CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Annexes

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1 Title of the small-scale project activity:

Title : Methane Capture and Utilization Project at Carotino Palm Oil Mill, Malaysia
Version : 1.0
Date : 09/12/2011

A.2. Description of the small-scale project activity:

The "Methane Capture and Utilization Project at Carotino Palm Oil Mill", Malaysia ("the project activity") will be implemented at the Carotino Palm Oil Mill ("the mill") located in Sri Jaya, Maran, Pahang in Peninsular Malaysia. The proposed project activity is being implemented by Carotino Sdn Bhd ("the project owner[1]").

The processing of crude palm oil from fresh palm fruit bunches (FFB) produces large amounts of Palm Oil Mill Effluent (POME) with high organic matter. The mill has a processing capacity of 144,000 tons[2] of FFB in the year 2011, which increases to approximately 216,000 tons of FFB per year in year 2013 onwards. Each tonne of FFB processed results in approximately 0.65 m^3 of POME produced[3].

The aim of the project activity is to capture anthropogenic methane emissions from the Palm Oil Mill anaerobic effluent treatment system and utilize the methane gas to generate renewable energy.

In the baseline scenario, POME is treated via a series of open anaerobic ponds, while electricity is generated primarily from biomass based boilers. The proposed project activity involves the installation of a new covered anaerobic digester tank system equipped with methane capture and collection system to replace existing open anaerobic ponds. Methane captured from the anaerobic digester system will be transferred to a biogas engine system for electricity generation.

An enclosed flare system will be installed to combust excess biogas generated from project activity. Implementation of the proposed project will result in an estimated reduction of emissions of 26,680 tonnes of CO_2e per year.

The project activity contributes to sustainable development of the agricultural sector in the region and will increase utilization of wastes from palm oil processing. The project activity promotes the National Green Technology Policy[4] and contributes to sustainable Development of the Host Country and on the four key aspects defined by the Country's Designated National Authority:

1. *Energy:* Seek to attain energy independence and promote efficient utilisation. The project activity conserves non-renewable natural resources (fossil fuels) through partially replacing fossil fuel sourced electricity generation;

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[1] Business Registration Form (Document 1.1)

[2] Malaysian Palm Oil Board (MPOB) Approval (Document 1.2)

[3] Frank Schudardt, et. al., 'Effect of New Palm Oil Mill Processes on the EFB and POME Utilization', Journal of Palm Oil Research, (Special Issue – October 2008), Page 118. (Document 1.3)

[4] http://www.kettha.gov.my/en/content/national-green-technology-policy-objective

2. *Environmental:* Conserve and minimise the impact on the environment. The project activity reduces GHG emissions through the avoidance of methane emissions from the existing open ponds directly to the atmosphere and improves the quality of wastewater discharged to the public waterways;

3. *Economic:* Enhance the national economic development through the use of technology. Promote and disseminate the successful application and integration of renewable energy technology for replication across Malaysia. The project activity will contribute towards the country's policy to promote the use of renewable energy;

4. *Social:* To improve the quality of the life. The project activity contributes to increase the stability and security of the local power supply which will in turn support an improved living standard.

A.3. Project participants:

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Malaysia (host)	Carotino Sdn Bhd (Private)	No
Australia	Perenia Pty Ltd (Private)	No

Contact information on the above participants is provided in Annex I.

A.4. Technical description of the small-scale project activity:

A.4.1. Location of the small-scale project activity:

A.4.1.1. Host Party(ies):

Malaysia

A.4.1.2. Region/State/Province etc.:

Pahang

A.4.1.3. City/Town/Community etc:

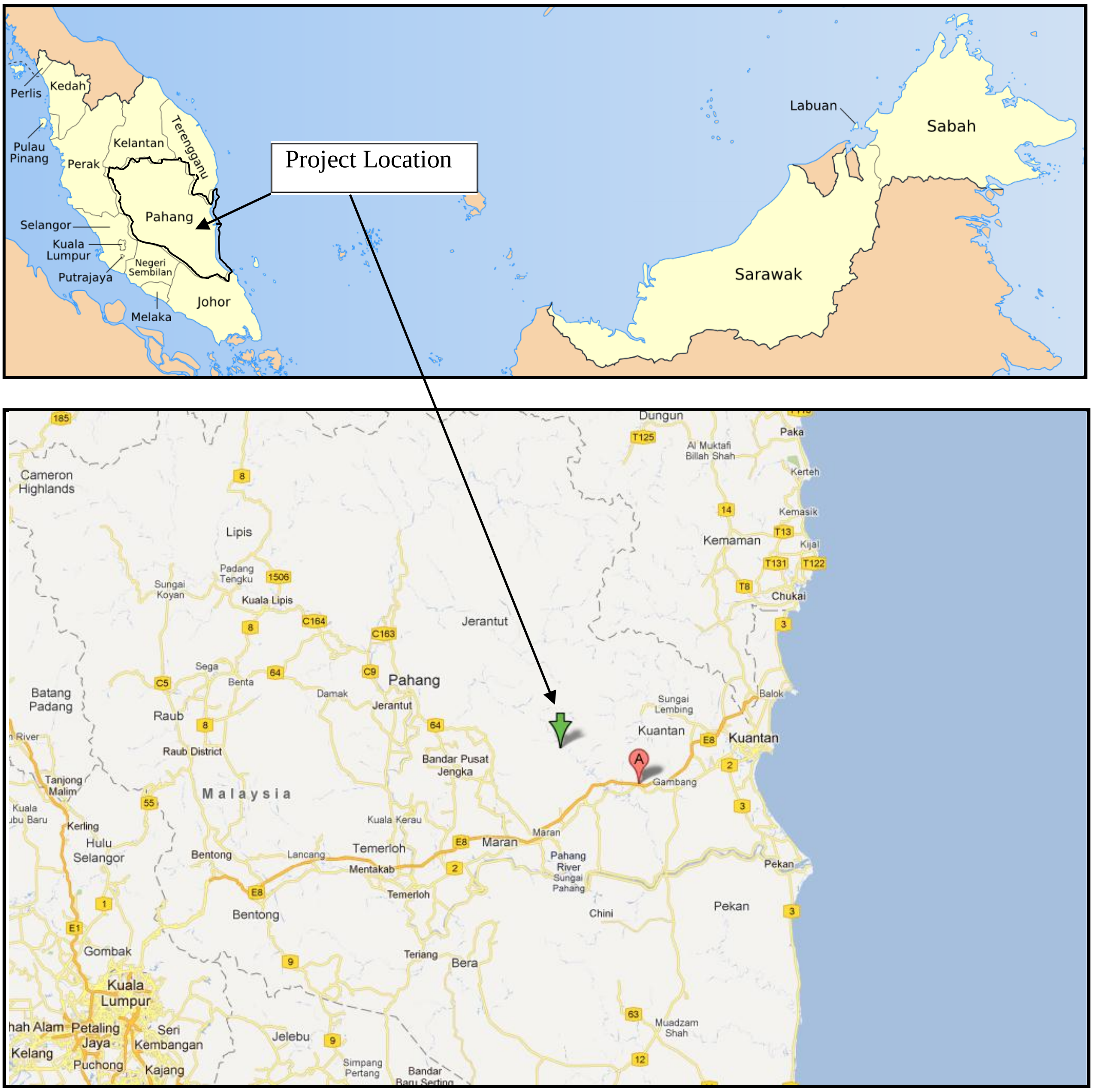
Maran, Sri Jaya Town

A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity:

The proposed project activity site is located within the Carotino Palm Oil Mill located at 23 km off Sri Jaya Town, Maran, Pahang in Peninsular Malaysia.

The project activity GPS coordinates are: +3° 49' 1.20", +102° 49' 4.44" E as illustrated in Figure A.1:

Figure A.1: Map of Malaysia, Indicating the Location of Pahang State and Location of Mill



A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:

(1) Types and categories of the small-scale project activity

In accordance with Appendix B of the simplified modalities and procedures for small-scale CDM project activities ("SSC M&P"), the proposed project activity falls under the following types and categories.
The primary purpose of the proposed project activity is the capture of biogas from wastewater treatment. Therefore, the applicable methodology is AMS-III.H, Methane Recovery in Wastewater Treatment. The relevant type and category is shown below.

Type III	:	Other Project Activities
Category H	:	Methane recovery in wastewater treatment
Reference	:	Version 16, EB 58, Scope 13

The proposed project activity will also generate renewable electricity from biogas captured during wastewater treatment. However, as no emission reductions are claimed from generation of renewable energy, the generated electricity has been excluded from the project boundary.

(2) Technology of the small-scale project activity

Watermech WM Closed Tank Anaerobic Digester System is designed to operate in the mesophilic temperature range of approximately 37°C and 15 - 20 days of hydraulic retention time. The feeding, mixing and discharge system incorporated in the cylindrical digester tank is equipped with withdrawal pipes for grit/sludge removal. The design allows for uniformity of environmental condition within the digester tank to be maintained.

The raw POME will be undergo hydrolysis and acidification process at the acidification pond. The larger materials in POME will be screened off prior to being pumped and distributed to the first stage digester system. The discharge from the first stage digester system overflows to the second stage digester system, while the effluent from the second digester tanks will be recycled and returned to the first stage digester system for better mixing and to maintain optimum percentage total solid. Treated effluent from the second stage digester overflows to the existing aerobic pond, settling pond and subsequently to an existing effluent polishing plant, prior to discharge to land irrigation. Digested excess sludge from the project activity will be dewatered periodically prior to land application in the plantation.

The generated biogas will be channelled through a desulphurisation plant before being transferred to biogas engine system. The biogas engine system will have total generation capacity of up to 2.00 MW[5].

The auxiliary power consumption of the project activity would be sourced from the renewable energy generated from the biogas engine. The net electricity generated from the gas engine will be supplied back to mill and other down-stream plants. Any excess biogas will be flared in an enclosed flare.

[5] General Specification of System & Project Process Flow by Watermech (Document (1.4)

Figure A.2: Proposed Project Activity Flow

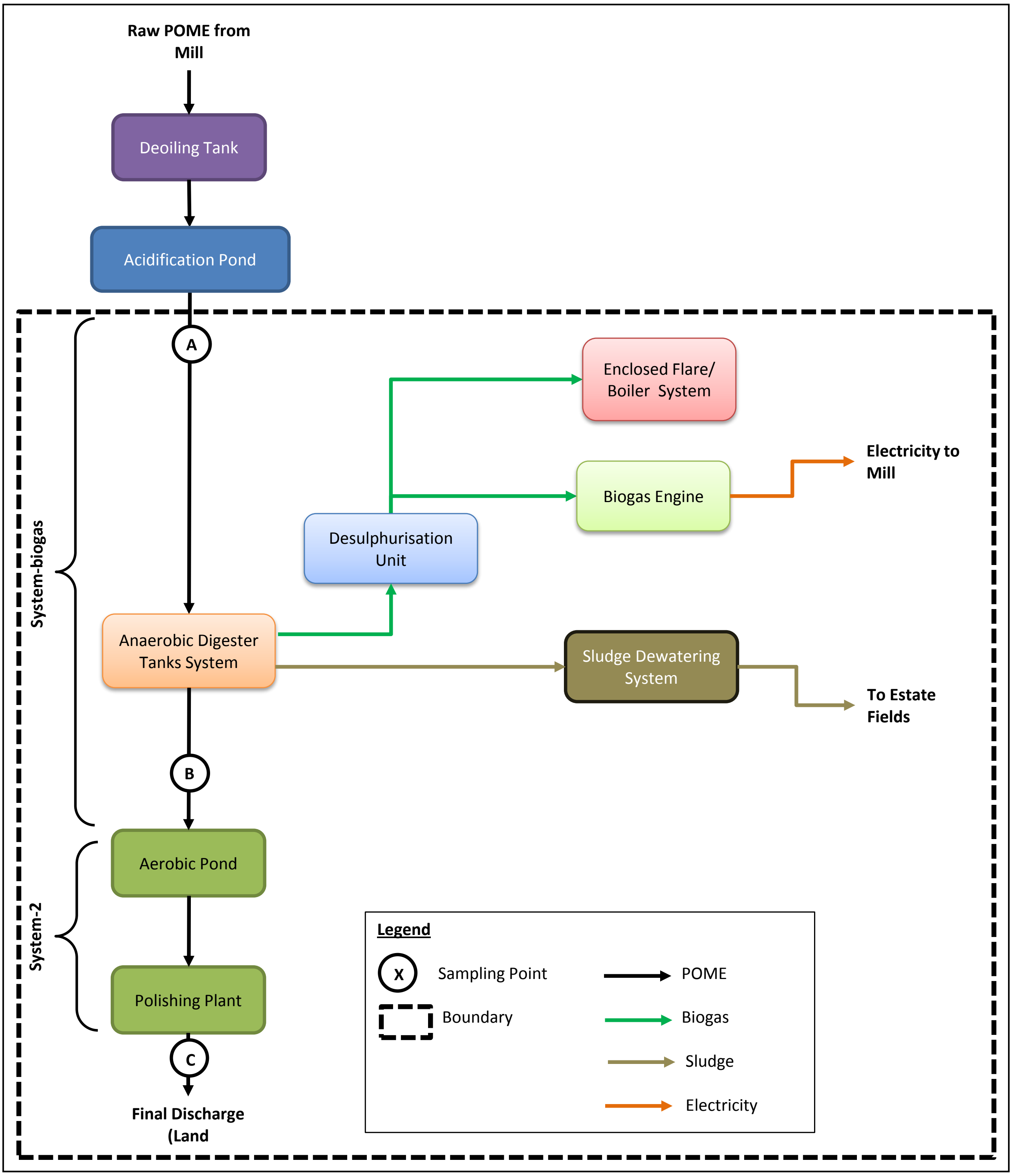


Table A.1.: Proposed Design Characteristics System

Anaerobic Digester Tank c/w Methane Capture System	
System Provider	Watermech Engineering Sdn. Bhd.
Design Capacity	500 m^3 (max.)
COD Inflow	58,479 mg/l
Average COD Removal Efficiency	80%[6]
Total Methane Generation	1,324 tCH_4/y (max.)
Gas Engine Capacity	1,000 kW total

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

Year	Estimation of total annual emission reductions from the project in tCO_2e
2013	26,680
2014	26,680
2015	26,680
2016	26,680
2017	26,680
2018	26,680
2019	26,680
2020	26,680
2021	26,680
2022	26,680
Total estimated reductions (tCO_2e)	**266,797**
Total number of crediting years	10
Annual average of the estimated reductions over the crediting period (tCO_2e)	26,680

A.4.4. Public funding of the small-scale project activity:

The project will not receive any public funding from Parties included in Annex I to the United Nations Convention on Climate Change.

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:

As defined in paragraph 2 of Appendix C of the modalities and procedures for small scale projects (SSC M&P), a proposed small-scale project activity shall be deemed to be a de-bundled component of a large

[6] http://www.watermech.com/p_anaerobic_digester_tank.php (Document 1.5)

project activity if there is a registered small-scale CDM project activity or a request for registration by another small-scale project activity:

- By the same project participants;
- In the same project category and technology/measure;
- Registered within the previous 2 years; and
- Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point.

The proposed project activity is not a de-bundled component of any large scale project activity as there is no other small-scale project activity that fulfils the above mentioned criteria.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the small-scale project activity:

The following approved small scale baseline and monitoring methodologies are applied to the proposed project activity.

- AMS-III.H. "Methane Recovery in Wastewater Treatment" (Version 16; EB 58, Scope 13), and

In accordance with the provisions of AMS-III.H. (Version 16; EB 58, Scope 13), the following tools are used:

- "Tool to determine project emissions from flaring gases containing methane" (Version 1, EB 28)
- "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" (Version 2, EB 41)

B.2 Justification of the choice of the project category:

The proposed project activity is eligible to utilise AMS-III.H. "Methane Recovery in Wastewater Treatment" (Version 16; EB58) as it meets all of the applicability conditions of the methodology as described in Table B.2 below.

Table B.2: Applicability conditions for AMS-III.H.

#	Applicability conditions	Project Scenario
1	This methodology comprises measures that recover biogas from biogenic organic matter in wastewaters by means of the following options: (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 pond without methane recovery).	The proposed project activity involves the introduction of an anaerobic digester tank system equipped with methane capture and collection system without sludge treatment. The existing system comprises anaerobic open ponds which does not have biogas recovery. Therefore the project activity is in compliance with option (f).
2	In cases where baseline system is anaerobic pond the methodology is applicable if: a) The ponds are ponds with a depth greater than two meters, without aeration. The value for depth	a) The anaerobic open ponds are all deeper than 2 meters[7], without aeration. b) The average temperature in Malaysia is consistently above 15°C[8].

[7] Effluent Treatment Plant Drawing (Document 1.6)

[8] Malaysia average temperature is 27.5 °C (82 °F). http://www.climatetemp.info/malaysia

#	Applicability conditions	Project Scenario
	is obtained from engineering design documents, or through direct measurement, or by dividing the surface area by the total volume. If the pond filling level varies seasonally, the average of the highest and lowest levels may be taken; b) Ambient temperature above 15°C, at least during part of the year, on a monthly average basis; c) The minimum interval between two consecutive sludge removal events shall be 30 days.	c) The loading rate of COD is above 0.1 kg $COD.m^3.day^{-1}$ (see Section B4). The desludging of accumulated solids in the anaerobic ponds in the baseline treatment system has more than 30 days of interval[9].
3	The recovered biogas from the above measures may also be utilised for the following applications instead of combustion/flaring: (a) Thermal or electrical energy generation directly	The proposed project activity includes the utilisation of the recovered biogas to generate electricity for its auxiliary consumption. Therefore the proposed project activity is in compliance with option (a).
4	If the recovered biogas is used for project activities covered under paragraph 3(a), that component of the proposed project activity can use a corresponding methodology under type I.	The recovered biogas is used to generate electricity for its auxiliary consumption. No emission reductions will be claimed from generation of renewable energy, thus methodologies under type I are not applied.
13	The location of the wastewater treatment plant shall be uniquely defined as well as the source generating the wastewater and described in the PDD.	The location of the wastewater treatment plant is uniquely defined in Section A2 of the PDD. The wastewater is generated through the production of crude palm oil from FFB processing.
14	Measures are limited to those that result in aggregate emission reductions of less than or equal to 60 kt CO_2 equivalent annually from all type III components of the project activity.	The estimated emission reductions are 26,680 tCO_2e per annum as demonstrated in Section B.6.3 which is lower than the 60,000 tCO_2e threshold.

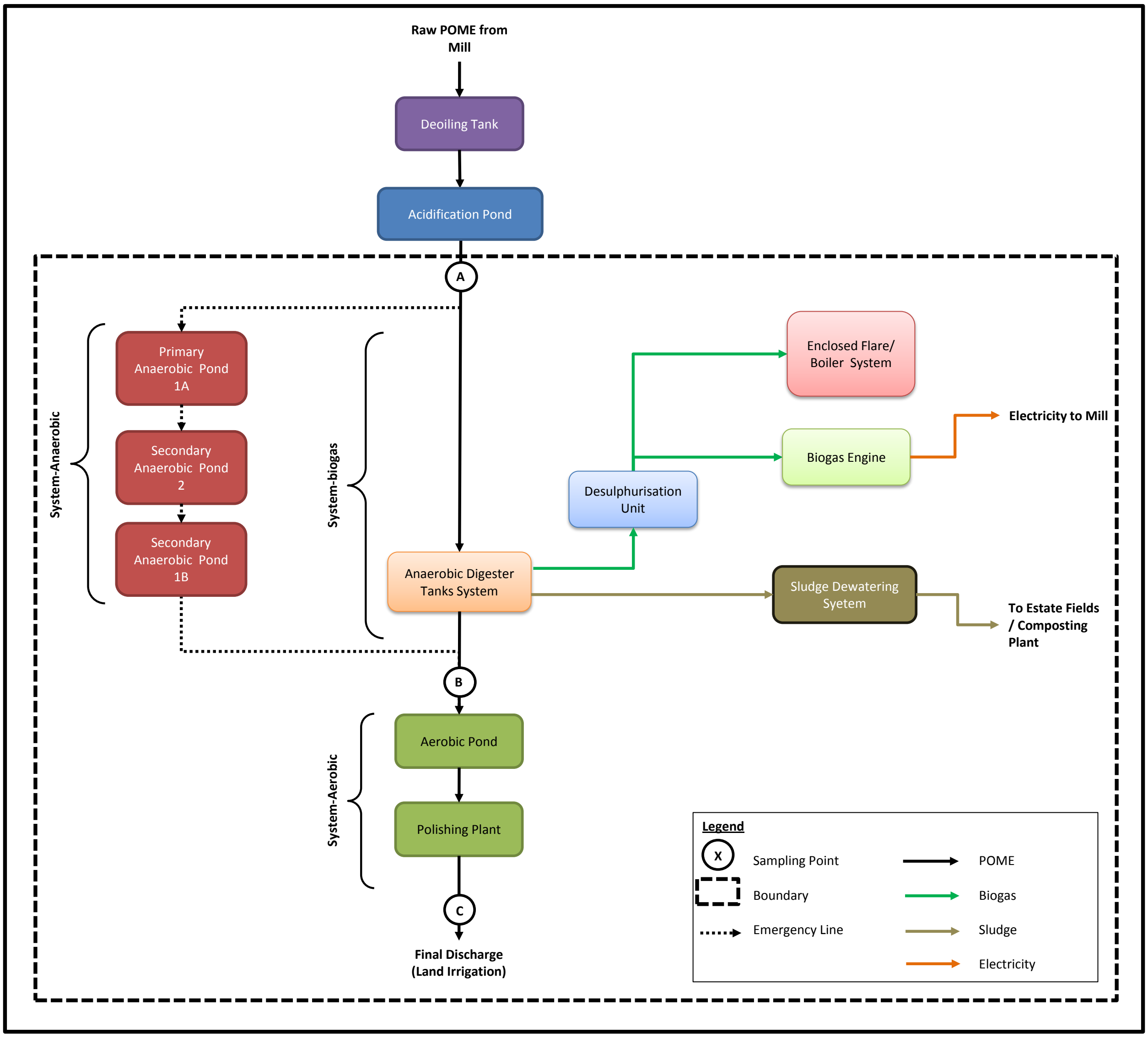
AMS-III.H. (Version 16; EB58) applicability conditions 5 – 12 are not relevant to the proposed project activity, as the proposed project activity does not fall under paragraph 3 (b), (c) or (d) and is not a Greenfield project. The project activity complies with all applicable eligibility requirements of the methodologies and therefore qualifies to be implemented as a small scale project activity and will remain as such during the entire crediting period.

[9] Desludging Approvals from Department of Environment (1999 – 2008) (Document 1.7)

B.3. Description of the project boundary:

As per AMS-III.H. (Version 16; EB58), the project boundary is the physical, geographical site where the wastewater treatment takes place in the baseline and project scenario. For the proposed project activity, the project boundary encompasses the existing open pond treatment system and the new anaerobic digester tank system, biogas desulphurisation system, biogas engine and enclosed flare system.

Figure B.2: Proposed project activity boundary



AMS-III.H (Version 16; EB58) paragraph 16 requires that an ex-ante assessment and identification of the systems affected by the project activity be undertaken. The purpose of this assessment is to identify any systems which are not affected by the proposed project activity, and hence can be excluded from baseline and project emission calculations.

The proposed project activity alters the baseline treatment system by introducing an anaerobic digester tank system upstream of the wastewater system; after the acidification pond. The treated water from the digester system flows to the existing aerobic pond and polishing plant. Therefore, the operation of the baseline system will be affected by the proposed project activity and in accordance with AMS-III.H (Version 16; EB58) emissions from affected open ponds will be accounted for in the calculation of baseline and project emissions.

B.4. Description of baseline and its development:

Baseline Wastewater Treatment Plant

In the absence of the proposed project activity, POME from The Mill would continue to be treated in the existing open pond treatment system.

In the baseline scenario, POME is treated in a sequential anaerobic and aerobic wastewater treatment system without biogas recovery system. From acidification pond 1 & 2, POME enters a series of anaerobic open ponds; primary anaerobic pond 1A, secondary anaerobic pond and secondary anaerobic pond 1B. Then it flows to an aerobic treatment system encompassing aerobic pond and effluent polishing plant before discharged for land irrigation. Sludge accumulated in the ponds will be desludged periodically to avoid siltation problems[10].

The methane correction factor (MCF) of baseline ponds are determined based on MCF values stated in table III.H.1, AMS IIIH (Version 16, EB 58). Based on Figure B.3, primary anaerobic pond 1A, secondary anaerobic pond and secondary anaerobic pond 1B has depth of more than two (2) metres, thus a methane correction factor of 0.8 for anaerobic deep has been applied. However, aerobic pond with depth of 4.6 m is equipped with diffusers for aeration purpose. Thus, the aerobic pond and effluent polishing plant are aerobically well managed[11]and a methane correction factor of zero has been applied.

Table B.3: Baseline open ponds [12]

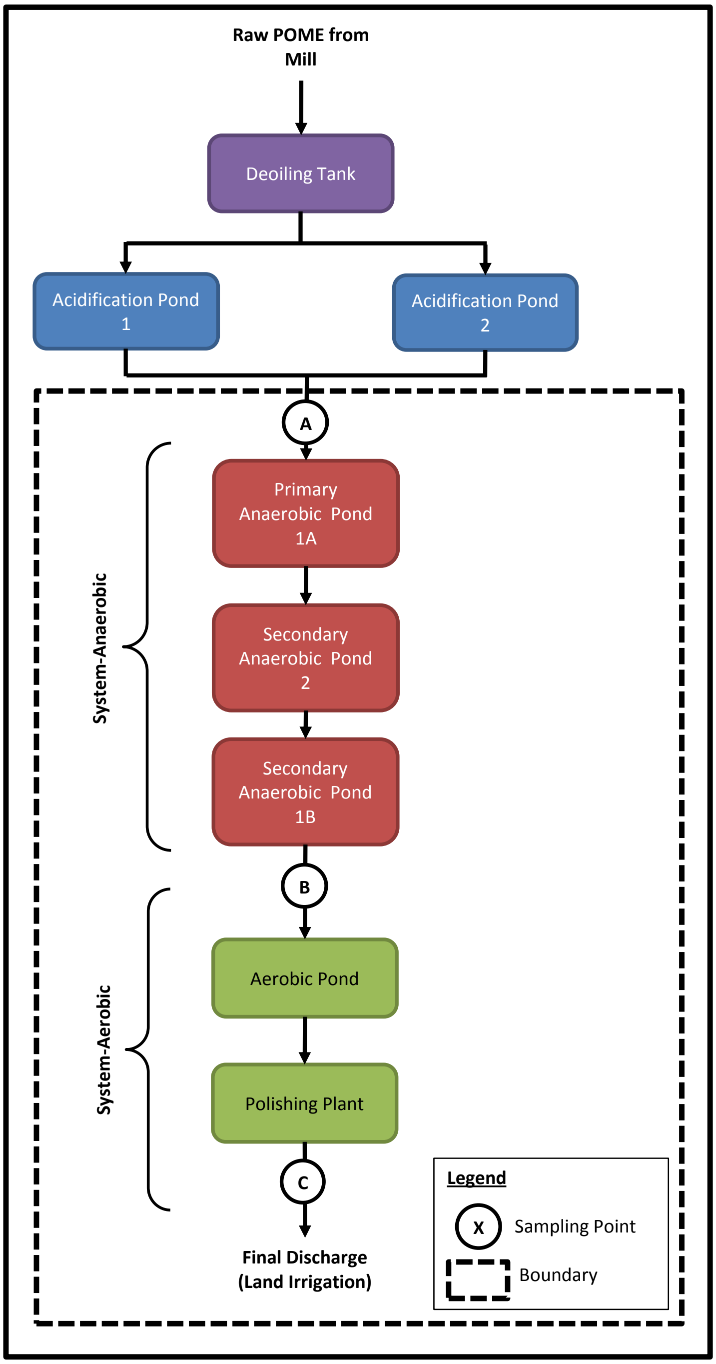
Type of Ponds	Pond Depth (m)	MCF factor used as per AMS-III.H ver16
Primary Anaerobic Pond 1A	4.34 m	0.8
Secondary Anaerobic Pond 2	4.42 m	0.8
Secondary Anaerobic Pond 1B	4.20 m	0.8
Aerobic Pond	4.60 m	0.0

[10] Desludging Approvals from Department of Environment (1999 – 2008) (Document 1.7)

[11] Description of Effluent Tertiary Plant (Document (1.8)

[12] Effluent Treatment Plant Drawing (Document 1.6)

Figure B.3: Baseline scenario existing open pond treatment system prior to implementation of the proposed project activity



The methodology for calculating baseline emissions has been developed in line with AMS-III.H (Version 16; EB58), paragraph 27 specifies that the parameters required to calculate the baseline emissions should be determined by a measurement campaign in the baseline wastewater systems in accordance with paragraph 27 where historical records from at least one year prior to the implementation of the project are not available.

In accordance with paragraph 27, a measurement campaign was undertaken for 10 normal operation days from 12th August – 21st August 2011. The measurements were taken during a period of normal operation, which is representative of the typical operating conditions and ambient temperature of the site.

Measurements were taken at three sampling points during the measurement campaign. With reference to Figure B.3, these are:

- Sample Point A: Wastewater entering the baseline anaerobic wastewater treatment system at the Primary Anaerobic Pond 1A inlet;
- Sample Point B: Wastewater exiting the baseline anaerobic wastewater treatment system at Secondary Anaerobic Pond 1B outlet; and
- Sample Point C: Wastewater exiting the polishing plant to land irrigation.

For each sampling point, the average COD value was taken and the results were multiplied by 0.89 to account for the uncertainty range (30-50%) associated with this approach, compared to one-year historical data.

The resulting values at Sampling Point A and Sampling Point B represent the *ex-ante* estimate of COD inflow and COD outflow of the baseline anaerobic wastewater system. COD removed is therefore calculated as $COD_{inflow,y} - COD_{outflow,y}$ and used to determine the COD removal efficiency for baseline anaerobic wastewater system.

The difference of COD between Sampling Point B and Sampling Point C represent ex-ante estimate of baseline aerobic wastewater system and determines the COD removal efficiency. The implementation of the project activity does not change the operational characteristics of baseline aerobic wastewater treatment system

Based on the results of the measurement campaign, the COD removal efficiency of the baseline anaerobic system and baseline aerobic system is 99.30% and 60.55% respectively**.**

Table B.4: Summary of key data used to determine the baseline emissions

Parameter	Value	Description	Source
Operating Hours	4,800	Operating hours per year (hours/year)	Mill Processing Capacity from year 2013 onwards (16/hr/day * 300 days/y)
FFB Production	216,000	Average processing rate of FFB per year(tonnes/year)	Mill Processing Capacity from year 2013 onwards (45 t/hr * 300 days/y * 16 hrs/day)
POME generation rate	0.65	Amount of wastewater produced (m^3) per tonne of FFB.	Frank Schudardt, et. al., 'Effect of New Palm Oil Mill Processes on the EFB and POME Utilization', Journal of Palm Oil Research, (Special Issue – October 2008), Page 118.
$Q_{ww,y}$	155,060	Volume of wastewater treated in baseline wastewater treatment system the year y (m^3/y)	Calculated as FFB x 0.65
$COD_{inflow,y}$	0.05848	COD of the wastewater entering the baseline wastewater system the year y (tonnes/m^3)	Measurement Campaign, Sample Point A
$COD_{outflow,y}$	0.00041	Chemical Oxygen Demand of the wastewater leaving the baseline wastewater system the year y(tonnes/m^3)	Measurement Campaign, Sample Point B
$COD_{ww,discharge,BL,y}$	0.00016	COD of the treated wastewater sent for plantation irrigation purpose (tonnes/m^3)	Measurement Campaign, Sample Point C

In the baseline scenario, sludge is periodically removed from the anaerobic open lagoons and sent to the plantation for soil application under aerobic conditions[13].

The power supply to the existing wastewater treatment system is supplied mainly by mill's biomass boiler, operated using mesorcarp fibre and/or palm kernel shell. Diesel generators are used during start-up, shut down or emergencies. There are two units of biomass boilers with turbine capacity of 650 kW and 1,000 kW. The two units back-up diesel engines has a capacity of 200 kW each[14].

As the electricity generation is primarily from a renewable source, it is assumed as carbon neutral. Thus, the baseline emission for power displacement is assumed as 0.

[13] Desludging Approvals from Department of Environment (1999 – 2008) (Document 1.7)

[14] Electrical Installation Licence by Suruhanjaya Tenaga (Document 1.9)

However, as the project activity displaces diesel use in the mill, the avoided cost for purchasing the diesel[15] will be calculated and added as revenue steam in project financial analysis. The amount of potential saving is increased proportionately to the mill's capacity expansion.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

Prior Consideration of the CDM

The start date of the project activity as defined in the *CDM Glossary of Terms* is 04/08/2011[16]. On this date the project proponent signed a letter of intent with project technology supplier. In line with the requirements in the *"Guidance on the demonstration and assessment of prior consideration of the CDM"*, the project participant informed the Host Party DNA and the UNFCCC Secretariat of its intention to seek CDM status on 21/10/11[17]. Acknowledgement was received from UNFCCC secretariat on 21/10/11[18] and the Host Party DNA on 15/11/2011[19].

A chronology of the key events in the development of the proposed project activity is provided in Table B.5 that demonstrates continuous real actions to secure CDM status:

Table B.5: Chronology of events and documents

Document Name	Date
Board approving development of the proposed project activity as a CDM project.	14/04/2011
Term sheet signed between Perenia and project proponent	27/05/2011
Project Proponent Signed "Letter of Acceptance of Offer" with Watermech Engineering Sdn. Bhd	04/08/2011
ERPA signed between Perenia & Carotino Sdn. Bhd.	17/10/2011
Prior consideration notification posted on UNFCCC website	21/10/2011
Response received from UNFCCC	21/10/2011
Prior consideration sent out to Malaysian DNA for the proposed biogas activity	21/10/2011
Local Stakeholder Consultation Meeting	02/11/2011
Response received from Malaysian DNA	15/12/2011

[15] Diesel Consumption Data from July 2010 – Jun 2011 (Document 1.10)

[16] Letter of Acceptance of Offer (Document 1.20)

[17] Prior Consideration Form (Document 1.12)

[18] Notification of Receipt by UNFCCC (Document 1.13)

[19] Notification of Receipt by Malaysian DNA (Document 1.14)

Demonstration and assessment of additionality

In accordance with Attachment A to Appendix B of the simplified modalities and procedures for small-scale CDM project activities, the additionality of the proposed project is demonstrated and assessed by the *"Investment Barrier"* analysis. The following section explains on how the proposed project activity would not have occurred in the absence of the CDM due to the presence of an investment barrier.

Investment barrier

Benchmark

To demonstrate that the proposed project activity is not financially attractive, a benchmark analysis has been conducted, which is consistent with the requirements of the *"Guidelines on the Assessment of Investment Analysis"* (Version 05; EB 62).

The default expected return on equity, of 10.9% for 'Waste Handling and Disposal' (Group 1, Sectoral Scope 13) in the Host Country, Malaysia as defined in the *"Guidelines on the Assessment of Investment Analysis"* is applied.

This value is applicable as a simple default option as the project is funded internally, and an Equity IRR calculation is carried out.

Sub-step2c: Calculation and comparison of financial indicators (if applicable)

Equity IRR of the Proposed Project Activity

The project generates no significant revenue except for cost savings from diesel displacement and revenue from Certified Emission Reductions (CERs). The diesel cost savings are negligible as electricity is primarily generated from biomass which is available at no cost.

The Equity IRR of the proposed project activity without the additional revenue from the sale of CERs is zero. The complete financial model (provided with the PDD) includes justification of all of the parameters used and assumptions made.

Table B.6: Key Financial Inputs

Assumption	Value	Unit	Source
Project life	15	years	Technology Provider
Total Capital Expenditure	13,913,790	RM	Board approving development of the proposed project activity as a CDM project.[20]
Operation and maintenance expenses	744,295	RM/year	Watermech Engineering Sdn. Bhd; Life Span, Operation & Maintenance Cost of Equipment & Internal Mill Estimate
Diesel Unit	2.19	RM/liter	Diesel Consumption Data from July 2010 – Jun 2011[21]

[20] Board approving development of the proposed project activity as a CDM project (Document 1.15)

Cost			
Tax rate	25%	-	Malaysia Inland Revenue Board (http://www.mida.gov.my/en_v2/index.php?page=company-tax)

The IRR has been calculated based on the expected 15 years operating life of the anaerobic digester which is the most significant capital item[22] . It is assumed that the fair value of the asset at the end of the 15 years operational life is zero, in accordance with local accounting regulations as the assets have fully devalued[23], as the investment period is equal to the technical lifetime of the equipment.

Sensitivity analysis

An analysis was conducted to demonstrate at what value each scenario included in the sensitivity analysis changes such that the IRR of the proposed project activity hits the nominated benchmark. The results of this analysis demonstrates that each of these scenarios is unlikely to occur.

Table B.7: Value at which each Sensitivity Scenario Hits the Nominated Benchmark

Scenario	Change at Which Scenario Hits Benchmark	Percentage Change at Which Scenario Hits Benchmark	Likelihood of Occurring
Project capital costs	Project Cost reduced from MYR 13.914 million to MYR 0	- 100%	The capital costs included within the financial model are taken from board meeting. The costing was primarily estimated based on proposal received from Watermech Engineering Sdn. Bhd[24]. Additionally, the project does not generate any significant revenue. Even if the total project cost is reduced to zero, their IRR will not hit the benchmark.
Operating & Maintenance Cost	Operation & Maintenance cost reduced from MYR 0.745 million annually to MYR 0	- 100%	The operational costs primarily based on estimated operation cost and plant maintenance cost provided by technologist[25]. Even if the total cost is reduced to zero, it is unlikely that project will hit the benchmark as the calculated IRR is – 6.8%

[21] Diesel Consumption Data from July 2010 – Jun 2011 (Document 1.10)

[22] Watermech Engineering Sdn. Bhd; Life Span, Operation & Maintenance Cost of Equipment (Document 1.11)

[23] http://www.pwc.com/my/en/assets/publications/pwctaxbbooklet_08-09.pdf (Page 22)

[24] Proposal received from Watermech Engineering Sdn.Bhd (Document 1.16)

[25] Watermech Engineering Sdn. Bhd; Life Span, Operation & Maintenance Cost of Equipment (Document 1.11)

Diesel Cost	Diesel cost increase over the years from RM 2.19 to RM 12.52	472%	It is extremely unlikely that the cost of diesel purchase price will increase by 472% to hit the benchmark.

Summary

The benchmark analysis clearly demonstrates that the proposed project activity is unlikely to be considered a financially attractive course of action without the revenue from the sale of CER's. CDM registration assists in alleviating the investment barrier faced by providing an important revenue stream through the sale of the CERs that supports the decision to develop the proposed project activity.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

The primary purpose of the proposed project activity is the capture of methane from wastewater treatment. Therefore, emission reductions have been calculated using AMS-III.H, Methane Recovery in Wastewater Treatment (Version 16; EB 58).

AMS-III.H is applicable to activities which comprise measures that recover biogas from biogenic organic matter in wastewaters by means of six options outlined in paragraph 1 of the methodology. Of these methods, option (f) is the option relevant to the proposed project activity.

(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 pond without methane recovery).

Baseline Emissions

As per AMS-III.H (Version 16; EB 58), baseline emissions are calculated using the following formula.

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

Where:

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

Baseline Emissions from electricity or fuel consumption ($BE_{power,y}$)

The treatment systems (anaerobic ponds, aerobic pond, polishing plant) affected by project activity biogas recovery will continue to operate with the same operational characteristics, as in the baseline scenario. Furthermore, power supply to the wastewater treatment system is from The Mill biomass boiler. Thus, the baseline electricity consumption, $BE_{power,y} = 0$.

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

The baseline treatment systems consists of anaerobic ponds with depths of more than 2m, and aerobic ponds that operate in aerobic conditions having a depth of less than 2 meters described in section B.4 as defined in Section B.4

The MCF for baseline aerobic wastewater treatment is 0, for well managed aerobic ponds. Therefore the baseline emissions from the aerobic wastewater treatment = 0.

The baseline emissions of the anaerobic wastewater treatment systems is determined as:

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

$Q_{ww,i,y}$	Volume of wastewater treated in baseline anaerobic wastewater treatment system i in year y (m^3). For *ex ante* estimation, forecasted wastewater generation volume or the designed capacity of the wastewater treatment facility can be used. However, the *ex post* emissions reduction calculation shall be based on the actual monitored volume of treated wastewater
$COD_{inflow,i,y}$	Chemical oxygen demand of the wastewater inflow to the baseline anaerobic treatment system in year y (t/m^3). Average value may be used through sampling with the confidence/precision level 90/10
$\eta_{COD,BL,i}$	COD removal efficiency of the baseline treatment system , determined as per the paragraphs 26, 27 or 28 in AMS-III.H (Version 16)
$MCF_{ww,treatment,BL,i}$	Methane correction factor for baseline anaerobic wastewater treatment systems i (*MCF* values as per Table III.H.1)
i	Index for baseline wastewater treatment system
$B_{o,ww}$	Methane producing capacity of the wastewater (IPCC value of 0.25 kg CH_4/kg COD)
UF_{BL}	Model correction factor to account for model uncertainties (0.89)[26]
GWP_{CH4}	Global Warming Potential for methane (value of 21)

In accordance with paragraph 20 of AMS-III.H, (Version 16; EB 58), if the baseline wastewater treatment system is different from the treatment system in the project scenario the monitored values of COD inflow during the crediting period will be used to calculated the baseline emissions *ex-post*.
Therefore:

Ex-ante estimate of baseline emissions in accordance with AMS-III.H:

$$COD_{removed,y} = COD_{inflow,y} - COD_{outflow,y}$$

Historical records of the COD removal efficiency of the baseline wastewater treatment system were not available. Therefore, in accordance with AMS-III.H, (Version 16; EB 58), paragraph 27, and a measurement campaign was undertaken in the baseline wastewater system, as detailed in Section B.4.

Baseline emissions of the sludge treatment systems affected by the project activity ($BE_{treatment,s,y}$)

The baseline scenario does not involve sludge treatment. Therefore, on this basis $BE_{treatment,s,y} = 0$.

[26] Reference: FCCC/SBSTA/2003/10/Add.2, page 25 (AMS IIIH).

Baseline methane emissions from degradable organic carbon in treated wastewater discharged into sea/river/lake in year y ($BE_{ww, discharge, y}$)

The baseline scenario involves well managed wastewater discharge for plantation irrigation purpose (MCF values as per Table III.H.1 is = 0). Therefore, on this basis $BE_{ww, discharge,y} = 0$.

Baseline methane emissions from anaerobic decay of the final sludge produced ($BE_{s,final.y}$)

In the baseline scenario sludge is periodically removed from the anaerobic open ponds and sent to the plantation for soil application as a fertiliser. All sludge removed is used for soil application under aerobic conditions. Therefore, on this basis $BE_{s,final.y} = 0$.

Total Baseline Emissions

The total baseline emissions in year y, is:

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

Project Activity Emissions

As per AMS-III.H. (Version 16; EB 58) project emissions are calculated using the following formula.

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

Where:

PE_y Project activity emissions in the year *y* (tCO_2e)

$PE_{power,y}$ Emissions from electricity or fuel consumption in the year *y* (tCO_2e). These emissions shall be calculated as per paragraph 19, for the situation of the project scenario, using energy consumption data of all equipment/devices used in the project activity wastewater and sludge treatment systems and systems for biogas recovery and flaring/gainful use

$PE_{ww,treatment,y}$ Methane emissions from wastewater treatment systems affected by the project activity, and not equipped with biogas recovery, in year *y* (tCO_2e). These emissions shall be calculated as per equation 2 in paragraph 20, using an uncertainty factor of 1.12 and data applicable to the project situation ($MCF_{ww,treatment,PJ,k}$ and $COD_{removed,PJ,k,y}$) and with the following changed definition of parameters:

- $MCF_{ww,treatment,PJ,k}$ Methane correction factor for project wastewater treatment system *k* (MCF values as per table III.H.1.)
- $\eta_{PJ,k}$ Chemical oxygen demand removal efficiency of the project wastewater treatment system *k* in year *y* (tonnes/m^3), measured based on inflow COD and outflow COD in system *k*.

$PE_{s,treatment,y}$ Methane emissions from sludge treatment systems affected by the project activity, and not equipped with biogas recovery, in year *y* (tCO2e).

$PE_{,ww,discharge,y}$ Methane emissions from degradable organic carbon in treated wastewater in year *y* (tCO2e).

$PE_{s,final,y}$ Methane emissions from anaerobic decay of the final sludge produced in year *y* (tCO_2e).

$PE_{fugitive,y}$ Methane emissions from biogas release in capture systems in year *y* (tCO_2e).

$PE_{biomass,y}$	Methane emissions from biomass stored under anaerobic conditions. In case storage of biomass under anaerobic conditions takes place due to the project activity that doesn't occur in the baseline situation, methane emissions due to anaerobic decay of this biomass shall be considered and be determined as per the procedure in the "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site" (tCO_2e).
$PE_{flaring,y}$	Methane emissions due to incomplete flaring in year *y* as per the "Tool to determine project emissions from flaring gases containing methane"(tCO2e). These emissions are accounted for when the flare is in use.

Project activity emission from fuel consumption ($PE_{power,y}$)

The auxiliary power consumption for project activity is sourced from electricity generated from biogas engine. Therefore $PE_{power,y} = 0$ if electricity generated from biogas engine is more than auxiliary power consumption. In the event the biogas engine generated electricity is lesser than auxiliary power consumption, the remaining electricity will be supplied by The Mill.

The Mill's primary electricity supply is from biomass turbines. Diesel engines are used during shut-down/start-up or emergencies. The emission factor of the electricity sourced from the mill can be calculated in accordance 'Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion'. The maximum estimated project emissions, assuming the total amount of electricity generated from biogas engine is zero, and auxiliary power is consumed 8760 hours per year is calculated below:

Parameter	Units	Value	Source
Total Electricity generated by biomass turbine from July 2010 – June 2011	kWh/y	2,651,540	Historical Generation Data July 2010 – Jun 2011 (a)[27]
Total Electricity generated by diesel engine from July 2010 – June 2011	%	393,760	Historical Generation Data July 2010 – Jun 2011 (b)[28]
% of Electricity Supply by Biomass Boiler	-	87.07%	Calculated (a /(a+b))
% of Electricity Supply by Diesel Engines	-	12.93%	Calculated (b /(a+b))
Emission Factor (EF) of electricity from Biomass turbine (renewable source)	tCO_2/MWh	0.0	EF = 0 for renewable energy
Emission Factor (EF) of electricity from Diesel engines	tCO_2/MWh	1.3	Conservative assumption as per tool
Weighted average Emission Factor	tCO_2/MWh	0.17	Calculated (0.129. * 1.3 tCO_2/MWh)
Auxiliary power consumption for project activity operation	kW	130	Power Generation Information[29]
Total project emission	**tCO_2**	**194**	0.13 MW * 8,760 h/y x 0.17 tCO_2/MWh

The calculated % of project emission from fossil fuel consumption at project activity much is lesser than 1% of baseline emissions (30,477 tCO_2/y) under an unlikely scenario.

[27] Historical Power Generation Turbine and Genset (July 2010 – Jun 2011) (Document 1.17)

[28] Historical Power Generation Turbine and Genset (July 2010 – Jun 2011) (Document 1.17)

[29] Power Generation Information (Document 1.4)

Thus, CO_2 emissions from the combustion of fossil fuels is estimated as negligible (< 1%) and not accounted for as project emissions.

Therefore, $PE_{power,y} = 0$.

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

$$\mathbf{PE_{ww,treatment,y} = (Q_{ww,y} * COD_{ww,treated,PJ,y} * \eta_{,PJ,k} * MCF_{ww,treatment,k}) * B_{o,ww} * UF_{PJ} * GWP_{CH4}}$$

Where:

$Q_{ww,y}$	Volume of wastewater treated in project wastewater treatment system (system biogas) in the year y (m^3)
$COD_{ww,treated,PJ,y}$	Chemical Oxygen Demand of the wastewater leaving the project wastewater treatment system (system biogas) in year y.
$\eta_{,PJ,k}$	Chemical oxygen demand removal efficiency of the project wastewater treatment system (not equipped with biogas recovery) in year y (t/m^3). This is equivalent to COD removal efficiency of the baseline aerobic treatment system, determined as per the paragraphs 26, 27 or 28 in AMS III.H ($\eta_{,PJ,aerobic}$)
$MCF_{ww,treatment,PJ,k}$	Methane correction factor of baseline aerobic wastewater treatment system (MCF values as per table III.H.1.) ($MCF_{ww,treatment,PJ,aerobic}$)
$B_{o,ww}$	Methane producing capacity of the wastewater (IPCC value of 0.25 kg CH_4/kg COD)[6]
UF_{PJ}	Model correction factor to account for model uncertainties (1.12)
GWP_{CH4}	Global Warming Potential for methane (value of 21)

Wastewater treatment systems (aerobic ponds) affected by the project activity that are not equipped with biogas recovery, will continue be the same as in the baseline scenario and the *MCF* values as per Table III.H.1 is '0', for aerobic treatment well managed ponds. The implementation of the project activity does not change the operational characteristics of the aerobic ponds.

Therefore, $PE_{ww,treatment,y} = 0$.

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

In the proposed project activity sludge from the wastewater ponds will be used land application which is an aerobic process. Therefore on this basis $PE_{s,treatment,y} = 0$.

Methane emissions from degradable organic carbon in treated wastewater ($PE_{ww, discharge, y}$)

In the proposed project activity, the final treated effluent is sent for land irrigation. The implementation of the project activity does not change the operational characteristics of treated wastewater discharged to plantation as in the baseline and the MCF values as per Table III.H.1 is = 0.

Therefore, on this basis $PE_{ww, discharge,y} = 0$.

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

In the proposed project activity, sludge will be removed from the anaerobic digester and used for land application. Land application of fertilizer qualifies as aerobic conditions.

Therefore on this basis $PE_{s,final,y} = 0$.

Methane emissions from biogas release in capture systems ($PE_{fugitive,y}$)

$$PE_{fugitive,y} = PE_{fugitive,ww,y} + PE_{fugitive,s,y} \quad (9)$$

Where:

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

In the proposed project activity there is no sludge treatment as sludge will be used as fertilizer. Therefore on this basis $PE_{fugitive,s,y} = 0$.

$$PE_{fugitive,y} = PE_{fugitive,ww,y}$$

Where

$$PE_{fugitive,ww,y} = (1-CFE_{ww}) * MEP_{ww,treatment,y} * GWP_{CH4} \quad (10)$$

Where:

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

And:

$$MEP_{ww,treatment,y} = Q_{ww,y} * B_{o,ww} * UF_{PJ} * \Sigma_k COD_{removed,PJ,k,y} * MCF_{ww,treatment,PJ,k} \quad (11)$$

Where:

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

$$MEP_{ww,treatment,y} = Q_{ww,y} * B_{o,ww} * UF_{PJ} * COD_{removed,PJ,y} * MCF_{ww,treatment,y}$$

Methane emissions from biomass stored under anaerobic conditions ($PE_{biomass}$)

Storage of biomass under anaerobic conditions will not take place due to the proposed project activity, therefore on this basis $PE_{Biomass}$ =0.

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

The biogas that is produced in the anaerobic digester will be combusted in the engines for electricity generation. Excess biogas will be flared using enclosed flare system. In this situation, any methane emissions that occur due to incomplete flaring will be calculated as per the "Tool to determine project emissions from flaring gases containing methane" (Version 1, EB28).

The flare that will be installed in the proposed project activity is an enclosed flare. Therefore in accordance with section II, step 6 of the "Tool to determine project emissions from flaring gases containing methane" (Version 1, EB28), a default value of 90% efficiency will be used. The flare efficiency will be determined using a default value. A default value of 100% will be used for biogas combusted in gas engines.

Calculation of annual project emission from flaring

Project emissions from flaring are calculated as the sum of emissions from each hour h, based on the methane flow rate in the residual gas ($TM_{RG,h}$) and the flare efficiency during each hour h ($\eta_{flare,h}$) as follows;

$$\mathbf{PE_{flare} = \sum_{h=1}^{8760} TM_{RG,h} * (1-\eta_{flare,h}) * (GWP_{CH4}/1000)} \quad \textbf{(15)}$$

Where:

PE_{flare}	Project emission from flaring of methane in the residual gas in year y
$FM_{RG,h}$	Mass flow rate of methane in hour h
$\eta_{flare,h}$	Flare efficiency in hour h
GWP_{CH4}	Global warming potential of methane

Leakage

As per AMS-III.H.(Version 16, EB 58), paragraph 31, there is no leakage expected from proposed project activity as the technology and equipment used is not transferred from another activity.

Emission Reductions

In accordance with paragraph 32 of AMS-III.H. (Version 16, EB 58), emission reductions associated with wastewater treatment are estimated *ex ante*, as follows:

$$\mathbf{ER_{y,ex\ ante} = BE_{y,ex\ ante} - (PE_{y,ex\ ante} + LE_{y,ex\ ante})} \quad \textbf{(14)}$$

Where:

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

In accordance with paragraph 33 of AMS-III.H. (Version 16, EB 58), the emission reductions achieved by the project activity will be determined as follows:

Ex post emission reductions will be based on the lowest value of the following:

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

$$ER_{y,ex-post} = \min\left((BE_{y,ex-post} - PE_{y,ex-post} - LE_{y,ex-post}), (MD_y - PE_{power,y} - PE_{biomass,y} - LE_{y,ex-post})\right) \quad (15)$$

Where:

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

In case of flaring/combustion MD_y will be measured using the conditions of the flaring process in accordance with AMS-III.H. (Version 16, EB 58), paragraph 35, as follows:

$$MD_y = BG_{burnt,y} * w_{CH4,y} * D_{CH4} * FE * GWP_{CH4} \quad (16)$$

Where:

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

In the proposed project activity, biogas will be typically combusted in the gas engines. Excess biogas will be combusted in the flare or utilized at mill. In addition, flare efficiency is already monitored in order to determine PE_{flare} and therefore $FE = \eta_{flare,h}$

On this basis:

$$MD_y = [Q_{biogas,\ combusted} \times fm_{CH4,RG} \times CFE_{ww} \times GWP_{CH4}] + [TM_{RG,h} \times \eta_{flare,h} \times GWP_{CH4}]$$

B.6.2. Data and parameters that are available at validation:

Data / Parameter:	**$MCF_{ww,treatment,BL}$**
Data unit:	Factor
Description:	Methane correction factor for the baseline anaerobic wastewater treatment system
Source of data used:	IPCC default value for anaerobic decay of the untreated wastewater
Value applied:	0.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	MCF values as per table III.H.1, AMS III.H (Anaerobic deep lagoon depth more than 2m).
Any comment:	-

Data / Parameter:	**$MCF_{ww,treatment, aerobic}$**
Data unit:	Factor
Description:	Methane correction factor for the baseline aerobic wastewater treatment system
Source of data used:	IPCC default value for aerobic treatment, well managed pond
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	MCF values as per table III.H.1, AMS III.H (Aerobic treatment, well managed pond).
Any comment:	-

Data / Parameter:	**$\eta_{COD,BL}$**
Data unit:	%
Description:	COD removal efficiency of the baseline treatment system, determined as per the paragraphs 26, 27 or 28 in AMS III.H
Source of data used:	Measurement campaign
Value applied:	99
Justification of the choice of data or description of measurement methods and procedures actually applied :	Measurement campaign was undertaken in the baseline wastewater treatment system for 10 normal operation days from 12th August – 21st August 2011.
Any comment:	-

Data / Parameter:	**$\eta_{PJ,,aerobic}$**
Data unit:	%
Description:	Chemical oxygen demand removal efficiency of the project wastewater treatment system (System-Aerobic) which is not equipped with biogas recovery digester in year y.
Source of data used:	Measurement campaign
Value applied:	61
Justification of the choice of data or description of measurement methods	Measurement campaign was undertaken in the baseline wastewater treatment system for 10 normal operation days from

and procedures actually applied :	12th August – 21st August 2011.
Any comment:	Equivalent to COD removal efficiency of the baseline aerobic treatment system, determined as per the paragraphs 26, 27 or 28 in AMS III.H

Data / Parameter:	**$B_{o,ww}$**
Data unit:	tCH_4/t COD
Description:	Methane producing capacity of wastewater
Source of data used:	AMS-III.H. Default value
Value applied:	0.25
Justification of the choice of data or description of measurement methods and procedures actually applied :	The default value as specified in AMS-III.H (Version 16; EB58).
Any comment:	-

Data / Parameter:	**UF_{BL}**
Data unit:	-
Description:	Model correction factor to account for model uncertainties
Source of data used:	AMS-III.H. Default value
Value applied:	0.89
Justification of the choice of data or description of measurement methods and procedures actually applied :	The default value as specified in AMS-III.H (Version 16; EB58) for the calculation of baseline emissions.
Any comment:	-

Data / Parameter:	**$MCF_{ww,treatment,PJ}$**
Data unit:	Factor
Description:	The chemical oxygen demand removed by the project wastewater treatment system (equipped with biogas recovery system digester) in year y.
Source of data used:	IPCC default value for aerobic treatment, well managed
Value applied:	0.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	MCF values per table III.H.1, AMS III.H for equipped with biogas recovery system digester
Any comment:	

Data / Parameter:	**$MCF_{ww,treatment,PJ,aerobic}$**
Data unit:	Factor
Description:	The chemical oxygen demand removed by the project wastewater treatment system (not equipped with biogas recovery system digester) in year y.
Source of data used:	IPCC default value for aerobic treatment, well managed
Value applied:	0.0
Justification of the choice of data or description of measurement methods	MCF values per table III.H.1, AMS III.H (Aerobic treatment, well managed pond).

and procedures actually applied :	
Any comment:	

Data / Parameter:	**$MCF_{ww,BL,discharge}$, $MCF_{ww,PJ,discharge}$**
Data unit:	Factor
Description:	Methane correction factor based on discharge pathway in the baseline & project situation (e.g. into sea, river or lake) of the wastewater.
Source of data used:	IPCC default value for discharge of wastewater or sea, river or lake
Value applied:	0.0
Justification of the choice of data or description of measurement methods and procedures actually applied :	MCF values per table III.H.1, AMS III.H for well managed aerobic treatment system as after anaerobic treatment, POME is treated in aerobic system and finally used for plantation irrigation purpose.
Any comment:	-

Data / Parameter:	**GWP_{CH4}**
Data unit:	tCO_2/ t CH_4
Description:	Global warming potential of methane
Source of data used:	IPCC default value
Value applied:	21
Justification of the choice of data or description of measurement methods and procedures actually applied :	The default value as specified in AMS-III.H (Version 16; EB58)
Any comment:	-

Data / Parameter:	**UF_{PJ}**
Data unit:	-
Description:	Model correction factor to account for model uncertainties
Source of data used:	AMS-III.H. Default value
Value applied:	0.89
Justification of the choice of data or description of measurement methods and procedures actually applied :	The default value as specified in AMS-III.H (Version 16; EB58)
Any comment:	-

Data / Parameter:	**CFE_{ww}**
Data unit:	Factor
Description:	Capture efficiency of the biogas recovery equipment in wastewater treatment system
Source of data used:	AMS-III.H. Default value
Value applied:	0.9
Justification of the choice of data or description of measurement methods and procedures actually applied :	The default value as specified in AMS-III.H (Version 16; EB58)
Any comment:	-

B.6.3 Ex-ante calculation of emission reductions:

The ex-ante estimate of emission reductions has been calculated as per AMS-III.H (Version 16; EB58). In accordance with paragraphs 32 - 36 the *ex-ante* emission reductions are estimated, and the actual emission reductions achieved will be calculated *ex-post*.

The ex-ante estimate of emission reductions is therefore based on:

- the methodology outlined in Section B.6.1;
- the parameters available at validation as listed in Section B.6.2; and
- the ex-ante estimates of certain parameters that will be monitored as listed in Section B.7.1.

Baseline Emissions

Baseline emissions are calculated as follows;

$BE_y = \{BE_{power,y} + BE_{ww,treatment,y} + BE_{s,treatment,y} + BE_{ww,discharge,y} + BE_{s,final,y}\}$			
Parameter	**Value**	**Description**	**Unit**
BE_y	**30,477**	Baseline emissions in year *y*	tCO_2e
$BE_{power,y}$	0	Baseline emissions from electricity or fuel consumption in year *y*	tCO_2e
$BE_{ww,treatment,y}$	**30,477**	Baseline emissions of the wastewater treatment systems affected by the project activity in year *y*	tCO_2e
$BE_{s,treatment,y}$	0	Baseline emissions of the sludge treatment systems affected by the project activity in year *y*	tCO_2e
$BE_{ww,discharge,y}$	0	Baseline methane emissions from degradable organic carbon in treated wastewater discharged to plantation for land irrigation in year *y*	tCO_2e
$BE_{s,final,y}$	0	Baseline methane emissions from anaerobic decay of the final sludge produced in year y (tCO_2e). If the sludge is controlled combusted, disposed in a landfill with biogas recovery, or used for soil application in the baseline scenario, this term shall be neglected.	tCO_2e

(a) Baseline emissions from electricity consumption ($BE_{power,y}$)

As described in Section B.6.1, $BE_{power,y} = 0$.

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

$BE_{ww,treatment,y} = Q_{ww,y} * COD_{inflow,y} * \eta_{COD,BL} * MCF_{ww,treatment,BL}) * B_{o,ww} * UF_{BL} * GWP_{CH4}$			
Parameter	**Value**	**Description**	**Unit**
$BE_{ww,treatment,y}$	**30,477**	Baseline emissions of the wastewater treatment systems affected by the project activity in year y	tCO_2e
$Q_{ww,y}$	140,400	Volume of wastewater treated in baseline wastewater treatment system i in year y (m^3). For ex ante estimation, projected FFB amount was multiplied by the default POME:FFB ratio of 65%.	m^3
$COD_{inflow,y}$	0.05848	Chemical oxygen demand of the wastewater inflow to the baseline anaerobic treatment system (System- anaerobic) in year y. Average value may be used through sampling with the confidence/ precision level 90/10.	t/m^3
$\eta_{COD,BL}$	0.99	COD removal efficiency of the baseline anaerobic treatment system (System- anaerobic), determined as per the paragraphs 26, 27 or 28 in AMS III.H (Version 16).	
$MCF_{ww,treatment,BL}$	0.8	Methane correction factor for baseline wastewater treatment systems (System- anaerobic)	
$B_{o,ww}$	0.25	Methane producing capacity of the wastewater	
UF_{BL}	0.89	Model correction factor to account for model uncertainties	
GWP_{CH4}	21	Global Warming Potential of methane	

Baseline Emission for aerobic waste water treatment system consisting of aerobic ponds is considered to be zero as the MCF value as per table III.H.1applied is equal to 0 (aerobic treatment, well managed ponds).

(c) Baseline emissions of the sludge treatment systems affected by the project activity ($BE_{treatment,s,y}$)

The baseline scenario does not involve sludge treatment. Therefore, on this basis $BE_{treatment,s,y} = 0$.

(d) Baseline methane emissions from degradable organic carbon in treated wastewater discharged into sea/river/lake in year y ($BE_{ww,discharge,y}$)

The baseline scenario, the final treated wastewater is used for land irrigation which indicates well managed aerobic treatment. Therefore, on this basis $BE_{ww, discharge,y} = 0$.

(e) Baseline methane emissions from anaerobic decay of the final sludge produced ($BE_{s,final.y}$)

As defined in Section B.6.1, $BE_{s,final,y} = 0$.

Project Activity Emissions

Project activity emissions are calculated as follows:

$PE_y = PE_{power,y} + PE_{ww,treatment,y} + PE_{s,treatment,y} + PE_{ww,discharge,y} + PE_{s,final,y} + PE_{fugitive,y} + PE_{biomass,y} + PE_{flaring,y}$			
Parameter	**Value**	**Description**	**Unit**
PE_y	**3,797**	Project activity emissions in the year y	tCO_2e
$PE_{power,y}$	0	Emissions from electricity or fuel consumption in the year y	tCO_2e
$PE_{ww,treatment,y}$	0	Methane Emissions from wastewater treatment systems affected by the project activity, and not equipped with biogas recovery, in year y	tCO_2e
$PE_{s,treatment,y}$	0	Methane emissions from sludge treatment systems affected by the project activity and not equipped with biogas recovery in year y	tCO_2e
$PE_{ww,discharge,y}$	0	Methane emissions from degradable organic carbon in treated wastewater in year y	tCO_2e
$PE_{s,final,y}$	0	Methane emissions from anaerobic decay of the final sludge produced in year y	tCO_2e
$PE_{fugitive,y}$	3,090	Methane emissions from biogas release in capture systems in year y	tCO_2e
$PE_{flaring,y}$	707	Methane emission due to incomplete flaring in year y	tCO_2e
$PE_{biomass,y}$	0	Methane emission from biomass stored under anaerobic conditions	tCO_2e

Project activity emissions are calculated as follows:

(a) Project activity emissions from electricity consumption ($PE_{power,y}$)

As described in Section B.6.1, $PE_{power,y} = 0$.

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

As described in Section B.6.1, $PE_{ww,treatment,y} = 0$.

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

As described in Section B.6.1, $PE_{s,treatment,y} = 0$.

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

As discussed in Section B.6.1, $PE_{ww,discharge,y} = 0$.

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

As described in Section B.6.1, $PE_{s,final,y} = 0$.

(f) Methane emissions from biogas release in capture systems ($PE_{fugitive,y}$)

The fugitive emissions through capture inefficiencies are calculated below:

$PE_{fugitive,y} = PE_{fugitive,ww,y} + PE_{fugitive,s,y}$			
Parameter	**Value**	**Description**	**Unit**
$PE_{fugitive,y}$	**3,090**	Methane emissions from biogas release in capture system in year y	tCO_2e
$PE_{fugitive,ww,y}$	3,090	Fugitive emissions through capture inefficiencies in the anaerobic wastewater treatment system year y	tCO_2e
$PE_{fugitive,s,y}$	0	Fugitive emissions through capture inefficiencies in the sludge treatment in year y	tCO_2e

Where:

$PE_{fugitive,ww,y} = (1 - CFE_{ww}) * MEP_{ww,treatment,y} * GWP_{CH4}$			
Parameter	**Value**	**Description**	**Unit**
$PE_{fugitive,ww,y}$	3,090	Fugitive emissions through capture inefficiencies in the anaerobic wastewater treatment system year y	tCO_2e
CFE_{ww}	0.9	Capture efficiency of the biogas recovery equipment in the wastewater treatment systems	Default Value
$MEP_{ww,treatment,y}$	1,471	Methane emission potential of the wastewater treatment system equipped with biogas recovery system in year y (t)	t
GWP_{CH4}	21	Global Warming Potential of methane	tCO_2e/tCH_4

Where:

$MEP_{ww,treatment,y} = Q_{ww,y} * B_{o,ww} * UF_{PJ} * \sum_k COD_{removed,PJ,k} * MCF_{ww,treatment,PJ,k}$			
Parameter	**Value**	**Description**	**Unit**
$MEP_{ww,treatment,y}$	1,471	Methane emission potential of the wastewater treatment system equipped with biogas recovery system in year *y*	tCH_4/y
$Q_{ww,y}$	140,400	Volume of wastewater treated in project wastewater treatment system (System-Aerobic) in year,y.	m^3
$B_{o,ww}$	0.25	Methane producing capacity of the wastewater	$kgCH_4$ /kgCOD
UF_{PJ}	1.12	Model correction factor to account for model uncertainties	
$COD_{removed,PJ}$	0.04678	The chemical oxygen demand removed by the project wastewater treatment system (System-biogas) which is equipped with biogas recovery digester in year y.Ex-ante estimate as per the Measurement Campaign Sample Point A; $COD_{inflow,y}$ less design value of digester removal efficiency (80%). Parameter to be recalculated ex-post in accordance with paragraph 20.	$tonnes/m^3$
$MCF_{ww,treatment,PJ}$	0.8	Methane correction factor for project wastewater treatment system (System-biogas) which is equipped with biogas recovery digester. (not equipped with biogas recovery) (MCF values as per Table III.H.1).	

As described in Section B.6.1, $PE_{fugitive,s,y} = 0$.

(g) Methane emissions from biomass stored under anaerobic conditions ($PE_{Biomass}$)

As described in Section B.6.1 $MEP_{s,treatment,y} = 0$.

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

The project emission from flaring is calculated below:

$PE_{flare} = \sum_{h=1}^{8760} TM_{RG,h} * (1-\eta_{flare,h}) * (GWP_{CH4}/1000)$			
Parameter	**Value**	**Description**	**Unit**
PE_{flare}	**707**	Project emission from flaring of methane in year y	tCO_2e
h	4,800.00	Hours of operation per year	h/y
$FM_{RG,h}$	70.16	Mass flow rate of methane in hour	kg/y
$\eta_{flare,h}$	0.9	Flare efficiency in hour h	
GWP_{CH4}	21	Global Warming Potential of methane	

Leakage

$LE_y = 0$

Emission reductions

Based on the steps outlined above, the ex-ante estimation of emission reductions associated with wastewater treatment is as follows:

$ER_{y,ex\ ante} = BE_{y,ex\ ante} - (PE_{y,ex\ ante} + LE_{y,ex\ ante})$			
Parameter	**Value**	**Description**	**Unit**
$ER_{y,ex\ ante}$	**26,680**	Ex ante emission reduction in year y	tCO_2e
$LE_{y,ex\ ante}$	0	Ex ante leakage emissions in year y	tCO_2e
$PE_{y,ex\ ante}$	3,797	Ex ante project emissions in year y calculated as per equation 8	tCO_2e
$BE_{y,ex\ ante}$	30,477	Ex ante baseline emissions in year y calculated as per equation 1	tCO2e

Where:

Baseline Emissions

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

$= 0 + 30,477 + 0 + 0 + 0$

= 30,477 tCO_2e/yr

Project Emissions

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

$PE_y = 0 + 0 + 0 + 0 + 0 + 3,090 + 0 + 707$

= 3,797 tCO_2e/yr

Leakages

$LE_y = 0$

B.6.4 Summary of the ex-ante estimation of emission reductions:

Year	**Estimation of project activity emission reductions (tonnes of CO_2e)**	**Estimation of baseline emission reductions (tonnes of CO_2e)**	**Estimation of leakage (tonnes of CO_2 e)**	**Estimation of Emission reductions (tonnes of CO_2e)**
2013	3,797	30,477	0	26,680
2014	3,797	30,477	0	26,680
2015	3,797	30,477	0	26,680
2016	3,797	30,477	0	26,680
2017	3,797	30,477	0	26,680
2018	3,797	30,477	0	26,680
2019	3,797	30,477	0	26,680
2020	3,797	30,477	0	26,680
2021	3,797	30,477	0	26,680
2022	3,797	30,477	0	26,680
Total (tonnes of CO_2e)	**37,970**	**304,767**	**0**	**266,797**
Average per annum	3,797	30,477	0	26,680

B.7 Application of a monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

Data / Parameter:	**$Q_{ww,y}$**
Data unit:	m^3
Description:	The flow of wastewater entering the project anaerobic digester system
Source of data to be used:	Measured
Value of data:	140,400
Description of measurement methods and procedures to be applied:	Flow of wastewater will be measured continuously using calibrated cumulative flow meters; data will be recorded monthly. Data will be kept electronically in a systematic and transparent manner during crediting period and two years after crediting period.
QA/QC procedures to be applied:	Equipment will be calibrated according to manufacturer specifications, or at least once in three years.
Any comment:	

Data / Parameter:	**$COD_{inflow,y}$**
Data unit:	$tonnes/m^3$
Description:	COD of wastewater entering the anaerobic digester system
Source of data used:	Laboratory testing
Value of data:	0.05848
Description of measurement methods and procedures to be applied:	5 COD samples will be tested every quarter according to national or international standards. The average of the COD measurement readings will be used.
QA/QC procedures to be applied:	The COD testing will be carried out by an accredited laboratory. Data will be kept electronically in a systematic and transparent manner during the crediting period and two years after the crediting period.
Any comment:	

Data / Parameter:	**$COD_{ww,treated,PJ,y}$**
Data unit:	$tonnes/m^3$
Description:	COD of wastewater exiting the anaerobic digester system
Source of data used:	Laboratory testing
Value of data:	0.01170
Description of measurement methods and procedures to be applied:	5 COD samples will be tested every quarter according to national or international standards. The average of the COD measurement readings will be used.
QA/QC procedures to be applied:	The COD testing will be carried out by an accredited laboratory. Data will be kept electronically in a systematic and transparent manner during the crediting period and two years after the crediting period.
Any comment:	

Data / Parameter:	$\mathbf{COD}_{ww,discharge,PJ,y}$
Data unit:	tonnes/m^3
Description:	COD of wastewater leaving the final discharge point
Source of data used:	Laboratory testing
Value of data:	0.00461
Description of measurement methods and procedures to be applied:	5 COD samples will be tested every quarter according to national or international standards. The average of the COD measurement readings will be used.
QA/QC procedures to be applied:	The COD testing will be carried out by an accredited laboratory. Data will be kept electronically in a systematic and transparent manner during the crediting period and two years after the crediting period.
Any comment:	

Data / Parameter:	$\mathbf{BG}_{burnt,y}$
Data unit:	Nm^3
Description:	Amount of biogas fuelled or flared in year,*y*.
Source of data used:	Measured
Value of data:	2,841,302
Description of measurement methods and procedures to be applied:	Calculated as the sum of $\mathbf{BG}_{fuelled,y}$ and $\mathbf{BG}_{flared,y}$
QA/QC procedures to be applied:	
Any comment:	*Ex-ante estimation based on STP condition*

Data / Parameter:	$\mathbf{BG}_{fuelled,y}$
Data unit:	Nm^3
Description:	Amount of biogas fuelled in the gas engine in year,*y*.
Source of data used:	Measured
Value of data:	2,118,718
Description of measurement methods and procedures to be applied:	The biogas flow, temperature and pressure will be measured continuously using calibrated volumetric flow meters, and a cumulative normalised flow (Nm^3) of the biogas will be calculated continuously by a flow meter or flow calculator. The normalised flow will be recorded at least monthly.
QA/QC procedures to be applied:	The meters will undergo maintenance/calibration as per the manufacturer's specifications, or at least once every three years.
Any comment:	*Ex-ante estimation based on STP condition*

Data / Parameter:	$\mathbf{BG}_{flared,y}$
Data unit:	Nm^3
Description:	Amount of biogas flared in year,*y*
Source of data used:	Measured
Value of data:	722,584
Description of	The biogas flow, temperature and pressure will be measured continuously

measurement methods and procedures to be applied:	using calibrated volumetric flow meters, and a cumulative normalised flow (Nm^3) of the biogas will be calculated continuously by a flow meter or flow calculator. The normalised flow will be recorded at least monthly.
QA/QC procedures to be applied:	The meters will undergo maintenance/calibration as per the manufacturer's specifications, or at least once every three years.
Any comment:	*Ex-ante estimation based on STP condition*

Data / Parameter:	$w_{CH4,y}$
Data unit:	%
Description:	Methane content in biogas in the year y
Source of data used:	Measured
Value of data:	65
Description of measurement methods and procedures to be applied:	Measured with a continuous analyser or, alternatively, with periodical measurements at a 90/10 confidence/precision level. The methane content measurement will be carried out close to a location in the system where a biogas flow measurement takes place
QA/QC procedures to be applied:	The meters will undergo maintenance/calibration as per the manufacturer's specifications, but at least once every three years.
Any comment:	

Data / Parameter:	T_{flare}
Data unit:	°Celsius
Description:	Temperature in the exhaust gas of the flare
Source of data to be used:	Measured
Value of data:	> 500°C
Description of measurement methods and procedures to be applied:	This parameter will be measured continuously, whenever the flare is in operation. Temperature of exhaust gas stream in the flare will be measured by a thermocouple.
QA/QC procedures to be applied:	Equipment will undergo maintenance/calibration as per the manufacturer's specifications, or at least once every three years.
Any comment:	

Data / Parameter:	$\eta_{flare,h}$
Data unit:	%
Description:	Flare efficiency in hour *h*
Source of data to be used:	Calculated
Value of data:	90%
Description of measurement methods and procedures to be applied:	Default flare efficiency for enclosed flare is estimated based on hourly flaring efficiency: • 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 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 specifications on proper operation of the flare are met continuously during the hour h.
QA/QC procedures to be applied:	
Any comment:	-

Data / Parameter:	$S_{l.,disposal,y}$
Data unit:	-
Description:	End use of final sludge from the digester system
Source of data to be used:	Records
Value of data:	-
Description of measurement methods and procedures to be applied:	The sludge removed periodically from the digester will be sent to the palm plantation as soil application and applied in a thin layer under aerobic conditions. Records of when sludge is removed, and where the sludge is applied to will be kept.
QA/QC procedures to be applied:	-
Any comment:	In any event of removal of sludge and soil application, the process will be monitored to ensure the conditions are aerobic.

B.7.2 Description of the monitoring plan:

The purpose of the monitoring plan is to ensure that the required data is accurately monitored and recorded to enable the calculation of the emission reductions achieved by the proposed project activity. The final monitoring plan will be prepared based on actual project implementation.

Organization of the Monitoring Activities and Monitoring Management

In order to obtain effective monitored data, a monitoring management structure which identified the relative staffs for data recording, collection and preservation will be established as proposed in Table B.8.

Table B.8: CDM Monitoring and Management Team

Position	Outline of Responsibilities	Reporting
CDM Project Coordinator	• Final analysis of the Emission Reduction Report for approval	Management Team
Mill Manager	• Oversees the collection, recording and storage of data. • Reviews the monthly reports and investigates any irregularities. • Ensures on-going compliance with the CDM monitoring plan. • Supervises meter calibration requirements • Calculates emission reductions • Prepares Emission Reduction Report	CDM Project Coordinator
Mill Assistant/Plant Technician	• Responsible for collection of wastewater samples for the purpose of the COD measurement campaigns • Responsible for the completeness and reliability of the data. • Responsible for carrying out meter calibration. • Generates metered net electricity generation data reports.	Mill Manager
Shift Supervisor (Shift Based)	• The person appointed for each shift must be an experienced officer involved in the operation and maintenance of the plant. • Responsible for ensuring data recording and meters are functioning correctly.	Mill Assistant/Plant Technician
Plant operators and Engine Driver (Shift Based)	• The person appointed for each shift involves in operating and maintaining the plant. • Responsible for data recording and checking meters functions.	Shift Supervisor (Shift Based)
Quality Assurance Officer	• Undertakes regular internal audits of the project. • Ensures compliance with Company Quality Assurance Procedures.	Management Team.

Training

Training for operating and maintaining the wastewater treatment system will be provided by the technology provider and internal operation team respectively.

All persons that are involved with monitoring for CDM purposes shall also receive appropriate CDM training. The training will provide an overview of the CDM and cover all elements of the monitoring plan in detail.

Quality Assurance and Quality Control

The CDM Monitoring and Management team mentioned above will ensure proper and timely calibration as scheduled for applicable monitoring instrumentation in accordance with the manufacturer's specification of system, data acquisition and storage. The responsible person will also undertake regular follow ups to ensure data measured is consistent.

Emergency Preparedness

The project activity is not expected to result in any emergency that can result in substantial emissions. The proposed project activity has the necessary provisions for emergency preparedness to deal with any unforeseen events such as fire or an electrical blackout.

An emergency management procedure will be developed that will outlines steps to be followed to quantify emission reductions in the event of equipment or meter failures.

Uncertainty in Data and Data Management

Some uncertainties may result due to malfunction of meters, calibration issues and wrong data collection (gaps in manual log sheets, human errors by plant operators, electronic recording system failure, etc.). The operator is expected to put best efforts to prevent such errors, however regular internal checks shall rectify any such uncertainty in the monitored data.

In the event that any of the wastewater or gas mass flow meters fails, details will be recorded summarized in a discrete section of the Monitoring Report.

In the situation where an emergency causes unintended emissions, attempts will be to quantify these emissions and summarized in a discrete section of the Monitoring Report.

The management of data records shall be kept both in soft copy and hard copy format with proper archive system by the CDM management team. All data should be electronically archived for a period of two years from the end of the crediting period.

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

Date of completion of the baseline development: 15/11/2011

Company Name:	Perenia Pty Ltd
Email Address:	cdm@pereniacarbon.com
Contact Address	
Head Office:	Level 7, 111 Pacific Highway North Sydney, NSW 2060 Australia
Telephone Number:	+61 2 9926 1700
Fax Number:	+61 2 9926 1799

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

04/08/2011[30]

C.1.2. Expected operational lifetime of the project activity:

15 years[31]

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

C.2.1.2. Length of the first crediting period:

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

01/01/2013 or date of registration, whichever is later[32].

C.2.2.2. Length:

Ten (10) years and zero (0) months.

[30] "Letter of Acceptance of Offer" with Watermech Engineering Sdn. Bhd. (Document 1.14)

[31] Watermech Engineering Sdn. Bhd; Life Span, Operation & Maintenance Cost of Equipment (Document 1.11)

[32] Project Implementation Schedule (Document 1.18)

SECTION D. Environmental impacts

D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

There is no requirement under Malaysia law[33] for an environmental impact assessment to be undertaken for this type of project. The Project activity complies with all local and national regulations related to establishment and operation of wastewater treatment. The proposed project activity will have a positive environmental impact on the local environment and neighbouring communities. A summary of the identified positive impacts are as follows:

- Improvement of local air quality. An issue associated with wastewater treatment in open ponds is the pungent odour produced due to the anaerobic decomposition of organic matter. By treating the wastewater in an anaerobic covered pond reactor that facilitates accelerated decomposition in a controlled environment, thereby eliminating the release of biogas to the atmosphere, the local air quality will be significantly improved for the benefit of neighbouring communities and staff working at the facility.

- Reduction in greenhouse gas emissions and generation of renewable energy. By utilising the methane in the biogas produced through the anaerobic decomposition of the POME to generate electricity, the proposed project activity avoids the release of methane to the atmosphere and reduces the carbon intensity of the Malaysian national grid by reducing the emission of GHGs on per MWh basis across the entire grid.

During the construction, some minor environmental impacts were identified, such as noise, dust and increased movement of vehicles. However, as the construction period is brief and construction activity is constrained within the existing palm oil mill these impacts were not considered significant.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

As described above, no negative environmental impacts are identified with the project.

[33] http://www.doe.gov.my/v2/files/legislation/a0127.pdf

SECTION E. Stakeholders' comments

E.1. Brief description how comments by local stakeholders have been invited and compiled:

A stakeholder meeting was held on 2nd November 2011 at Zenith Hotel, in Kuantan, Malaysia.

Stakeholders were invited by local newspaper advertisement; in The Star & Utusan Malaysia from 24th – 27th October 2011. Personal letter invitations were also sent out to relevant Government and Administrative organisations and local villagers.

The mill management team thanked all the participants for their attendance and provided an overview of the purpose of the stakeholder meeting. Pn. Jeyashri of Perenia Carbon introduced participants to the concept of climate change and CDM. Mr. Syed Salim of Watermech Engineering Sdn. Bhd., technologist described the proposed project activity in detail, including its positive environmental impacts.

Following the initial presentations a question and answer session was held where participants were given the opportunity to raise issues and provide comments on the presentations.

Thirty (30) participants attended the meeting[34].

E.2. Summary of the comments received:

A summary of question received and responses provided is outlined below.

NO.	QUESTIONER	QUESTION	ANSWER
1.	Mr Ngoh Chin Huan, Bakti Juwita Sdn Bhd	The power generation capacity is 1 MW. Please elaborate on the utilization of generated electricity.	• The generated electricity is used mainly for mill operation and associated downstream activities. • There is no potential for supply to the grid as the mill is located 23 km away from the main road and does not have any grid connectivity. This makes possible connection too expensive and not a viable option.
2.	Mr Chong Tian Sang, Assistant Manager, ZCM (local mining company)	Does the project pose any social impact to the local community?	• For the local economy, there are employment opportunities and technology knowledge transfer for the locals both during project construction and implementation. • Environmental perspective, the project potentially will improve the air quality from the avoidance of methane emissions and release of odour from hydrogen sulphide. • From a health and safety aspect, no impact is expected to affect the health of the locals. The steel tank digester has been designed with DOSH approval to qualify as a non-pressure vessel, with necessary safety devices installed to minimize

[34] Refer to Stakeholder Meeting Report (Document 1.19)

NO.	QUESTIONER	QUESTION	ANSWER
			leakages. • If leakages do occur, the design allows it to flow through the top of the tanks or at elevated pipes. Risk is only if there is presence of oxygen, which is addressed by flaring of biogas when in contact with the air outside of the tank.
3.	Mr Seow Chee Siang, JC Chang	Can the gas be directed to be used for cooking purposes?	• This is possible, although gas for cooking must be compressed in order to become economical, which will require additional equipment. In fact, technology wise there are future considerations for extraction and bottling of carbon dioxide and methane for industrial purposes.
4.	Mr Hong Chat Chai, Dara Lam Soon Sdn Bhd	Is 100% of the POME supplied to the wastewater treatment plant?	• Yes. The design will accommodate 100% of the POME treatment – continuous flow into the digester tanks. Existing anaerobic ponds will not be used, but will be maintained only for emergency use.
5.	Mr Eric Choo, Secretary, ZCM (local mining company)	Please elaborate further on the sludge handling system.	• Upon completion of the anaerobic system, digested effluent shall flow out into the sludge handling system which will terminate the anaerobic process. • Sludge handling consists of a settling tank, a forced aeration process of the effluent. Solids are processed using a backpress filter system to produce fertilizers. Treated effluent is pumped back into the aerobic ponds.
6.	Mr Hong Chat Chai, Dara Lam Soon Sdn Bhd	How do you dispose of the desulphurization residues?	• Quantity of chemical used is very small and can be disposed of by sending to Kualiti Alam under DOE regulation. It is also possible to recycle back into consumption.
7.	Mr Hong Chat Chai, Dara Lam Soon Sdn Bhd	What is the cost of the whole project?	• The cost of the whole project depends on mill size. The overall cost including biogas engines for electricity generation cost from RM 11 – 20 million depending on mill capacity, the bigger mills needs bigger treatment system, soil condition for earthwork & piling and power transmission costs.
8.	Mr Chong Tian Sang, Assistant Manager, ZCM (local mining company)	How many job opportunities will the project create?	• The project will potentially require 3 – 4 workers as operators to run the biogas plant, as the project is fully automated. Otherwise additional resources required to supervise and monitor the project for compliance purpose.

E.3. Report on how due account was taken of any comments received:

All comments were addressed during the stakeholder meeting.

Annex 1
CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

Annex 3

BASELINE INFORMATION

Annex 4

MONITORING INFORMATION

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