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

CONTENTS

Annexes

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:

Felda Triang Regional Biogas PoA – CPA 1

Version : 1.0
Date : 12/03/2012

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

The CPA for Felda Triang Regional Biogas PoA – CPA 1 is developed by Felda Palm Industrial Sdn. Bhd. ("FPISB") (hereafter referred to as the "project host") who will act as "Project Implementer". It is a biogas recovery and utilization project. The CPA will be developed under the PoA of Regional Biogas PoA and it is located in Triang, Pahang, Malaysia ("host country"). It is an existing mill with a capacity to process up to 54 metric tonnes of Fresh Fruit Bunch (FFB) per hour[3]. The palm oil extraction process generates about 1.0 m^3 of palm oil mill effluent (POME) for each metric tonnes of FFB processed[4]. In order to reduce the impact on the environment, the discharge limits of POME are currently reduced by treatment in a series of lagoons in Effluent Treatment Plant ("ETP"). It consists of several steps including cooling/mixing, anaerobic, facultative, algae ponds, bio-polishing treatment systems to reduce the BOD to a level acceptable for river discharge. There is no land application of the treated effluent.

Purpose of project activity:

This project aims to mitigate methane emissions, a highly potent Greenhouse Gas resulting from anaerobic digestion of palm oil mill effluent (POME) in the open lagoons treatment system (baseline). It involves the introduction of a sequential stage wastewater treatment with biogas recovery and combustion, without sludge treatment, from an existing anaerobic wastewater treatment system without biogas recovery. The captured biogas may be utilized either in gas engine(s) for electricity generation to export to grid and/or for diesel displacement at mill and/or combusted in the biomass boiler(s) for heat generation and/or flared. Currently there are no mandatory laws or regulations in Malaysia that require biogas recovery at wastewater open lagoons system and to destroy or use it for any purpose. It is estimated that the CPA will reduce 29,280 tCO_{2e} annually.

The project activity will reduce GHG emissions by capture and destruction of methane from anaerobic decomposition of biogenic organic matter in an open lagoons treatment system, and potentially by displacing fossil fuel that would be used for electricity or heat generation in the absence of the project activity.

Environmental criterion

- The reduction of CH_4 emissions will improve the quality of the surrounding air.
- It will also reduce the GHG emissions and results in the preservation of the climate.

[3] SD 1 - Mill License EQA 1974

[4] Mill designed for existing effluent treatment system

- The new treatment plant is expected to improve the quality of the discharge water due to better management.

Social criterion

- By reducing the methane emission, the project will contribute to the health of the population in the area and nearby.
- Besides providing job opportunities, the project will also set in motion a *demonstration effect* leading to other units adopting similar activity, which would go to improve the job opportunity;
- The increased job opportunity will reduce social disparity in the society and thereby contribute to peace in the society.

Economic criterion

- The project involves a technology transfer into host country. Indeed, the open anaerobic lagoons are replaced by either bio-digester.
- Training will be provided to the locals to ensure them to be able to execute and manage the project. It leads to the increase of the local skills.
- Provide job opportunities especially for the local community live nearby.

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

Felda Palm Industrial Sdn. Bhd. is the entity responsible for the Felda Triang Regional Biogas PoA – CPA 1.

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

Technology Description:

The project activity includes the following systems:

a) The methane capture in newly built covered lagoon:

The project activity involves the introduction of a sequential stage covered lagoon(s) to an existing open lagoons system. The biogas recovery system is designed by KPSR Construction Ltd. with experience in implementing projects at palm oil mills. The project activity consists of newly constructed covered lagoon(s) anaerobic treatment system that will be built for the treatment of POME effluent and biogas recovery.

The covered lagoon treatment system developed by KPSR Construction Ltd. adopts a series of treatment processes consisting mainly of pretreatment and anaerobic degradation. Raw POME will be channeled to the cooling pond/tower intended for cooling of the effluent before being sent to the covered anaerobic digester system. The new lagoon(s) will be covered by synthetic high-density polyethylene (HDPE) geo-membrane which is sealed by means of strip-to-strip welding and a peripheral anchor trench dug around the perimeter of the existing lagoon. HDPE is an excellent product for large applications requiring UV, ozone, and chemical resistance and because of these attributes is one of the most commonly used geo-membranes worldwide.

The recovery of biogas reduces odour and prevents methane emissions. The covered lagoon system is expected to be able to achieve 90% COD treatment efficiency. The covered lagoon will utilize biogas for mixing to enhance the anaerobic processes in the system. The biogas mixing will ensure the POME is well-mixed and homogenized in the digester tank for optimum system performance. Treated POME from the covered lagoon will send to existing Facultative, Algae lagoons system and bio-polishing system for further treatment to reduce the BOD/COD to meet the discharge standard before discharging to the watercourse[5]. Existing anaerobic lagoons will be closed after the treatment systems is stable and achieving the discharge standard.

b) Flaring system:

Enclosed or open flare will be utilized to burn the excess of biogas, in case of maintenance of the gas engine(s) / boiler(s), in case no gas engine(s) / boiler is installed, or during emergency.

c) Gainful use of biogas

The technology that will be used is environmentally safe and sound: the renewable based captive power plant that will be installed will improve the security on site by controlling methane emissions. The recovered biogas will be gainfully use and it is depending on the final requirement of energy by the mill.

Recovered biogas may be combusted in gas engines for grid export and/or utilisation at the mill, while balance of biogas (if any) is sent to existing biomass boiler(s) for heat generation and thus displacing biomass (Palm Kernel Shell (PKS)), excess biogas will be combusted either in enclosed or open flare equipped with safety features. The flare type to be installed is not defined yet, it might be an enclosed flare or an open flare. Flare(s) will be operating whenever suitable, in case engines or biomass boiler(s) are unavailable.

According to theoretical volumes of biogas to be captured, the installed capacity of the power plant is likely to be 1.2 MW or more. For 1.2 MW engine, the electrical efficiency is around 41% (assumptions for ex-ante calculations).Bio-scrubber and gas drying system will be installed before the biogas is combusted in the gas engine(s).

The equipments maybe connected to the public grid electricity system to satisfy their energy needs and may use back-up such as reciprocating engines or other source of energy.

The operational lifetime of the equipment is expected to be 20 years, if the maintenance is performed correctly. No technology substitution is expected during the crediting period, unless if it appears that the chosen capacity is not adapted to the actual flow or if the equipment is damaged.

[5] SD 1 - Mill License EQA 1974

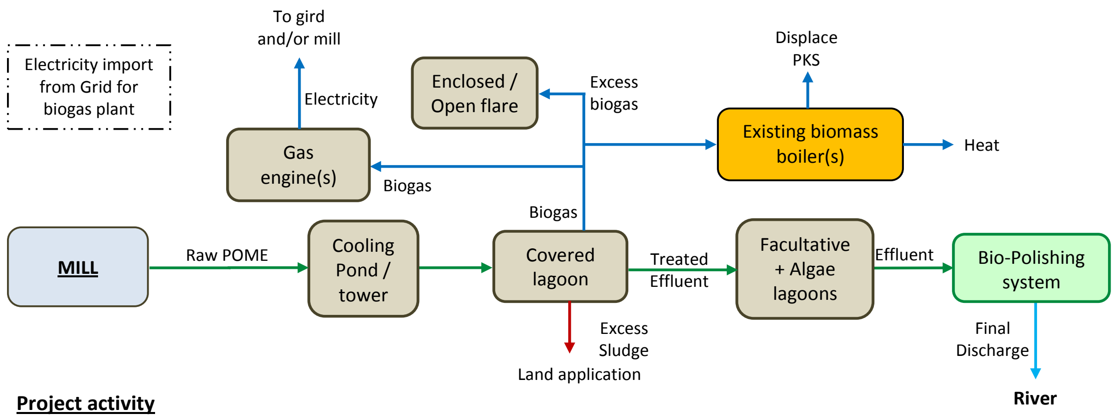

Figure A.1: Flow diagram of the Project Activity

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

A.4.1.1. Host Party:

The host party of this CPA is Malaysia.

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

Table A.1: Details of the geographic reference of CPA

Name of entity responsible for CPA	Felda Palm Industrial Sdn. Bhd.
Contact details of entity responsible for CPA	Jabatan Biomass, Tingkat 4, Balai Felda, Jalan Gurney Satu, 54000, Kuala Lumpur, Malaysia. Tel: +603 2692 8066 Fax: +603 2691 2563
City/Town/Community	Kuala Lumpur
Region/State/Province	Kuala Lumpur
Country	Malaysia
Geographic coordinates of the site	3° 16.152 N, 102° 34.567 E, OR 3.2692, 102.5761

A map indicating the location of the CPA site is given below:

Figure A.2: Location of the Project Activity

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

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

Starting date of the CPA will be the date on which the Engineering Procurement and Construction (EPC) contract for the CPA will be awarded. The EPC contract for the CPA has not yet been awarded.

The start date of the CPA is not or will not be, prior to the commencement of validation of the PoA.

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

The operational lifetime of the CPA will be 20 years.

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

Renewable crediting period

A.4.3.1. Starting date of the crediting period:

01/12/2012 or the date of its inclusion in the PoA, 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 first crediting period of the CPA[6] will be 7 years.

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

Years*	Annual estimation of emission reductions in tonnes of CO_{2e}
2012	2,440
2013	29,280
2014	29,280
2015	29,280
2016	29,280
2017	29,280
2018	29,280
2019	26,840
Total estimated reductions (tonnes of CO_{2e})	**204,960**
Total number of crediting years	**7**
Annual average over the crediting period of estimated reductions (tonnes of CO_{2e})	**29,280**

**The starting date of the crediting period is 01/12/2012 or the date of its inclusion in the PoA, whichever is later*

A.4.5. Public funding of the CPA:

The project has not received and will not be seeking public funding from Annex 1 countries.

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

1. For the purposes of registration of a Programme of Activities (PoA)[7] a proposed small-scale CPA of a PoA shall be deemed to be a de-bundled component of a large scale activity if there is already an activity[8], which:

   (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 sectoral scope, and;

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

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[6] Please note that the duration of crediting period of any CPA shall be limited to the end date of the PoA regardless of when the CPA was added.

[7] Only those POAs need to be considered in determining de-bundling that are: (i) in the same geographical area; and (ii) use the same methodology; as the POA to which proposed CPA is being added

[8] Which may be a (i) registered small-scale CPA of a PoA, (ii) an application to register another small-scale CPA of a PoA or (iii) another registered CDM project activity

2. If a proposed small-scale CPA of a PoA is deemed to be a debundled component in accordance with paragraph 2 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 and small-scale A/R project activities as set out in Annex II of the decision 4/CMP.1 and 5/CMP.1 respectively, the CPA of a PoA can qualify to use simplified modalities and procedures for small-scale CDM and small-scale A/R CDM project activities.

The CPA implementer is also implementing other methane recovery project activities but these projects are more than 1km away from the proposed small-scale CPA at the closest point. Therefore the proposed CPA is not a de-bundled component of a large scale project activity as it does not satisfy any of the above provisions.

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 project information of this CPA has been checked against the PoA and CDM database available on UNFCCC website and no duplicate entries were identified. It is confirmed that the proposed CPA is neither registered as an individual CDM project activity nor is part of another PoA. This has also been confirmed by the project implementer Felda Palm Industrial Sdn. Bhd.

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:

Regional Biogas PoA
Version : 1.0
Date : 12/03/2012

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

Table B.1: Eligibility of CPA to be included in the Registered PoA

N°	Criteria	Justification
1	**Geographical boundary** The CPA takes place within the borders of Malaysia.	The proposed CPA-1 is located in the state of Pahang, Malaysia with GPS coordinates of 3° 16.152 N, 102° 34.567 E OR 3.2692, 102.5761
2	No **double counting** The CPA is not already included in another PoA or developed as a stand-alone CDM project.	The proposed CPA is not already included in another PoA or developed as a stand-alone CDM project.

3	Applicability conditions of AMS-III.H : a) Substitution of aerobic wastewater or sludge treatment systems with anaerobic systems with biogas recovery and combustion; b) Introduction of anaerobic sludge treatment system with biogas recovery and combustion to a wastewater treatment plant without sludge treatment; c) Introduction of biogas recovery and combustion to a sludge treatment system; d) Introduction of biogas recovery and combustion to an anaerobic wastewater treatment system such as anaerobic reactor, lagoon, septic tank or an on site industrial plant; e) Introduction of anaerobic wastewater treatment with biogas recovery and combustion, with or without anaerobic sludge treatment, to an untreated wastewater stream; f) Introduction of a sequential stage of wastewater treatment with biogas recovery and combustion, with or without sludge treatment, to an anaerobic wastewater treatment system without biogas recovery (e.g. introduction of treatment in an anaerobic reactor with biogas recovery as a sequential treatment step for the wastewater that is presently being treated in an anaerobic lagoon without methane recovery)	The CPA is applying Option (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)
4(a)	The recovered methane measured may also be utilized for thermal or mechanical, electrical generation directly – AMS-III.H, para 3(a).	The recovered biogas may be used for electricity generation through combustion in biogas engine(s) system and/or biomass boiler(s) for heat generation. Excess biogas, if any, will be flared. This in compliance with only AMS-III.H, paragraph 3(a) and not the others.
4(b)	The recovered methane measured may also be utilized for thermal or mechanical, electrical energy generation after bottling of upgraded biogas – AMS-III.H, para 3(b).	Not applicable.
4(c)	The recovered methane measured may also be utilized for thermal or mechanical, electrical energy generation after upgrading and distribution – AMS-III.H, para 3(c).	Not applicable.
4(d)	The recovered methane measured may also	Not applicable.

	be utilized for hydrogen production – AMS-III.H, para 3(d).	
4(e)	The recovered methane measured may also be utilized for use as fuel in transportation applications after upgrading – AMS-III.H, para 3(e).	Not applicable.
5	If the recovered biogas is used for project activities covered under AMS-III.H, paragraph 3(a), that component of the project activity can use a corresponding methodology under Type I.	The recovered biogas is planned for gainfully use for electricity and/or heat generation in the CPA. The approved baseline and monitoring methodology AMS I.A (version 14) and/or AMS-I.D (version 17) are used for the electricity component of the CPA.
6	Conditions that ensure compliance with applicability and other requirements of single or multiple methodology/ies applied by CPA.	The proposed CPA-01 will apply AMS-III.H, AMS-I.A and/or AMS-I.D. Applicability criteria are listed below.
7	The project has to fulfill Host Country National CDM criteria, if any.	Malaysia’s National CDM criteria have been fulfilled by the proposed CPA.
8	The starting date of CPA is compliant with the latest UNFCCC guidelines.	The start date of the CPA is not or will not be, prior to the commencement of validation of the PoA. The EPC contract for biogas plant yet to be awarded.
9	Confirmation that the CPA does not involve any public funding from Annex I Parties or that in case public funding is used, it does not result in diversion of Official Development Assistance (ODA)	The proposed CPA has not received and will not be seeking public funding from Annex 1 countries.
10	A local Stakeholder consultation has been conducted prior to the CPA inclusion	Stakeholder consultation has been organized on 05/03/2012 and it is prior to the CPA inclusion.
11	Conditions pertaining to the demonstration of additionality of each small scale CPA to be included (less than 60 ktCO_2 / year) for Type III and 15MW for Type I methodologies.	The proposed CPA may install gas engine with maximum capacity of 1.2 MW and methane avoidance of less than 60,000 tCO_2/yr for AMS-III.H.
12	Where applicable, the conditions that ensure that CPA in aggregate meets the small-scale threshold criteria and remain within this threshold throughout the crediting period of the CPA	The proposed CPA may install gas engine with maximum capacity of 1.2 MW and methane avoidance of less than 60,000 tCO_2/yr for AMS-III.H.
13	Where applicable, the requirements for the debundling check, in case CPAs belong to small-scale (SSC) project categories	The proposed CPA is not a debundled component of a large activity as described in the latest “Guidelines on assessment of debundling for SSC project activities”
14	Where applicable, the conditions related to sampling requirements for a PoA in accordance with the approved guidelines/standard from the Board pertaining to sampling and surveys	Not applicable, all CPAs will be verified
15	Where applicable, target group (e.g.	The target group is prospective POME plants in

	domestic/commercial/industrial, rural/urban, grid-connected/off-grid) and distribution mechanisms (e.g. direct installation).	Malaysia. There are no specific distribution mechanisms.
16	Whether an EIA is required by local authorities	Not applicable for the proposed CPA as EIA is not required.
17	The crediting period of the CPA shall not exceed the length of the PoA (i.e. 28 years) regardless of the time of inclusion of CPA in the PoA.	The crediting period of the proposed CPA will not exceed the length of PoA, 28 years.

Additional eligibility criteria applicable in case of CPA that gainfully use of biogas for electrical and/or thermal energy generation

The proposed project conforms to the applicable requirements of AMS - I.D, version 17.

Applicability Criteria	Justification
This methodology comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass: a) Supplying electricity to a national or a regional grid; b) Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	Applicable: The proposed project activity is based on biogas recovered from anaerobic bio-digester, a renewable energy generation source. The proposed project shall supply electricity to the national grid. The project activity is not supplying electricity to an identified consumer facility.
This methodology is applicable to project activities that: (a) Install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant); (b) Involve a capacity addition; (c) Involve a retrofit of (an) existing plant(s); (d) Involve a replacement of (an) existing plant(s).	Applicable to (a) where the proposed project activity shall 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.
Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology.	Not applicable. The project activity is a biogas recovery and utilization project.
If the new unit has both renewable and non-renewable components (e.g. a wind/diesel unit), the eligibility limit of 15MW for a small-scale CDM project activity applies only to the renewable component. If the new unit co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15MW.	Not applicable: The project does not incorporate a mix of renewable and non-renewable components.
Combined heat and power (co-generation) systems are not eligible under this category.	Applicable: There is no combined heat and power component in the project activity.

In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.	Not applicable: The project activity does not involve the addition of renewable energy generation units at an existing facility.
In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.	Not applicable: The project activity does not seek to retrofit or replacement an existing facility.

The proposed project conforms to the applicable requirements of AMS - I.A, version 14.

Applicability Criteria	Justification
This category comprises renewable electricity generation units that supply individual Households / users or groups of households / users included in the project boundary. The applicability is limited to individual households and users that do not have a grid connection except when: a) A group of households or users are supplied electricity through a standalone mini grid powered by renewable energy generation unit(s) where the capacity of the generating units does not exceed 15 MW; or b) The emissions reduction per renewable energy based lighting system is less than 5 tonnes of CO_2e a year and where it can be shown that fossil fuel would have been used in the absence of the project activity by; (i) A representative sample survey (90% confidence interval, ±10% error margin) of target households; or (ii) Official statistics from the host country government agencies.	Applicable: The proposed project activity is not grid connected. Furthermore, the total installed capacity of the generating units will not exceed 15 MW.
The renewable energy generation units include technologies such as solar, hydro, wind, biomass gasification and other technologies that produce electricity all of which is used on-site/locally by the user.	Applicable: The project activity involves the combustion of the recovered biogas from the anaerobic bio-digester for electricity generation to be use on-site.
The renewable generating units may be new installations (Greenfield) or replace existing onsite fossil-fuel-fired generation. To qualify as a small-scale project, the total output of the unit(s) shall not exceed the limit of 15 MW.	Applicable: The project activity involve the replacement of existing onsite fossil fuel fired generation and the total installed capacity is not

	exceed 15 MW.
Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: • The project activity is implemented in an existing reservoir with no change in the volume of reservoir; • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m2; • 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/m2.	Not applicable: The project activity is not a hydro power plant.
Combined heat and power (co-generation) systems are not eligible under this category.	Applicable: There is no combined heat and power component in the project activity.
If the unit added 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 unit added co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15 MW.	Not applicable: The project does not incorporate a mix of renewable and non-renewable components.
Project activities that involves retrofit or replacement of an existing facility for renewable energy generation are included in this category. To qualify as a small-scale project, the total output of the modified or retrofitted unit shall not exceed the limit of 15 MW.	Not applicable: The project activity does not seek to retrofit or replacement an existing facility.
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[3] from the existing units.	Not applicable: The project activity does not involve the addition of renewable energy generation units at an existing facility.

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

In Malaysia, Environmental Quality (Prescribed Premises) (Crude Palm Oil) Regulation 1977 governs environmental considerations including the wastewater treatment and discharge at palm oil mills. The regulation stipulates the discharge standards for water discharge or land application. The regulation however, does not specify the required treatment technologies for wastewater or GHG emissions from wastewater treatment operations.

More than 85% of palm oil mills are utilizing open based anaerobic ponds and it is considered the prevailing practice for oil palm industry to treat the POME. The open anaerobic ponds system is an effective and low-tech solution that can easily meet the water discharge limits applicable to the palm oil industry[9, 10].

There is no financial incentive for the palm oil mill owners to invest into methane capture projects, particularly when there is no requirement under existing, pending, or planned national, state or local regulatory. This is partly related to the fact that there are a lot of attractive and competing investments in the sector. However, the PP has undertaken to set up this project in order to reduce the GHG emissions and contribute his mite to the global GHG emission reduction.

The project is a small scale project activity. As such, the provisions of Attachment A to Appendix B of the *simplified modalities and procedures for small-scale CDM project activities* will apply to this project. The '*indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories*' require the project proponents to demonstrate that the project activity would not have occurred anyway due to *at least one* of the following barriers:

a) *Investment barrier*: a financially more viable alternative to the project activity would have led to higher emissions;

b) *Technological barrier*: a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions;

c) *Barrier due to prevailing practice*: prevailing practice or existing regulatory or policy requirements would have led to the implementation of a technology with higher emissions;

d) *Other barriers*: without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

Subsequently, in its 35th Meeting, the EB had issued '*Non-binding best practice examples to demonstrate additionality for SSC project activities*', wherein EB had given best practice examples of each of the aforementioned category of barriers.

The project participant has chosen Investment Barrier to demonstrate the additionality, which is discussed in the following paragraphs:

Investment barrier:

The most important of all the barriers faced by the company is the investment barrier. The investment analysis reveals that the project is not financially attractive. The additionality tool permits the use of simple cost analysis or investment comparison analysis or benchmark analysis to demonstrate the additionality of the project.

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9 SD 05 – Yeoh, B. G., 2004. A Technical and Economic Analysis of Heat and Power Generation from Biomethanation of Palm Oil Mill Effluent. *Electrcity Supply Industry in Transition: Issues and Prospect for Asia.*

10 SD 06 – Eco-Ideal Consulting Sdn. Bhd. (Eco-Ideal), 2004. MEWC/PTM/DANIDA: *Study on Clean Development Mechanism Potential in the Waste Sectors in Malaysia*. Unpublished

As the project activity generates revenue (other than CDM revenue) by exporting the electricity to the grid and from the likely sale of biomass and/or saving from diesel usage at the mill which is being displaced by biogas, simple cost analysis cannot be used. Of the remaining, PP has chosen the benchmark analysis to demonstrate the financial unattractiveness of the project activity without carbon credits.

There is a national policy on Feed-In-Tariff (FiT), gazetted in June 2011[11], that gives comparative advantages to less emissions-intensive technologies over more emissions-intensive technologies (E-policy, as national and/or sectoral policies or regulations that give comparative advantages to less emissions-intensive technologies over more emissions-intensive technologies).

This is very conservative as paragraph 7. 6 (b) EB22, Annex 3 states that *"National and/or sectoral policies or regulations … that have been implemented since the adoption by the COP of the CDM M&P (decision 17/CP.7, 11 November 2001) need not be taken into account in developing a baseline scenario (i.e. the baseline scenario could refer to a hypothetical situation without the national and/or sectoral policies or regulations being in place).* In absence of the FiT, the prevailing electricity sales tariff to consumers is RM 0.21 per kWh

Project IRR has been chosen as the financial indicator for the financial analysis of the project activity. The project IRR has to be compared with a benchmark rate of return to demonstrate the additionality of the project. The Guidelines on the Assessment of Investment Analysis (Version 05, point 12) states, "In cases where a benchmark approach is used the applied benchmark shall be appropriate to the type of IRR calculated. Local commercial lending rates or weighted average costs of capital (WACC) are appropriate benchmarks for a project IRR. Required/expected returns on equity are appropriate benchmarks for an equity IRR. Benchmarks supplied by relevant national authorities are also appropriate if the DOE can validate that they are applicable to the project activity and the type of IRR calculation presented".
In line with the Guidelines on the Assessment of Investment Analysis (Version 05), a default value for the expected returns on equity is selected as the benchmark, with 10.90%. The logic of choosing this rate as benchmark is that, the project should yield a return at least equivalent to the expected returns of equity to merit consideration.

For making the investment analysis, the following assumptions have been made:

Table B.2: Investment Analysis

Sl No	Description	Value
1	Budgeted CAPEX: - Bioreactor & accessories - Flaring system - Boiler adaptation cost for burners - Gas engine(s) - KPSR consultancy cost	 4,350,000 140,670 205,000 4,630,000 220,000
	Total	9,545,670
2	Annual maintenance costs are estimated based on a % of CAPEX[12]	
	Bioreactor (3% of CAPEX)	= MYR 130,500
	Gas engine(s) (5% of CAPEX)	= MYR 231,500
3	Corporate tax (%)[13]:	25%

11 http://www.mbipv.net.my/dload/FiT%20Handbook%20English.pdf

12 SD 05 – Maintenance cost (SIRIM Environmental and Bioprocess Technology Centre of Malaysia)

	Since losses can be carried forward indefinitely (so long as the ownership remains unchanged), the incidence of taxation does not arise in the case of this project activity.	
4	Manpower cost has been estimated based on 1 supervisor, 2 operators, 1 chargeman envisaged to be appointed and the ruling wage/salary structure of the company[14].	182,588 MYR / yr
5	Salary increment rate has been applied based on the average expected salary increment rate for year 2010/11[15].	4.0%
6	Price of Biomass ex-factory (PKS)	156 MYR/mt
7	Price of diesel	2.20 MYR/liter
8	RE tariff export to grid (MYR/kWh)	0.21
9	Laboratory Cost is estimated based on the quotations from accredited laboratory, anticipated number of tests and samples to be carried out and transportation cost during the running and operating of the biogas plant for maintaining optimum operating conditions.	1,920 MYR / yr
10	Insurance premium per year (% of CAPEX)[16]	0.412
11	Estimate of CER price (EUR)	8
12	Depreciation of equipment (years) has been provided as per the Inland Revenue Authority regulations[17]. Since the project consists of only environmental protection equipment, it is entitled to initial capital allowance of 40% and annual capital allowance of 20% as per the Inland Revenue Authority notifications.	4 years
13	Project life time for IRR calculation[18]	20 years
14	Residual value: a fair value (5%) of the project activity assets at the end of the assessment period as per the Guidelines on The Assessment of Investment Analysis, version 05, EB 62.	MYR 466,284

Based on the above assumption, the project IRR works out to be – 0.85% in contrast to the benchmark rate of 10.90%. Thus, the analysis proves that the project is not financially attractive.

Sensitivity Analysis

A sensitivity analysis has also been conducted to test the robustness of the conclusions drawn. Four (4) factors have been identified as critical to IRR of the project, viz., project cost, maintenance costs, RE tariff. The results of sensitivity analysis are given below:

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[13] SD 08 – Malaysian Tax and Business Booklet, 2010/11. Page 12. http://www.pwc.com/en_MY/my/assets/publications/taxbooklet1011.pdf

[14] SD 3 - Salary structure (biogas plant)

[15] SD 09 - Salary increment rate (2010/11)

[16] SD 2 - Biogas plant insurance policy

[17] SD 08 – Malaysian Tax and Business Booklet, 2010/11, Page 21. http://www.pwc.com/en_MY/my/assets/publications/taxbooklet1011.pdf

[18] As per the Guidelines on the Assessment of Investment Analysis, version 05 (Annex 5 EB 62, point 3), "In general a minimum period of 10 years and a maximum of 20 years will be appropriate". PP has chosen 20 years for financial assessment as it is conservative.

Table B.3: Sensitivity Analysis

FACTORS	PROJECT IRR		
	-10%	**0%**	**+10%**
Project cost	-1.85%	-0.85%	0.33%
Maintenance cost	-4.91%	-0.85%	1.89%
RE tariff	1.12%	-0.85%	-3.54%

It could be seen from the above that even under the most optimistic conditions, the project activity would not yield a positive IRR, let alone crossing the benchmark. Therefore the project is not a business-as-usual scenario and it is additional

Prior Consideration of CDM

As per the guidance of EB Meeting Report 49 Annex 22, the project proponent notified the UNFCCC and the DNA of the intent to implement the project as a CDM project activity.

Conclusion

The conclusion of the investment analysis remains identical to reasonable variations of the critical assumptions (sensitivity analysis). Therefore the project activity IRR remains lower than the benchmark. In the above background, it is proved that the project faces an investment barrier that establishes the additionality.

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.

The emission sources and type of GHG which are included or excluded within the project boundary are shown in the following table:

Table B.4: Emission Sources and Type of GHG

	Source	Gas	Included	Justification / Explanation
Baseline	Direct emissions from the wastewater treatment processes	CO_2	No	Neutral CO_2 emissions from biomass decaying
		CH_4	Yes	Methane emissions from open lagoons treatment process
		N_2O	No	Not significant. Excluded for simplification and conservativeness
	Diesel usage in diesel genset at mill	CO_2	Yes	CO_2 emissions from combustion of diesel fuel
		CH_4	No	Not significant. Excluded for simplification and conservativeness
		N_2O	No	Not significant. Excluded for simplification and conservativeness
Project Activity	Bio-digester	CO_2	No	Neutral CO_2 emissions from biomass decaying
		CH_4	Yes	Methane emissions from anaerobic treatment process
		N_2O	No	Not significant. Excluded for simplification and conservativeness
	Existing wastewater treatment lagoons	CO_2	No	Neutral CO_2 emissions from biomass decaying
		CH_4	Yes	Methane emissions from poorly managed treatment process (without aerators)

	(Facultative & algae system)	N_2O	No	Not significant. Excluded for simplification and conservativeness
	Gas engine(s) (biogas combustion)	CO_2	No	Neutral CO_2 emissions from biogas combustion
		CH_4	No	Not significant and excluded from calculation. Biogas combustion efficiency is considered 100%[19]
		N_2O	No	Not significant. Excluded for simplification and conservativeness
	Biomass Boiler(s) (Biogas combustion)	CO_2	No	Neutral CO_2 emissions from biogas combustion
		CH_4	No	Not significant and excluded from calculation. Biogas combustion efficiency is considered 100%[20]
		N_2O	No	Not significant. Excluded for simplification and conservativeness
	Grid electricity consumption from national grid	CO_2	Yes	CO_2 emissions from grid energy
		CH_4	No	Not significant. Excluded for simplification and conservativeness
		N_2O	No	Not significant. Excluded for simplification and conservativeness
	Enclosed or Open flaring system	CO_2	No	Neutral CO_2 emissions from biogas combustion
		CH_4	Yes	CH_4 emissions due to incomplete combustion in enclosed flare
		N_2O	No	Not significant. Excluded for simplification and conservativeness

The CPA is implemented at the address below:
Kilang Sawit Felda Triang, Triang, Pahang, Malaysia.

The site is located at state of Pahang, Malaysia with GPS coordinates 3° 16.152 N, 102° 34.567 E or 3.2692, 102.5761 (refer also Section A.4.1.2) and thus is located within the geographical boundary of the PoA.

B.5. Emission reductions:

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

Data / Parameter:	**GWP_{CH4}**
Data unit:	tCO_2/tCH_4
Description:	Global Warming Potential, the equivalent in CO_2 of the effect of methane gas to the atmosphere
Source of data used:	IPCC 2006
Value applied:	21
Justification of the choice of data or description of measurement methods and procedures actually applied :	Global warming potential for methane gas since this is a methane capture project

[19] AMS-III.H, para 35

[20] AMS-III.H, para 35

Any comment:	

Data / Parameter:	$\mathbf{MCF_{ww,treatment,BL,1}}$
Data unit:	Fraction
Description:	Methane correction factor for baseline wastewater anaerobic treatment systems
Source of data used:	Table III.H.1, AMS III.H version 16
Value applied:	0.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	Table III.H.1, for baseline emission. The lagoons depth are more than 2m. MCF value of 0.8 for anaerobic deep lagoon (depth > 2 m)
Any comment:	

Data / Parameter:	$\mathbf{MCF_{ww,treatment,BL,2}}$
Data unit:	Fraction
Description:	Methane correction factor for baseline wastewater aerobic treatment systems
Source of data used:	Methane correction factor for baseline aerobic wastewater treatment system (poorly managed)
Value applied:	Table III.H.1, AMS III.H version 16
Justification of the choice of data or description of measurement methods and procedures actually applied :	0.3
Any comment:	No aerators installed

Data / Parameter:	$\mathbf{MCF_{ww,BL,discharge}}$
Data unit:	Fraction
Description:	Methane correction factor based on discharge pathway in the baseline situation
Source of data used:	Table III.H.1, AMS III.H version 16
Value applied:	0.1
Justification of the choice of data or description of measurement methods and procedures actually applied :	Table III.H.1, for baseline emission. The final discharge of treated effluent into river. MCF value of 0.1 for river discharge
Any comment:	

Data / Parameter:	$\mathbf{B_{o,\,ww}}$
Data unit:	$kgCH_4$ / kgCOD
Description:	Methane generation capacity of treated wastewater
Source of data used:	IPCC 2006
Value applied:	0.25
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default value as prescribed in the methodology
Any comment:	

Data / Parameter:	**UF_{BL}**
Data unit:	-
Description:	Model correction factor to account for model uncertainties (baseline)
Source of data used:	AMS III.H. version 16
Value applied:	0.89
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per methodology AMS-III.H, point 24
Any comment:	-

Data / Parameter:	**UF_{PJ}**
Data unit:	-
Description:	Model correction factor to account for model uncertainties (project activity)
Source of data used:	AMS III.H. version 16
Value applied:	1.12
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per methodology AMS-III.H, point 30(a)
Any comment:	-

Data / Parameter:	**CFE_{ww}**
Data unit:	Fraction
Description:	Capture efficiency of the biogas recovery equipment in the wastewater treatment system
Source of data used:	AMS III.H. version 16
Value applied:	0.9
Justification of the choice of data or description of measurement methods and procedures actually applied :	A default value of 0.9 has been used as per the guidance in the methodology
Any comment:	

Data / Parameter:	**$MCF_{ww, treatment,PJ,1}$**
Data unit:	Fraction
Description:	Methane correction factor for the project wastewater anaerobic treatment system equipped with biogas recovery equipment
Source of data used:	Table III.H.1, AMS III.H version 16
Value applied:	0.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	The lagoons depth are more than 2 m. MCF values in table III.H.1 has been used as per the guidance in the methodology (depth > 2 m).
Any comment:	

Data / Parameter:	**$MCF_{ww, treatment,PJ,2}$**

Data unit:	Fraction
Description:	Methane correction factor for the project wastewater aerobic treatment system not equipped with biogas recovery equipment
Source of data used:	Table III.H.1, AMS III.H version 16
Value applied:	0.3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Aerobic treatment, poorly managed.
Any comment:	

Data / Parameter:	**$MCF_{ww,PJ,discharge}$**
Data unit:	Fraction
Description:	Methane correction factor based on discharge pathway in the project activity
Source of data used:	Table III.H.1, AMS III.H version 16
Value applied:	0.1
Justification of the choice of data or description of measurement methods and procedures actually applied :	Table III.H.1, for project emission. The final discharge of treated effluent into river. MCF value of 0.1 for river discharge
Any comment:	Same discharge pathway as in the baseline

Data / Parameter:	**$\eta_{COD,BL,1}$**
Data unit:	%
Description:	COD removal efficiency of the baseline system (anaerobic treatment system)
Source of data used:	10 days measurement campaign
Value applied:	Anaerobic Treatment system: 88.80%
Justification of the choice of data or description of measurement methods and procedures actually applied :	One year historical data not available
Any comment:	This data will be used for *ex post* emission reduction calculation

Data / Parameter:	**$\eta_{COD,BL,2}$**
Data unit:	%
Description:	COD removal efficiency of the baseline system (aerobic treatment system)
Source of data used:	10 days measurement campaign
Value applied:	Aerobic Treatment system: 63.69%
Justification of the choice of data or description of measurement methods and procedures actually applied :	One year historical data not available
Any comment:	This data will be used for *ex post* emission reduction calculation

Data / Parameter:	**NCV_{CH4}**
Data unit:	MJ/kg

Description:	Net Calorific Value of methane
Source of data used:	IPCC 2006 Default Value
Value applied:	50.4
Justification of the choice of data or description of measurement methods and procedures actually applied:	IPCC 2006 value is used; Volume 2, Chapter 1, Table 1.2
Any comment:	

Data / Parameter:	**NCV_{FF}**
Data unit:	MJ/kg
Description:	Net Calorific Value of diesel
Source of data used:	IPCC 2006 Default Value
Value applied:	43.0
Justification of the choice of data or description of measurement methods and procedures actually applied:	IPCC 2006 value is used; Volume 2, Chapter 1, Table 1.2
Any comment:	

Data / Parameter:	**$EF_{CO2,diesel}$**
Data unit:	tCO_2/MWh
Description:	CO_2 emission factor diesel genset
Source of data used:	AMS-I.A., version 14, point 14
Value applied:	0.8
Justification of the choice of data or description of measurement methods and procedures actually applied:	Default value for diesel generation unit.
Any comment:	

Data / Parameter:	**Grid Emission Factor**
Data unit:	$kgCO_{2e}/kWh$
Description:	Emission factor for grid electricity in Peninsular Malaysia
Source of data used:	Pusat Tenaga Malaysia, March 2010
Value applied:	0.672
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per AMS-I.D, point 12
Any comment:	Study on Grid Connected Electricity Baselines in Malaysia, 2008

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

The *ex ante* emission reductions are calculated based on AMS-III.H., version 16 as per equations explained in section E.6.2. of PoA-DD, Biogas PoA in Malaysia.

Calculation for AMS-III.H

Baseline emissions

Source of baseline emissions	**Reference**	**Applicable (Y/N)**	**Comments**
Wastewater and sludge treatment systems equipped with a biogas recovery facility shall be excluded from the baseline	AMS-III.H Point 17	N	No biogas recovery in the baseline.
Emissions on account of electricity or fossil fuel used ($BE_{power,y}$)	AMS-III.H Point 18 (i)	N	For conservativeness, no emissions due to electricity or fossil fuel will be claimed. → $BE_{power,y} = 0$
Methane emissions from baseline wastewater treatment systems ($BE_{ww,treatment,y}$)	AMS-III.H Point 18 (ii)	Y	Baseline includes anaerobic and aerobic treatment conditions with different MCF values selected as per Table III.H.1.
Methane emissions from baseline sludge treatment systems ($BE_{s,treatment,y}$) = 0	AMS-III.H Point 18 (iii)	N	The baseline plant corresponds to scenario Para 1(f) without sludge treatment → $BE_{s,treatment,y} = 0$
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 ($BE_{ww,discharge,y}$)	AMS-III.H Point 18 (iv)	Y	Treated effluent is currently discharged into the river.
Methane emissions from the decay of the final sludge generated by the baseline treatment systems ($BE_{s,final,y}$)	AMS-III.H Point 18 (v)	N	Zero because in the baseline, final sludge used for soil application → $BE_{s,final,y} = 0$

A) Calculation of baseline emissions:

$$BE_y = BE_{ww,treatment,y} + BE_{ww,discharge,y}$$

Abbreviation	*Description*	*Value*	*Source*
BE_y	Baseline emissions in year *y* (tCO_{2e})	30,762	Calculated
$BE_{power,y}$	Baseline emissions of diesel genset in year *y*, tCO_{2e}/year	0	Calculated
$BE_{ww,treatment,y}$	Baseline emissions of the wastewater treatment systems, tCO_{2e}/year	30,663	Equation 2
$BE_{ww,discharge,y}$	The methane emissions from degradable organic carbon in treated wastewater discharged, tCO_{2e}/year	100	Equation 6

A.1) Baseline emissions

Equation 2: $BE_{ww,treatment,y} = Q_{ww,y} * \{(COD_{inflow,1,y} * \eta_{COD,BL,1} * MCF_{ww,treatment,BL,1}) + (COD_{inflow,2,y} * \eta_{COD,BL,2} * MCF_{ww,treatment,BL,2})\} * B_{o,ww} * UF_{BL} * GWP_{CH4}$			
Abbreviation	*Description*	*Value*	*Source*
$BE_{ww,treatment,y}$	Baseline emissions of the wastewater treatment systems (tCO_{2e}/year)	30,663	Calculated
$Q_{ww,y}$	Volume of wastewater treated in baseline wastewater treatment system *i* in year *y* (m^3/year)	333,293	Volume based on 1.0 m^3/mt FFB[21] & FFB historical data (2009 – 2011)
$COD_{inflow,1,y}$	Chemical oxygen demand of the wastewater inflow to the baseline treatment system (anaerobic) in year *y* (tCOD / m^3)	0.026905	10 days measurement campaign
$\eta_{COD,BL,1}$	COD removal efficiency of the baseline treatment system (anaerobic) (%)	88.80	10 days measurement campaign
$COD_{inflow,2,y}$	Chemical oxygen demand of the wastewater inflow to the baseline treatment system (aerobic) in year *y* (tCOD / m^3)	0.003013	10 days measurement campaign
$\eta_{COD,BL,2}$	COD removal efficiency of the baseline treatment system (aerobic) (%)	63.69	10 days measurement campaign
$MCF_{ww,treatment,BL,1}$	Methane correction factor for baseline wastewater anaerobic treatment systems	0.8	MCF values as per table III.H.1. anaerobic > 2m
$MCF_{ww,treatment,BL,2}$	Methane correction factor for baseline wastewater aerobic treatment systems	0.3	MCF values as per table III.H.1. – poorly managed
$B_{o,ww}$	Methane producing capacity of the wastewater (kg CH_4/kg COD)	0.25	IPCC 2006
UF_{BL}	Model correction factor to account for model uncertainties	0.89	IPCC 2006
GWP_{CH4}	Global Warming Potential for methane	21	IPCC 2006

A.2) The methane emissions from degradable organic carbon in treated wastewater discharged			
Equation 6: $BE_{ww,discharge,y} = Q_{ww,y} * GWP_{CH4} * B_{o,ww} * UF_{BL} * COD_{ww,discharge,BL,y} * MCF_{ww,BL,discharge}$			
Abbreviation	*Description*	*Value*	*Source*
$BE_{ww,discharge,y}$	The methane emissions from degradable organic carbon in treated wastewater discharged (tCO_{2e}/year)	100	Calculated
$Q_{ww,y}$	Volume of treated wastewater discharged in year *y* (m^3/year)	333,293	Volume based on 1.0 m^3/mt FFB[22] & FFB historical data (2009 – 2011)
GWP_{CH4}	Global warming potential of methane	21	IPCC 2006
$B_{o,ww}$	Methane producing capacity of the treated wastewater ($kgCH_4$ / kgCOD)	0.25	IPCC 2006

21 Mill designed data for baseline effluent treatment plant

22 Mill designed data for baseline effluent treatment plant

UF_{BL}	Model correction factor to account for model uncertainties	0.89	IPCC 2006
$COD_{ww,discharge, BL,y}$	Chemical oxygen demand of the treated wastewater discharged into sea, river or lake in the baseline situation in the year *y* (tonnes/m^3).	0.000642	10 days measurement campaign
$MCF_{ww,BL,discharge}$	Methane correction factor based on discharge pathway in the baseline situation (e.g. into sea, river or lake) of the wastewater (fraction)	0.1	MCF values as per table III.H.1, version 16

Project activity emissions:

The project activity emission sources as per the methodology and their relevance with respect to the proposed CDM project activity are given below in a tabular format:

Source of project activity emission	Reference	Applicable (Y/N)	Comments
CO_2 emissions on account of power and fossil fuel used by the project activity facilities ($PE_{power,y}$)	AMS-III.H, point 29(i)	Y	The project activity uses the electricity imported from the national grid.
Methane emissions from wastewater treatment systems affected by the project activity, and not equipped with biogas recovery in the project situation ($PE_{ww,treatment,y}$)	AMS-III.H, point 29 (ii)	Y	CH_4 emissions from the poorly managed aerobic lagoons.
Methane emissions from sludge treatment systems affected by the project activity, and not equipped with biogas recovery in the project situation ($PE_{s,treatment,y}$)	AMS-III.H, point 29 (iii)	N	The project activity corresponds to scenario (vi) without sludge treatment → $PE_{y,s,treatment,y} = 0$
Methane emissions on account of inefficiency of the project activity wastewater treatment systems and presence of degradable organic carbon in treated wastewater ($PE_{ww,discharge,y}$)	AMS-III.H, point 29 (iv)	Y	Treated effluent from ETP will be discharged into river.
Methane emissions from the decay of the final sludge generated by the project activity treatment systems ($PE_{s,final,y}$)	AMS-III.H, point 29 (v)	N	In the proposed CDM project activity, final sludge is used for soil application in the same manner as in the baseline → $PE_{s,final,y} = 0$

Methane fugitive emissions on account of inefficiencies in capture systems ($PE_{fugitive,y}$)	AMS-III.H, point 29 (vi)	Y	Applicable to $PE_{fugitive,ww,y}$
		N	The project activity corresponds to scenario (vi) without sludge treatment → $PE_{fugitive,s,y}$ = 0
Methane emissions due to incomplete flaring ($PE_{flaring,y}$)	AMS-III.H, point 29 (vii)	Y	Enclosed flaring system installed
Methane emissions from biomass stored under anaerobic conditions which does not take place in the baseline situation ($PE_{biomass,y}$)	AMS-III.H, point 29 (viii)	N	In the project activity, the biomass (PKS + mesocarp fibres) displaced will not be stored under anaerobic conditions. The conditions of onsite storage are identical in the baseline as in the project activity. The biomass will be sold to the market on a regular basis → $PE_{biomass,y} = 0$

B) Calculation of project emissions:

$$PE_y = PE_{power,y} + PE_{ww,treatment,y} + PE_{ww,discharge,y} + PE_{fugitive,y} + PE_{flaring,y}$$

Abbreviation	*Description*	*Value*	*Source*
PE_y	Project activity emissions in the year *y* (tCO_{2e}/yr)	6,050	Equation 8
$PE_{power,y}$	CO_2 emissions on account of power used by the project activity facilities (tCO_{2e}/yr)	604	-
$PE_{ww,treatment,y}$	Methane emissions from wastewater treatment systems affected by the project activity, and not equipped with biogas recovery, in year *y* (tCO_{2e}/yr)	1,523	Equation 9
$PE_{ww,discharge,y}$	Methane emissions on account of inefficiency of the project activity wastewater treatment systems and presence of degradable organic carbon in treated wastewater (tCO_{2e}/yr)	126	Equation 12
$PE_{fugitive,y}$	Methane fugitive emissions on account of inefficiencies in capture systems (tCO_{2e}/yr)	3,796	Equation 15
$PE_{flaring,y}$	Methane emissions due to incomplete flaring (tCO_{2e}/yr)	0	Equation 19

B.1) Project emissions from CO_2 emissions on account of power and fuel used by the project activity facilities in year "y" in tCO_{2e}/year

$$PE_{power,y} = EC_{PJ,j,y} * EF_{grid,y}$$

Abbreviation	Description	Value	Source
$PE_{power,y}$	Project emissions from electricity consumption in the year *y* (tCO_{2e}/yr)	604	Calculated
$EC_{PJ,j,y}$	Internal power consumption from the grid	749	100 kW is the effective

	(MWh / year)		power based on the equipments installed at the site
$EF_{grid,y}$	Grid Emission factor in Peninsular Malaysia, 2008 (tCO_2 / MWh)	0.672	Study on Grid Connected Electricity Baselines in Malaysia, 2008, published in 2010 by PTM

B.2) Methane emissions from wastewater treatment systems affected by the project activity, and not equipped with biogas recovery in the project situation in year "y" in tCO_{2e}

Equation 9: $PE_{ww,treatment,y} = Q_{ww,k,y} * COD_{inflow,k,y} * \eta_{PJ,k,y} * MCF_{ww,treatment,PJ,k}) * B_{o,ww} * UF_{PJ} * GWP_{CH4}$

Abbreviation	Description	Value	Source
$PE_{ww,treatment,y}$	Methane emissions from wastewater treatment systems affected by the project activity, and not equipped with biogas recovery in the project situation (tCO_{2e}/yr)	1,523	Calculated
$Q_{ww,k,y}$	Volume of wastewater treated in project activity wastewater treatment system *k* in year *y* (m^3/year)	333,293	Volume based on 1.0 m^3/mt FFB[23] & FFB historical data (2009 – 2011)
$COD_{inflow,k,y}$	Chemical oxygen demand of the wastewater inflow to the project activity treatment system *k* in year *y* (tonnes COD / m^3)	0.002690	10 days measurement campaign
$\eta_{PJ,k,y}$	Chemical oxygen demand removal efficiency of the project wastewater treatment system *k* in year *y* (t/m3), measured based on inflow COD and outflow COD in system *k*	90%	Based on bio-digester COD removal efficiency of 90%.
$MCF_{ww,treatment,PJ,k,}$	Methane correction factor for project wastewater treatment system *k* (MCF values as per table III.H.1.)	0.3	MCF values table III.H.1, Version 16 – aerobic poorly managed (conservative)
$B_{o,ww}$	Methane generation capacity of the treated wastewater (kg CH_4/kg COD)	0.25	IPCC 2006
UF_{PJ}	Model correction factor to account for model uncertainties	1.12	IPCC 2006
GWP_{CH4}	Global warming potential of methane	21	IPCC 2006

[23] Mill designed data for baseline effluent treatment plant

B.3) Methane emissions on account of inefficiency of the project activity wastewater treatment systems and presence of degradable organic carbon in treated wastewater in the year "*y*" (tonnes)

Equation 12: $PE_{ww,discharge,y} = Q_{ww,y} * GWP_{CH4} * B_{o,ww} * UF_{PJ} * COD_{ww,discharge,PJ,y} * MCF_{ww,PJ,discharge}$

Abbreviation	*Description*	*Value*	*Source*
$PE_{ww,discharge,y}$	Methane emissions from degradable organic carbon in treated wastewater (tCO_{2e}/yr)	126	Calculated
$Q_{ww,y}$	Quantity of wastewater treated in year *y* (m^3/year)	333,293	Volume based on 1.0 m^3/mt FFB[24] & FFB historical data (2009 – 2011)
$COD_{ww,discharged,PJ,y}$	Chemical oxygen demand of the treated wastewater discharged into river in the project situation in year *y* (tCOD / m^3)	0.000642	10 days measurement campaign
$MCF_{ww,PJ\ discharge}$	Methane correction factor based on discharge pathway in the project situation (river) of the wastewater (fraction)	0.1	MCF values as per table III.H.1, Version 16
$B_{o,ww}$	Methane generation capacity of the treated wastewater (kg CH_4/kg COD)	0.25	IPCC 2006
UF_{PJ}	Model correction factor to account for model uncertainties	1.12	IPCC 2006
GWP_{CH4}	Global warming potential of methane	21	IPCC 2006

B.4.1) Methane fugitive emissions on account of inefficiencies in capture systems in the year "*y*" (tonnes)

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

Abbreviation	*Description*	*Value*	*Source*
$PE_{fugitive,y}$	Methane fugitive emissions on account of inefficiencies in capture systems (tCO_{2e}/yr)	3,796	Calculated
CFE_{ww}	Capture efficiency of the biogas recovery equipment in the wastewater treatment systems	0.9	AMS III.H, Version 16
$MEP_{y,ww,treatment}$	Methane emission potential of wastewater treatment systems equipped with biogas recovery system in year *y* (tCH_4/yr)	1,808	Refer Equation 11 of AMS III.H, version 16
GWP_{CH4}	Global warming potential of methane	21	IPCC 2006

B.4.2) Methane emission potential of wastewater treatment plant in the year "*y*" (tonnes)

Equation 16: $MEP_{ww,treatment,y} = Q_{ww,y} * B_{o,ww} * UF_{PJ} * (COD_{removed,PJ,k,y} * MCF_{ww,treatment,PJ,k})$

[24] Mill designed data for baseline effluent treatment plant

Abbreviation	*Description*	*Value*	*Source*
$MEP_{ww,treatment,y}$	Methane emission potential of wastewater treatment systems equipped with biogas recovery system in year *y* (tonnes CH_4/yr)	1,808	Calculated
$Q_{y,ww}$	Quantity of wastewater treated in year *y* (m^3/year)	333,293	Volume based on 1.0 m^3/mt FFB[25] & FFB historical data (2009 – 2011)
$B_{o,ww}$	Methane generation capacity of the treated wastewater (kg CH_4/kg COD)	0.25	IPCC 2006
$COD_{removed,PJ,y}$	The chemical oxygen demand removed by the treatment anaerobic system of the project activity equipped with biogas recovery in the year *y* (tCOD / m^3)	0.024214	10 days measurement campaign & bio-digester design parameter
$MCF_{ww,treatment,PJ}$	Methane correction factor for the project wastewater treatment system *k* equipped with biogas recovery equipment	0.8	MCF values as per table III.H.1, Version 16
UF_{PJ}	Model correction factor to account for model uncertainties	1.12	IPCC 2006

B.5) Methane emissions due to incomplete flaring in the year "*y*" (tonnes)			
Equation 13a: $PE_{flaring,y} = TM_{flared,y} * (1 - \eta_{flare,y}) * GWP_{CH4}$			
Abbreviation	*Description*	*Value*	*Source*
$PE_{flaring,y}$	Methane emissions due to incomplete flaring (tCO_{2e}/yr)	0	Calculated
$TM_{flared,h}$	Mass flow rate of methane flared in dry basis in the hour, *h* (tCH_4 / yr)	0	Calculated
$\eta_{flare,y}$	Flare efficiency in hour, *h* based on default values.	50%	Tools for methane flaring (open flare) for conservative
GWP_{CH4}	Global warming potential of methane	21	IPCC 2006

Leakage emissions:

No leakage emission will occur in the project activity.

→ $LE_{y,1} = 0$

Emission reductions:

Equation 22: $ER_{y, ex\ ante} = BE_{y, ex\ ante} - (PE_{y, ex\ ante} + LE_{y, ex\ ante})$

[25] Mill designed data for baseline effluent treatment plant

Abbreviation	*Description*	*Value*	*Source*
$ER_{y1, ex\ ante}$	*Ex ante* emission reduction in year *y* (tCO_{2e})	24,712	Equation 22
$BE_{y1, ex\ ante}$	*Ex ante* baseline emissions in year *y* (tCO_{2e})	30,762	Equation 1
$PE_{y1, ex\ ante}$	*Ex ante* project emissions in year *y* (tCO_{2e})	6,050	Equation 8
$LE_{y1, ex\ ante}$	*Ex ante* Leakage emissions in year *y* (tCO_{2e})	0	-

Calculation for AMS-I.D

Baseline emissions

Electricity generated from biogas engines will be exported to the Peninsular Malaysia National Grid. The baseline emissions are described in AMS-I.D. (Version 17, EB 61) as the "product of electrical energy baseline expressed in kWh of electricity produced by the renewable energy generating unit multiplied by an emission factor".

Baseline emissions due to electricity exported to the grid in the year "*y*" (tonnes)			
$BE_{EG,y} = EG_{BL,y} * EF_{CO2,grid,y}$			
Abbreviation	*Description*	*Value*	*Source*
$BE_{EG,y}$	Baseline emissions in year *y* (tCO_{2e}/yr)	4,568	Calculated
$EG_{BL,y}$	Quantity of net electricity supplied to the grid as a result of the implementation of the project activity in year y (kWh / yr)	6,797,625	Calculated
$EF_{CO2,grid,y}$	CO_2 emission factor of the grid in year (tCO_2/kWh)	0.672	Study on Grid Connected Electricity Baselines in Malaysia, 2008, published in 2010 by PTM

Project Activity Emissions

As per AMS-I.D. (Version 17, EB 61) project emissions for renewable energy project activities are zero.

$PE_{EG,y} = 0$

Leakage

If the energy generating equipment is transferred from another activity, leakage is to be considered.

No leakage emission will occur in the project activity →$\mathbf{LE_y = 0}$

Emission reductions:

$ER_y = BE_y – PE_y - LE_y$			
Abbreviation	*Description*	*Value*	*Source*
ER_y	Emission reduction in year *y* (tCO_{2e}/y)	4,568	-
BE_y	Baseline emissions in year *y* (tCO_{2e}/y)	4,568	-
PE_y	Project emissions in year *y* (tCO_{2e}/y)	0	-
LE_y	Leakage emissions in year *y* (tCO_{2e}/y)	0	-

Calculation for AMS-I.A

Baseline emissions

The energy baseline is the fuel consumption of the technology in use or that would have been used in the absence of the project activity to generate the equivalent quantity of energy, Option 2 is applied. This methodology is only apply shall the recovered is in excess after export to the grid.

Annual electricity sent to the mill for FF displacement in the year "*y*" (kWh)			
$E_{BL,y} = \Sigma EG_{i,y} / (1 – l)$			
Abbreviation	*Description*	*Value*	*Source*
$E_{BL,y}$	Annual energy baseline (kWh/yr)		Calculated
$EG_{i,y}$	The estimated annual output of the renewable energy technologies of the group of *i* renewable energy technologies installed (kWh/yr)	0	Estimated
l	Average technical distribution losses that would have been observed in diesel powered mini-grids installed by public programmes or distribution companies in isolated areas, expressed as a fraction	0	Conservative by applying Zero (0).

Baseline electricity sent to the mill for FF displacement in the year "*y*" (tonnes)			
$BE_{CO2,y} = E_{BL,y} * EF_{CO2}$			
Abbreviation	*Description*	*Value*	*Source*
$BE_{CO2,y}$	Baseline emission in the year *y* (tCO_2/yr)	0	Calculated
$E_{BL,y}$	Annual energy baseline (kWh/yr)	0	Calculated
EF_{CO2}	CO_2 emission factor (tCO_2/kWh)	0.8	Default value which is derived from diesel generation units is used.

Project Activity Emissions

As per AMS-I.A. (Version 14, EB 54) project emissions for renewable energy project activities are zero.
$PE_y = 0$

Leakage
If the energy generating equipment is transferred from another activity or if the existing equipment is transferred to another activity, leakage is to be considered.

No leakage emission will occur in the project activity → $\mathbf{LE_y = 0}$

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

<u>Estimated emission reductions (total project activity):</u>

Year*	Estimation of project activity emissions (tCO_{2e})	Estimation of baseline emissions (tCO_{2e})	Estimation of leakage (tCO_{2e})	Estimation of overall emission reductions (tCO_{2e})
2012	504	2,944	0	2,440
2013	6,050	35,330	0	29,280
2014	6,050	35,330	0	29,280
2015	6,050	35,330	0	29,280
2016	6,050	35,330	0	29,280
2017	6,050	35,330	0	29,280
2018	6,050	35,330	0	29,280
2019	5,546	32,386	0	26,840
Total (tCO_2)	**42,350**	**247,310**	**0**	**204,960**

** The starting date of the crediting period is 01/12/2012 or the date of registration, whichever is later*

<u>Estimated emission reductions for AMS-III.H:</u>

Year*	Estimation of project activity emissions (tCO_{2e})	Estimation of baseline emissions (tCO_{2e})	Estimation of leakage (tCO_{2e})	Estimation of overall emission reductions (tCO_{2e})
2012	504	2,563	0	2,059
2013	6,050	30,762	0	24,712

2014	6,050	30,762	0	24,712
2015	6,050	30,762	0	24,712
2016	6,050	30,762	0	24,712
2017	6,050	30,762	0	24,712
2018	6,050	30,762	0	24,712
2019	5,546	28,199	0	22,653
Total (tCO_2)	**42,350**	**215,334**	**0**	**172,984**

** The starting date of the crediting period is 01/12/2012 or the date of registration, whichever is later*

Estimated emission reductions for AMS-I.D:

Year*	Estimation of project activity emissions (tCO_{2e})	Estimation of baseline emissions (tCO_{2e})	Estimation of leakage (tCO_{2e})	Estimation of overall emission reductions (tCO_{2e})
2012	0	381	0	381
2013	0	4,568	0	4,568
2014	0	4,568	0	4,568
2015	0	4,568	0	4,568
2016	0	4,568	0	4,568
2017	0	4,568	0	4,568
2018	0	4,568	0	4,568
2019	0	4,187	0	4,187
Total (tCO_2)	**0**	**31,976**	**0**	**31,976**

** The starting date of the crediting period is 01/12/2012 or the date of registration, whichever is later*

Estimated emission reductions for AMS-I.A:

Year*	Estimation of project activity emissions (tCO_{2e})	Estimation of baseline emissions (tCO_{2e})	Estimation of leakage (tCO_{2e})	Estimation of overall emission reductions (tCO_{2e})
2012	0	0	0	0
2013	0	0	0	0
2014	0	0	0	0
2015	0	0	0	0
2016	0	0	0	0

2017	0	0	0	0
2018	0	0	0	0
2019	0	0	0	0
Total (tCO_2)	**0**	**0**	**0**	**0**

** The starting date of the crediting period is 01/12/2012 or the date of registration, whichever is later*

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

B.6.1. Description of the monitoring plan:

The parameters to be monitored are:

Please note that the amount of methane recovered and fuelled or flared (MD_y) is calculated as follows:

$MD_y = TM_{fuelled,y} + TM_{flared,y}$		**Equation A**
Where	*Description*	*Units*
MD_y	Quantity of methane recovered and fuelled or flared in the year *y*	tonnes CH_4/year
$TM_{fuelled,y}$	Quantity of methane fuelled in the year *y*	tonnes CH_4/year
$TM_{flared,y}$	Quantity of methane flared in year *y*	tonnes CH_4/year

Where:

$TM_{fuelled,y} = \sum_{h=1}^{8,760} (FV_{fuelled,h} * fv_{CH4,h} * \eta_{fuelled,h} * \rho_{CH4,n}) / 1,000$		**Equation B**
Where	*Description*	*Units*
$TM_{fuelled,y}$	Quantity of methane fuelled in the year *y*	tonnes CH_4/year
$FV_{fuelled,h}$	Volumetric flow rate of the fuelled biogas gas at normal conditions in hour *h*	Nm^3 biogas/hour
$\eta_{fuelled,h}$	100% for gainful purpose[26]	%
$fv_{CH4,h}$	Volumetric fraction of methane in the biogas gas in the hour *h*	%
$\rho_{CH4,n}$	Density of methane at normal conditions	$kgCH_4/Nm^3CH_4$

And;

$TM_{flared,y} = \sum_{h=1}^{8,760} (FV_{flared,h} * fv_{CH4,h} * \eta_{flare,h} * \rho_{CH4,n}) / 1,000$		**Equation C**
Where	*Description*	*Units*
$TM_{flared,y}$	Quantity of methane flared in year *y*	tonnes CH_4/year
$FV_{flared,h}$	Volumetric flow rate of the flared biogas gas at normal conditions in hour *h*	Nm^3 biogas/hour

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$\eta_{flare,h}$	Flare efficiency in the hour *h*	%
$fv_{CH4,h}$	Volumetric fraction of methane in the biogas gas in the hour *h*	%
$\rho_{CH4,n}$	Density of methane at normal conditions	$kgCH_4/Nm^3CH_4$

Data / Parameter:	**ID1: $Q_{ww,y}$**
Data unit:	m^3 / month
Description:	The flow of wastewater entering the bio-digester
Source of data:	Measurement by project participant by using a flowmeter
Value of data	~ 28,000
Brief description of measurement methods and procedures to be applied:	The flow is measured with an online flow meter or equivalent
QA/QC procedures to be applied (if any):	• Data are monitored continuously and recorded periodically (monthly or at shorter interval) in a data log file (DLF). • Uncertainty level of data: low • Maintenance and calibration as per manufacturer's specifications or at least once every three (3) years
Any comment:	

Data / Parameter:	**ID2: $COD_{ww,untreated,y}$**
Data unit:	tCOD / m^3
Description:	Raw COD of wastewater entering the bio-digester
Source of data:	Laboratory (internal and external)
Value of data	~ 0.030230
Brief description of measurement methods and procedures to be applied:	Measure of COD according to national or international standards. COD is measure through representative sampling.
QA/QC procedures to be applied (if any):	• Minimum once a month COD sampling to ensure a 90/10 confidence/precision level • COD reports are recorded manually • Uncertainty level of data: low • Maintenance and calibration as per manufacturer's specifications or at least once every three (3) years for internal laboratory equipment
Any comment:	
Data / Parameter:	**ID3: $COD_{ww,treated,y}$**
Data unit:	tCOD / m^3
Description:	COD of treated wastewater leaving the bio-digester
Source of data:	Laboratory (internal and external)
Value of data	~ 0.003023
Brief description of measurement methods and procedures to be applied:	Measure of COD according to national or international standards. COD is measure through representative sampling.
QA/QC procedures to be applied (if any):	• Minimum once a month COD sampling to ensure a 90/10 confidence/precision level • COD reports are recorded manually • Uncertainty level of data: low

	• Maintenance and calibration as per manufacturer's specifications or at least once every three (3) years for internal laboratory equipment
Any comment:	

Data / Parameter:	**ID4: $COD_{ww, discharge,y}$**
Data unit:	tCOD / m^3
Description:	COD of treated wastewater discharge into river by treatment system
Source of data:	Laboratory (internal and external)
Value of data	~ 0.000100
Brief description of measurement methods and procedures to be applied:	Measure of COD according to national or international standards. COD is measure through representative sampling.
QA/QC procedures to be applied (if any):	• Minimum once a month COD sampling to ensure a 90/10 confidence/precision level • COD reports are recorded manually • Uncertainty level of data: low • Maintenance and calibration as per manufacturer's specifications or at least once every three (3) years for internal laboratory equipment
Any comment:	

Data / Parameter:	**ID5: End-use of the final sludge**
Data unit:	–
Description:	The final sludge generated by the project activity will be sent to control landfill site, if any
Source of data:	By project participant
Value of data :	–
Brief description of measurement methods and procedures to be applied:	The final disposal of the sludge will be monitored during the crediting period, if any. For each disposal of the sludge, the following will be recorded; disposal site and date of disposal.
QA/QC procedures to be applied (if any):	
Any comment:	

Data / Parameter:	**ID6: $FV_{flared,h}$**
Data unit:	Nm^3 / hour
Description:	Volumetric flow of biogas recovered and flared at normal conditions in the hour *h*
Source of data:	By project participant
Value of data:	0
Brief description of measurement methods and procedures to be applied:	The volume of biogas will be measured with a normalised flow meter or calculated from the volumetric flow, pressure, temperature. Biogas volume and methane content measurements shall be on the same basis (wet or dry).
QA/QC procedures to be applied (if any):	• The biogas flow is monitored continuously, recorded and stored electronically in a data log file (DLF) (monthly or at shorter interval).

	• Uncertainty level of data: low • Maintenance and calibration as per manufacturer's specifications or at least once every 3 years
Any comment:	

Data / Parameter:	**ID7: $FV_{fuelled,gas\ engine,h}$**
Data unit:	Nm^3 / hour
Description:	Volumetric flow of biogas recovered and fuelled (gas engine) at normal conditions in the hour *h*
Source of data:	By project participant
Value of data:	~ 509
Brief description of measurement methods and procedures to be applied:	The volume of biogas will be measured with a normalised flow meter or calculated from the volumetric flow of biogas, pressure, temperature. Biogas volume and methane content measurements shall be on the same basis (wet or dry).
QA/QC procedures to be applied (if any):	• The biogas flow is monitored continuously, recorded and stored electronically in a data log file (DLF) (monthly or at shorter interval). • Uncertainty level of data: low • Maintenance and calibration as per manufacturer's specifications or at least once every 3 years
Any comment:	

Data / Parameter:	**ID8: $FV_{fuelled,boiler,h}$**
Data unit:	Nm^3 / hour
Description:	Volumetric flow of biogas recovered and fuelled (boilers) at normal conditions in the hour *h*
Source of data:	By project participant
Value of data:	~ 0
Brief description of measurement methods and procedures to be applied:	The volume of biogas will be measured with a normalised flow meter or calculated from the volumetric flow of biogas, pressure, temperature. Biogas volume and methane content measurements shall be on the same basis (wet or dry).
QA/QC procedures to be applied (if any):	• The biogas flow is monitored continuously, recorded and stored electronically in a data log file (DLF) (monthly or at shorter interval). • Uncertainty level of data: low • Maintenance and calibration as per manufacturer's specifications or at least once every 3 years
Any comment:	

Data / Parameter:	**ID9: $w_{CH4,h}$**
Data unit:	%
Description:	Methane content in biogas in same basis (wet/dry) as the biogas flows in year *y*
Source of data:	By project participant using a gas analyzer
Value of data:	~ 60

Brief description of measurement methods and procedures to be applied:	Using calibrated gas analyzer either continuous or periodical measurement at confidence/precision level of 90/10.
QA/QC procedures to be applied (if any):	• In case a continuous gas analyser is used, data will be recorded and stored electronically in a data log file (DLF) every hour or at shorter interval. • Uncertainty level of data: low • Maintenance and calibration as per manufacturer's specifications or at least once every 3 years.
Any comment:	• See also clarification by EB Meth Panel, 30/10/2009 – SSC_360. http://cdm.unfccc.int/UserManagement/FileStorage/AM_CLAR_QS83SX5B7WM6UGZE31JYQEQ4F65F6V • The biogas flow and the methane content measurements shall be carried out close to each others

Data / Parameter:	**ID10: T_{biogas}**
Data unit:	ºC
Description:	Temperature of biogas
Source of data:	Temperature probe
Value of data:	20 – 65
Brief description of measurement methods and procedures to be applied:	By project participant
QA/QC procedures to be applied (if any):	• Shall be measured and recorded at the same time when methane content in biogas (ID8) is measured. • Uncertainty level of data: low • Maintenance and calibration as per manufacturer's specifications or at least once every 3 years.
Any comment:	• Pressure and temperature are required to determine the density of the methane. If the biogas flow meter employed measures flow, pressure and temperature and displays/outputs normalised flow of biogas, there is no need to separate monitoring of pressure and temperature of the biogas.

Data / Parameter:	**ID11: P_{biogas}**
Data unit:	Bar(g)
Description:	Pressure of biogas
Source of data:	By project participant
Value of data:	50 – 200 mbar
Brief description of measurement methods and procedures to be applied:	Pressure measurement device
QA/QC procedures to be applied (if any):	• Shall be measured and recorded at the same time when methane content in biogas (ID8) is measured. • Uncertainty level of data: low • Maintenance and calibration as per manufacturer's specifications or at least once every three (3) years
Any comment:	• Pressure and temperature are required to determine the density of the methane. If the biogas flow meter employed measures flow,

	pressure and temperature and displays/outputs normalised flow of biogas, there is no need to separate monitoring of pressure and temperature of the biogas. • Shall be measured at the same time when methane content in biogas (ID9) is measured

Parameter:	**ID12:** $\eta_{flare,h}$ **(enclosed flare)**
Unit:	%
Description:	Enclosed flare efficiency in the hour *h*
Source of data:	Calculated
Value of data:	0 or 50 or 90
Brief description of measurement methods and procedures to be applied:	This yearly efficiency will be based on hourly flare efficiencies calculated as per the provisions in the “Tool to determine project emissions from flaring gases containing methane”. The hourly flare efficiency will be calculated based on: • 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*
QA/QC procedures to be applied (if any):	• Data are logged hourly in a data log file (DLF). • Uncertainty level of data: low
Any comment:	For enclosed flare

Or

Parameter:	**ID13:** $\eta_{flare,h}$ **(open flare)**
Unit:	%
Description:	Flare efficiency in the hour *h*
Source of data:	Calculated
Value of data:	0 or 50
Brief description of measurement methods and procedures to be applied:	This yearly efficiency will be based on hourly flare efficiencies calculated as per the provisions in the “Tool to determine project emissions from flaring gases containing methane”. The hourly flare efficiency will be calculated based on the duration of time during which the flame is detected, by the thermocouple (or flame detector) installed in the open flare. Flare efficiency in hour *h* is based on default values: • 0% if the flame detected for not more than 20 minutes during the hour *h* and;

	• 50% if the flame detected for more than 20 minutes during the hour *h* A flame detector or thermocouple will be used.
QA/QC procedures to be applied (if any):	• Data are logged hourly in a data log file (DLF). • Uncertainty level of data: low
Any comment:	The only monitored parameter related to the flare is its efficiency. Indeed, according to the clarification SSC_199[27] of the methodology AMS III.H version 9, accepted by the SSC WG on the 3/09/2008 "If a thermocouple is used as a flame detection system, it is sufficient to reach the given minimum temperature from the manufacturer ". Hence, it is not necessary to monitor the temperature of the open type flares (T_{flare}).

Data / Parameter:	**ID14: $EC_{PJ,j,y}$**
Data unit:	MWh
Description:	The yearly grid electricity consumption of the project activity for the year '*y*'
Source of data:	Onsite instrument
Value of data:	~749
Brief description of measurement methods and procedures to be applied:	The grid electricity consumption of the project activity is measured continuously with an energy meter (cumulative reading).
QA/QC procedures to be applied (if any):	• Data are monitored continuously and recorded periodically (yearly or at shorter interval) in a data log file (DLF). • Uncertainty level of data: low • Maintenance and calibration as per manufacturer's specifications or at least once every three (3) years
Any comment:	

Data / Parameter:	**ID15: $EG_{BL,y}$**
Data unit:	MWh
Description:	Quantity of net electricity generated and send to grid in year *y*
Source of data:	By project participant
Value of data:	~ 6,798
Brief description of measurement methods and procedures to be applied:	The electricity generated and sent to grid is measured continuously with an energy meter (cumulative readings).
QA/QC procedures to be applied (if any):	• Data are monitored continuously and recorded periodically (yearly or at shorter interval) in a data log file (DLF). • Uncertainty level of data: low • Maintenance and calibration as per manufacturer's specifications or at least once every 3 years.
Any comment:	As per AMS-I.D

[27] The clarification SSC_199 if available here (last access on the 24/05/2011): http://cdm.unfccc.int/filestorage/A/M/_/AM_CLAR_HIOZ5CS1PASC187C0JQ668L2E9RCRJ/Response%20WG%20provided%20at%20SSC%20WG%2017.pdf?t=bU98MTMwNjIxNjY0OS4xMQ==|BOKHqtO94N6XF1N2N1vo8Ori-Rc=

Or

Data / Parameter:	**ID16: $EG_{mill,y}$**
Data unit:	MWh
Description:	Quantity of annual output of renewable energy sent to the mill in year *y*
Source of data:	By project participant
Value of data:	~ 0
Brief description of measurement methods and procedures to be applied:	The electricity generated and sent to mill to displace diesel use in diesel gensets is measured continuously with an energy meter (cumulative readings).
QA/QC procedures to be applied (if any):	• Data are monitored continuously and recorded periodically (yearly or at shorter interval) in a data log file (DLF). • Uncertainty level of data: low • Maintenance and calibration as per manufacturer's specifications or at least once every 3 years.
Any comment:	As per AMS-I.A

Data / Parameter:	**ID17: Displacement of Biomass**
Data unit:	Mt
Description:	Total amount of biomass (PKS) displaced from biomass boilers
Source of data:	Weighing bridge
Value of data :	Measurement at site
Brief description of measurement methods and procedures to be applied:	Biomass (PKS) displaced due to the project activity will be weighed using weighing bridge at the palm oil mill
QA/QC procedures to be applied (if any):	• Monthly calculation based on every single trip of trucks recorded • Data is recorded manually in a data log file based on the weighing records • Maintenance and calibration as per manufacturer's specifications • Uncertainty level of data: low
Any comment:	In the project activity, the biomass (PKS) displaced will not be stored under anaerobic conditions. The conditions of onsite storage are identical in the baseline as in the project activity. The biomass will be sold to the market on a regular basis → $PE_{biomass,y} = 0$

A final monitoring plan will be prepared prior the initial verification based on the as-built project activity. It will address the following aspects:

MONITORING

The Project will be managed by CME with the involvement from Project Implementer. CME will ensure safety in operation of the plant as well as in the monitoring of emission reduction which is generated from the project activity.

CME will implement and be responsible for the monitoring plan. Their responsibility covers operation of the monitoring, maintenance of the monitoring equipment, data collection and archiving, and management of total scheme of the monitoring. CME and Project Implementer will assign specific trained personnel during project implementation for the overall monitoring, measurement and reporting of key parameters as required in this PDD.

DATA LOGGING AND STORAGE

The data measured by the instruments will be collected and stored in a data logging system. The data will be retrieved remotely by modem or directly on site.

If data cannot be retrieved, no emissions reductions will be claimed for the period of data failure. The data collected will be recorded in a central data base. Access to production data will be restricted. All records and data (hard copy and soft copy) will be archived up to two years after the end of the crediting period or the last issuance of CERs for this project activity whichever occurs later.

CALIBRATION AND MAINTENANCE PROCEDURES, MALFUNCTION OF EQUIPMENT

Maintenance includes all preventive and corrective actions necessary for the good functioning of the equipment, such as:

- Visual control of the equipment state and real-time check of displayed parameters,
- Cleaning up the equipment and the sensors,
- Adding lubricant,
- Replacement and change of defective parts.

Calibration of equipment consists in verifying, by comparison with a standard, the accuracy of a measuring instrument.

Measuring instruments will be periodically and appropriately calibrated according to the procedures, timing and methods recommended by the manufacturer, or national/international standards, as available.

General malfunction of equipment:
Daily inspections of the equipment will allow controlling equipment failure. If equipment fails, the supplier will be notified and repairs will be carried out. If the damaged equipment cannot be repaired, it will be replaced at the earliest. In some cases, portable tools will be used in order to carry out daily monitoring of the missing parameter(s). In such case, this data will be recorded manually.

Discrepancies:
To avoid discrepancies between projected data in the PDD and actual data (e.g. due to deferred starting date, malfunction of equipment), cross-checks between internal meter readings and external sources (e.g. electricity invoices) will be carried out. Any source of inconsistencies will be clarified.

Case of emergency:
For the case of emergency (earthquakes, explosions, fires etc.), an emergency preparedness plan will be adapted to the project activity. All employees involved in the project on-site will be trained in the code of conduct and required actions at time of commissioning of the plant.

OPERATIONAL AND MANAGEMENT STRUCTURE

The CDM monitoring team will be composed by the following staff:

Position	Report to
Operators	Project owner
Supervisors (technical/maintenance)	
Operation Engineer	
CDM monitoring project manager	External CDM consultant

TRAINING OF MONITORING PERSONNEL

The maintenance will be conducted in-house by staff employed and trained by the Project Participants. Employees involved in the monitoring will be trained internally and/or externally. Training may include *inter alia*:

a) Review of equipment and captors
b) Calibration requirement
c) Configuration of monitoring equipment
d) Maintenance requirement

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 host country does not require an analysis of environmental impacts. As the project involves reduction of GHG through recovery and controlled combustion, which improves the quality of air, therefore there are no significant environmental impacts identified.

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:

In accordance with Malaysia environmental regulations, Environmental Quality (Prescribed Activities Environmental Impact Assessment) Order 1987, an Environmental Impact Assessment (EIA) is not required for this CPA.

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 meeting was conducted at the office of Kilang Sawit Felda Triang on 05/03/2012. There were 37 stakeholders attending the consultation. Posters were pasted at the guard house, and at the entrance to office 1 week before the stakeholder consultation to inform the locals stakeholders which comprise mostly the workers of the mill. 20 stakeholders out of the 37 who attended the consultation are 2nd generation of the Felda settlers, who live in the vicinity to the project activity and adequately represent the local community, composed entirely of Felda settlers (no other people live in the vicinity of this remote plantation). Continuous input of ideas/comments were allowed to all stakeholders, who could either send their input though an email account especially setup for the biogas project or directly inform the project proponents.

During the meeting, presentations were made by the project owner to outline the proposed project activity in a non-technical manner (including environmental, social and technological considerations), climate change, and the role of the CDM. Attendees were given opportunity to raise their concern and opinion about the proposed project activity during the question and answer session.

D.3. Summary of the comments received:

Below are the questions raised during the stakeholder meeting:

NAME	QUESTION
Mohd Tarmizi Bin Mat Daud	What is CDM in Bahasa Malaysia?
Mohd Tarmizi Bin Mat Daud	What is DoE's standard for treated water released into river?
Mohd Azizi Bin Abdul Aziz	Would the biogas be captured from the existing effluent treatment ponds or a new structure?
Azhar Bin Abdul	What to do with the captured biogas from the bioreactor?

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

Below are the answers to the questions asked during the stakeholder meeting:

QUESTION	ANSWER
What is CDM in Bahasa Malaysia?	The meaning of CDM in Bahasa Malaysia is Mekanisme Pembangunan Bersih or in English is Clean Development Mechanism. By: Abd. Karim Bin Mohd Zin
What is DoE's standard for treated water released into river?	The discharge standard for BOD into river is less than 100ppm. By: Abd. Karim Bin Mohd Zin
Would the biogas be captured from the existing effluent treatment ponds or a new structure?	New bioreactor will be constructed to replace the existing anaerobic lagoon treatment system. The new bioreactor will capture the biogas produced from this anaerobic treatment process. By: Abd. Karim Bin Mohd Zin
What to do with the captured biogas from the bioreactor?	The biogas recovered from the bioreactor will mainly contain methane (approximately 60%) and the rest are CO_2, H_2 and H_2S. Currently, the biogas is just released to the atmosphere from the existing open lagoons system. During the project activity, captured biogas will be combusted thus will improve the air quality. By: Abd. Karim Bin Mohd Zin

Annex 1

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

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The project activity is not receiving any funding from parties included in Annex 1 of the Kyoto Protocol

Annex 3

BASELINE INFORMATION

					1	2
Year	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
FFB (mt/yr)	343,720	345,910	310,250	333,293	333,293	333,293
POME Volume (cu.m/yr)[1]	343,720	345,910	310,250	333,293	333,293	333,293
Mill Opearing hour (hr/yr)	6886.5	6922.5	6209	6,673	6,673	6,673
PKS (mt/yr)	18,905	19,025	17,064	18,331	18,331	18,331

3	4	5	6	7	8	9	10
2015	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
333,293	333,293	333,293	333,293	333,293	333,293	333,293	333,293
333,293	333,293	333,293	333,293	333,293	333,293	333,293	333,293
6,673	6,673	6,673	6,673	6,673	6,673	6,673	6,673
18,331	18,331	18,331	18,331	18,331	18,331	18,331	18,331

10 days measurement campaign for baseline wastewater treatment system

Day	Date	ETP			
		Inlet Anaerobic system (mg/l)	Outlet Anaerobic system (mg/l)	Outlet Algae System (mg/l)	Final Discharge to River (mg/l)
1	23-Feb-12	35,693	3,120	811	603
2	25-Feb-12	19,511	2,559	1,186	83
3	26-Feb-12	32,864	2,767	749	437
4	27-Feb-12	30,195	2,330	1,210	404
5	28-Feb-12	32,436	1,927	1,188	941
6	29-Feb-12	38,259	4,256	896	717
7	1-Mar-12	28,717	3,584	1,232	695
8	3-Mar-12	31,002	4,660	1,658	1,210
9	4-Mar-12	22,400	4,346	1,389	963
10	5-Mar-12	31,226	4,301	1,971	1,165
Average		**30,230**	**3,385**	**1,229**	**722**

		ETP
COD removal efficiency (anaerobic system)		**88.80%**
COD removal efficiency (Facultative/algae system)		**63.69%**
COD removal efficiency (Bio-polishing system)		**41.27%**
Total COD removal efficiency of the treatment system		**97.61%**

*The COD of the raw effluent during ex-post may vary from the one year historical records depending on the improvement of the production process (outside of project boundary), thus $ER_{ex\text{-}post}$ may vary from the estimated $ER_{ex\text{-}ante}$.

Annex 4

MONITORING INFORMATION

General information

Monitoring refers to the collection and archiving of all relevant data necessary for determining the baseline, measuring anthropogenic emissions by sources of greenhouse gases (GHG) within the project boundary of a CDM project activity and leakage. It includes developing suitable data collection methods and data interpretation techniques for monitoring and verification of GHG emissions.

On-line monitoring system
Most key meters required to determine GHG emissions and emission reductions will be monitored from a central control point which will record meter readings at a pre-determined interval.

Ensuring adequate maintenance and calibration of monitoring instruments

- Specific maintenance, repair or replacement of monitoring equipment will be recorded, dated and described.
- The calibration will occur at intervals determined on the basis of instrument manufacturers' recommendations, stability, purpose, usage and history of repeatability. Recalibration should be performed whenever an event occurs that places the accuracy of the instrument in doubt.
- Calibration will take place at least once every three (3) years to ensure that the monitoring equipments are properly installed and functioning properly
- Calibration will be performed according to national or international standards
- Last calibration certificates will be provided during periodic verification

Sampling procedure
Wherever a statistical sample is used for monitoring, the "general guidelines for sampling and surveys for SSC project activities" shall be used. COD shall be measured from a composite sample to obtain a representative value.

Data archiving
The monitored data will be kept for a minimum of 2 years after the end of the crediting years by using paper documents or electronic files.

Identification of non-conformities
A verification of inconsistencies of the data recorded will be performed based for example on:

- The comparison of the calculated quantities of methane versus expected.
- Spot checks of field instruments (local reading) and data in the log file.

Any discrepancies (completeness, calculation errors, transcription errors, instrument calibration issues) will be analyzed and actions taken to correct the problem.

Ensuring adequate training of staff

- All new staff members will undergo 'on job training' covering the monitoring requirements
- The monitoring plan will be made available to staff member involved in the monitoring.
  A copy will be located in the control room at the site.

- During the training, the employees will sign a training attendance list. All training records shall be documented inclusive of training attendance, training memo and training material if any.