology:

1. The lagoons are ponds with a depth greater than two meters, without aeration. The value for depth is obtained from engineering design documents, or through direct measurement, or by dividing the surface area by the total volume. If the lagoon filling level varies seasonally, the average of the highest and lowest levels may be taken;

2. Ambient temperature above 15 C, at least during part of the year, on a monthly average basis;

3. The minimum interval between two consecutive sludge removal events shall be 30 days.

In addition to the above, the following must be considered when applying AMS III.H Version 16 to any SSC-CPA that aims to be included in the PoA:

4. Baseline emissions from sludge treatment systems affected by the project activity will not be accounted for in the calculations for the purpose of simplicity and conservativeness in the calculation of the baseline emissions.

5. No leakage emissions will be considered since only projects using new biogas recovery equipment are eligible under the SEA Biogas PoA. None of the biogas recovery equipment to be introduced under the SEA Biogas PoA shall be transferred from or to another project activity.

In accordance to paragraphs 3 and 4 of the approved methodology AMS-III.H version 16, where the biogas recovered in the SSC-CPA is to be utilized also for grid connected electrical energy generation directly then that component of the project activity can use a corresponding a Type I methodology, in this case, AMS I.D Version 17 shall be applied.

The following applicability conditions are fulfilled in order to apply the referred methodology:

1. The project emission for most renewable energy project activity, PE_y=0, except for cases in which fossil fuels are consumed as a result of the project activity. If such is the case, CO_2

emissions from on-site consumption of fossil fuels due to the project activity shall be calculated using the Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion version 02.

2. The emission factor can be calculated in a transparent and conservative manner based on the 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 02.2.1.

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

Emission reduction from methane recovery in waste water treatment:

A. Baseline Emissions

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

(i) Emissions on account of electricity or fossil fuel used ($BE_{power,y}$);

(ii) Methane emissions from baseline wastewater treatment systems ($BE_{ww,treatment,y}$);

(iii) Methane emissions on account of inefficiencies in the baseline wastewater treatment systems and presence of degradable organic carbon in the treated wastewater discharged into river/lake/sea ($BE_{ww,discharge,y}$);

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

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

Where:

BE_y	Baseline emissions in year y (tCO_2e)
$BE_{power,y}$	Baseline emissions from electricity or fuel consumption in year y (tCO_2e)
$BE_{ww,treatment,y}$	Baseline emissions of the wastewater treatment systems affected by the project activity in year y (tCO_2e)
$BE_{ww,discharge,y}$	Baseline methane emissions from degradable organic carbon in treated wastewater discharged into sea/river/lake in year y (tCO_2e). The value of this term is zero for the case 1 (b) of approved methodology AMS-III.H version 16
$BE_{s,final,y}$	Baseline methane emissions from anaerobic decay of the final sludge produced in year y (tCO2e). If the sludge is controlled combusted, disposed in a landfill with biogas recovery, or used for soil application in the baseline scenario, this term shall be neglected.

Emissions from the sludge treatment system affected by the project activity ($BE_{s,treatment,y}$) are not considered for the purpose of simplicity and conservativeness in the determination of the baseline emissions. Thus, the relevant baseline emissions under SEA Biogas PoA are described below.

1. Baseline emissions from electricity and fossil fuel consumption ($BE_{power,y}$) are determined as per the procedures described in the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption” version 01 and “Tool to calculate project or leakage CO2 emissions from fossil fuel combustion” version 02, respectively.

   The equations to be applied, including the ex ante parameters and parameters to be monitored, however need to reflect the specific baseline of each particular SSC-CPA, firstly in terms of where any electricity used is sourced from and secondly, whether any fossil fuel is used or not. Thus, whether such CO2 baseline emissions need to be accounted for at all needs to be discussed for each specific SSC-CPA. In cases where such emissions do exist, methodological choices will have to be made by the CPA implementers when applying the above tools. Hence, it is more appropriate that such equations, and consequently the relevant ex ante parameters and parameters to be monitored, be described in the SSC-CPA-DD because they need to reflect the specific aspects of each SSC-CPA and the methodological choices of those who implement them.

   The energy consumption, if relevant to the proposed SSC-CPA, shall include all equipment/devices in the baseline wastewater treatment system. If recovered biogas in the baseline is used to power auxiliary equipment it should be taken into account accordingly, using zero as its emission factor.

2. Methane emissions from the baseline wastewater treatment systems affected by the project ($BE_{ww,treatment,y}$) are determined using the COD removal efficiency of the baseline plant:

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

Where:

$Q_{ww,i,y}$	Volume of wastewater treated in baseline wastewater treatment system *i* in year *y* (m^3). For *ex ante* estimation, forecasted wastewater generation volume or the designed capacity of the wastewater treatment facility can be used. However, the *ex post* emissions reduction calculation shall be based on the actual monitored volume of treated wastewater
$COD_{inflow,i,y}$	Chemical oxygen demand of the wastewater inflow to the baseline treatment system *i* in year *y* (t/m^3). Average value may be used through sampling with the confidence/precision level 90/10. For ex-post baseline emission calculation, the parameter $COD_{ww,untreated,y}$ refers to the baseline COD of wastewater inflow ($COD_{inflow,i,y}$)
$\eta_{COD,BL,i}$	COD removal efficiency of the baseline treatment system *i*, determined as per the paragraphs 6, 7 or 8 below or paragraph 26,27 or 28 of the approved methodology AMS-III.H version 16
$MCF_{ww,treatment,BL,i}$	Methane correction factor for baseline wastewater treatment systems *i* (*MCF* values as per Table III.H.1) of the approved methodology
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)[29]
UF_{BL}	Model correction factor to account for model uncertainties (0.89)[30]
GWP_{CH4}	Global Warming Potential for methane (value of 21)

If the baseline treatment system is different from the treatment system in the project scenario, the monitored values of the COD inflow during crediting period will be used to calculate the baseline emissions *ex post*.

3. The Methane Correction Factor (*MCF*) shall be determined based on the following table:

Table III.H.1. IPCC default values[31] for Methane Correction Factor (*MCF*)

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

4. Methane emissions from degradable organic carbon in treated wastewater discharged in e.g. a river, sea or lake in the baseline situation are determined as follows:

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

Where:

$Q_{ww,y}$	Volume of treated wastewater discharged in year *y* (m^3)
UF_{BL}	Model correction factor to account for model uncertainties (0.89)
$COD_{ww,discharge,BL,y}$	Chemical oxygen demand of the treated wastewater discharged into sea, river or lake in the baseline situation in the year *y* (t/m^3). If the baseline scenario is the discharge of untreated wastewater, the COD of untreated wastewater shall be used
$MCF_{ww,BL,discharge}$	Methane correction factor based on discharge pathway in the baseline situation (e.g. into sea, river or lake) of the wastewater (fraction) (*MCF* values as per Table III.H.1 of approved methodology)

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

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

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

To determine $COD_{ww,discharge,BL,y}$: if the baseline treatment system(s) is different from the treatment system(s) in the project scenario, the monitored values of the COD inflow during crediting period will be used to calculate the baseline emissions *ex post*. The outflow COD of the baseline systems will be estimated using the removal efficiency of the baseline treatment systems, estimated as per paragraphs 6, 7 or 8 below. Ex-post the parameter $COD_{ww,discharge,BL,y}$ would thus be calculated as follows:

$$COD_{ww,discharge,BL,y} = \prod_i (1 - \eta_{COD,BL,i}) * COD_{ww,untreated,y}$$

Where:

$\eta_{COD,BL,i}$	The COD removal efficiency of the baseline treatment system *i* (%)
$COD_{ww,untreated,y}$	The COD of the untreated wastewater in the project scenario in year *y*. This parameter is measured before the biogas digester. ($tCOD/m^3$)

5. Methane emission from anaerobic decay of the final sludge produced are determined as follows:

$$BE_{s,final,y} = S_{final,BL,y} * DOC_s * UF_{BL} * MCF_{s,BL,final} * DOC_F * F * 16/12 * GWP_{CH4} \quad \textbf{(4)}$$

Where:

$S_{final,BL,y}$ — Amount of dry matter in the final sludge generated by the baseline wastewater treatment systems in the year *y* (t). In SSC CPAs where the baseline wastewater treatment system is different from the project system, this parameter will be estimated using the monitored amount of dry matter in the final sludge generated by the project activity ($S_{final,PJ,y}$) corrected for the sludge generation ratios of the project and baseline systems as per equation 5 of AMS III.H Version 16.

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

$MCF_{s,BL,final}$ — Methane correction factor of the disposal site that receives the final sludge in the baseline situation, estimated as per the procedures described in the "Emissions from solid waste disposal sites" Version 06.0.1. Application A (final sludge disposed and left to dry on land), to determine the $MCF_{s,BL,final}$ will use MCF default value of the referred tool.

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

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

SGR_{BL} — Sludge generation ratio of the wastewater treatment plant in the baseline scenario (tonne of dry matter in sludge/t COD removed). This ratio will be determined as per paragraph 26, 27 or 28 of approved methodology AMS-III.H version 16.

SGR_{PJ} — Sludge generation ratio of the wastewater treatment plant in the project scenario (tonne of dry matter in sludge/t COD removed). Calculated using the monitored values of COD removal (i.e $COD_{inflow,i}$ minus $COD_{outflow,i}$) and sludge generation in the project scenario.

DOC_s	Degradable organic content of the untreated sludge generated in the year *y* (fraction, dry basis).
DOC_F	Fraction of DOC dissimilated to biogas (IPCC default value 0.5)
F	Fraction of CH_4 in biogas (IPCC default value 0.5)

6. In determining baseline emission using equation 1 of the approved methodology AMS-III.H version 16, historical records of at least one year prior to the project implementation shall be used. This shall include for example the COD removal efficiency of the wastewater treatment system, power and electricity consumption per m^3 of wastewater treated and all other parameter required for determination of baseline emissions.

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

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

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

(c) The baseline emission in year *y* is taken as the minimum between the result of 7 (a) and (b).

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

(1) For existing plant without three years operating history, procedures in paragraph 7 shall be followed;

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

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

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

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

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

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

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

B. Project Activity Emissions

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

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

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

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

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

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

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

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

(viii) Methane emissions from biomass stored under anaerobic conditions which would not have occurred in the baseline situation ($PE_{biomass,y}$).[32]

$$PE_y = \begin{Bmatrix} PE_{power,y} + PE_{ww,treatment,y} + PE_{s,treatment,y} + PE_{ww,discharge,y} + PE_{s,final,y} + \\ PE_{fugitive,y} + PE_{biomass,y} + PE_{flaring,y} \end{Bmatrix} \quad \textbf{(6)}$$

Where:

PE_y	Project activity emissions in the year y (tCO_2e)
$PE_{power,y}$	Emissions from electricity or fuel consumption in the year y (tCO_2e).
$PE_{ww,treatment,y}$	Methane emissions from wastewater treatment systems affected by the project activity, and not equipped with biogas recovery, in year y (tCO_2e). These emissions shall be calculated as per equation 2 in paragraph 20 of the approved methodology AMS-III.H version 16, using an uncertainty factor of 1.12 and data applicable to the project situation ($MCF_{ww,treatment,PJ,k}$ and $\eta_{,PJ,k,y}$) and with the following changed definition of parameters:
$MCF_{ww,treatment,PJ,k}$	Methane correction factor for project wastewater treatment system k (MCF values as per Table III.H.1)
$\eta_{,PJ,k,}$	Chemical oxygen demand removal efficiency of the project wastewater treatment system k in year y (t/m^3), measured based on inflow COD and outflow COD in system k
$PE_{s,treatment,y}$	Methane emissions from sludge treatment systems affected by the project activity, and not equipped with biogas recovery, in year y (tCO_2e). These emissions shall be calculated as per equations 3 and 4 in paragraph 22 of the approved methodology AMS-III.H version 16, using an uncertainty factor of 1.12 and data applicable to the project situation ($S_{l,PJ,y}$, $MCF_{s,treatment,l}$) and with the following changed definition of parameters:
$S_{l,PJ,y}$	Amount of dry matter in the sludge treated by the sludge treatment system l in the project scenario in year y (t)
$MCF_{s,treatment,l}$	Methane correction factor for the project sludge treatment system l (MCF values as per Table III.H.1)
$PE_{ww,discharge,y}$	Methane emissions from degradable organic carbon in treated wastewater in year y (tCO_2e). These emissions shall be calculated as per equation 6 in paragraph 24 of the approved methodology AMS-III.H version 16, using an uncertainty factor of 1.12 and data applicable to the project conditions ($COD_{ww,discharge,PJ,y}$, $MCF_{ww,PJ,discharge}$) and with the following changed definition of parameters:
$COD_{ww,discharge,PJ,y}$	Chemical oxygen demand of the treated wastewater discharged into the sea, river or lake in the project scenario in year y (t/m^3)
$MCF_{ww,PJ,discharge}$	Methane correction factor based on the discharge pathway of the wastewater in the project scenario (e.g. into sea, river or lake) (MCF values as per Table III.H.1)

[32] For instance in the baseline situation Palm Kernel Shells (PKS) are used as fuel in a boiler. In the project situation PKS is replaced by biogas captured at a wastewater treatment system. The PKS will no longer be used as fuel in the boiler, but sold on the market. Before it is sold it is likely it will be stored for a period of time (few months or longer) on site which might lead to methane emissions from anaerobic decay.

$PE_{s,final,y}$	Methane emissions from anaerobic decay of the final sludge produced in year y (tCO_2e). These emissions shall be calculated as per equation 7 in paragraph 25 of the approved methodology AMS-III.H version 16, using an uncertainty factor of 1.12 and data applicable to the project conditions ($MCF_{s,PJ,final}$, $S_{final,PJ,y}$). If the sludge is controlled combusted, disposed in a landfill with biogas recovery, or used for soil application in aerobic conditions in the project activity, this term shall be neglected, and the sludge treatment and/or use and/or final disposal shall be monitored during the crediting period with the following revised definition of the parameters:
$MCF_{s,PJ,final}$	Methane correction factor of the disposal site that receives the final sludge in the project situation, estimated as per the procedures described in the tool "Emissions from solid waste disposal sites, version 06.0.1"
$S_{final,PJ,y}$	Amount of dry matter in final sludge generated by the project wastewater treatment systems in the year y (t)
$PE_{fugitive,y}$	Methane emissions from biogas release in capture systems in year y, calculated as per paragraph 30 of approved methodology AMS-III.H version 16 (tCO_2e)
$PE_{flaring,y}$	Methane emissions due to incomplete flaring in year y (tCO_2e). For *ex ante* estimation, baseline emission calculation for wastewater treatment (i.e. equation 2 of the approved methodology AMS-III.H version 16) can be used but without the consideration of GWP for CH4. However, the *ex post* emission reduction shall be calculated as per the "Tool to determine project emissions from flaring gases containing methane" version 01 by using actual monitored data. This emissions ($PE_{flaring,y}$), as per approved methodology AMS-III.H version 16, are the same as the project emissions from flaring of the residual gas stream in year y ($PE_{flare,y}$), as per Tool to determine project emissions from flaring gases containing methane, version 01, EB28 Annex 13.
$PE_{biomass,y}$	Methane emissions from biomass stored under anaerobic conditions.

9. Project emission from electricity or fossil fuel consumption in the year y (tCO_2e). These emissions shall be calculated as per paragraph 1 of PoA-DD, for the situation of the project scenario, using energy consumption data of all equipment/devices used in the project activity wastewater and sludge treatment systems and systems for biogas recovery and flaring/gainful use.

   The CO2 emissions from electricity and fossil fuel consumed by the project facilities are however expected in most cases to be zero. This is because the project facilities in most cases will rely on power generated by the biogas plant to run such facilities. Fossil fuels are not expected to be used in general either. However in certain cases, for example, power to run such facilities could be drawn from the grid for instance or from a captive power plant running on a fossil fuel. Should the SSC-CPA design contemplate such a possibility then the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption", version 01 and/or the "Tool to calculate the project or leakage CO2 emissions from fossil fuel combustion", version 02 shall be applied. It shall be noted though, that when applying tools such as the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption", several scenarios and options are given, which may or may not be applicable or appropriate depending on their particular circumstances of the proposed SSC-CPA. Hence, since such tools will not always be applied to all SSC-CPAs, nor when applied, will they

necessarily be applied in the same way, it is more practical to describe how these tools are applied to a given SSC-CPA in the corresponding SSC-CPA-DD. Consequently, ex ante parameters and parameters to be monitored that need to be considered when applying the above mentioned tools, where applicable, shall also be described in the SSC-CPA-DD to reflect the specifics of the SSC-CPA.

10. Methane emission from wastewater treatment systems affected by the project activity, and not equipped with biogas recovery, in year y (tCO_2e).

$$PE_{ww,treatment,y} = \sum_k (Q_{ww,k,y} * COD_{inflow,k,y} * \eta_{COD,PJ,k,y} * MCF_{ww,treatment,PJ,k}) * B_{o,ww} * UF_{PJ} * GWP_{CH4} \quad \textbf{(7)}$$

As described earlier this emission shall be calculated as per equation 2 in paragraph 20 of the approved methodology AMS-III.H version 16. The project specific $PE_{ww,treatment,y}$ would depend on the configuration in the particular CPA. As an example for most common CPA configurations, the $PE_{ww,treeatment,y}$ is calculated as below. The figure describes the COD representations for a particular configuration for clarity. (The figure is not a complete representation of a CPA).

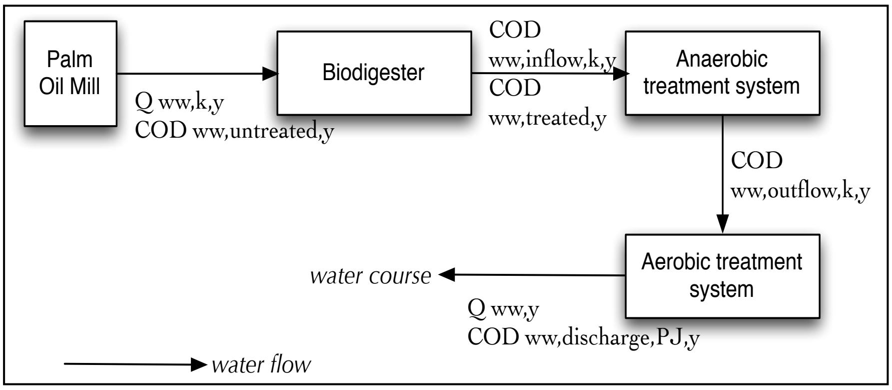

figure 3. The COD representation figure for COD removal efficiency determination**.**

In the project activity, the COD of the wastewater inflow to the project treatment system *k* ($COD_{ww,inflow,k,y}$) equals to the monitored COD of the wastewater after the treatment system affected by the project activity ($COD_{ww,treated,y}$). Therefore, for ex-post calculation, the monitoring parameter $COD_{ww,treated,y}$ is used to determine the COD of the wastewater inflow to the treatment system *k* ($COD_{inflow,k,y}$) in the equation (7) above.

Hence, $COD_{ww,inflow,k,y} = COD_{ww,treated,y}$ where *k* is anaerobic treatment system (system without biogas recovery, affected by project activity).

Furthermore, the monitored parameter $COD_{ww,treated,y}$ is also used to determine the COD removal efficiency of the project wastewater treatment system *k* in year *y* ($\eta_{COD,PJ,k,y}$), which in turn is based on inflow COD and outflow COD in system *k*. The chemical oxygen demand removal efficiency is however, calculated differently depending on whether an aerobic system is present or not, as described below.

If an aerobic pond exists in the wastewater treatment system of the SSC-CPA, then the COD removal efficiency of the project wastewater treatment system *k* in year *y* is given by:

$$\eta_{COD,PJ,k,y} = (COD_{ww,treated,y} - COD_{ww,outflow,k,y}) / COD_{ww,treated,y}$$

Therefore, by substituting the above equation for $\eta_{COD,PJ,k,y}$ in equation (7), the project emissions from the wastewater treatment system affected by the project activity where an aerobic pond exists can be expressed as follows: :

$$PE_{ww,treatment,y} = \sum_k (Q_{ww,k,y} * (COD_{ww,treated,y} - COD_{ww,outflow,k,y}) * MCF_{ww,treatment,PJ,k}) * B_{o,ww} * UF_{PJ} * GWP_{CH4} \quad \textbf{(8.a)}$$

If on the other hand, an aerobic pond does not exist in the wastewater treatment system of the SSC-CPA, then:

$$COD_{ww,outflow,k,y} = COD_{ww,discharge,PJ,y}$$

and the COD removal efficiency of the project wastewater treatment system *k* in year *y* is given by:

$$\eta_{COD,PJ,k,y} = (COD_{ww,treated,y} - COD_{ww,discharge,PJ,y}) / COD_{ww,treated,y}$$

Therefore, by substituting the above equation for $\eta_{COD,PJ,k,y}$ in equation (7), the project emissions from the wastewater treatment system affected by the project activity where an aerobic pond does not exist can be expressed as follows:

$$PE_{ww,treatment,y} = \sum_k (Q_{ww,k,y} * (COD_{ww,treated,y} - COD_{ww,discharge,PJ,y}) * MCF_{ww,treatment,PJ,k}) * B_{o,ww} * UF_{PJ} * GWP_{CH4} \quad \textbf{(8.b)}$$

Where:

$Q_{ww,k,y}$	Volume of wastewater treated in project wastewater treatment system *k* in year *y* (m^3)
$COD_{ww,inflow,k,y}$	The chemical oxygen demand of the wastewater to the project treatment system *k* in year *y* (t/m^3).
$COD_{ww,treated,y}$	The chemical oxygen demand of the wastewater after the treatment system affected by the project activity in year *y*. This parameter is measured after the biogas digester (t/m^3).
$COD_{ww,outflow,k,y}$	The outflow chemical oxygen demand of the treated wastewater in system *k* in year *y* (COD leaving the anaerobic pond) (t/m^3).
$COD_{discharge,PJ,y}$	The chemical oxygen demand of the treated wastewater discharge to the river in the project scenario in year *y*. It is measured in the last anaerobic pond or after the aerobic pond (in case existence) (t/m^3).
$\eta_{,COD,PJ,k,}$	Chemical oxygen demand removal efficiency of the project wastewater treatment system *k* in year *y* (t/m^3), measured based on inflow COD and outflow COD in system *k*
$MCF_{ww,treatment,PJ,k}$	Methane correction factor for project wastewater treatment system *k* (*MCF* values as per Table III.H.1)
k	Index for project wastewater treatment system
$B_{o,ww}$	Methane producing capacity of the wastewater
UF_{PJ}	Model correction factor to account for model uncertainties (1.2)
GWP_{CH4}	Global warming potential for methane

11. Methane emission from sludge treatment system affected by the project activity, and not equipped with biogas recovery, in year *y* (tCO_2e).

$$PE_{treatment,s,y} = \sum_{l} s_{l,PJ,y} * MCF_{s,treatment,PJ,l} * DOC_s * UF_{PJ} * DOC_F * F * 16/12 * GWP_{CH4} \quad (9)$$

Where:

$S_{l,PJ,y}$	Amount of dry matter in the sludge treated by the sludge treatment system *l* in the project scenario in year *y* (t).
l	Index for project sludge treatment system
DOC_s	Degradable organic content of the untreated sludge generated in the year *y* (fraction, dry basis). Default values of 0.5 for domestic sludge and 0.257 for industrial sludge[33] shall be used
$MCF_{s,treatment,PJ,l}$	Methane correction factor for the project sludge treatment system *l* (*MCF* values as per Table III.H.1)
UF_{PJ}	Model correction factor to account for model uncertainties (1.12)
DOC_F	Fraction of DOC dissimilated to biogas (IPCC default value of 0.5)
F	Fraction of CH_4 in biogas (IPCC default of 0.5)

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

$$PE_{s,treatment,y} = \sum_{l} S_{l,PJ,y} * EF_{composting} * GWP_{CH4} \quad (10)$$

Where:

$EF_{composting}$	Emission factor for composting organic waste (t CH_4/t waste treated). Emission factors can be based on facility/site-specific measurements, country specific values or IPCC default values (Table 4.1, chapter 4, Volume 5, 2006 IPCC Guidelines for National Greenhouse Gas Inventories). IPCC default value is 0.01 t CH_4/ t sludge treated on a dry weight basis

12. Methane emissions from degradable organic carbon in treated wastewater discharged in e.g. a river, seas or lake in the project situation are determined as follows:

$$PE_{ww,discharge,y} = Q_{ww,y} * GWP_{CH4} * B_{o,ww} * UF_{PJ} * COD_{ww,discharge,PJ,y} * MCF_{ww,PJ,discharge} \quad (11)$$

Where:

$Q_{ww,y}$	Volume of treated wastewater discharged in year *y* (m^3)
UF_{PJ}	Model correction factor to account for model uncertainties (1.12)
$COD_{ww,discharge,PJ,y}$	Chemical oxygen demand of the treated wastewater discharged into sea, river or lake in the project scenario in the year *y* (t/m^3).
$MCF_{ww,PJ,discharge}$	Methane correction factor based on discharge pathway of the wastewater in the project scenario (e.g. into sea, river or lake) (*MCF* values as per Table III.H.1)

13. Methane emission from anaerobic decay of the final sludge produced in year *y* (tCO_2e)

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

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[33] The IPCC default values of 0.05 for domestic sludge (wet basis, considering a default dry matter content of 10%) or 0.09 for industrial sludge (wet basis, assuming dry matter content of 35%), were corrected for dry basis.

Where:

$S_{final,PJ,y}$	Amount of dry matter in the final sludge generated by the project wastewater treatment systems in the year *y* (t).
$MCF_{s,PJ,final}$	Methane correction factor of the disposal site that receives the final sludge in the project situation, estimated as per the procedures described in the "Emissions from solid waste disposal sites" version 06.0.1. Application A, MCF default value, of the referred tool will be used to determine the $MCF_{s,PJ,final.}$
UF_{PJ}	Model correction factor to account for model uncertainties (1.12)

14. Project activity emissions from methane release in capture systems are determined as follows:

(a) Based on the methane emission potential of wastewater:

$$PE_{fugitive,y} = PE_{fugitive,ww,y} + PE_{fugitive,s,y} \quad \textbf{(13)}$$

Where:

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

PE $_{fugitive,s,y}$ is zero since the PoA does not introduce biogas recovery and combustion to a sludge treatment system (either existent or new). Therefore scenario 1 (b) and (c) of the approved methodology AMS-III.H version 16 have been excluded from the list of potential technologies/measures to be introduced under the SEA Biogas PoA. Since the parameter "Amount of sludge treated in the project sludge treatment system *l* equipped with biogas recovery system in year y" is zero, the calculation of PE $_{fugitive,s,y}$ becomes zero. This project emission only occurs at the biogas recovery equipment on the sludge treatment system. Since biogas recovery equipment is not introduced on the sludge treatment systems under this POA, this project emission is not generated, and the fugitive emission is not calculated. Therefore the value is considered zero.

$$PE_{fugitive,ww,y} = (1 - CFE_{ww}) * MEP_{ww,treatment,y} * GWP_{CH4} \quad \textbf{(14)}$$

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)

$$MEP_{ww,treatment,y} = Q_{ww,y} * B_{o,ww} * UF_{PJ} * \sum_k COD_{removed,PJ,k,y} * MCF_{ww,treatment,PJ,k} \quad \textbf{(15)}$$

Where:

$COD_{removed,PJ,k,y}$	The chemical oxygen demand removed[34] by the treatment system *k* of the project activity equipped with biogas recovery in the year *y* (t/m^3). This parameter will be measured based on the difference between the inflow COD

[34] Difference between the inflow COD and the outflow COD.

	($COD_{ww,untreated,y}$) and the outflow COD ($COD_{ww,treated,y}$).
$MCF_{ww,treatment,PJ,k}$	Methane correction factor for the project wastewater treatment system *k* equipped with biogas recovery equipment (*MCF* values as per Table III.H.1)
UF_{PJ}	Model correction factor to account for model uncertainties (1.12)

(b) Optionally a default value of 0.05 m³ biogas leaked/m³ biogas produced may be used as an alternative to calculations per equation 9 to 13 of the approved methodology AMS-III.H version 16.

15. Project activity emissions from flaring gases containing methane are determined as follows:

In a SSC-CPA, a portion of the total recovered biogas is used to generate electricity and any the balance generated will be flared. The flaring device used may be either an Open flare or an Enclosed flare.

For ex-ante estimation, baseline emission calculation for wastewater treatment (i.e. equation 2 of the approved methodology AMS-III.H version 16) can be used but without the consideration of GWP for CH4. However, the ex-post emission reduction shall be calculated as per the "Tool to determine project emissions from flaring gases containing methane" by using actual monitored data. It shall be noted that the methane emissions due to incomplete flaring in year *y* ($PE_{flaring,y}$), as per approved methodology AMS-III.H version 16 are the same as the project emissions from flaring of the residual gas stream in year *y* ($PE_{flare,y}$), as per Tool to determine project emissions from flaring gases containing methane, version 01, EB28 Annex 13 .

In case of open flares, the flare efficiency cannot be measured in a reliable manner (i.e. external air will be mixed and will dilute the remaining methane) and a default value of 50%[35] is to be used provided that it can be demonstrated that the flare is operational (e.g. through a flame detection system reporting electronically on continuous basis). If the flare is not operational the default value to be adopted for flare efficiency is 0%.

For an enclosed flare, the temperature in the exhaust gas of the flare is measured to determine whether the flare is operating or not.

For an enclosed flare, either of the following two options can be used to determine the flare efficiency:

(a) To use 90% default value. Continuous monitoring of compliance with manufacturer's specification of flare (temperature, flow rate of residual gas at the inlet of flare) must be performed. If in a specific hour any of the parameters are out of the limit of manufacturer's specifications, a 50% default value for the flare efficiency should be used for the calculations for the specific hour.

(b) Continuous monitoring of the methane destruction efficiency of the flare (flare efficiency).

[35] Whenever the default value for the flare efficiency (either open flare or closed flare) is to be used for calculation of project emission in equation 15 of Tool to determine project emissions from flaring gases containing methane version 01, the value should be converted into fraction (e.g. 50/100=0.5) before use in equation.

The flare type applied in the SSC-CPA shall be clearly stated in the SSC-CPA-DD. Default values for flare efficiency provided in the "Tool to determine project emissions from flaring gases containing methane" EB28 Annex 13 shall be applied.

The tool involves seven steps. Project participants shall apply these steps to calculate project emissions from flaring ($PE_{flare,y}$) based on the measured hourly flare efficiency or based on the default values for the flare efficiency ($\eta_{flare,h}$). Note that steps 3 and 4 are only applicable in case of enclosed flares and continuous monitoring of the flare efficiency. Since a default value for flare efficiency is applied in the case of enclosed flares steps 3 and 4 are not applicable to SSC-CPAs under the SEA Biogas PoA.

STEP 1. Determination of the mass flow rate of the residual gas that is flared

$$FM_{RG,h} = \rho_{RG,n,h} \times FV_{RG,h}$$

Where:

Variable	SI Unit	Description
$FM_{RG,h}$	kg/h	Mass flow rate of the residual gas in hour *h*
$P_{RG,n,h}$	kg/m3	Density of the residual gas at normal conditions in hour *h*
$FV_{RG,h}$	m3/h	Volumetric flow rate of the residual gas in dry basis at normal conditions in the hour *h*

and:

$$\rho_{RG,n,h} = \frac{P_n}{\frac{R_u}{MM_{RG,h}} x T_n}$$

Where:

Variable	**SI Unit**	**Description**
$P_{RG,h}$	kg/m3	Density of the residual gas at normal conditions in hour *h*
P_n	Pa	Atmospheric pressure at normal conditions (101325)
R_u	Pa.m3/kmol.K	Universal ideal gas constant (8314)
$MM_{RG,h}$	kg/kmol	Molecular mass of the residual gas in hour h
T_n	K	Temperature at normal conditions (273.15)

and:

$$MM_{RG,h} = \sum_i (fv_{i,h} \, x MM_i)$$

Where,

Variable	**SI Unit**	**Description**
$MM_{RG,h}$	kg/kmol	Molecular mass of the residual gas in hour h
$fv_{i,h}$	-	Volumetric fraction of component i in the residual gas in the

		hour *h*
MM_i	kg/kmol	Molecular mass of residual gas component *i*
i		The components CH_4, CO, CO_2, O_2, H_2, N_2

As a simplified approach, project participants may only measure the volumetric faction of methane and consider the difference to 100% as being nitrogen (N_2).

STEP 2. Determination of the mass fraction of carbon, hydrogen, oxygen, and nitrogen in the residual gas

Determine the mass fraction of carbon, hydrogen, oxygen and nitrogen in the residual gas, calculated from the volumetric faction of each component I in the residual gas, as follow :

$$fm_{j,h} = \frac{\sum_i fv_{i,h} \; x \; AM_j \; x \; NA_{j,i}}{MM_{RG,h}}$$

Where,

Variable	SI Unit	Description
$fm_{j,h}$	-	Mass fraction of element j in the residual gas in hour *h*
$fv_{i,h}$	-	Volumetric fraction of component *i* in the residual gas in the hour *h*
AM_j	kg/kmol	Atomic mass of element *j*
$NA_{j,i}$	-	Number of atoms of element j in component *i*
$MM_{RG,h}$	kg/kmol	Molecular mass of the residual gas in hour *h*
j		The elements carbon, hydrogen, oxygen and nitrogen
i		The components CH_4, CO, CO_2, O_2, H_2, N_2

STEP 5. Determination of methane mass flow rate in the residual gas on a dry basis

The quantity of methane in the residual gas flowing into the flare is the product of the volumetric flow rate of the residual gas ($FV_{RG,h}$), the volumetric fraction of methane in the residual gas ($fv_{CH4,RG,h}$) and the density of methane ($\rho_{CH4,n,h}$) in the same reference conditions (normal conditions and dry or wet basis).

It is necessary to refer both measurements (flow rate of the residual gas and volumetric fraction of methane in the residual gas) to the same reference condition that may be dry or wet basis. If the residual gas moisture is significant (temperature greater than 60ºC), the measured flow rate of the residual gas that is usually referred to wet basis should be corrected to dry basis due to the fact that the measurement of methane is usually undertaken on a dry basis (i.e. water is removed before sample analysis).

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

Where:

Variable	SI Unit	Description
$TM_{RG,h}$	kg/h	Mass flow rate of methane in the residual gas in the hour *h*
$FV_{RG,h}$	m^3/h	Volumetric flow rate of the residual gas in dry basis at normal conditions in hour *h*
$fv_{CH4,RG,h}$	-	Volumetric fraction of methane in the residual gas on dry basis in hour *h* (NB: this corresponds to $fv_{i,RG,h}$ where *i* refers to methane)
$\rho_{CH4,n}$	kg/m^3	Density of methane at normal conditions (0.716)

It shall be noted that it is necessary to refer the flow rate of biogas and the volumetric fraction of methane contained in it to the same reference conditions and basis (dry or wet)

STEP 6. determination of the hourly flare efficiency

If the type of flare installed at site is an open flare, the flare efficiency in the hour *h* ($\eta_{flare,h}$) is

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

This will be monitored during project activity.

If the type of flare installed is an enclosed flare then the following option shall be used to determine the flare efficiency:

To use a 90% default value. Continuous monitoring of compliance with manufacturer's specification of flare (temperature, flow rate of residual gas at the inlet of the flare) must be performed if the temperature in the exhaust gas of the flare is above 500°C for more than 40 minutes during the hour *h* and the manufacturers specification on proper operation of the flare are met continuously during the hour *h*.

If the temperature in the exhaust gas of the flare is above 500°C for more than 40 minutes during the hour h but the manufacture's specifications on proper operation of the flare are not met at any point in time during the hour *h*, a 50% default value for the flare efficiency should be used for the calculations for this specific hour.

If there is no record of the temperature of the exhaust gas of the flare or if the recorded temperature is less than 500 °C for any particular hour, it shall be assumed that during that hour the flare efficiency is zero.

STEP 7. Calculation of annual project emissions from flaring

The project emissions from the flaring are calculated as the sum of emission from each hour h, based on the methane flow rate in the residual gas and the flare efficiency during each hour h, as follows:

$$\textbf{PE}_{\textbf{flare, y}} = \sum_{h=1}^{8760} TM_{RG,h}\, x\, (1-\eta_{flare,h})\, x \frac{GWP_{CH4}}{1000} \qquad \textbf{(16)}$$

Where,

$PE_{flare,y}$ = Project emissions from flaring of the residual gas stream in year *y* (tCO2e)
$TM_{RG,h}$ = Mass Flow rate of methane in the residual gas in the hour *h* (kg/h)
$\eta_{flare,h}$ = Flare efficiency in hour *h*
GWP_{CH4} =Global warming Potential of methane valid for the commitment period ($tCO2e/tCH_4$)

16. Project activity emissions from biomass stored under anaerobic conditions. If storage of biomass under anaerobic conditions takes place in the project and does not occur in the baseline, methane emissions due to anaerobic decay of that biomass shall be considered and be determined as per the procedure in the "Emissions from solid waste disposal sites" version 06.0.1 (tCO_2e).

    However, it is unlikely that biogas recovered in a SSC-CPA would be used in such a way that it would result in any biomass residue being displaced as source of energy. SSC-CPAs under this PoA aim to use the recovered gas only to generate power to the grid (i.e. not to the site) because this provides a crucial source of revenue to the project. Nevertheless, if a SSC-CPA is designed in such a way that it could result in biomass being displaced as a source of energy at the project site, and if the biomass so displaced were to be disposed of anaerobically then the resulting methane emissions would be accounted for as project emissions. These emissions would be determined as per the tool "Emissions from solid waste disposal sites" version 06.0.1. However, since SSC-CPAs aim to generate power for grid supply, such situation is not expected. Hence if pertinent, the relevant equations, ex-ante parameters and parameters to be monitored shall be described in the corresponding SSC-CPA-DD.

Leakage

As per approved methodology AMS-III.H version 16, paragraph 31, if the technology is using equipment transferred from another activity, leakage effects at the site of the other activity are to be considered. Leakage is taken as zero because only new biogas recovery equipment shall be used in CPAs.

$LE_y=0$

Emissions Reductions

For all the scenarios listed in section E.2, emissions reductions from methane recovery in wastewater treatment shall be estimated *ex ante* in the CPA-DD using the equations provided in the baseline, project and leakage emissions in the above sections of the PoA-DD. The Emissions reductions shall be estimated *ex ante* as follows:

$$ER_{y,ex\ ante} = BE_{y,ex\ ante} - \left(PE_{y,ex\ ante} + LE_{y,ex\ ante}\right) \quad \textbf{(17)}$$

Where:

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

Ex post emission reductions shall be determined for case 1 (a) and 1 (e) of section E.2 as per paragraph 36 of AMS III.H Version 16. For cases 1 (d) and 1 (f), *ex post* emission reductions shall be based on the lowest of the following

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

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

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

$$ER_{y,ex\ post} = \min((BE_{y,ex\ post} - PE_{y,ex\ post} - LE_{y,ex\ post}), (MD_y - PE_{power,y} - PE_{biomass,y} - LE_{y,ex\ post})) \quad \textbf{(18)}$$

Where:

$ER_{y,ex\ post}$	Emission reductions achieved by the project activity based on monitored values for year *y* (tCO_2e)
$BE_{y,ex\ post}$	Baseline emissions calculated as per paragraph 18 of approved methodology using *ex post* monitored values
$PE_{y,ex\ post}$	Project emissions calculated as per paragraph 29 of approved methodology using *ex post* monitored values
MD_y	Methane captured and destroyed/gainfully used by the project activity in the year *y* (tCO_2e)

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

$$MD_y = BG_{burnt,y} * w_{CH4,y} * D_{CH4} * FE * GWP_{CH4} \quad \textbf{(19)}$$

Where:

$BG_{burnt,y}$	Biogas[36] flared/combusted in year *y* (m^3)
$w_{CH4,y}$	Methane content of the biogas in the year *y* (volume fraction)
D_{CH4}	Density of methane at the temperature and pressure of the biogas in the year *y* (t/m^3)
FE	Flare efficiency in year *y* (fraction). If the biogas is combusted for gainful purposes, e.g. fed to an engine, an efficiency of 100% may be applied

[36] Biogas volume and methane content measurements shall be on the same basis (wet or dry).

For the cases listed in Section E.2 such as:

(a) Substitution of an aerobic wastewater with an anaerobic treatment system with methane recovery and combustion; and

(b) Introduction of an anaerobic wastewater treatment system with methane recovery and combustion to an untreated wastewater stream.

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

$$ER_{y,ex\ post} = BE_{y,ex\ post} - (PE_{y,ex\ post} + LE_{y,ex\ post}) \quad \textbf{(20)}$$

The historical records of electricity and fuel consumption, the COD content of untreated and treated wastewater will be used for the baseline calculation.

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

Emission reduction for grid electricity generation

$$ER_y = BE_y - PE_y - LE_y \quad \textbf{(21)}$$

Where:
ER_y is the emission reductions in year y (tCO_2 /y).
BE_y is the baseline emissions in year y (tCO_2 /y).
PE_y is the project emissions in year y (tCO_2 /y).
LE_y is the leakage emission in year y (tCO_2 /y).

Baseline emission

$$BE_y = EG_{BL,y} \times EF_{CO_2,grid,y} \text{ ....} \quad \textbf{(22)}$$

Where:

BE_y	=	Baseline emissions in year y (tCO_2/y)
$EG_{BL\,y}$	=	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) "Tool to calculate the emission factor for an electricity system, version 02.2.1".

Based on methodology AMS-I.D version 17, paragraph 10, the baseline scenario is the electricity delivered to the grid by the project activity that would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources into grid. Moreover, as per approved methodology paragraph 11, the baseline emissions are the product of electrical energy baseline EG_{BL}, y expressed in MWh of electricity produced by the renewable generating unit multiplied by an emission factor of electricity system/grid.

CO_2 Emission Factor Determination

As per paragraph 12 of AMS I.D. v17 the emission factor can be calculated as follows:

(a) 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 02.2.1.

OR

(b) The weighted average emissions (in t CO_2/MWh) of the current generation mix. The data of the year in which project generation occurs must be used.

Calculations shall be based on data from an official source (where available) and made publicly available.

The CO_2 Emission Factor applied in all SSC CPAs shall be calculated using option a) above**,** *A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM)* Thus, $EF_{CO2,grid,y}$ will be calculated as the Combined Margin (CM) emission factor determined using the *'Tool to calculate the Emission Factor for an electricity system'* version 02.2.1 and applying the following steps:

STEP 1. Identify the relevant electricity systems.
STEP2. Choose whether to include off-grid power plants in the project electricity system (optional).
STEP 3. Select a method to determine the operating margin (OM).
STEP 4. Calculate the operating margin emission factor according to the selected method.
STEP 5. Calculate the build margin (BM) emission factor.
STEP 6. Calculate the combined margin (CM) emissions factor.

Step 1. Identify the relevant electricity systems

According to the "Tool to calculate the emission factor for an electricity system" (version 02.2.1), a project electricity system has to be defined by the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity and that can be dispatched without significant transmission constraints.

Similarly any connected electricity system, an electricity system that is connected by transmission lines to the project electricity system, has to be identified. Power plants within the connected electricity system can be dispatched without significant transmission constraints but transmission to the project electricity system has significant transmission constraint.

If the DNA of the host country has published a delineation of the above systems these delineations shall be used. SSC CPAs to be implemented in regions where such information is not available shall define the project electricity system and any connected electricity by applying the criteria given in Tool to calculate the emission factor for an electricity system" (version 02.2.1), and documenting any assumptions made in the corresponding SSC CPA DD.

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.
The option I corresponds to the procedure contained in earlier version of the tool. Option II allows the inclusion of off grid power generation in the grid emission factor. Option II requires collecting data off grid power generation as per Annex 2 of Tool to calculate the emission factor for an electricity system version 02.2.1 and can only be used if the conditions outlined therein are met.

Step 3. Select a method to determine the operating margin (OM)

The calculation of the operating margin emission factor ($EF_{grid,OM,}$) is based on one of the following methods:

(a) Simple OM, or
(b) Simple adjusted OM, or
(c) Dispatch data analysis OM, or
(d) Average OM.

The simple OM method (option a) can only be used if low-cost/must-run resources[37] constitute less than 50% of total grid generation in : 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production.

The dispatch data analysis (Option c) cannot be used if off-grid power plants are included in the project electricity system as per Step 2 above.

For the simple OM, the simple adjusted OM and the average OM, the emissions factor can be calculated using either of the two following data vintages:

- *Ex ante* option: If the *ex ante* option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required. For grid power plants, use a three-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation.

[37] Los-cost/must-run resources are defined as power plants with low marginal generation costs or power plants that are dispatched independently of the daily or seasonal load of the grid. They typically include hydro, geothermal, wind, low-cot biomass, nuclear and solar generation. If coal is obviously used as must-run, it should also be included in the list, i.e. excluded from the set of plants.

For off-grid power plants, use a single calendar year within the five most recent calendar years prior to the time of submission of the CDM-PDD for validation.

- *Ex post* option: if the *ex post* option is chosen, the emission factor is determined for the year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring. If the data required to calculate the emission factor for year y is usually only available later than six months after the end of year y, alternatively the emission factor of the previous year y-1 may be used. If the data is usually only available 18 months after the end of year y, the emission factor of the year proceeding the previous year y-2 may be used. The same data vintage (y, y-1 or y-2) should be used throughout all crediting periods

Step 4. Calculate the operating margin emission factor according to the selected method

(a) Simple OM

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

The simple OM may be calculated:

- Based on the net electricity generation and a CO_2 emission factor of each power unit (OptionA); or
- Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system (Option B).

Option B can only be used if:

(a) The necessary data for Option A is not available; and
(b) Only nuclear and renewable power generation are considered as low-cost/must-run power sources and the quantity of electricity supplied to the grid by these sources is known; and
(c) Off-grid power plants are not included in the calculation (i.e. if Option I has been chosen in Step 2)

Option A – Calculation based on average efficiency and electricity generation of each plant

Under this option, the simple OM emission factor is calculated based on the net electricity generation of each power unit and an emission factor for each power unit, as follow:

$$EF_{grid,OMsimple,y} = \frac{\sum_m EG_{m,y} \bullet EF_{EL,m,y}}{\sum_m EG_{m,y}} \qquad \textbf{(23)}$$

Where:

$EF_{grid,OMsimple,y}$	=	Simple Operating margin CO_2 emission factor in year *y* (tCO_2 e/MWh)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
$EF_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2 e/MWh)

m	=	All power units serving the grid in year y except low-cost/must run power units
y	=	The relevant years as per data vintage chosen in step 3

Option B – Calculation based on total fuel consumption and electricity generation of the system

Under this option, the simple OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost/must-run power plants/units, and based on the fuel type(s) and total fuel consumption of the project electricity system, as follows:

$$EF_{grid,OMsimple,y} = \frac{\sum_i (FC_{i,y} x NCV_{i,y} x EF_{CO2,i,y})}{EG_y} \quad \textbf{(24)}$$

Where:

$EF_{grid,\ Omsimple,\ y}$	=	Simple Operating margin CO_2 emission factor in year *y* (tCO_2 e/MWh)
$FC_{i,y}$	=	Amount of fossil type i consumed in the project electricity system in year *y* (mass or volume unit)
$NCV_{i,y}$	=	CO_2 emission factor of fossil fuel type i in year *y* (tCO_2 e/MWh)
EG_y	=	Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost/must-run power plants/units, in year y (MWh)
i	=	All fossil fuel types combusted in power sources in the project electricity system in year y
y	=	The relevant years as per data vintage chosen in step 3

(b) <u>Simple Adjusted OM</u>

The simple adjusted OM emission factor ($EF_{grid,\ OM-ajd,y}$) is a variation of the simple OM, where the power plants/units (including import) are separated in low-cost/must-run power sources (k) and other power sources (m).

(c) <u>Dispatched data analysis OM</u>

The dispatch data analysis OM emission factor ($EF_{grid,OM-DD,y}$) is determined based on the grid power units that actually dispatched at the margin during each hour h where the project is displacing grid electricity, This approach is not applicable to historical data and, thus, requires annual monitoring of $EF_{grid,OM-DD,y}$.

(d) <u>Average OM</u>

The average OM emission factor ($EF_{grid,OM-ave,y}$) is calculated as the average emission rate of all power plants serving the grid, using the methodological guidance as described under (a) above for the simple OM but also including the los-cost/must-run power plants in all equations.

Step 5. Calculate the build margin (BM) emission factor

Capacity additions from retrofits of power plants should not be included in the calculation of the build margin emission factor.

The sample group of power units *m* used to calculate the build margin should be determined as per the following procedure, consistent with the data vintage selected above:

a. Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently ($SET_{5\text{-units}}$) and determine their annual electricity generation ($AEG_{SET\text{-}5\text{-units}}$, in MWh);
b. Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities (AEG_{total}, in MWh). Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20% of AEG_{total} (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) ($SET_{\geq 20\%}$) and determine their annual electricity generation ($AEG_{SET\text{-}\geq 20\%}$, in MWh);
c. From $SET_{5\text{-units}}$ and $SET_{\geq 20\%}$ select the set of power units that comprises the larger annual electricity generation (SET_{sample});
   Identify the date when the power units in SET_{sample} started to supply electricity to the grid. If none of the power units in SET_{sample} started to supply electricity to the grid more than 10 years ago, then use SET_{sample} to calculate the build margin. In this case ignore steps (d), (e) and (f).

   Otherwise:

d. Exclude from SET_{sample} the power units, which started to supply electricity to the grid more than 10 years ago. Include in that set the power units registered as CDM project activities, starting with power units that started to supply electricity to the grid most recently, until the electricity generation of the new set comprises 20% of the annual electricity generation of the project electricity system (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) to the extent is possible. Determine for the resulting set ($SET_{sample\text{-}CDM}$) the annual electricity generation ($AEG_{SET\text{-}sample\text{-}CDM}$, in MWh);

   If the annual electricity generation of that set is comprises at least 20% of the annual electricity generation of the project electricity system (i.e. $AEG_{SET\text{-}sample\text{-}CDM} \geq 0.2$ Å~ AEG_{total}), then use the sample group $SET_{sample\text{-}CDM}$ to calculate the build margin. Ignore steps (e) and (f).

   Otherwise:

e. Include in the sample group $SET_{sample\text{-}CDM}$ the power units that started to supply electricity to the grid more than 10 years ago until the electricity generation of the new set comprises 20% of the annual electricity generation of the project electricity system (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation);
f. The sample group of power units m used to calculate the build margin is the resulting set ($SET_{sample\text{-}CDM\text{-}>10yrs}$).

The build margin emissions factor is the generation-weighted average emission factor (tCO_2 e/MWh) of all power unit *m* during the most recent year *y* for which power generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \bullet EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad \textbf{(25)}$$

Where:

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

The CO_2 emission factor of each power unit *m* ($FE_{EL,m,y}$) should be determined as per guidance in step 4 (a) for the simple OM, using option A1, using for *y* the most recent historical year for which power generation data is available, and using for *m* the power *units* included in the build margin.

Step 6. Calculate the combined margin (CM) emission factor

The calculation of the combined margin (CM) emission factor ($EF_{grid,CM,y}$) is based on one of the following methods:

a. Weighted average CM; or
b. Simplified CM

The weighted average CM method (option A) should be used as the preferred option.

The simplified CM method (option B) can only be used if:

- The project activity is located in a Least Developed Country (LDC) or in a country with less than 10 registered CDM projects at the starting date of validation; and
- The data requirements for the application of step 5 above cannot be met.

a. Weighted average CM is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,\ y}\ x\ \ w_{OM} + EF_{grid,BM,\ y}\ x\ w_{BM} \quad \textbf{(26)}$$

Where:

$EF_{grid,\ BM,\ y}$	=	Build margin CO_2 emission factor in year *y* (tCO_2 e/MWh)
$EF_{grid,\ OM,\ y}$	=	Operating margin CO_2 emission factor in year *y* (tCO_2 e/MWh)
w_{OM}	=	Weighting of operation margin emission factor (%)
W_{BM}	=	Weighting of build margin emission factor (%)

Where the weights w_{OM} and w_{BM}, by default, are 50% (i.e., $w_{OM} = w_{BM} = 0.5$) for first crediting period, and $w_{OM} = 0.25$ and $w_{BM} = 0.75$ for the second and third crediting period.

<u>Host Country: Republic of Indonesia</u>

The Grid Emissions Factor for SSC-CPAs that are to be connected to the Sumatera grid is described in Annex 3 of the PoA-DD. It is determined ex ante and fixed for the first crediting period of the PoA. Upon renewal of the crediting period of the PoA the Grid Emissions Factor

shall be renewed as well. The new value shall be applied to all SSC-CPAs connected to the Sumatera grid that are newly included or renewing their crediting period during the second crediting period of the PoA.

For SSC-CPAs connected to grids other than Sumatera, the grid emission factors will be provided in the corresponding SSC-CPA-DD and calculated as per the "Tool to calculate the emission factor for an electricity system", version 02.2.1 by using available data from the Indonesian DNA or self-calculated by PPs using PT. PLN's published data or other publicly-made documentation. Grid definition will be based on PT. PLN grid boundary. For calculating the Combined Margin grid emission factor in such cases, the method chosen to calculate OM GEF and the option chosen to calculate the BM GEF shall be indicated and the relevant calculations clearly described in the SSC-CPA-DD. In the case of the simple OM, the simple adjusted OM and the average OM methods being applied, the data vintage chosen shall also be clearly indicated in the SSC-CPA-DD (i.e. whether this shall be *ex-post* or *ex-ante)*.

Table 7: CO_2 emission factor of the grids that will be fixed for the first crediting period of PoA.

Grid	$EF_{CO2,grid,y}$
Sumatera	0.743

The emission factor above is calculated and provided by the DNA. The values of grid emission factor are published on the DNA's website[38] and will be fixed *ex-ante* for the first crediting period of the PoA.

Project emissions

According to AMS.I.D/ Version 17, paragraph 20, for most renewable energy project activities, $PE_y = 0$

SSC-CPAs to be implemented under the PoA are expected to rely on recovered biogas to meet the electrical requirements. Hence, since most SSC-CPA's will rely entirely on biogas to run their power plants, project emissions due to the onsite consumption of fossil fuel will not be relevant in most cases.

However, should there be any fossil fuel consumption due to the power generation component SSC-CPA project activity, CO_2 emissions from on-site consumption of fossil fuels shall be calculated using the "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion" version 02. Projects, in which fossil fuel consumption in the SSC-CPA power plant may occur, shall describe this in the SSC-CPA-DD and shall apply the referred tool and describe the ex-ante parameters and parameters to be monitored in the SSC-CPA-DD.

In other words, since not all SSC-CPAs will use fossil fuels it is concluded that such situations are best described on a case-by-case basis, in the corresponding SSC-CPA-DD when relevant to the SSC-CPA in question. Moreover, in cases where a fossil fuel is used, the selection of the Option given in the above mentioned tool to be used to determine how the CO2 emissions coefficient is to be calculated for instance or how the quantity of fuel combusted is to be measured will depend on

[38] http://pasarkarbon.dnpi.go.id/web/index.php/dnacdm/cat/6/other-information.html

the availability of data of the fossil fuel type used (two options for this are given in the tool) and means of measurement of fuel combusted that is chosen. How such emission factor is to be determined and how the fuel is to be measured, if at all relevant that is therefore a SSC-CPA specific issue and therefore is to be discussed in the relevant SSC-CPA-DD.

Leakage (LE_y)

According to the approved methodology AMS –I.D Version 17, paragraph 22, if the energy generating equipment is transferred from another activity, leakage is to be considered. The project activity emission leakage is not applicable as the renewable energy technology is not using equipment transferred from another activity. Therefore, no leakage calculation is required, or leakage is considered zero.
LE_y=0

The SEA Biogas PoA will apply both AMS-III.H Version 16 and AMS-I.D. Version 17. Thus the total estimation of emission reduction by the CPAs would be:

$$ER_{total,y} = ER_{y,\exp ost} + ER_y \quad \textbf{(27)}$$

$$ER_{total,y} = [BE_{y,\exp ost} - (PE_{y,\exp ost} + LE_{y,\exp ost})] + (BE_y - PE_y - LE_y) \quad \textbf{(28)}$$

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

Data / Parameter:	$\eta_{COD,BL,i}$
Data unit:	%
Description:	The COD removal efficiency of the baseline treatment system *i*
Source of data used:	
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied:	Determined according to paragraphs 26, 27 or 28 of AMS III.H Version 16
Any comment:	This parameter will also be used to calculate $COD_{ww,discharge,BL,y}$ ex-post.

Data / Parameter:	$\mathbf{MCF_{ww,treatment,BL,i}}$
Data unit:	-
Description:	Methane correction factor for baseline wastewater treatment system *i*
Source of data used:	AMS-III.H version 16: Table III.H.1.
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied:	

Any comment:	-

Data / Parameter:	$MCF_{ww,treatment,PJ,k}$
Data unit:	-
Description:	Methane correction factor for project wastewater treatment system *k*
Source of data used:	AMS-III.H version 16: Table III.H.1.
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied:	
Any comment:	-

Data / Parameter:	$B_{o,ww}$
Data unit:	$kgCH_4/kgCOD$
Description:	Methane producing capacity of the wastewater
Source of data used:	AMS-III.H version 16 Paragraph 20
Value applied:	0.25
Justification of the choice of data or description of measurement methods and procedures actually applied:	Corrected IPCC (2006) default value
Any comment:	-

Data / Parameter:	UF_{BL}
Data unit:	-
Description:	Model correction factor to account model uncertainties
Source of data used:	AMS-III.H version 16 Paragraph 20 The value is based on Reference: FCCC/SBSTA/2003/10/Add.2, page 25
Value applied:	0.89[39]
Justification of the choice of data or description of measurement methods and procedures actually applied:	This is default value applied to estimate the methane emission from the baseline wastewater treatment system affected by the project.
Any comment:	-

Data / Parameter:	UF_{PJ}
Data unit:	-

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

Description:	Model correction factor to account model uncertainties
Source of data used:	AMS-III.H version 16 Paragraph 30
Value applied:	1.12
Justification of the choice of data or description of measurement methods and procedures actually applied:	This is default value applied to estimate the methane emission from the wastewater treatment system affected by the project.
Any comment:	-

Data / Parameter:	**GWP_{CH4}**
Data unit:	tCO_2e/tCH_4
Description:	Global warming potential (GWP) of methane
Source of data used:	AMS-III.H version 16
Value applied:	21
Justification of the choice of data or description of measurement methods and procedures actually applied:	As per meth AMS-III.H version 16
Any comment:	-

Data / Parameter:	**$MCF_{s,treatment,PJ,l}$**
Data unit:	-
Description:	Methane correction factor for the project sludge treatment system *l*
Source of data used:	AMS-III.H version 16; Table III.H.1
Value applied:	Described at applicable CPA
Justification of the choice of data or description of measurement methods and procedures actually applied:	
Any comment:	This parameter is used to calculate methane emissions from sludge treatment systems affected by the project activity and not equipped with biogas recovery ($PE_{s,treatment,y}$) (in case existent).

Data / Parameter:	**DOC_s**
Data unit:	-
Description:	Degradable organic content of the untreated sludge generated in the year *y* (fraction, dry basis).
Source of data used:	AMS-III.H version 16
Value applied:	Described at applicable CPA
Justification of the choice of data or description of	Default values of 0.5 for domestic sludge; (wet basis, considering a default dry matter content of 10%) or 0.09 for industrial sludge (wet basis, assuming dry matter content of 35%), were corrected for dry basis.

measurement methods and procedures actually applied:	
Any comment:	This parameter is used to calculate methane emissions from sludge treatment systems affected by the project activity and not equipped with biogas recovery in year y ($PE_{s,treatment,y}$) and/or methane emissions from anaerobic decay of the final sludge produced in year y ($PE_{s,final,y}$) (in case existent).

Data / Parameter:	**DOC_F**
Data unit:	-
Description:	Fraction of DOC dissimilated to biogas (IPCC default value)
Source of data used:	AMS-III.H version 16
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied:	
Any comment:	This parameter is used to calculate methane emissions from sludge treatment systems affected by the project activity and not equipped with biogas recovery in year y ($PE_{s,treatment,y}$) and/or methane emissions from anaerobic decay of the final sludge produced in year y ($PE_{s,final,y}$) (in case existent).

Data / Parameter:	**F**
Data unit:	-
Description:	Fraction of CH4 in biogas (IPCC default value)
Source of data used:	AMS-III.H version 16
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied:	
Any comment:	This parameter is used to calculate methane emissions from sludge treatment systems affected by the project activity and not equipped with biogas recovery in year y ($PE_{s,treatment,y}$) and/or methane emissions from anaerobic decay of the final sludge produced in year y ($PE_{s,final,y}$) (in case existent).

Data / Parameter:	**$EF_{composting}$**
Data unit:	t CH4/t waste treated
Description:	Emission factor for composting organic waste
Source of data used:	AMS-III.H version 16

Value applied:	0.01 (dry weight basis)
Justification of the choice of data or description of measurement methods and procedures actually applied:	Emission factors can be based on facility/site-specific measurements, country specific values or IPCC default values (Table 4.1 chapter 4, volume 5, 2006 IPCC Guidelines for National Greenhouses Gas Inventories). IPCC default value is 0.01 tCH4/t waste treated on a dry weight basis.
Any comment:	This parameter is used to calculate methane emissions from sludge treatment systems affected by the project activity and not equipped with biogas recovery in year y ($PE_{s,treatment,y}$) and where the sludge is composted (in case existent).

Data / Parameter:	**$MCF_{ww,BL,discharge}$**
Data unit:	-
Description:	Methane correction factor based on discharged pathway in the baseline situation of the wastewater
Source of data used:	AMS-III.H version 16: Table III.H.1.
Value applied:	0.1
Justification of the choice of data or description of measurement methods and procedures actually applied:	IPCC default value for Methane Correction Factor (MCF) for discharged of wastewater to sea, river or lake
Any comment:	-

Data / Parameter:	**$MCF_{ww,PJ,discharge}$**
Data unit:	-
Description:	Methane correction factor based on discharge pathway in the project scenario
Source of data used:	AMS-III.H version 16: Table III.H.1.
Value applied:	0.1
Justification of the choice of data or description of measurement methods and procedures actually applied:	IPCC default value for Methane Correction Factor (MCF) for discharged of wastewater to sea, river or lake
Any comment:	-

Data / Parameter:	**$MCF_{s,BL,final}$**
Data unit:	-
Description:	Methane correction factor of the disposal site that receives the final sludge in the baseline situation
Source of data used:	AMS-III.H version 16; table III.H.1
Value applied:	Estimated as per the procedures described in the “Emissions from solid waste disposal sites”, version 06.0.1

	Described at applicable CPA
Justification of the choice of data or description of measurement methods and procedures actually applied:	Application A of the tool is selected to determine the $MCF_{s,BL,final}$
Any comment:	This parameter is used to calculate baseline methane emissions from anaerobic decay of the final sludge ($BE_{s,final,y}$) (in case existent)

Data / Parameter:	**$MCF_{s,PJ,final}$**
Data unit:	-
Description:	Methane correction factor of the disposal site that receives the final sludge in the project situation
Source of data used:	AMS-III.H version 16; table III.H.1
Value applied:	Estimated as per the procedures described in the “Emissions from solid waste disposal sites” version 06.0.1 Described at applicable CPA
Justification of the choice of data or description of measurement methods and procedures actually applied:	Application A of the tool is selected to determine the $MCF_{s,PJ,final}$
Any comment:	This parameter is used to calculate project methane emissions from anaerobic decay of the final sludge ($PE_{s,final,y}$) (in case existent)

Data / Parameter:	**CFE_{ww}**
Data unit:	-
Description:	Capture efficiency of the biogas recovery equipment in the wastewater treatment system
Source of data used:	AMS-III.H version 16
Value applied:	0.9
Justification of the choice of data or description of measurement methods and procedures actually applied:	This is default value applied to estimate the fugitive emission through capture inefficiencies in the anaerobic wastewater treatment system in the year y.
Any comment:	-

Data / Parameter:	**$EF_{CO2, grid, y}$**
Data unit:	tCO_2/MWh
Description:	CO_2 emission factor of the grid in year *y*
Source of data used:	Host country DNA, Power Companies, other Government or public authorities
Value applied:	

Grid	**$EF_{CO2,grid,y}$**

	Sumatera	0.743 The value above shall be applied for *ex-ante* calculations and will remain fixed during the first crediting period of the PoA. SSC-CPAs that displace electricity from the Sumatera grid shall apply this value ex-ante and it shall remain fixed for the first crediting period of such SSC-CPA. The ex-ante grid emission factor above will be revised along with renewal of the crediting period of the PoA. SSC-CPAs that displace electricity from the Sumatera grid that are newly included or that renew their crediting period shall always apply the value given in the corresponding table of the PoA-DD available (valid) at the particular time. For SSC-CPAs connected to grids other than the Sumatera grid, the value of the grid emission factor will be provided in the corresponding SSC-CPA-DD and calculated on CPA level as per the "Tool to calculate the emission factor for an electricity system", version 02.2.1 by using available data from the Host Country DNA or self-calculated by the PPs using PT. PLN's published data or other publicly-made documentation.
Justification of the choice of data or description of measurement methods and procedures actually applied:	The emission factor from grid where the project is connected
Any comment:	

Data / Parameter:	$\rho_{CH4,n}$
Data unit:	kg/m^3
Description:	Density of methane at normal conditions
Source of data used:	Default value
Value applied:	0.716
Justification of the choice of data or description of measurement methods and procedures actually applied:	As per "Tool to determine project emissions from flaring gases containing methane" version 01
Any comment:	

Data / Parameter:	SGR_{BL}
Data unit:	-
Description:	Sludge generation ratio of the wastewater treatment plant in the baseline scenario (tonne of dry matter in sludge/t COD removed).
Source of data used:	Described at applicable CPA
Value applied:	Described at applicable CPA
Justification of the	This ratio will be determined as per paragraph 26, 27 or 28 of approved

choice of data or description of measurement methods and procedures actually applied:	methodology AMS-III.H version 16
Any comment:	This parameter is used to calculate methane emissions from anaerobic decay of the final sludge ($BE_{s,final,y}$) (in case existent). It is thus used to calculate $S_{final,BL,y}$ ex-post as per AMS-III.H.

Other data and parameters to be reported in the SSC-CPA-DD

Additonal data and parameter tables shall be included to the SSC CPA DD form to describe any ex ante Data/Parameter that may be required as part of the application of a given tool to a particular SSC- CPA.

Data / Parameter:	
Data unit:	
Description:	Parameters related to emissions from electricity consumption in year *y*
Source of data used:	Described at applicable CPA
Value applied:	Described at applicable CPA
Justification of the choice of data or description of measurement methods and procedures actually applied:	As per the procedure in the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" version 01. Alternatively it shall be assumed that all relevant electrical equipment operate at full rated capacity, plus 10% to account for distribution losses, for 8760 hours per annum.
Any comment:	shall be described as per the corresponding tool, whenever such tool is applied to a Specific SSC-CPA

Data / Parameter:	
Data unit:	
Description:	Parameters related to emissions from fossil fuel consumption in year *y*
Source of data used:	Described at applicable CPA
Value applied:	Described at applicable CPA
Justification of the choice of data or description of measurement methods and procedures actually applied:	As per the procedure in the "tool to calculate project or leakage CO2 emissions from fossil fuel combustion" version 02.
Any comment:	shall be described as per the corresponding tool, whenever such tool is applied to a Specific SSC-CPA

Data / Parameter:	
Data unit:	
Description:	Parameters related to the calculation of methane emissions from biomass stored under anaerobic conditions which does not occur in the

	baseline situation
Source of data used:	Described at applicable CPA
Value applied:	Described at applicable CPA
Justification of the choice of data or description of measurement methods and procedures actually applied:	As per the tool "Emissions from solid waste disposal sites" version 06.0.1.
Any comment:	shall be described as per the corresponding tool, whenever such tool is applied to a Specific SSC-CPA

Data / Parameter:	
Data unit:	
Description:	Parameters related to the determination of the remaining lifetime of equipment
Source of data used:	Described at applicable CPA
Value applied:	Described at applicable CPA
Justification of the choice of data or description of measurement methods and procedures actually applied:	As per the procedure in the "tool to determine the remaining lifetime of equipment" version 01.
Any comment:	shall be described as per the corresponding tool, whenever such tool is applied to a Specific CPA-DD

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

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

Data / Parameter:	$\mathbf{Q_{ww,i,y}}$
Data unit:	m^3/year
Description:	Volume of wastewater treated in baseline wastewater treatment system *i* in year y
Source of data to be used:	Flow meter
Value of data applied for the purpose of calculating expected emission reduction in section B.5	Described in CPA
Description of measurement methods and procedures to be applied:	Monitored continuously and recorded daily. In case totalized volumes are not measured, at least hourly measurements are undertaken, if less, confidence/precision level of 90/10 shall be attained.
QA/QC procedures to	Calibration and maintenance are carried out periodically, according to

be applied:	the manufacturer's specification
Any comment:	These parameters are assumed to be identical: $Q_{ww,,i,y} = Q_{ww,y}$ This parameter is also used to monitor the volume of wastewater treated in the project wastewater treatment system *k* in year *y* ($Q_{ww,k,y}$)

Data / Parameter:	**$COD_{ww,untreated,y}$**
Data unit:	$tCOD/m^3$
Description:	The Chemical Oxygen Demand (COD) of the untreated wastewater in the project scenario in year *y*. This parameter is measured before the biogas digester.
Source of data to be used:	Representative sampling
Value of data applied for the purpose of calculating expected emission reduction in section B.5	Described in CPA
Description of measurement methods and procedures to be applied:	Measurement according to national or international standards.
QA/QC procedures to be applied:	Samples and measurements shall ensure a 90/10 confidence/precision level
Any comment:	To be measured monthly. Measurements may be carried out by a third party laboratory. This monitoring parameter as per AMS-III.H version 16 is identical with the $COD_{inflow,i,y}$. This is used to calculate the ex-post $BE_{ww,treatment,y}$ This parameter is also used to calculate $COD_{ww,discharge,BL,y}$ ex-post as per AMS-III.H.

Data / Parameter:	**$COD_{ww,treated,y}$**
Data unit:	$tCOD/m^3$
Description:	The Chemical Oxygen Demand (COD) of the wastewater after the treatment system affected by the project activity and equipped with biogas recovery in year *y*. This parameter is measured after the biogas digester.
Source of data to be used:	Representative sampling
Value of data applied for the purpose of calculating expected emission reduction in section B.5	Described in CPA
Description of measurement methods and procedures to be applied:	Measurement according to national or international standards.
QA/QC procedures to be applied:	Samples and measurements shall ensure a 90/10 confidence/precision level

Any comment:	To be measured monthly. Measurements may be carried out by a third party laboratory. This monitoring parameter as per AMS-III.H version 16 is measured to determine the $COD_{inflow,k,y}$ in the project scenario wastewater treatment system *k* in year *y* and to calculate ($\eta_{PJ,k,y}$). This is used to calculate the ex-post $PE_{ww,treatment,y}$

Data / Parameter:	$\mathbf{COD_{ww,outflow,k,y}}$
Data unit:	$tCOD/m^3$
Description:	The outflow Chemical Oxygen Demand (COD) of the treated wastewater in system *k* in year *y*. This parameter is measured after the wastewater treatment system affected by the project activity and not equipped with biogas recovery.
Source of data to be used:	Representative sampling
Value of data applied for the purpose of calculating expected emission reduction in section B.5	Described in CPA
Description of measurement methods and procedures to be applied:	Measurement according to national or international standards.
QA/QC procedures to be applied:	Samples and measurements shall ensure a 90/10 confidence/precision level
Any comment:	To be measured monthly. This parameter and previous parameter ($\mathbf{COD_{ww,treated,y}}$) will be used to determine the COD removal efficiency ($\eta_{PJ,k,y}$) of the project wastewater treatment system *k* in year *y*.

Data / Parameter:	$\mathbf{S_{l,PJ,y}}$
Data unit:	t
Description:	Amount of dry matter in the sludge treated by the sludge treatment system *l* in the project scenario in year *y*
Source of data to be used:	Monitoring of 100% of the sludge amount through continuous or batch measurements and moisture content through representative sampling to ensure the 90/10 confidence/precision level.
Value of data applied for the purpose of calculating expected emission reduction in section B.5	Described in applicable CPA
Description of measurement methods and procedures to be applied:	Measure the total quantity of sludge on a wet basis. The volume (m^3) and density or direct weighing may be used to determine the sludge amount (wet basis). Representative samples are taken to determine the moisture content to calculate the total sludge amount on dry basis
QA/QC procedures to be applied:	
Any comment:	This parameter is used to calculate methane emissions from sludge treatment systems affected by the project activity and not equipped with

	biogas recovery ($PE_{s,treatment,y}$) (in case existent).

Data / Parameter:	$S_{final,PJ,y}$
Data unit:	t
Description:	Amount of dry matter in the final sludge generated in the project wastewater treatment system in year *y*
Source of data to be used:	Monitoring of 100% of the sludge amount through continuous or batch measurements and moisture content through representative sampling to ensure the 90/10 confidence/precision level.
Value of data applied for the purpose of calculating expected emission reduction in section B.5	Described in CPA
Description of measurement methods and procedures to be applied:	Measure the total quantity of sludge on a wet basis. The volume (m^3) and density or direct weighing may be used to determine the sludge amount (wet basis). Representative samples are taken to determine the moisture content to calculate the total sludge amount on dry basis
QA/QC procedures to be applied:	If the methane emissions from anaerobic decay of the final sludge are to be neglected because the sludge is controlled combusted, disposed of in a landfill with methane recovery, or used for soil application, then end-use of the final sludge will be monitored during the crediting period.
Any comment:	This parameter is used to calculate methane emission from anaerobic decay of the final sludge ($PE_{s,final,y}$) (in case existent). This parameter is also used to calculate $S_{final,BL,y}$ ex-post in the calculation of methane emissions from anaerobic decay of the final sludge ($BE_{s,final,y}$) (in case existent) as per AMS-III.H.

Data / Parameter:	$COD_{ww,discharge,PJ,y}$
Data unit:	$tCOD/m^3$
Description:	The Chemical Oxygen Demand (COD) of the treated wastewater discharged to the river in the project scenario in year *y*. It is measured in the last anaerobic pond or after the aerobic pond (in case existence).
Source of data to be used:	Representative sampling
Value of data applied for the purpose of calculating expected emission reduction in section B.5	Described in CPA
Description of measurement methods and procedures to be applied:	Measurement according to national or international standards
QA/QC procedures to be applied:	Samples and measurements shall ensure a 90/10 confidence/precision level
Any comment:	To be measured monthly. Measurements may be carried out by a third party laboratory.

Data / Parameter:	**$BG_{Burnt, y}$**
Data unit:	m^3
Description:	Biogas volume in year *y*
Source of data to be used:	Flow meter
Value of data applied for the purpose of calculating expected emission reduction in section B.5	Described in CPA
Description of measurement methods and procedures to be applied:	Monitored continuously and recorded on daily or weekly basis. In case totalizer readings are not available, at least hourly measurements are undertaken, if less, confidence/precision level of 90/10 shall be attained.
QA/QC procedures to be applied:	Calibration and maintenance are carried out periodically, according to the manufacturer's specification
Any comment:	In all cases, the amount of biogas recovered, fuelled, flared or otherwise utilized (e.g. injected into a natural gas distribution grid or distributed via a dedicated piped network) shall be monitored ex-post, using continuous flow meters. If the biogas streams used as fuel and flared are monitored separately, the two fractions can be added together, without the need to monitor the recovered biogas before the separation. The methane content measurement shall be carried out close to a location in the system where a biogas flow measurement takes place.

Data / Parameter:	**$w_{CH4,y}$**
Data unit:	%
Description:	Methane content in biogas in the year *y (volume fraction)*
Source of data to be used:	Gas Analyser
Value of data applied for the purpose of calculating expected emission reduction in section B.5	Provided in CPA Monitoring report
Description of measurement methods and procedures to be applied:	The fraction of methane in the gas will be measured with a continuous analyser or alternatively, with periodical measurement at a 90/10 confidence/precision level. It will be measured using equipment that can directly measure methane content in the biogas – the estimation of methane content of biogas based on measurement of other constituents of biogas such as CO_2 is not permitted. The methane content measurement shall be carried out close to a location in the system where a biogas flow measurement takes place. This parameter will be used to determine the methane content and applied to calculate MD_y as per approved methodology AMS-III.H version 16.
QA/QC procedures to be applied:	Calibration and maintenance are carried out periodically, according to the manufacturer's specification.

Any comment:	This parameter will also represent the volumetric fraction of methane in the residual gas on dry basis in hour h **($fv_{CH4,RG,h}$)** and will be applied to calculate mass flow rate of methane in the residual gas ($TM_{RG,h}$) as per the "Tool to determine the project emission from flaring gases containing methane" version 01. The location of methane measurement shall be chosen to make sure that measurement is before the gas streams separate out for the gas engines and flare

Data / Parameter:	**T**
Data unit:	^0C
Description:	Temperature of the biogas
Source of data to be used:	Thermocouple
Value of data applied for the purpose of calculating expected emission reduction in section B.5	Described in CPA
Description of measurement methods and procedures to be applied:	Shall be measured at the same time when methane content in biogas ($w_{CH4,y}$) is measured. The temperature of the gas is required to determine the density of the methane combusted. If the biogas flow meter employed measure flow, pressure and temperature and display or output the normalised flow of biogas, then there is no need for separate monitoring of pressure and temperature of the biogas.
QA/QC procedures to be applied:	Calibration and maintenance are carried out periodically, according to the manufacturer's specification
Any comment:	The temperature of biogas shall be monitored in cases where biogas volumes are measured in terms of m3. The temperature values shall be used to convert biogas volume in m3 into Nm3. However if biogas volumes are measured in terms of Nm3, this parameter is not applicable.

Data / Parameter:	**P**
Data unit:	Pa
Description:	Pressure of the biogas
Source of data to be used:	Pressure Gauge
Value of data applied for the purpose of calculating expected emission reduction in section B.5	Described in CPA
Description of measurement methods and procedures to be applied:	Shall be measured at the same time when methane content in biogas ($w_{CH4,y}$) is measured. The pressure of the gas is required to determine the density of the methane combusted. If the biogas flow meter employed measure flow, pressure and temperature and display or output the normalised flow of biogas, then

	there is no need for separate monitoring of pressure and temperature of the biogas.
QA/QC procedures to be applied:	Calibration and maintenance are carried out periodically, according to the manufacturer's specification
Any comment:	The pressure of biogas shall be monitored in cases where biogas volumes are measured in terms of m3. The pressure values shall be used to convert biogas volume in m3 into Nm3. However if biogas volumes are measured in terms of Nm3, this parameter is not applicable.

Data / Parameter:	**$FV_{RG,h}$**
Data unit:	Nm3/hr
Description:	Volumetric flow rate of the residual gas in dry basis at normal conditions in the hour h
Source of data to be used:	Measurements by project participants using a flow meter
Value of data applied for the purpose of calculating expected emission reduction in section B.5	Provided in CPA monitoring report
Description of measurement methods and procedures to be applied:	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 ($fv_{i,h}$) when the residual gas temperature exceeds 60 ºC. Monitoring frequency is continuously. Values to be averaged hourly or at a shorter time interval. The parameter represents biogas flow rate to the flare.
QA/QC procedures to be applied:	Flow meters are to be periodically calibrated according to the manufacturer's recommendation.
Any comment:	

Data / Parameter:	**$\eta_{open\ flare,h}$**
Data unit:	%
Description:	flare efficiency in hour *h* (open flare)
Source of data to be used:	Determined based on operation flaring time
Value of data applied for the purpose of calculating expected emission reduction in section B.5	Described in CPA
Description of measurement methods and procedures to be applied:	Default values will be applied. The default figure used for calculation will be determined based on the flame detection.
QA/QC procedures to be applied:	For open flares, the flare efficiency in hour *h* is : • 0% if the flare is not operational (eg. if no flame is detected by a continuous flame detection monitoring system) for more than 20 minutes during the hour *h*.

	• 50% if the flare is operational (eg. if a flame is detected by a continuous flame detection monitoring system) for more than 20 minutes during the hour *h*)
Any comment:	Regular maintenance shall be carried out to ensure optimal operation of flares.

Data / Parameter:	η **enclosed** flare,h
Data unit:	%
Description:	flare efficiency in hour *h* (enclosed flare)
Source of data to be used:	Biogas to flare flow meter, flare exhaust temperature readings. Flare manufacturer's range of biogas flow and exhaust temperature
Value of data applied for the purpose of calculating expected emission reduction in section B.5	Described in CPA
Description of measurement methods and procedures to be applied:	Default values will be applied. The default figure used for calculation will be determined based on the flame detection.
QA/QC procedures to be applied:	• 0% if the temperature in the exhaust gas of the flare (T_{flare}) is below 500 °C for more than 20 minutes during the hour *h*. • 50%, if the temperature in the exhaust gas of the flare (T_{flare}) is above 500 °C for more than 40 minutes during the hour *h*, but the manufacturer's specifications on proper operation of the flare are not met at any point in time during the hour *h*. • 90%, if the temperature in the exhaust gas of the flare (T_{flare}) is above 500 °C for more than 40 minutes during the hour h and the manufacturer's specifications on proper operation of the flare are met continuously during the hour *h*.
Any comment:	Regular maintenance shall be carried out to ensure optimal operation of flares.

Data / Parameter:	$\mathbf{T}_{flare}$
Data unit:	^{0}C
Description:	Temperature in the exhaust of the flare
Source of data to be used:	Thermocouple measurements by project participants
Value of data applied for the purpose of calculating expected emission reduction in section B.5	Provided in CPA monitoring report
Description of	Measure the temperature of the exhaust gas stream in the flare by Type

measurement methods and procedures to be applied:	N thermocouple. A temperature above 500 °C indicates a significant amount of gases are still being burnt and that the flare is operating.
QA/QC procedures to be applied:	Thermocouples should be replaced or calibrated every year.
Any comment:	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 its capacity is not adequate to the actual flow

Data / Parameter:	**Other flare operation parameters**
Data unit:	-
Description:	This should include all data and parameters that are required to monitor whether the flare operates within the range of operating conditions according to manufacturer's specification including a flame detector in case of open flares
Source of data to be used:	Measurements by CPA implementer.
Value of data applied for the purpose of calculating expected emission reduction in section B.5	Provided in CPA monitoring report
Description of measurement methods and procedures to be applied:	Parameter monitored continuously
QA/QC procedures to be applied:	-
Any comment:	Only applicable in case of use a default values

Other data and parameters to be monitored by each SSC-CPA-DD

Additional data and parameter tables shall be included to the SSC-CPA-DD form to describe any monitoring Data/Parameter that may be required as part of the application of a given tool to a particular SSC-CPA.

Data / Parameter:	
Data unit:	-
Description:	Parameters related to emissions from electricity consumption in year *y*
Source of data to be used:	Measurements by CPA implementer.
Value of data applied for the purpose of calculating expected emission reduction in section B.5	Provided in CPA monitoring report
Description of measurement methods and procedures to be	As per the procedure in the "tool to calculate baseline, project and/or leakage emissions from electricity consumption" version 01. Alternatively it shall be assumed that all relevant electrical equipment

applied:	operate at full rated capacity, plus 10% to account for distribution losses, for 8760 hours per annum.
QA/QC procedures to be applied:	-
Any comment:	shall be described as per the corresponding tool, whenever such tool is applied to a Specific CPA-DD

Data / Parameter:	
Data unit:	-
Description:	Parameters related to emissions from fossil fuel consumption in year *y*
Source of data to be used:	Measurements by CPA implementer.
Value of data applied for the purpose of calculating expected emission reduction in section B.5	Provided in CPA monitoring report
Description of measurement methods and procedures to be applied:	As per the procedure in the "tool to calculate project or leakage CO2 emissions from fossil fuel combustion" version 02.
QA/QC procedures to be applied:	-
Any comment:	shall be described as per the corresponding tool, whenever such tool is applied to a Specific CPA-DD

Data / Parameter:	
Data unit:	
Description:	Parameters related to the calculation of methane emissions from biomass stored under anaerobic conditions which does not occur in the baseline situation
Source of data to be used:	Measurements by CPA implementer.
Value of data applied for the purpose of calculating expected emission reduction in section B.5	Provided in CPA monitoring report
Description of measurement methods and procedures to be applied:	As per the "Emissions from solid waste disposal sites" version 06.0.1.
QA/QC procedures to be applied:	-
Any comment:	shall be described as per the corresponding tool, whenever such tool is applied to a Specific CPA-DD

For electricity generation

Data / Parameter:	**EG** $_{BL,y}$
Data unit:	kWh
Description:	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y*
Source of data to be used:	kWh meter
Value of data applied for the purpose of calculating expected emission reduction in section B.5	Described in CPA
Description of measurement methods and procedures to be applied:	Continuous monitoring and monthly recording. Measurement results shall be cross checked with records for sold electricity (invoices) The net electricity export/supplied to a grid is the difference between the measured quantities of the grid electricity export and the import. If applicable, cross check net electricity supplied to a grid as gross energy generation in the project activity power plant minus the auxiliary/station electricity consumption, technical losses and electricity import from the grid to the project power plant measured at the grid interface/connection used for billing purposes.
QA/QC procedures to be applied:	Calibration should be undertaken as prescribed in the relevant paragraph of the General Guidelines to SSC CDM Methodologies.
Any comment:	-

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

The monitoring plan details the actions necessary to record all the data parameters required by the methodology AMS III.H, version 16, as detailed in section E.7.1 above as well as AMS I. D Version 17 for SSC-CPAs.

The monitoring plan for this PoA has been developed to ensure that CPAs collect complete data from the very start of their crediting period.

1. Monitoring Plan Objective and Organization

The purpose of the monitoring plan is to determine the emission reductions achieved by each CPA. Details of the CPA monitoring plans will be described in each SSC-CPA-DD.

2. Monitoring Data and archiving

Data to be monitored is defined in section E.7 and will be recorded at the appropriate frequency. The operator of each biogas facility will be responsible for collecting the monitoring data and will provide the Coordinating Entity with full data records and if applicable calibration certificates. The data will be archived electronically, backed up regularly, and be stored by the Coordinating Entity for two years after the end of the crediting period of each CPA or the last issuance of CERs of this project, whichever occurs last.

3. Quality Assurance and Quality Control

The installation of the monitoring equipment is detailed in each SSC-CPA-DD. The CPA entity will implement QA&QC measures to calibrate and guarantee the accuracy of metering and safety of the project operation. The metering devices will be calibrated and inspected properly and periodically as per standard industry norms and requirements.

Procedures to discount conservatively the emission reductions from the projects will be defined at CPA level, in the event either the project owner or the coordinating entity detects any distortion or mal-function of the monitoring equipment.

The readings from monitoring equipment will be readily accessible for the Designated Operational Entity (DOE) carrying out the verification of monitoring data.

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

The baseline study was concluded on 24 May 2011. The entity determining the baseline is South Pole Carbon Asset Management Ltd, listed in Annex 1 to the present document.

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Annex 1

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding is involved in the SEA Biogas PoA.

Annex 3

BASELINE INFORMATION

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

Emission factor of Sumatera Grid

Step 1. Identify the relevant electricity system

The spatial extent of the proposed project boundary includes the project site and all power plants connected physically to the electricity system that the CDM project power plant is connected to. As per DNA of Indonesia, the Sumatera grid covers NAD province North Sumatera province, Riau province, Jambi province, West Sumatera province, South Sumatera province and Lampung province.

Step 2. Choose whether to include off-grid power plants in the project electricity system

Option 1- only grid power plants are included in the calculation selected in the determination of Sumatera grid emission factor

Step 3. Select a method to determine the operating margin (OM)

Simple OM is chosen as the method to calculate the operating margin due to low cost/must run resources constitute less than 50% of total grid generation in average of the five most recent years. Ex-ante option – A 3 years generation - weighted average, based on the most recent data available at the time of submission of the CDM PDD to the DOE for validation, has been selected for the purpose of emission reductions calculation.

Step 4. Calculate the operating margin emission factor according to the selected method

Option B is selected to calculate the OM emission factor due to the following reason:

(a) The necessary data for Option A is not available
(b) Only nuclear and renewable power generation are considered as low-cost/must-run power sources and the quantity of electricity supplied to the grid by these sources is known
(c) Off-grid power plants are not include in the calculation

Calculation of Operating Margin

Table 3: Simple OM Emission Factors Calculation of Sumatera Grid for Year 2005

Fuel	Unit	Sumbagsel (include IPP) A	Sumbagut B	Total C = A + B	EF (tC/TJ) D	Oxidation (%) E	NCV F	CO_2 Emission (tCO_{2e}) G
MFO	kiloliter	510	323,472	323,982	21.1	100%	40,767 MJ/kl	1,021,834
IDO	kiloliter	15,662	0	15,662	20.2	100%	37,219 MJ/kl	43,177
HSD	kiloliter	176,692	1,009,112	1,185,804	20.2	100%	36,542 MJ/kl	3,209,402
Coal	ton	1,651,943	0	1,651,943	25.8	100%	27,444 MJ/ton	4,288,852
Natural Gas	MMBTU	20,792,324	14,299,034	35,091,358	15.3	100%		2,076,978
								10,640,244

Table 4: Simple OM Emission Factors Calculation of Sumatera Grid for Year 2006

Fuel	Unit	Sumbagsel (Include IPP) A	Sumbagut B	Total C = A + B	EF (tC/TJ) D	Oxidation (%) E	NCV F	CO_2 Emission (tCO_{2e}) G
MFO	kiloliter	0	256,020	256,020	21.1	100%	40,767 MJ/kl	807,483
IDO	kiloliter	17,137	0	17,137	20.2	100%	37,219 MJ/kl	47,243
HSD	kiloliter	188,208	1,150,461	1,338,668	20.2	100%	36,542 MJ/kl	3,623,133
Coal	ton	1,530,391	0	1,530,391	25.8	100%	27,444 MJ/ton	3,973,273
Natural Gas	MMBTU	27,980,333	7,994,188	35,974,521	15.3	100%		2,129,251
								10,580,383

Table 5: Simple OM Emission Factors Calculation of Sumatera Grid for Year 2007

Fuel	Unit	Sumbagsel (Include IPP) A	Sumbagut B	Total C = A + B	EF (tC/TJ) D	Oxidation (%) E	NCV F	CO_2 Emission (tCO_{2e}) G
MFO	kiloliter	0	281,427	281,427	21.1	100%	40,767 MJ/kl	887,616
IDO	kiloliter	7,989	0	7,989	20.2	100%	37,219 MJ/kl	22,025
HSD	kiloliter	108,594	1,250,672	1,359,267	20.2	100%	36,542 MJ/kl	3,678,883
Coal	ton	1,706,554	0	1,706,554	25.8	100%	27,444 MJ/ton	4,430,637
Natural Gas	MMBTU	32,399,087	10,131,294	42,530,382	15.3	100%		2,517,277

Total Generation Capacity (2005-2007) excl. Low-Cost/Must-Run

		2005	2006	2007
Type of Power Plant	**Fuel type**	**MWh**	**MWh**	**MWh**
Hydro		2,505,314	2,948,239	3,593,005
Geothermal		0	0	0
Steam - Oil	MFO	1,060,814	837,664	949,438
Steam - Gas	Natural Gas	125,254	113,808	119,821
Steam - Coal	Coal	2,932,330	2,868,414	3,257,691
Diesel	HSD	529,384	567,470	498,576
Diesel	IDO	66,887	73,971	34,026
Diesel	PPO	0	5,108	0
Combustion Turbine - Oil	HSD	451,084	517,802	417,080
Combustion Turbine - Gas	Natural Gas	1,154,204	974,046	1,206,994
Combined Cycle - Oil	HSD	0	0	0
Combined Cycle - Gas	Natural Gas	5,672,687	6,221,137	6,259,426
Total		14,497,958	15,127,659	16,336,057
Total Low Cost Must Run		2,505,314	2,953,347	2,953,347
Total Generation excl. Low-Cost/Must-Run		11,992,644	12,174,312	13,382,710
Internal use rate		3.98%	3.47%	3.52%
Net Electricity		11,514,899	11,751,548	12,911,406

Total Emissions / Total Generation

		2005	2006	2007
Total Emissions	**tCO2e**	10,640,244	10,580,383	11,536,438
Total Generation	**MWh**	11,514,899	11,751,548	12,911,406
$EF_{OM,y}$	**tCO2e/MWh**	0.924	0.900	0.894

EF_{OM2006}	0.906	**tCO2e/MWh**	**Operating Margin**

Step 5. Calculate the build margin emission factor

Option B – the set of power units that supply electricity to the grid most recently and that comprise 20% (SET≥20%) is selected to calculate the build margin.

Calculation of Building Margin

#	Station	Installed capacity (kW)	Year of Commission	Fuel Type	Fuel: Coal (ton)	Fuel: Gas (MMBTU)	Fuel: HSD (kl)	Electricity Generation: 2007 (Gross)	Electricity Generation: Parasitic load (ave)	Electricity Generation: 2007 (Net)
	--	--	--	--	--			MWh	%	MWh
1	PLTU Tarahan 1	100,000	2007	coal & HSD	47,926		1,284	105,450	3.52%	101,736
2	PLTU Tarahan 2	100,000	2007	coal & HSD	98,072		2,903	204,410	3.52%	197,212
3	PLTG Riau Power (rental)	20,000	2007	Gas		1,119,896		74,994	0.00%	74,994
4	PLTD Sewa Arti Duta AU (rental)	15,000	2007	HSD			20,270	77,297	0.00%	77,297
5	PLTG Meppo Gen (IPP)	80,000	2007	Gas		5,292,873		297,674	0.00%	297,674
6	PLTG Apung	30,000	2007	HSD			2,816	9,817	3.52%	9,471
7	PLTA 1 Renun	41,000	2006	Hydro				163,003	3.52%	157,262
8	PLTA Musi 1	71,825	2006	Hydro				183,105	3.52%	176,657
9	PLTA Musi 2	71,825	2006	Hydro				183,499	3.52%	177,036
10	PLTA Musi 3	71,825	2006	Hydro				197,278	3.52%	190,330
11	PLTD-12 Gunung Sitoli	1,010	2005	HSD			866	3,176	3.52%	3,064
12	PLTD-13 Gunung Sitoli	1,010	2005	HSD			866	3,176	3.52%	3,064
13	PLTD-1 Teluk Dalam	1,010	2005	HSD			871	3,176	3.52%	3,064
14	PLTA-2 Renun	41,000	2005	Hydro				163,003	3.52%	157,262
15	PLTG Inderalaya II	40,000	2004	Gas & HSD		2,492,620	1	227,141	3.52%	219,141
16	PLTG Truck Mounted 1	20,000	2004	Gas		1,463,191		125,434	3.52%	125,434
17	PLTG Truck Mounted 2	20,000	2004	Gas		0		0	3.52%	0
18	PLTG Rental Tl. Duku #1	20,000	2004	Gas		365,123		16,040	0.00%	16,040
19	PLTD 12 LUENG BATA*	3,450	2004	HSD			1,451	5,017	3.52%	4,841
20	PLTD 13 LUENG BATA*	3,450	2004	HSD			1,451	5,017	3.52%	4,841
21	PLTD 14 LUENG BATA*	3,450	2004	HSD			1,451	5,017	3.52%	4,841
22	PLTGU Borang (IPP)	150,000	2004	Gas		13,156,205		1,247,034	0.00%	1,247,034

		2007
Total Generation	MWh	16,336,057
22-last	MWh	3,299,757
22-last / Total	%	20.2

22-last Total Emissions / 22-last Total Generation

Parameter	Unit	2007
Total Power Generated (net)	**MWh**	3,248,295
Fuel Consumption (HSD)	kl	34,230
	TJ	1,251
EF	tC/TJ	20.20
Oxidation		100%
Emissions from HSD	**tCO2e**	**92,644**
Fuel Consumption (Gas)	MMBTU	23,889,909
	TJ	25,205
EF	tC/TJ	15.30
Oxidation		100%
Emissions from Natural Gas	**tCO2e**	**1,413,990**
Fuel Consumption (Coal)	ton	145,998
	TJ	4,007
EF	tC/TJ	25.8
Oxidation		100%
Emissions from Coal	**tCO2e**	**379,047**
Total Emissions	**tCO2e**	**1,885,681**
EF_{BM2008}	**tCO2e/GWh**	**580.5**
EF_{BM2008}	**tCO2e/MWh**	**0.581**

EF_{BM2008}	**0.581**	**tCO2e/MWh**	**Building Margin**

Step 6. Calculate the combined margin emission factor

Calculate the baseline emission factor EF_y

W_{OM}	0.5	(Default value)
W_{BM}	0.5	(Default value)

EF_y = W_{OM} * EF_{OM2008} + W_{BM} * EF_{BM2008}

EF_y	=	W_{OM}	*	EF_{OM2008}	+	W_{BM}	*	EF_{BM2008}
0.743		0.5		0.906		0.5		0.581

The EF of the Sumatera Electricity Grid for 2008 is EF_{2008} 0.743 tCO_2e/MWh

Annex 4

MONITORING INFORMATION

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