CLEAN DEVELOPMENT MECHANISM
SMALL-SCALE PROGRAM ACTIVITY DESIGN DOCUMENT FORM (CDM-SSC-CPA-DD)
Version 01

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NOTE:

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

(ii) The coordinating/managing entity shall prepare a CDM Small Scale Programme Activity Design Document (CDM-SSC-CPA-DD)[1,2] that is specified to the proposed PoA by using the provisions stated in the SSC PoA DD. At the time of requesting registration the SSC PoA DD must be accompanied by a CDM-SSC CPA-DD form that has been specified for the proposed SSC PoA, as well as by one completed CDM-SSC CPA-DD (using a real case). After the first CPA, every CPA that is added over time to the SSC PoA must submit a completed CDM-SSC CPA-DD.

[1] The latest version of the template form CDM-CPA-DD is available on the UNFCCC CDM web site in the reference/document section.

[2] At the time of requesting validation/registration, the coordinating managing entity is required to submit a completed CDM-POA-DD, the PoA specific CDM-CPA-DD, as well as one of such CDM-CPA-DD completed (using a real case).

SECTION A. General description of small scale CDM programme activity (CPA)

A.1. Title of the small-scale CPA:

AeroPod Co-composting Programme for [XX] in [XX]

Version: [XX]
Date: [date]

A.2. Description of the small-scale CPA:

The AeroPod Co-composting Programme for [XX] in [XX] ("the CPA") is implemented on the premises of the [CPA palm oil mill name] by [CPA implementer]. [CPA palm oil mill name] is located at the [CPA region], situated in the [CPA state] of Malaysia, with an installed capacity of [XX] tonne/hour, and expected FFB processing capacity of [XX]tonne/hr..

During the palm oil production process, a large quantity of waste materials, including empty fruit brunches (EFB), fibers and shells, wastewater (known as palm oil mill effluent or POME) are produced. As part of [CPA palm oil mill name]'s vision to provide a total waste treatment solution for the Mill's biowaste, the CPA will use Empty Fruit Bunches (EFBs), [other solid wastes] currently being landfilled, as well as a portion of wastewater currently treated in open lagoons to produce bio-organic fertiliser that can be used by the surrounding palm oil estates.

The production of the bio-organic fertiliser will be carried out in an aerobic environment. When implemented, the CPA will prevent the atmospheric release of methane that is released when EFB, sludge and wastewater decompose anaerobically in the landfill and open lagoons, thereby reducing a potent greenhouse gas (GHG). The GHG reduction effect of the Project is estimated to vary between [XX] tCO_2e/yr in Year 1 to [XX] tCO_2e/yr in Year 10, averaging [XX] tCO_2e/yr over the 10 year crediting period.

The CPA contributes to the sustainable development of Malaysia in the following ways:

- The improvement of the local environment through the introduction of a sustainable solution to waste management. Apart from the reduction in methane, a potent GHG, the CPA will improve the environmental performance of the [CPA palm oil mill name] by (a) eliminating the need for EFBs, [other solid wastes] to be landfilled, and (b) reducing the wastewater that is otherwise left to degrade in open lagoons. The effect will be both a reduction in the stench coming from putrescible waste, as well as reduction in a flammable gas (methane) that is freely being emitted to the atmosphere.

- Reduction in the use of chemical fertilizers. The bio-organic fertiliser product from the CPA is an effective natural replacement to chemical fertilizers. Such replacement has multiple benefits including, significantly, the reduction of chemical run off into waterways.

- The use of bio-organic fertilizers leads to better fruit yield and plant health, thereby improving the earnings of local farmers. Moreover, a steady and consistent supply of bio-fertilzer at a lower cost will encourage displacement of imported chemical fertilizers, which helps mitigate foreign exchange risk that the farmers are exposed to.

It is hoped that the successful implementation of the CPA will pave the way for other palm oil mills to follow in [CPA implementer]'s footsteps.

A.3. Entity/individual responsible for the small-scale CPA:

CPA implementer: [CPA implementer]

A.4. Technical description of the small-scale CPA:

Description of the manufacturing process

The EFB from the palm oil mills will be shredded into a pre-determined size at the material setdown area. A Mixer will blend the shredded EFB together with boiler ash, POME and a special microbial inoculum into a premix feedstock. Some quantities of effluent sludge may be used in the blending as an additive. The feedstock is then loaded by front end loader to deposit into the composting module, which is a sealed aerobic composting apparatus, AeroPod® module.

The premix feedstock will undergo a 14-Day period of aerobic composting in a controlled, sealed environment inside the AeroPod®. The AeroPod® process is automated and computer programmed to enable the feedstock to undergo a controlled, accelerated composting process.

Leachate from the controlled composting process will be collected and recycled in a closed system, resulting in zero liquid discharge from the composting facility. Additional POME effluent and bio-inoculum may be further added in the controlled process to convert the feedstock into enriched compost.

After the 14-Day controlled processing inside AeroPod® the composted feedstock will be unloaded by front end loader and placed into the Curing Area where the compost will undergo a further 14-Day curing period. At the end of curing, the compost will be screened and graded. The refined product will be bio-fertilizers ready for land application

This process is described diagrammatically in the figure below.

[Process diagram]

Figure 1: Co-composting plant process flow

A.4.1. Identification of the small-scale CPA:

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A.4.1.1. Host Party:

Malaysia

A.4.1.2. Geographic reference or other means of identification allowing the unique identification of the small-scale CPA (maximum one page):

[CPA implementer] is the responsible entity for the CPA. The CPA is located in the [CPA palm oil mill name] in the state of [XX], with GPS coordinates of [latitude], [longitude].

Address: [XX]
Contact number: [XX]

[Map]
Figure 2: Physical location of the proposed CPA

A.4.2. Duration of the small-scale CPA:

A.4.2.1. Starting date of the small-scale CPA:

[(Expected) Starting date: DD/MM/YYYY]

A.4.2.2. Expected operational lifetime of the small-scale CPA:

10 years

A.4.3. Choice of the crediting period and related information:

Fixed Crediting period

A.4.3.1. Starting date of the crediting period:

[DD/MM/YYYY], or the date of [registration of the PoA / inclusion of the CPA], whichever is later.

A.4.3.2. Length of the crediting period, first crediting period if the choice is renewable CP:

The length of the fixed crediting period is 10 years, limited to the duration of the registered PoA , regardless of the crediting period type of the CPA.

A.4.4. Estimated amount of emission reductions over the chosen crediting period:

Years	Estimation of annual emission reductions in tonnes of CO_2e
1 [YYYY]	[XX]
2 [YYYY]	[XX]
3 [YYYY]	[XX]
4 [YYYY]	[XX]
5 [YYYY]	[XX]
6 [YYYY]	[XX]
7 [YYYY]	[XX]
8 [YYYY]	[XX]
9 [YYYY]	[XX]
10 [YYYY]	[XX]

Total estimated reductions (tonnes of CO_2e)	[XX]
Total number of crediting years	10
Annual average of the estimated reductions over the crediting period (tonnes of CO_2e)	[XX]

A.4.5. Public funding of the CPA:

The CPA does [yes/no] involve public funding.

A.4.6. Information to confirm that the proposed small-scale CPA is not a de-bundled component

As check in the UNFCCC website, since there is [yes/no] other activity registered as small-scale CPA of a PoA, or applied to register another small-scale CPA of a PoA, or registered as CDM project activity, which:

(a) Has the same activity proposed small scale CPA implementer, or as the same coordinating or managing entity, which also manages a large scale PoA of same sectoral scope, and

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

[If there is other activity satisfies both of the above conditions, then the following shall be checked:

1. If a proposed small-scale CPA of the PoA is deemed to be a debundled component in accordance with the conditions above, but the total size of such a CPA combined with a registered small-scale CPA of a PoA or a registered CDM project activity does not exceed the limits for small-scale CDM as set out in paragraph 28 of the decision 1/CMP.2, the CPA can qualify to use simplified modalities and procedures for small-scale CDM project activities.

2. If each of the independent subsystems/measures (e.g., biogas digester, solar home system) included in the CPA of the PoA is no larger than 1% of the small-scale thresholds defined by the methodology applied, then that CPA of PoA is exempted from performing de-bundling check i.e., considering as not being a de-bundled component of a large scale activity.]

Thus, according to the *"Guidelines on Assessment of Debundling for SSC Project Activity (version 03)"*, the proposed small-scale CPA of the PoA is [yes/no] considered as a de-bundled component of a large scale activity.

A.4.7. Confirmation that small-scale CPA is neither registered as an individual CDM project activity or is part of another Registered PoA:

The proposed CPA is not registered as an individual CDM project activity and is not part of another registered PoA.

SECTION B. Eligibility of small-scale CPA and Estimation of emissions reductions

B.1. Title and reference of the Registered PoA to which small-scale CPA is added:

AeroPod Co-composting Programme for [XX] in [XX].

B.2. Justification of the why the small-scale CPA is eligible to be included in the Registered PoA :

The proposed CPA is eligible to be included in the PoA as it fulfils all the eligibility criteria outlined in section A.4.2.2 of the PoA.

Table 1: Eligibility criteria for the PoA

	Eligibility criteria	Project case
1	The geographical boundary of the CPA.	The CPA is located in the [XX] in the state of [XX], which is within Malaysia.[Official documents such as mill license will be provided to DOE during validation].
2	Conditions to avoid double counting: (a) The location of the CPA and its GPS coordinates are uniquely identified. (b) Measures as elaborated in Section A.4.4.1 (ii) of the PoA-DD are followed to avoid double counting.	(a) The location of the CPA and its GPS coordinates are identified in Section A.4.1.2. (b) As checked in the accordance with Section A.4.4.1 (ii) of the PoA-DD, the proposed CPA is not registered either as a CDM project activity or as a CPA of another PoA. The confirmation from [CPA implementer] was obtained.
3	Specifications of technology/measure including the level and type of service, performance specifications including compliance with testing/certifications.	The CPA involves the installation of composting facility to compost EFBs, [other solid wastes] and POME aerobically. Detail specification is described in Section A.2. [Proposal / technical specification from the technology provider will be provided to DOE during validation].
4	The start date of the CPA will be checked through documentary evidence, the date which will be defined as the start date of the CPA. This date shall not precede the PoA-DD global stakeholder consultation publication.	The start date of the CPA is provided in Section A.4.3.1. The [Contract between each CPA implementer and NOSB to agree to proceed with the construction of the co-composting facility for the CPA, or contracts for purchasing main equipments/ construction services will be provided to DOE during validation. The earlier date should be chosen. In case that no contract has been signed and therefore the underlying project has not started, the expected date when the EPC (Engineering Procurement and Construction) contract signed

		shall be used as the Project started date.]
5	Each CPA shall comply with the applicability and other requirements stipulated in AMS-III.F.	The proposed CPA meets all the requirements described in AMS-III.F. Please refer to [Table X] below.
6	Each CPA shall meet the requirements pertaining to the demonstration of additionality in Section E.5 of the PoA-DD.	The additionality of the CPA meets the requirement in Section E.5 of the PoA-DD, which is demonstrated in Section B.3.
7	The PoA-specific requirements stipulated by the CME. (a) Local stakeholder consultations must be held by the CPA (b) As at current, an environmental impact analysis (EIA) is not required for co-composting projects. In case of EIA related regulation changes in the future, the CPA will follow the latest regulation.	(a) Local stakeholder consultation meeting of the CPA was held. The stakeholders' comments is described in Section D. Minutes of meeting and the attendance list of the local stakeholder consultation will be provided to DOE during validation (b) According to the Malaysian regulations, EIA is [yes/ no] required for composting industries. Please refer to section C.3 for details. [EIA exemption letter from the Department of Environmental/ EIA report (if required by the government) will be provided to DOE during validation.]
8	Each CPA shall affirm that it will not source public funding from Annex I parties. In case a CPA sources public funding from an Annex I party, that CPA shall obtain a CPA-level confirmation that such funding does not result in a diversion of official development assistance.	Not applicable. This CPA does [yes/no] involve any funding from Annex-1 parties. Declaration of no public funding signed by the CPA implementer will be provided to the DOE.
9	The small-scale CPA shall meet the threshold criterion described in *"General Guidelines to SSC CDM methodologies (version 17)*For methane recovery projects, the emission reductions every year will not go beyond the limits of 60 $ktCO_2e/y$ over the entire crediting period.	Annual emission reductions of the CPA is less than 60 $ktCO_2$, as shown in the CER calculation spreadsheet.
10	Demonstration of whether the CPA is a de-bundled component.	The CPA is not a de-bundled component, as discussed in Section A.4.6.

Table 2: Applicability conditions for AMS-III.F version 10

	Applicability condition	Project case
1	*This methodology comprises measures to avoid the emissions of methane to the atmosphere from biomass or other organic matter that would have otherwise been left to decay anaerobically in a solid waste disposal site (SWDS), or in an*	The CPA avoids the emissions of methane to the atmosphere from EFBs, [other solid wastes] and POME that would have otherwise been left to decay anaerobically in a solid waste disposal site (SWDS), or in a wastewater treatment system

	animal waste management system (AWMS), or in a wastewater treatment system (WWTS). In the project activity, controlled aerobic treatment by composting of biomass is introduced.	(WWTS). The CPA involves implementation of controlled biological aerobic treatment by composting of biomass.
2	*The project activity does not recover or combust landfill gas from the disposal site (unlike AMS-III.G "Landfill methane recovery"), and does not undertake controlled combustion of the waste that is not treated biologically in a first step (unlike AMS-III.E "Avoidance of methane production from decay of biomass through controlled combustion, gasification or mechanical/thermal treatment"). Project activities that recover biogas from wastewater treatment shall use methodology AMS-III.H "Methane recovery in wastewater treatment". Project activities involving co-digestion of organic matters shall apply methodology AMS-III.AO "Methane recovery through controlled anaerobic digestion".*	The CPA does not recover or combust landfill gas, undertake controlled combustion of the waste, recover biogas from wastewater treatment, or involve co-digestion of organic matters.
3	*Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO_2 equivalent annually.*	Average annual emission reductions of the CPA are [XX] tCO_2e (or up to [XX] tCO_2e in Year 10), less than the 60 kt CO_2 threshold.
4	*This methodology is applicable to the composting of the organic fraction of municipal solid waste and biomass waste from agricultural or agro-industrial activities including manure.*	The CPA involves the composting of the organic fraction of biomass waste from agro-industrial activities (palm oil milling).
5	*This methodology includes construction and expansion of treatment facilities as well as activities that increase capacity utilization at an existing facility. For project activities that increase capacity utilization at existing facilities, project participant(s) shall demonstrate that special efforts are made to increase the capacity utilization, that the existing facility meets all applicable laws and regulations and that the existing facility is not included in a separate CDM project activity. The special efforts should be identified and described.*	The CPA includes the construction of a new treatment facility. Expansion and increase capacity utilization at existing co-composting facility will not be involved.
6	*This methodology is also applicable for co-composting wastewater and solid biomass waste, where wastewater would otherwise have been treated in an anaerobic wastewater treatment system without biogas recovery. The wastewater in the project scenario is used as a source of moisture and/or nutrients to the*	The CPA involves co-composting wastewater and solid biomass wastes, where the wastewater would have otherwise been treated in the anaerobic open lagoon system located at the palm oil mill. In the CPA, the wastewater will be used as a source of moisture, pH balance and nutrients for the composting process.

	biological treatment process e.g. composting of empty fruit bunches (EFB), a residue from palm oil production, with the addition of palm oil mill effluent (POME) which is the wastewater co-produced from palm oil production.	
7	*In case of co-composting, if it can not be demonstrated that the organic matter would otherwise been left to decay anaerobically, baseline emissions related to such organic matter shall be accounted for as zero, whereas project emissions shall be calculated according to the procedures presented in this methodology for all co-composted substrates.*	Baseline emissions related to anaerobic decay of solid bio-wastes and POME will be accounted for as zero.
8	*The location and characteristics of the disposal site of the biomass, animal manure and co-composting wastewater in the baseline condition shall be known, in such a way as to allow the estimation of its methane emissions, using the provisions of AMS-III.G, AMS-III.E (concerning stockpile), AMS-III.D "Methane recovery in animal manure management systems" or AMS-III.H respectively.* *Project activities for composting of animal manure shall also meet the requirements under paragraphs 1, and 2 (c) of AMS-III.D. Further no bedding material is used in the animal barns or intentionally added to the manure stream in the baseline. Blending materials may be added in the project scenario to increase the efficiency of the composting process (e.g. to achieve a desirable C/N ratio or free air space value), however, only monitored quantity of solid waste or manure or wastewater diverted from the baseline treatment system is used for emission reduction calculation. The following requirement shall be checked ex ante at the beginning of each crediting period:* *(a) Establish that identified landfill(s)/stockpile(s) can be expected to accommodate the waste to be used for the project activity for the duration of the crediting period;* *or* *(b) Establish that it is common practice in the region to dispose off the waste in solid waste disposal site (landfill)/stockpile(s)*	The location and characteristics of the disposal site of the biomass and co-composting wastewater in the baseline condition is known ([XX]). AMS-III.H will be employed to estimate the methane emissions. No composting of animal manure is involved in the CPA. Blending materials may be added in the project scenario to increase the efficiency of the composting process. The monitored quantity of solid waste or wastewater diverted from the baseline treatment system is used for emission reduction calculation. It will be checked ex ante at the beginning of each crediting period that the landfill can be expected to accommodate the waste to be used for the project activity for the duration of the crediting period.
9	*The project participants shall clearly define the geographical boundary of the region referred in*	Not applicable, a criterion 8(a) is chosen.

	paragraph 8 (b), and document it in the CDM-PDD. In defining the geographical boundary of the region, project participants should take into account the source of the waste i.e. if waste is transported up to 50 km, the region may cover a radius of 50 km around the project activity. In addition, it should also consider the distance to which the final product after composting will be transported. In either case, the region should cover a reasonable radius around the project activity that can be justified with reference to the project circumstances but in no case it shall be more than 200 km. Once defined, the region should not be changed during the crediting period(s).	
10	*In case produced compost is handled aerobically and submitted to soil application, the proper conditions and procedures (not resulting in methane emissions) must be ensured.*	The produced compost will be handled aerobically and submitted to soil application. The proper conditions and procedures for the soil application will be ensured such that methane emissions will not occur.
11	*In case produced compost is treated thermally/mechanically, the provisions in AMS-III.E related to thermal/mechanical treatment shall be applied*	Not applicable. Compost produced will not be treated thermally/mechanically.
12	*In case produced compost is stored under anaerobic conditions and/or delivered to a landfill, emissions from the residual organic content shall to be taken into account and calculated as per the latest version of the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site".*	Not applicable. Compost produced will not be stored under anaerobic conditions and/or landfilled.
13	*In case the project activity involves the replacement of equipment, and the leakage effect of the use of the replaced equipment in another activity is neglected, because the replaced equipment is scrapped, an independent monitoring of scrapping of replaced equipment needs to be implemented. The monitoring should include a check if the number of project activity equipment distributed by the project and the number of scrapped equipment correspond with each other. For this purpose scrapped equipment should be stored until such correspondence has been checked. The scrapping of replaced equipment should be documented and independently verified.*	Not applicable. The CPA involves the construction of new co-composting facility.

B.3. Assessment and demonstration of additionality of the small-scale CPA , as per eligibility criteria listed in the Registered PoA:

According to Section E.5 of the PoA-DD, investment analysis shall be carried out at CPA level to demonstrate additionality of the CPA. The investment decision was finalized on the date of [XX] on the [XX].

WACC (post-tax benchmark) calculation

For the proposed CPA, WACC was determined by [employing the CAPM simulation, cost of equity is calculated to be [XX] %, details of the calculation is summarized in Table 3 below.

$$k_e = R_f + \beta_L(R_{m,premium} - R_f)$$

Table 3: CAPM calculation

Parameter	Description	Value	Source
k_e	Average cost of equity financing	[XX] %	Calculated as per CAPM
R_f	Risk-free rate at the time of decision making	[XX] %	Malaysian government bond 10 year yield as at [XX] [3]
$R_{m,\ premium}$ - R_f	Equity risk premium	[XX]%	Calculated. Spread between market returns and risk free returns over 10-year period.
$R_{m,\ premium}$	Market Return	[XX]%	FTSE Bursa Malaysia Palm Oil Plantation Index
	Average risk-free return	[XX]%	Data for 10 years' worth of government bonds to [YYYY]. Only bonds with 10-year maturity (or closest to 10 years) are used to correspond to expectations for returns over 10 years.

The WACC is calculated as follows:

$$r = w_d k_d (1 - T) + w_e k_e$$

Table 4: WACC calculation

Parameter	Description	Value	Source
r	WACC	[XX]%	Calculated
w_d	Percentage of debt financing	[XX]%	[XX]
w_e	Percentage of equity financing	[XX]%	
k_d	Average cost of debt financing	[XX]%	Interest rate based on [XX]
k_e	Average cost of equity financing	[XX]%	Calculated
T	Applicable corporate tax rate	[XX]%	-

[3] Central Bank of Malaysia - Malaysia Government Securities Indicative Prices: http://www.bnm.gov.my/index.php?ch=12&pg=444

As shown in the table above, the benchmark is determined to be [XX]%, this value was set to determine the attractiveness of the CPA. A project activity is considered to be financially feasible when the project IRR is above or equal to the corresponding financial benchmark. /employing the same WACC as the previous CPA which the CPA start date is within 2 years of the proposed CPA. As per [name of the previous CPA] which the CPA started date is [XX], the benchmark of the proposed CPA is [XX]%. A project activity is considered to be financially feasible when the project IRR is above or equal to the corresponding financial benchmark.]

Post-tax Project IRR calculation

The parameters required for IRR calculation are summarized in Table 5. It is noted that the input values were valid and applicable at the time of decision making and will be explained and/ or submitted to the DOE.

Table 5: Basic parameters for investment analysis

Input parameter		Value	Unit	Notes
Project Cost		[XX]	RM	
O&M cost		[XX]	RM	
	Technical lifetime	[XX]	Year	
Depreciation	Depreciation rate	[XX]	-	
	Depreciation period	[XX]	years	
	Salvage value	[XX]	RM	
Revenue	Bio-fertilizer price	[XX]	RM /t	
Tax	Tax rate	[XX]	-	
	Debt ratio	[XX]	-	
	Loan repayment period	[XX]	years	
	Interest rate	[XX]	-	
CERs	CER sales price assumption	[XX]	EUR/CER	
	Exchange rate	[XX]	RM/EUR	

Based on the input data in Table 5, the IRR of the CPA without the revenue of CDM is calculated to be [XX]%, which is below the IRR benchmark. The CPA is considered as financially attractive only if its IRR is above or equal to the corresponding financial benchmark. Thus it can be concluded that the CPA is financially infeasible.

Sensitivity analysis

It is noted that only the variations which would result in a more favorable IRR were summarized in the table below:

Table 6: Results of sensitivity analysis of the CPA (without CDM)

Sensitivity test	Variation	IRR
Base	-	[XX]

Capital cost	-10%	[XX]
O&M costs	-10%	[XX]
Bio-fertilizer price	10%	[XX]
Amount of bio-fertilizer produced	10%	[XX]

As can be seen, the IRRs remain below the benchmark after variations on the chosen financial parameters. The sensitivity analysis thus confirmed that the CPA is financially unattractive.

To ensure the robustness of the sensitivity test, the variation of the major financial parameters when the Project IRR reaches the benchmark was also examined as in the table below.

Table 7: Variation of financial parameters with Project IRR of [XX]% (without CDM)

Sensitivity test	Variation of the parameter to make the IRR reach [XX]%	Value
Capital cost	[XX]	[XX]
O&M costs	[XX]	[XX]
Bio-fertilizer price	[XX]	[XX]
Amount of bio-fertilizer produced	[XX]	[XX]

The above variations are unlikely to happen, justifications as below:

[Explanation of why the above variations are unlikely to happen.]

B.4. Description of the sources and gases included in the project boundary and proof that the small-scale CPA is located within the geographical boundary of the registered PoA.

In line with paragraph 13 of AMS-III.F (Version 10), the project boundary is the physical, geographical site:

(a) Where the solid waste would have been disposed and the methane emission occurs in absence of the proposed project activity;
(b) In the case of projects co-composting wastewater, where the co-composting wastewater would have been treated anaerobically in the absence of the project activity;
(c) Where the treatment of biomass through composting takes place;
(d) Where the products from composting (compost) is handled, disposed, submitted to soil application, or treated thermally/mechanically;
(e) And the itineraries between them (a, b, c, and d), where the transportation of waste, wastewater, where applicable manure, product of treatment (compost) occurs.

[Process diagram]

Figure 3: Baseline and project boundary

Table 8 summarizes the GHGs and emission sources included in or excluded from the project boundary for the emission reductions calculation.

Table 8: Overview on emissions sources included in or excluded from the project boundary

	Source	Gas	Included?	Justification / Explanation
sel in	Disposal of biomass in landfills	CO_2	No	CO_2 emissions from biomass decay in landfills is considered GHG neutral.

		CH_4	Yes	Methane emission from biomass decay in the landfills.
		N_2O	No	Not significant. Excluded for simplification and conservativeness.
	Wastewater treatment processes (open lagoons)	CO_2	No	CO_2 emissions from biomass decay in landfills is considered GHG neutral.
		CH_4	Yes	Methane emission from anaerobic process
		N_2O	No	Not significant. Excluded for simplification and conservativeness.
Project activity	Composting process	CO_2	No	CO_2 emissions from biomass decay in landfills is considered GHG neutral.
		CH_4	Yes	Methane emissions for composting of organic waste.
		N_2O	No	Excluded for simplification.
	Transportation of biomass and wastewater	CO_2	Yes	CO_2 emissions from combustion of fossil fuel in transport vehicles.
		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.
	Electricity and/or fossil fuel consumption	CO_2	Yes	CO_2 emissions from energy consumption of all equipment/devices installed by the project activity.
		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.

B.5. Emission reductions:

B.5.1. Data and parameters that are available at validation:

Data / Parameter:	φ_y
Data unit:	-
Description:	*Model correction factor to account for model uncertainties*
Source of data used:	*Default value as per "Emission from solid waste disposal sites (version 06.0.1)"*
Value applied:	*[To be determined at each CPA]*
Justification of the choice of data or description of measurement methods and procedures actually applied :	*Option 1 was chosen.* *For baseline emissions: refer to table below to identify the appropriate factor based on the climate where the SWDS is located.* *Humid/wet conditions* — *0.85* *Dry conditions* — *0.8*
Any comment:	*According to Weatherbase, the mean annual precipitation is [XX].*

Data / Parameter:	***OX***
Data unit:	-
Description:	*Oxidation factor (reflecting the amount of methane from SWDS that is oxidized*

	in the soil or other material covering the waste)
Source of data used:	*Based on an extensive review of published literature on this subject, including the IPCC 2006 Guidelines for National Greenhouse Gas Inventories*
Value applied:	*0.1*
Justification of the choice of data or description of measurement methods and procedures actually applied :	-
Any comment:	*When methane passes through the top-layer, part of it is oxidized by methanotrophic bacteria to produce CO_2. The oxidation factor represents the proportion of methane that is oxidized to CO_2 This should be distinguished from the methane correction factor (MCF) which is to account for the situation that ambient air might intrude into the SWDS and prevent methane from being formed in the upper layer of SWDS*

Data / Parameter:	***F***
Data unit:	*Volume fraction*
Description:	*Fraction of methane in the SWDS gas*
Source of data used:	*IPCC 2006 Guidelines for National Greenhouse Gas Inventories*
Value applied:	*0.5*
Justification of the choice of data or description of measurement methods and procedures actually applied :	-
Any comment:	*Upon biodegradation, organic material is converted to a mixture of methane and carbon dioxide*

Data / Parameter:	$DOC_{f,y}$
Data unit:	*Weight fraction*
Description:	*Fraction of degradable organic carbon (DOC) in MSW that decomposes in the SWDS*
Source of data used:	*IPCC 2006 Guidelines for National Greenhouse Gas Inventories*
Value applied:	*0.5*
Justification of the choice of data or description of measurement methods and procedures actually applied :	*For Application B of "Emissions from solid waste disposal sites (version 06.0.1)", default value was chosen.*
Any comment:	-

Data / Parameter:	MCF_y
Data unit:	-

Description:	*Methane correction factor*
Source of data used:	*IPCC 2006 Guidelines for National Greenhouse Gas Inventories*
Value applied:	*[To be determined at each CPA]*
Justification of the choice of data or description of measurement methods and procedures actually applied :	- *As* [XX], *value for "*[XX]*" was employed.*
Any comment:	*MCF accounts for the fact that unmanaged SWDS produce less methane from a given amount of waste than managed SWDS, because a larger fraction of waste decomposes aerobically in the top layers of unmanaged SWDS. In case of a water table above the bottom of the SWDS, a larger proportion of the SWDS is anaerobic and MCF shall be estimated according to the tool "Emissions from solid waste disposal sites (version 06.0.1)"*

Data / Parameter:	DOC_j
Data unit:	*Weight fraction*
Description:	*Fraction of degradable organic carbon in the waste type j*
Source of data used:	*IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Tables 2.4 and 2.5)*
Value applied:	*0.20*
Justification of the choice of data or description of measurement methods and procedures actually applied :	*For MSW, the following values for the different waste types j should be applied:*

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

For empty fruit brunches (EFB), as their characteristics are similar to garden waste, the value for garden, yard and park waste in the above table may be used as a default.

If a waste type is not comparable to MSW and can not clearly be described as a combination of waste types in the table above or if a default value is not available or if the project participants wish to measure DOCj, then, project participants should measure DOC_j *in an ignition loss test according to the procedure in EN 15169 or similar national or international standards. This measurement is only required once for each waste type j and the value determined for* DOC_j *remains valid during the crediting period.*

Any comment:	*The procedure for the ignition loss test is described in BS EN 15169:2007 "Characterization of waste. Determination of loss on ignition in waste, sludge and sediments".*

	The percentages listed in table above are based on a wet waste basis which are concentrations in the waste as it is delivered to the SWDS. The IPCC Guidelines also specify DOC values on a dry waste basis, which are the concentrations after complete removal of all moist from the waste, which is not believed practical for this situation.

Data / Parameter:	k_j
Data unit:	*1/yr*
Description:	*Decay rate for the waste type j*
Source of data used:	*IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Table 3.3)*
Value applied:	*[To be determined at each CPA]*
Justification of the choice of data or description of measurement methods and procedures actually applied :	*Apply the following default values for the different waste types j*

Waste type j		*Boreal and Temperate (MAT≤20°C)*		*Tropical (MAT>20°C)*	
		Dry (MAP/PT <1)	*Wet (MAP/PET >1)*	*Dry (MAP< 1000mm)*	*Wet (MAP> 1000mm)*
Slowly degrading	*Pulp, paper, Cardboard (other than sludge), textiles*	*0.04*	*0.06*	*0.045*	*0.07*
	Wood, wood products and straw	*0.02*	*0.03*	*0.025*	*0.035*
Moderately degrading	*Other (nonfood) organic putrescible garden and park waste*	*0.05*	*0.10*	*0.065*	*0.17*
Rapidly degrading	*Food, food waste, sewage sludge, beverages and tobacco*	*0.06*	*0.185*	*0.085*	*0.40*

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

If a waste type disposed in a SWDS can not clearly be attributed to one of the waste types in the table above, project participants should choose, among the waste types that have similar characteristics, the waste type where the values of DOC_j and k_j result in a conservative estimate (lowest emissions), or request a revision of/deviation from this methodology
In the case of EFB, as their characteristics are similar to garden waste, the parameter values correspondent of garden waste shall be used. In case of sludge from pulp and paper industry, a conservative value of 0.03 shall be used for all precipitation and temperature combinations

Any comment:	*According to* [XX]*, the mean annual minimum temperature of [XX] is [XX]°C, and the mean annual precipitation is [XX]mm.*

Data / Parameter:	$MCF_{ww,treatment,BL,i}$
Data unit:	-
Description:	*Methane correction factor for baseline wastewater treatment systems i*
Source of data used:	*"2006 IPCC Guidelines for National Greenhouse Gas Inventories" default values (Chapter 6 of Volume 5, Table 6.8).* *Table III.H.1 in AMS-III.H, version 16.*
Value applied:	*[To be determined at each CPA]*
Justification of the choice of data or description of measurement methods and procedures actually applied :	*The depth of the anaerobic lagoons in the baseline wastewater treatment system is [more/less] than 2 meters, therefore MCF value is chosen as [XX].*
Any comment:	

Data / Parameter:	$\eta_{COD,BL,i}$
Data unit:	-
Description:	*Chemical oxygen demand removal efficiency of the baseline treatment system i*
Source of data used:	*Calculated*
Value applied:	*[To be determined at each CPA]*
Justification of the choice of data or description of measurement methods and procedures actually applied :	*According to AMS-III.H, [COD removal efficiency shall be determined as per paragraph 26, 27 or 28 of AMS-III.H.]*
Any comment:	-

Data / Parameter:	UF_{BL}
Data unit:	-
Description:	*Model correction factor to account for model uncertainties (baseline)*
Source of data used:	*Default value from AMS-III.H, version 16.*
Value applied:	*0.89*
Justification of the choice of data or description of measurement methods and procedures actually applied :	*FCCC/SBSTA/2003/10/Add.2, page 25.*
Any comment:	-

Data / Parameter:	$B_{o,\,ww}$
Data unit:	*kg CH_4/kg COD*
Description:	*Methane producing capacity of the wastewater.*

Source of data used:	*2006 IPCC Guidelines*
Value applied:	*0.25*
Justification of the choice of data or description of measurement methods and procedures actually applied :	-
Any comment:	-

Data / Parameter:	EF_{CO2}
Data unit:	*kg CO_2/km*
Description:	*CO_2 emission factor from fuel use due to transportation*
Source of data used:	*2006 IPCC Guidelines*
Value applied:	*[To be determined at each CPA]*
Justification of the choice of data or description of measurement methods and procedures actually applied :	*[XX]*
Any comment:	-

Data / Parameter:	$EF_{EL,i,y}$
Data unit:	*t CO_2/MWh*
Description:	*Emission factor for electricity generation for source j in year*
Source of data used:	*[XX]*
Value applied:	*[To be determined at each CPA]*
Justification of the choice of data or description of measurement methods and procedures actually applied :	*[XX]*
Any comment:	*[XX]*

Data / Parameter:	$EF_{FF,I,y}$
Data unit:	*t CO_2/ l*
Description:	*Emission factor of fuel type i in year y*
Source of data used:	*2006 IPCC Guidelines*
Value applied:	*[To be determined at each CPA]*
Justification of the choice of data or description of measurement methods and procedures actually applied :	*[XX]*

Any comment:	-

B.5.2. Ex-ante calculation of emission reductions:

According to AMS-III.F (version 10), in the case of construction of new composting facilities, the annual emission reductions for the proposed project (ER_y) are measured as follow:

$$ER_y = BE_y - \left(PE_y + LE_y\right)$$

Where:

ER_y	*Emission reduction in year y (tCO_2e).*
BE_y	*Baseline emissions in year y (tCO_2e).*
PE_y	*Project activity emissions in year y (tCO_2e).*
$LE_{y,}$	*Leakage emissions in year y (tCO_2e).*

Baseline emissions

Baseline emissions shall exclude emissions of methane that would have to be captured, fuelled or flared to comply with national or local safety requirement or legal regulations.

$$BE_y = BE_{CH4,SWDS,y} + BE_{ww,y} + BE_{CH4,manure,y} - MD_{y,reg} * GWP_CH_4$$

Where

$BE_{CH4,SWDS,y}$	Yearly methane generation potential of the solid waste composted by the project activity during the years x from the beginning of the project activity (x=1) up to the year y estimated as per the latest version of the 'Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site' (tCO2e). With the definition of year x as 'the year since the project activity started diverting wastes from landfill disposal, x runs from the first year of crediting period (x=1) to the year for which emissions are calculated (x=y)'
$BE_{ww,y}$	Baseline emissions from the wastewater co-composted, calculated as per the procedures in AMS-III.H
$BE_{CH4,manure,y}$	Baseline emissions from manure composted by the project activities, calculated as per the procedures in AMS-III.D
$MD_{y,reg}$	Amount of methane that would have to be captured and combusted in the year y to comply with the prevailing regulations (tonne)
GWP_CH_4	GWP for CH4

Baseline methane emissions occurring in year y generated from waste disposal at a SWDS during a time period ending in year y ($BE_{CH4,SWDS,y}$)

As per the *"Emissions from solid waste disposal sites (version 06.0.1)"*, the amount of methane generated from disposal of waste at the SWDS is calculated based on a first order decay (FOD) model.

The tool can be used to determine emissions for the following types of applications:

- Application A: The CDM project activity mitigates methane emissions from a specific existing SWDS
- Application B: The CDM project activity avoids or involves the disposal of waste at a SWDS.

For the CPA, bio-solid wastes will be composted, which is then prevented from being disposed of in a landfill. The methane is generated from waste disposed or avoided from disposal during the crediting period. Thus, Application B is chosen for determining parameters in the tool.

$$BE_{CH4,SWDS,y} = \varphi_y \cdot (1 - f_y) \cdot GWP_{CH4} \cdot (1 - OX) \cdot \frac{16}{12} \cdot F \cdot DOC_{f,y} \cdot MCF_y \cdot \sum_{x=1}^{y} \sum_{j} W_{j,x} \cdot DOC_j \cdot e^{-k_j(y-x)} \cdot (1 - e^{-k_j})$$

Where

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

Year	Year disposal (x)	Crediting (y)	$W_{j,x}$ (t)	DOC_j (% wet waste)	k_j	Cumulative waste (t)
[XX]	1	1	[XX]	[XX]	[XX]	[XX]
[XX]	2	2	[XX]			[XX]
[XX]	3	3	[XX]			[XX]
[XX]	4	4	[XX]			[XX]
[XX]	5	5	[XX]			[XX]
[XX]	6	6	[XX]			[XX]
[XX]	7	7	[XX]			[XX]
[XX]	8	8	[XX]			[XX]
[XX]	9	9	[XX]			[XX]
[XX]	10	10	[XX]			[XX]

Year	$BE_{CH4,SWDS,y}$ (tCO_2e)	φ_y	f_y	GWP_{CH4} (tCO_2e/ tCH_4)	OX	F	$DOC_{f,y}$	MCF_y	Cumulative waste (t)
[XX]	[XX]	[XX]	[XX]	21	0.10	0.50	0.50	[XX]	[XX]
[XX]	[XX]		[XX]						[XX]
[XX]	[XX]		[XX]						[XX]
[XX]	[XX]		[XX]						[XX]
[XX]	[XX]		[XX]						[XX]

[XX]	[XX]		[XX]						[XX]
[XX]	[XX]		[XX]						[XX]
[XX]	[XX]		[XX]						[XX]
[XX]	[XX]		[XX]						[XX]
[XX]	[XX]		[XX]						[XX]

Baseline emissions of the wastewater treatment systems affected by the project activity in year y ($BE_{ww,y}$)

According to *"AMS-III.H Methane recovery in wastewater treatment (version 16.0)"*, the methane emissions from the baseline wastewater treatment systems affected by the project are determined using the COD removal efficiency of the baseline plant:

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

Where:

$Q_{ww,i,y}$	*Volume of wastewater treated in baseline wastewater treatment system i in year y (m^3). For ex ante estimation, forecasted wastewater generation volume or the designed capacity of the wastewater treatment facility can be used[4]. However, the ex post emissions reduction calculation shall be based on the actual monitored volume of treated wastewater*
$COD_{inflow,y}$	*Chemical oxygen demand of the wastewater inflow to the baseline treatment system in year y (t/m^3).*
$\eta_{COD,BL,i}$	*COD removal efficiency of the baseline treatment system i.*
$MCF_{ww,treatmen}$	*Methane correction factor for baseline wastewater treatment system i.*
$B_{o,ww}$	*Methane producing capacity of the wastewater ($kgCH_4/kgCOD$).*
UF_{BL}	*Model correction factor to account for model uncertainties.*
GWP_{CH4}	*Global Warming Potential for methane (tCO_2/tCH_4).*

Year	$BE_{ww,y}$ (tCO_2e)	$Q_{ww,i,y}$ (m^3)	$COD_{inflow,y}$ (t/m^3)	$\eta_{COD,BL}$	$MCF_{ww,treatment,BL}$	$B_{o,ww}$ (kg CH_4/kg COD)	UF_{BL}
[XX]	[XX]	[XX]	[XX]				
[XX]	[XX]	[XX]	[XX]				
[XX]	[XX]	[XX]	[XX]				
[XX]	[XX]	[XX]	[XX]				
[XX]	[XX]	[XX]	[XX]	[XX]	[XX]	0.25	0.89
[XX]	[XX]	[XX]	[XX]				
[XX]	[XX]	[XX]	[XX]				
[XX]	[XX]	[XX]	[XX]				
[XX]	[XX]	[XX]	[XX]				
[XX]	[XX]	[XX]	[XX]				

Baseline emissions from manure composted by the project activities ($BE_{CH4,manure,y}$)

No manure is composted by the project activity, thus, this term shall be neglected.

[4] *It is noted that some wastewater is required in the co-composting system for moisture and pH control and this is in the order of 10% of the total wastewater, i.e. not all of the wastewater generated in the baseline is required for the CPA.*

Amount of methane that would have to be captured and combusted in the year y to comply with the prevailing regulations ($MD_{y,reg}$)

In Malaysia, there are no prevailing regulations which require methane to be captured and combusted. Therefore, this term is not accounted for.

Project emission

$$PE_y = PE_{y,transp} + PE_{y,power} + PE_{y,comp} + PE_{y,runoff} + PE_{y.res\ waste}$$

Where

PE_y	Project activity emissions in the year y (tCO_2e)
$PE_{y,transp}$	Emissions from incremental transportation in the year y (tCO_2e)
$PE_{y,power}$	Emissions from electricity or fossil fuel consumption in the year y (tCO_2e)
$PE_{y,comp}$	Methane emissions during composting process in the year y(tCO_2e)
$PE_{y,runoff}$	Methane emissions from runoff water in the year y (tCO_2e)
$PE_{y,res\ waste}$	Methane emissions from the anaerobic decay of the residual organic content (tCO_2e)

Year	PE_y (tCO_2e)	$PE_{y,transp}$ (tCO_2e)	$PE_{y,power}$ (tCO_2e)	$PE_{y,comp}$ (tCO_2e)	$PE_{y,runoff}$ (tCO_2e)	$PE_{y,res\ waste}$ (tCO_2e)
[XX]	[XX]	[XX]	[XX]	[XX]	-	-
[XX]	[XX]	[XX]	[XX]	[XX]	-	-
[XX]	[XX]	[XX]	[XX]	[XX]	-	-
[XX]	[XX]	[XX]	[XX]	[XX]	-	-
[XX]	[XX]	[XX]	[XX]	[XX]	-	-
[XX]	[XX]	[XX]	[XX]	[XX]	-	-
[XX]	[XX]	[XX]	[XX]	[XX]	-	-
[XX]	[XX]	[XX]	[XX]	[XX]	-	-
[XX]	[XX]	[XX]	[XX]	[XX]	-	-
[XX]	[XX]	[XX]	[XX]	[XX]	-	-

Emissions from** incremental transportation **in the year y ($PE_{y,transp}$)

Project emissions due to incremental transport distances are calculated based on the incremental distances between:

i. The collection points of biomass and/or manure and the compost treatment site as compared to the baseline or manure treatment site;
ii. When applicable, the collection points of wastewater and treatment site as compared to baseline wastewater treatment site;
iii. Treatment sites and the sites for soil application, landfilling and further treatment of the produced compost.

$$PE_{y,transp} = (Q_y/CT_y) * DAF_w * EF_{CO2} + (Q_{y,treatment}/CT_{y,treatment}) * DAF_{treatment} * EF_{CO2}$$

Where

Q_y	Quantity of raw waste/manure treated and/or wastewater cotreated in the year y (tonnes)
CT_y	Average truck capacity for transportation (tonnes/truck)
DAF_w	Average incremental distance for raw solid waste/manure and/or wastewater transportation (km/truck)
EF_{CO2}	CO_2 emission factor from fuel use due to transportation ($kgCO_2$/km, IPCC default values or local values may be used)
$Q_{y,treatment}$	Quantity of compost produced in year y (tonnes)
$CT_{y,treatment}$	Average truck capacity for compost transportation (tonnes/truck)
$DAF_{treatment}$	Average distance for compost transportation (km/truck)

Year	$PE_{y,transp}$ (tCO_2e)	Q_y (t, wet basis)	CT_y (t/ truck)	DAF_w (km/truck)	EF_{CO2} ($kgCO_2$/km)	$Q_{y,treatment}$ (t)	$CT_{y,treatment}$ (t/truck)	$DAF_{treatment}$ (km/truck)
[XX]	[XX]	[XX]	[XX]	[XX]	[XX]	[XX]	[XX]	[XX]
[XX]	[XX]	[XX]				[XX]		
[XX]	[XX]	[XX]				[XX]		
[XX]	[XX]	[XX]				[XX]		
[XX]	[XX]	[XX]				[XX]		
[XX]	[XX]	[XX]				[XX]		
[XX]	[XX]	[XX]				[XX]		
[XX]	[XX]	[XX]				[XX]		
[XX]	[XX]	[XX]				[XX]		
[XX]	[XX]	[XX]				[XX]		

Emissions from electricity or fossil fuel consumption in the year y ($PE_{y,power}$)

For the calculation of project emissions from electricity and/or fossil fuel consumption by the project activity facilities all the energy consumption of all equipment/devices installed by the project activity shall be included e.g. energy used for aeration and/or turning of compost piles/heaps, chopping of biomass for size reduction, screening, drying of the final compost product and for the runoff wastewater treatment. The project emission from electricity is:

$$PE_{y,power} = PE_{EC,y} + PE_{FC,j,y}$$

$$PE_{y,power} = \sum_j EC_{PJ,j,y} \times EF_{EL,j,y} + \sum_i FC_{i,j,y} \times EF_{FF,j,y}$$

Where:

$PE_{EC,y}$	*Project emissions from electricity consumption in year y(tCO_2/yr)*
$PE_{FC,j,y}$	*Project emissions from fossil fuel combustion in process j during the year y (tCO_2/yr)*
$EC_{PJ,j,y}$	*Quantity of electricity consumed by the project electricity consumption source j in year y (MWh/yr)*
$EF_{EL,j,y}$	*Emission factor for electricity generation for source j in year y (tCO_2/ MWh)*
$FC_{i,j,y}$	*Quantity of fuel type i combusted in process j during the year y (mass or volume unit/yr);*
$EF_{FF,j,y}$	*Emission factor for fuel type i in year y (tCO_2/mass or volume unit)*

	$PE_{y,power}$ (tCO_2e)	$EC_{PJ,y}$ (MWh)	EF_{EL} (tCO2/ MWh)	$FC_{PJ,y}$ (litre)	EF_{FF} (tCO_2/ litre)
[XX]	[XX]	[XX]	[XX]	[XX]	[XX]
[XX]	[XX]	[XX]		[XX]	
[XX]	[XX]	[XX]		[XX]	
[XX]	[XX]	[XX]		[XX]	
[XX]	[XX]	[XX]		[XX]	
[XX]	[XX]	[XX]		[XX]	
[XX]	[XX]	[XX]		[XX]	
[XX]	[XX]	[XX]		[XX]	
[XX]	[XX]	[XX]		[XX]	
[XX]	[XX]	[XX]		[XX]	

Methane emissions during composting process in the year y ($PE_{y,comp}$)

Methane emissions during composting shall be calculated as follows:

$$PE_{y,comp} = Q_y * EF_{composting} * GWP_CH_4$$

Where

$EF_{composting}$ Emission factor for composting of organic waste and/or manure (t CH_4/ton waste treated). Emission factors can be based on facility/site-specific measurements, country specific values or IPCC default values.

	$PE_{y,comp}$ (tCO_2e)	Q_y (t, dry basis)	$EF_{cpmosting}$ (t CH_4/ton waste treated)	GWP_{CH4} (tCO_2e/ tCH_4)
[XX]	[XX]	[XX]	[XX]	21
[XX]	[XX]	[XX]	[XX]	
[XX]	[XX]	[XX]	[XX]	
[XX]	[XX]	[XX]	[XX]	
[XX]	[XX]	[XX]	[XX]	
[XX]	[XX]	[XX]	[XX]	
[XX]	[XX]	[XX]	[XX]	
[XX]	[XX]	[XX]	[XX]	
[XX]	[XX]	[XX]	[XX]	
[XX]	[XX]	[XX]	[XX]	

Methane emissions from runoff water in the year y ($PE_{y,runoff}$)

Under the CPA, all leachate from the AeroPod composting modules will be collected and recycled in the AeroPod process, and there will be no runoff water leaving the composting facility.

Methane emissions from the anaerobic decay of the residual organic content ($PE_{y,res\ waste}$)

The produced compost is not subjected to anaerobic storage or disposed in a landfill. The compost will be transported by truck to the final end-use site for land application frequently. Thus, this term is not relevant.

Leakage (LE_y)
If the project technology is the equipment transferred from another activity or if the existing equipment is transferred to another activity, leakage effects are to be considered

For each CPA, biomass wastes are collected and used, according to the *"General guidance on leakage in biomass project activities (version 03)"* (attachment C to Appendix B), the biomass type of each CPA is "biomass residues or wastes", the emission source that is potentially significant and attributable to the CPAs is "competing uses of biomass". Assessment on whether the quantity of available biomass in [the CPA region], is [XX]% larger than the quantity of biomass that is utilised including the CPA is conduct (See [Annex X]). Thus, this source of leakage is [yes/ no] considered to be zero.

B.5.3. Summary of the ex-ante estimation of emission reductions:

Year	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of project activity emissions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of overall emission reductions (tonnes of CO_2e)
1 [YYYY]	[XX]	[XX]	[XX]	[XX]
2 [YYYY]	[XX]	[XX]	[XX]	[XX]
3 [YYYY]	[XX]	[XX]	[XX]	[XX]
4 [YYYY]	[XX]	[XX]	[XX]	[XX]
5 [YYYY]	[XX]	[XX]	[XX]	[XX]
6 [YYYY]	[XX]	[XX]	[XX]	[XX]
7 [YYYY]	[XX]	[XX]	[XX]	[XX]
8 [YYYY]	[XX]	[XX]	[XX]	[XX]
9 [YYYY]	[XX]	[XX]	[XX]	[XX]
10 [YYYY]	[XX]	[XX]	[XX]	[XX]
Total (tonnes of CO_2e)	[XX]	[XX]	[XX]	[XX]

B.6. Application of the monitoring methodology and description of the monitoring plan:

B.6.1. Description of the monitoring plan:

1. Implementation of the monitoring plan

The CME/ CPA implementer will be responsible for implementation of the monitoring plan. The planned operation and management structure for the CPA is described in Figure 4 below.

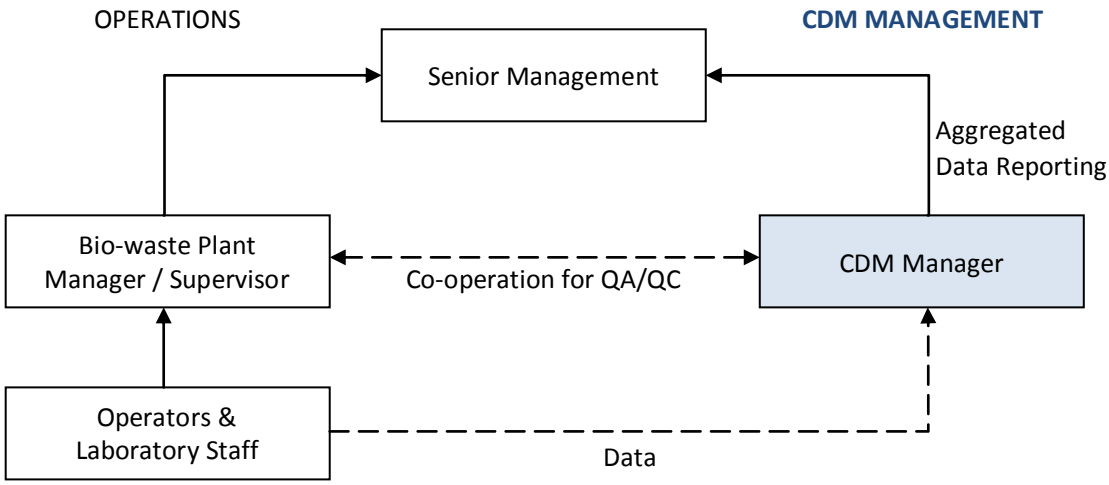

Figure 4: Operation and Management Structure for Monitoring Activities

2. Staff training

Staff will be trained on the safe and proper operation of major equipments such as the shredder, mixer, screener and AeroPod®, and will also be trained on the monitoring equipment installed. Such training will be carried out prior to the commissioning of the CPA plant, and will be documented.

3. Data recording and archiving

(a) Data recording

Recording will be done online for as many parameters as possible, though the exact meters to be connected is yet to be determined. For manual records (including backup manual recording when there is an error with the online system for parameters normally recorded online), recording will be carried out once daily where measurement is continuous, and as and when measurements occur for when measurement is done on batch basis (e.g. weekly COD measurements).

(b) Data archiving

All monitored data will be archived for the duration of the crediting period and 2 years thereafter.

4. Emergency procedures

A standard operating procedure (SOP), which describes the operation of the composting facility, will be prepared. Emergency procedures are defined in the SOP. In case of the monitoring equipment fails, backup equipments will be in place.

Monitoring parameters

Data / Parameter:	f_y
Data unit:	-

Description:	*Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere in year y*
Source of data to be used:	*According to "Emissions from solid waste disposal sites", for project activity involves disposal of waste at SWDS (Application B), this parameter shall be monitored.* *Select the maximum value from the following:* *(a) contract or regulation requirements specifying the amount of methane that must be destroyed/used (if available) and* *(b) historic data on the amount captured*
Value of data applied for the purpose of calculating expected emission reductions in section B.5	*[To be determined at each CPA]*
Description of measurement methods and procedures to be applied:	*Monitoring frequency* *Annually*
QA/QC procedures to be applied:	-
Any comment:	*For Application B.*

Data / Parameter:	$W_{j,x}$
Data unit:	*t*
Description:	*Total amount of waste type j disposed in a SWDS in year x*
Source of data to be used:	*Measurements by [CPA implementer] / NOSB*
Value of data applied for the purpose of calculating expected emission reductions in section B.5	*[To be determined at each CPA]*
Description of measurement methods and procedures to be applied:	*Measure on wet basis* *[Details to be included at each CPA]* *Monitoring frequency* *Continuously, aggregated at least annually for year x*
QA/QC procedures to be applied:	-
Any comment:	*For Application B.*

Data / Parameter:	GWP_{CH4}
Data unit:	$t\ CO_2e\ /\ t\ CH_4$
Description:	*Global Warming Potential of methane*

Source of data to be used:	*IPCC 2006 Guidelines for National Greenhouse Gas Inventories*
Value of data applied for the purpose of calculating expected emission reductions in section B.5	*21 for the first commitment period.*
Description of measurement methods and procedures to be applied:	*Shall be updated for future commitment periods according to any future COP/MOP decisions*
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	$Q_{ww,i,y}$
Data unit:	*m^3/month*
Description:	*The flow of wastewater*
Source of data to be used:	*Measured by [CPA implementer] / NOSB*
Value of data applied for the purpose of calculating expected emission reductions in section B.5	*[To be determined at each CPA]*
Description of measurement methods and procedures to be applied:	*Measurements are undertaken using flow meters.* *Monitoring frequency* *Monitored continuously (at least hourly measurements are undertaken, if less, confidence/precision level of 90/10 shall be attained).*
QA/QC procedures to be applied:	*Calibration will be undertaken from one of the following, from most to least preferred:* *(a) According to the manufacturer's instructions;* *(b) According to national / industry standards, if available;* *(c) At least once every three years.*
Any comment:	-

Data / Parameter:	$COD_{ww,untreated,y}$
Data unit:	*t COD /m^3*
Description:	*Chemical oxygen demand of the wastewater before the treatment system affected by the project activity*
Source of data to be used:	*Measured by [CPA implementer]/ NOSB*
Value of data applied for the purpose of calculating expected	*[To be determined at each CPA]*

emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	*Measure the COD according to national or international standards. COD is measured through representative sampling.* *Monitoring frequency* *Samples and measurements shall ensure a 90/10 confidence/precision level.To meet this 90/10 confidence/precision level comfortably, COD measurements will be carried out on a weekly basis in-house.*
QA/QC procedures to be applied:	*Calibration will be carried out according to manufacturer's instructions.*
Any comment:	-

Data / Parameter:	Q_y
Data unit:	*tonnes*
Description:	*Quantity of raw waste/manure treated and/or wastewater cotreated in the year y*
Source of data to be used:	*Measured by [CPA implementer] / NOSB*
Value of data applied for the purpose of calculating expected emission reductions in section B.5	*[To be determined at each CPA]*
Description of measurement methods and procedures to be applied:	*On-site data sheets recorded monthly using weigh bridge.* *Weighbridge will be subject to periodic calibration (in accordance with stipulation of the weighbridge supplier), also cross check with sales of compost* *Monitoring frequency* *Monthly*
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	CT_y
Data unit:	*Tonnes/ truck*
Description:	*Average truck capacity for transportation*
Source of data to be used:	*On site measurement*
Value of data applied for the purpose of calculating expected emission reductions in section B.5	*[To be determined at each CPA]*
Description of measurement methods and procedures to be	-

applied:	
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	$Q_{y,treatment}$
Data unit:	*tonnes*
Description:	*Quantity of compost produced in the year y*
Source of data to be used:	*Measured by [CPA implementer] / NOSB*
Value of data applied for the purpose of calculating expected emission reductions in section B.5	*[To be determined at each CPA]*
Description of measurement methods and procedures to be applied:	*On-site data sheets recorded monthly using weigh bridge.* *Weighbridge will be subject to periodic calibration (in accordance with stipulation of the weighbridge supplier), also cross check with sales of compost* *Monitoring frequency* *Monthly*
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	$CT_{y,treatment}$
Data unit:	*Tonnes/ truck*
Description:	*Average truck capacity for compost transportation*
Source of data to be used:	*On site measurement*
Value of data applied for the purpose of calculating expected emission reductions in section B.5	*[To be determined at each CPA]*
Description of measurement methods and procedures to be applied:	-
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	DAF_w
Data unit:	*km/ truck*
Description:	*Average incremental distance for raw solid waste/manure and/or wastewater transportation*

Source of data to be used:	*On site measurement*
Value of data applied for the purpose of calculating expected emission reductions in section B.5	*[To be determined at each CPA]*
Description of measurement methods and procedures to be applied:	*Monitoring frequency* *Annually*
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	$DAF_{w,treatment}$
Data unit:	*km/ truck*
Description:	*Average distance for compost transportation*
Source of data to be used:	*On site measurement*
Value of data applied for the purpose of calculating expected emission reductions in section B.5	*[To be determined at each CPA]*
Description of measurement methods and procedures to be applied:	*Monitoring frequency* *Annually*
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	$EC_{PJ,y}$
Data unit:	*MWh/yr*
Description:	*Quantity of electricity consumed by the project electricity consumption in year y*
Source of data to be used:	*Measured by [CPA implementer] / NOSB*
Value of data applied for the purpose of calculating expected emission reductions in section B.5	*[To be determined at each CPA]*
Description of measurement methods and procedures to be applied:	*This parameter will be measured continuously by electricity meters. Alternatively the consumption can be calculated by assuming that all relevant electrical equipment operate at full rated capacity for 8,760 hours per year, with 10% added to account for distribution losses.*

QA/QC procedures to be applied:	*Industry standards will be adhered to for calibration. In the absence of industry standards, the electricity meters will either be calibrated or replaced every 12 months*
Any comment:	*The CPA plans to use carbon-neutral electricity provided by SOM. However, the CPA may supplement by diesel genset when required. In such as case, separate electricity meters will be installed for each source and $EC_{PJ,y}$ will therefore be the sum of the two meters.*

Data / Parameter:	$FC_{PJ,y}$
Data unit:	*L/yr*
Description:	*Amount of fossil fuel consumed by the project activity in year y*
Source of data to be used:	*Measured by [CPA implementer] / NOSB*
Value of data applied for the purpose of calculating expected emission reductions in section B.5	*[To be determined at each CPA]*
Description of measurement methods and procedures to be applied:	*Diesel will be used to power machinery such as front end loaders. Diesel will be drawn from SOM's diesel refuelling station, which will monitor the amount of diesel used by the CPA.*
QA/QC procedures to be applied:	*Readings from SOM's refuelling point will be consistent with the purchase receipt issued by SOM.*
Any comment:	-

Data / Parameter:	$EF_{composting}$
Data unit:	*t CH_4/ ton waste treated*
Description:	*Emission factor for composting of organic waste and/or manure*
Source of data to be used:	*Measured by [CPA implementer] / NOSB / Default value as per AMS-III.F (version 10.0)*
Value of data applied for the purpose of calculating expected emission reductions in section B.5	*0*
Description of measurement methods and procedures to be applied:	*$EF_{composting}$ can be set to zero for the portions of Q_y for which the monitored oxygen content of the composting process is above 8%.*
QA/QC procedures to be applied:	-
Any comment:	*If $EF_{composting}$ is not monitored, IPCC default values of 0.01 kg CH_4/kg waste treated on a dry weight basis and 0.004 kg CH_4/kg waste treated on a wet weight basis can be applied.*

Data / Parameter:	***Check of aerobic conditions of the composting process***

Data unit:	-
Description:	-
Source of data to be used:	*Measured by the project participants*
Value of data applied for the purpose of calculating expected emission reductions in section B.5	*N/A*
Description of measurement methods and procedures to be applied:	*For this purpose a portable oxygen meter with lancets of at least 1m length will be used. There will be 14 modules each filled daily and with a composting period of 14 days. Thus, at any one time, the 14 modules will represent the different stages of the composting process. A weekly sampling of all 14 modules will be carried out*[5].
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	$Q_{y,ww,runoff}$
Data unit:	*The runoff wastewater from composting yard*
Description:	m^3
Source of data to be used:	*By the project participants*
Value of data applied for the purpose of calculating expected emission reductions in section B.5	*0*
Description of measurement methods and procedures to be applied:	*Measurements are undertaken using flow meters or direct measurement of the accumulative volume overtime. Consisting of the wastewater applied in excess (i.e. moisture over and above the field capacity of the biomass being composted) and rainwater in the case of unroofed sites* *Monitoring frequency* *Monitored with periodic measurements sufficient to comply with confidence/precision level of 90/10*
QA/QC procedures to be applied:	-
Any comment:	*This parameter will only be monitored if there is runoff. Based on the current technology configuration, there is no runoff. There is therefore expected to only be a visual confirmation.*

[5] It is clarified that the methodology AMS-III. F provided a method for windrow composting. It is not applicable to the PoA which in-vessel composting technology will be employed. Thus, a measurement methods and procedures were developed

Data / Parameter:	***$COD_{y,ww,runoff}$***
Data unit:	*t COD/m^3*
Description:	*The chemical oxygen demand of the runoff wastewater from composting yard*
Source of data to be used:	*By the project participants*
Value of data applied for the purpose of calculating expected emission reductions in section B.5	*N/A*
Description of measurement methods and procedures to be applied:	*Measure the COD according to national or international standards. COD is measured through representative sampling* *Monitoring frequency* *Samples are representatively taken from unfiltered wastewater and measurements shall ensure a 90/10 confidence/precision level*
QA/QC procedures to be applied:	-
Any comment:	*This parameter will only be monitored if there is runoff.*

Data / Parameter:	***Soil application of the compost***
Data unit:	*Text*
Description:	-
Source of data to be used:	*[CPA implementer] / NOSB*
Value of data applied for the purpose of calculating expected emission reductions in section B.5	*[To be determined at each CPA]*
Description of measurement methods and procedures to be applied:	*This includes documenting sales or delivery of the compost final product. It shall also include an in situ verification of the proper soil application of the compostto ensure aerobic conditions for further decay. Such verification shall be done at representative sample of user sites.*
QA/QC procedures to be applied:	-
Any comment:	-

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:

☐ Please tick if this information is provided at the PoA level. In this case sections C.2. and C.3. need not be completed in this form.

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

The CPAs will contribute to positive environmental impacts to the neighbouring environment and neighbouring residences. The impacts are as follows:

- ***Reducing GHGs emission:*** elimination of the need to landfill EFB, [other solid wastes], and reduction in the amount of POME flowing to the open lagoon system. Both result in reduction of methane emitted during the decomposition process. The air quality will be improved by lessening the accompanying pungent stench from the putrefying solid wastes.

- ***Eliminating leachate run off:*** leachate from the composting process will be re-circulated in the system (a zero discharge system).

- ***Reducing use of chemical fertilizers:*** the use of replacement bio-fertilizer product by the end users will improve soil conditions in the oil palm plantations and will reduce the run-off of chemicals associated with the use of chemical fertilizers.

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

Composting industrial waste is not listed as activities prescribed under *Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 1987"*[6], thus, an environmental impact assessment (EIA) for a typical CPA is not required by the host country. An EIA exemption letter was [obtained/ applied] on [DD/MM/YYYY].

SECTION D. Stakeholders' comments

>>

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

☐ Please tick if this information is provided at the PoA level. In this case sections D.2. to D.4. need not be completed in this form.

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

The stakeholder's consultation meeting for the CPA was held by [CPA implementer] on [DD/MM/YYYY], at the [XX].

[Explain how the stakeholders were invited to the stakeholder meeting and describe the meeting process.]

[6] Department of Environment (Malaysian) http://www.doe.gov.my/v2/files/penilaian26/Appendix_2.pdf

D.3. Summary of the comments received:

During the Q&A session, in addition to questions about the composting process and product, questions about the environmental performance of the Project were raised. Questions and answers are summarized below.

Table 9: Question and answers relating to environmental performance

Question	Response
[XX]	[XX]
[XX]	[XX]

[If applicable, results of the questionnaires]

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

As all questions raised were answered during the stakeholder consultation forum and [yes/no] negative comments were received. Thus [yes/no] further action was deemed necessary.

[Description of further action, if necessary.]

Annex 1

CONTACT INFORMATION ON ENTITY/INDIVIDUAL RESPONSIBLE FOR THE SMALL-SCALE CPA

Organization:	[XX]
Street/P.O.Box:	[XX]
Building:	[XX]
City:	[XX]
State/Region:	[XX]
Postfix/ZIP:	[XX]
Country:	[XX]
Telephone:	[XX]
FAX:	[XX]
E-Mail:	[XX]
URL:	[XX]
Represented by:	[XX]
Title:	[XX]
Salutation:	[XX]
Last Name:	[XX]
Middle Name:	[XX]
First Name:	[XX]
Department:	[XX]
Mobile:	[XX]
Direct FAX:	[XX]
Direct tel:	[XX]
Personal E-Mail:	[XX]

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The CPA does [yes/no] involve public funding.

Annex 3

BASELINE INFORMATION

[If applicable, provision of further background information used in the application of the baseline methodology.]

Annex 4

MONITORING INFORMATION

[If applicable, provision of further background information used in the application of the monitoring methodology.]

Annex 5

ASSESSMENT OF EMPTY FRUIT BUNCHES (EFB) AVAILABILITY

For the CPA, biomass wastes are collected and used, according to the *"General guidance on leakage in biomass project activities (version 03)"* (attachment C to Appendix B), the biomass type of each CPA is "biomass residues or wastes", the emission source that is potentially significant and attributable to the CPAs is "competing uses of biomass". The assessment on whether the quantity of available biomass in [XX], is 25% larger than the quantity of biomass that is utilised including the CPA is conducted as follow:

1. Identifying the uses of EFB
[To be inserted at CPA level]

2. Estimating EFB availability
[To be inserted at CPA level]

3. Estimating EFB usage
[To be inserted at CPA level]

Thus, the quantity of available biomass in [XX], is [XX]% larger than the quantity of biomass that is utilised including the CPA, therefore [yes/no] leakage should be account.

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