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:

ID090101, Methane recovery from POME, North Sumatera Province, Republic of Indonesia
Version 1
25 December 2009

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

(1) The purpose of the project activity

The proposed project activity is to be implemented at Sei Silau Palm Oil Mill (hereinafter referred as to" Sei Silau POM") which is located in Perkebunan Sei Silau Village, Buntu Pane Sub-district, Asahan Regency, North Sumatera Province, Indonesia. Sei Silau POM, owned by PT Perkebunan Nusantara III (hereinafter referred as to "PTPN III"), has an installed processing capacity of 60 tons/hour Fresh Fruit Bunch (herein after referred as to "FFB"). The POM is equipped with an anaerobic open lagoon waste water facility for the treatment of Palm Oil Mill Effluent (hereinafter referred as to "POME").

The purpose of the project activity is to recover methane-rich biogas emitted from the existing anaerobic lagoons by introducing methane recovery and combustion system to the existing anaerobic effluent treatment system (lagoons). The project activity will reduce greenhouse gas (hereinafter referred as to "GHG") due to methane emission avoidance through flaring of the methane-rich biogas. The project will result in the estimated GHG reduction of 17,738 ton eq CO_2 per annum.

The project activity is developed by PTPN III (as a POM owner), PT Indonesia Indah Lestari (as the project operator and project proponent), and Recycle One Inc. (as the project developer and project proponent),).

(2) The way to reduce GHG emissions reduction

The wastewater from the POM is treated through a lagoon system consisting of four anaerobic lagoons and a maturation pond. Using this system, the organic substances in the wastewater is reduced to an acceptable level for land application purpose. And the biogas containing methane is emitted from the anaerobic lagoon to atmosphere directly without any recovery at the current situation. In the proposed project activity, two of the existing anaerobic lagoons are covered by a synthetic high-density polyethylene (hereinafter referred as to "HDPE") geo-membrane to create anaerobic digester system. The recovered methane-rich biogas produced by the system is flared in an enclosed flare stack, thereby reducing GHG. All of the treated wastewater, which will meet the State Ministerial Decree No. 28/2003 regarding the Technical Manual of Waste Water application from palm oil industry to palm plantation land (maximum BOD value is 5,000 mg/litre)[1], is discharged from maturation pond to the plantation land using pump.

In the simple terms, the project activity converts a high-GHG-emitting anaerobic open air lagoon system, to a lower-GHG-emitting anaerobic digester with capture and flaring system.

(3) Contribution to sustainable development

Environmental benefits

The environmental benefit of the methane recovery and flaring system is the reduction of GHG, particularly methane gas that can cause a more powerful global warming potential than CO_2. Other benefit to local community and surrounding is the improvement of air quality by reducing the odour and noxious gases (e.g. hydrogen sulphide).

The project activity will not disturb local ecological function and it will be performed in the area of the POM itself which complies with the land use allocation. Though the waste water treated by the existing treatment system has already met the government regulation standard for land application, the introduction of methane recovery and flaring system would even more reduce the gas emission to the environment. Overall, the project activity will maintain environment sustainability.

Economic benefits

The current utilization of digested POME is for land application, and not used as the source of local community income. Therefore, any additional treatment to the POME by the project activity will not influence the local communities' income. The project activity will also discharge the digested POME for land application.

[1] http://puu-pi.menlh.go.id/screen/09_peraturan.php?pageNum_puu=3&totalRows_puu=20&group=7&selectYear=2003&PHPSESSID=220ae90eee5a96ea0fba214e3b27d29f&PHPSESSID=220ae90eee5a96ea0fba214e3b27d29f

The project activity will trigger local economic benefit through the employment of local people during the construction phase, the business activities in the civil construction and other indirect business activities. Assuming that ancillaries to the main equipment are provided locally, the project activity will create business opportunity to local contractor.

Social benefits

The project activity is located in the area of the POM where no community area is involved. The establishment of a methane recovery system in the POM will induce socio economic potential impacts covering local business and work opportunities during construction phase. The installation of the system and necessary civil construction will involve several local technicians and labours respectively, which will available for several months.

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)
Indonesia (host)	PT Indonesia Indah Lestari	No
Indonesia (host)	PT Perkebunan Nusantara III	No
Japan	Recycle One, Inc.	No

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):

Republic of Indonesia

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

North Sumatra Province

A.4.1.3. City/Town/Community etc:

Asahan Regency

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

The project is located in the palm oil mill owned by PTPNIII. The short description of the site is as follows;

Sei Silau POM:

The mill has capacity of processing 60 tons of FFB per hour, and processes about 270,000 tons of FFB per year. In this mill, POME is treated by open lagoon system with 1 cooling pond, 4 anaerobic lagoons, and 1 maturation pond.

The size of all the anaerobic lagoons are length: 67.5m * width:40.0m * depth:5.0m .

Detailed location is as below.

Site Name	Address	Town/Province	Country	GPS
Sei Silau POM	Perkebunan Sei Silau Village, Buntu Pane Sub-district	Asahan Regency, North Sumatera Province	Republic of Indonesia	N 2° 54' 7.50" E 99° 30' 30.30"

The project location is figured below.

Figure 1: Map illustrating the location of the project activity

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

(1) Type 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;

AMS-III.H

Type III : other project activities

Category H : methane recovery

(2) Technology to be applied to the project

The technologies introduced by the project activity are HDPE geo-membrane sheet covering system, enclosed flare stack, and gas measurement systems. Characteristics of each technology are as follows;

HDPE geo-membrane sheet covering system

The project will introduce HDPE geo-membrane sheet cover to the existing anaerobic lagoons to capture the biogas emitted from them. The HDPE sheet introduced by the project is utilized as a bottom sheet at landfill in Japan, because of high tension strength, tear strength, and extensibility. HDPE sheet is welded to cover the entire lagoon, and the welded seams will be tested to ensure air-tight coupling between HDPE pieces. In addition, lagoon berm will be upgraded, as necessary, to ensure secure anchoring. This covering approach enables capture and combustion of the biogas produced in these lagoons.

Enclosed Flare System

In this project, enclosed flare stack and surrounding monitoring equipments will be introduced to combust the captured biogas. Enclosed flare stack is environmentally safe, because all the combusting process is undertaken inside the stack, and no flare can be seen from outside. And enclosed flare system will be operated automatically. The stack will be ignited automatically when the pressure of the captured gas reaches a preset pressure, and the gas pressure and the temperature of the exhaust gas are automatically monitored continuously, and archived electronically.

The monitoring items during operation are the pressure of residual gas, and volume of residual gas by manufacturer's specifications.

Gas analyzer

The project activity will introduce gas analyzer to measure the fraction of methane gas. The fraction of methane is measured directly by infrared rays measurement technology.

Water flow meter

The project activity will introduce the water flow meter to measure the amount of wastewater into the covered lagoon. Water flow meter can measure velocity of the wastewater by ultrasonic technology. Data can be measured directly, and stored electronically.

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

Years	Estimation of annual emission reductions in tonnes of CO_2 e
2011 (from 1 Sept)	5,913
2012	17,738

2013	17,738
2014	17,738
2015	17,738
2016	17,738
2017	17,738
2018	17,738
2019	17,738
2020	17,738
2021 (till 31 Aug)	11,825
Total estimated reductions (tonnes of CO_2 e)	**177,380**
Total number of crediting years	**10**
Annual average of the estimated reductions over the crediting period (tonnes of CO_2 e)	**17,738**

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

No public funding is being provided for this project.

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

A proposed small-scale project activity shall be deemed to be a debundled component of a large 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
- Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point.

This project activity is not a debundled component of any larger project activity as there is no other small-scale project activity that fulfils the criteria listed above.

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:

AMS III.H version 13 – Methane Recovery in Wastewater Treatment

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

The Project meets all the applicability conditions set forth by the methodologies as below;

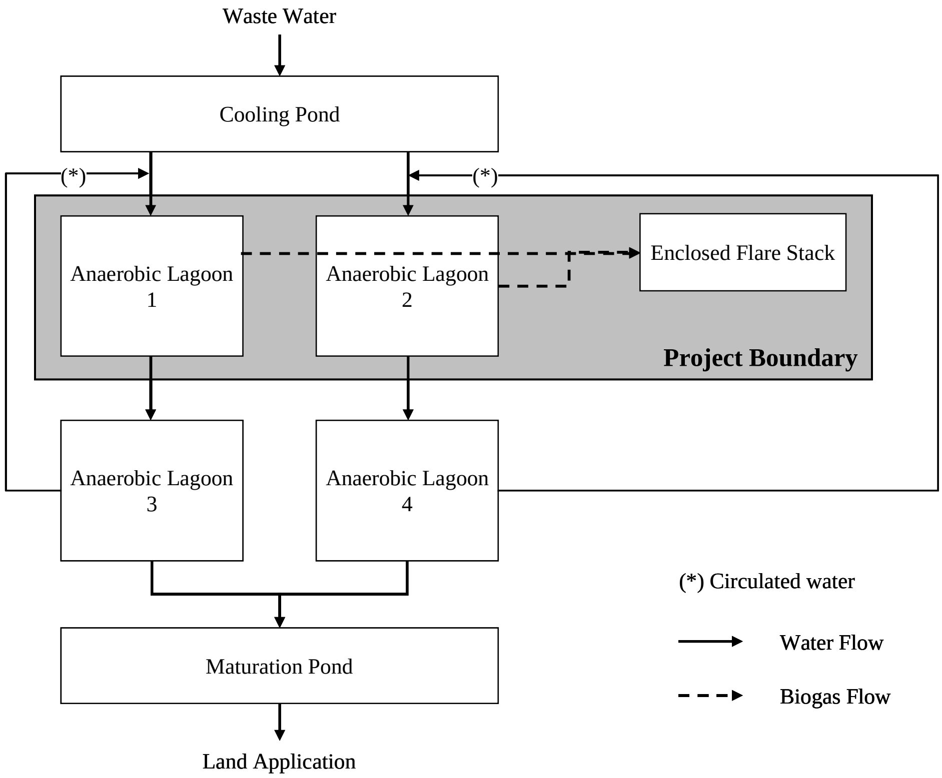
	Applicability condition	Project case
1	This methodology comprises measures that recover biogas from biogenic organic matter in wastewaters by means of (iv) Introduction of biogas recovery and combustion to an existing anaerobic wastewater treatment system such as anaerobic reactor, lagoon, septic tank or an on site industrial plant	The project proposes to introduce methane recovery and combustion system (HDPE lagoon cover, enclosed flare stack, and measurement systems) to an existing open lagoon system which does not have methane recovery equipment at present.
2	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; or (b) Thermal or electrical energy generation after bottling of upgraded biogas; or (c) Thermal or electrical energy generation after upgrading and distribution: (d) Hydrogen production.	Not applicable.
3	If the recovered biogas is used for project activities covered under paragraph 2 (a), that component of the project activity can use a corresponding methodology under Type I.	Not applicable.
4	If the recovered biogas is utilized for production of hydrogen (project activities covered under paragraph 2 (d)), that component of project activity shall use corresponding category AMS-III.O.	Not applicable.
5	In case of project activities covered under paragraph 2	Not applicable.

	(b) if bottles with upgraded biogas are sold outside the project boundary the end-use of the biogas shall be ensured via a contract between the bottled biogas vendor and the end-user. No emission reductions may be claimed from the displacement of fuels from the end use of bottled biogas in such situations. If however the end use of the bottled biogas is included in the project boundary and is monitored during the crediting period CO2 emissions avoided by the displacement of the fuels is eligible under a corresponding Type I methodology, e.g., AMS-I.C.	
6	In case of project activities covered under paragraph 2 (c i) emission reductions from the displacement of the use of natural gas is eligible under this methodology, provided the geographical extent of the natural gas distribution grid is within the host country boundaries.	Not applicable.
7	In case of project activities covered under paragraph 2 (c ii) emission reductions for the displacement of the use of fuels can be claimed following the provision in the corresponding Type I methodology, e.g., AMS-I.C.	Not applicable.
8	In case of project activities covered under paragraph 2 (b) and (c), this methodology is applicable if upgrade is done by one of the following technologies3 such that the methane content of the upgraded biogas is in accordance with relevant national regulations (where these exist) or, in the absence of national regulations, a minimum of 96% (by volume). These conditions are necessary to ensure that the recovered biogas is completely destroyed through combustion in an end use: • Pressure Swing Adsorption; • Absorption with/without water circulation; • Absorption with water, with or without water recirculation (with or without recovery of methane emissions from discharge).	Not applicable.
9	New facilities (Greenfield projects) and project activities involving a change of equipment resulting in a capacity addition of the wastewater or sludge treatment system compared to the designed capacity of the baseline treatment system are only eligible to apply this methodology if they comply with the requirements in the General Guidance for SSC methodologies concerning these topics. In addition the requirements for demonstration of the remaining	Not applicable.

	lifetime of the equipment replaced as described in the general guidance shall be followed.	
10	For project activities covered under paragraph 2 (b) and (c) additional guidance provided in annex 1 shall be followed for the calculations in addition to the procedures in the relevant sections below.	Not applicable.
11	The location of the wastewater treatment plant shall be uniquely defined as well as the source generating the wastewater and described in the PDD.	In the proposed project, the source generating wastewater is one of the palm oil mills in Indonesia, and the wastewater is treated with the anaerobic lagoon beside the mill plant at present. The proposed project will introduce the lagoon cover to the existing anaerobic lagoon. Details on the location are described in Section A.4.1.4.
12	Measures are limited to those that result in aggregate emission reductions of less than or equal to 60 kt CO2 equivalent annually from all Type III components of the project activity.	Ex-ante emission reductions due to the wastewater treatment were calculated as 17,738 tCO_2e annually (see Section A.4.3. for detail). The result is lower than the 60kt CO_2 threshold.

B.3. Description of the project boundary:

The project boundary is shown as below.



The project boundary includes;

- Two anaerobic lagoons (which will be covered by HDPE sheet to capture the emitted gas)
- Gas pipes to transfer captured gas to enclosed flare stack
- Enclosed flare stack

The sludge treatment is excluded from the project boundary because the sludge treatment is not affected by the project activity.

B.4. Description of baseline and its development:

Baseline determination for wastewater treatment

In Indonesia, there are no regulatory or contractual requirements which enforce implementation of a specific wastewater treatment technology such as anaerobic digesters or aerobic treatment systems to POME treatment. Utilization of an open lagoon system for treatment of POME has historically been the standard operating practice in Indonesia because of its low capital, O&M and maintenance cost requirements as well as its simple maintenance requirement.

At the project site, open lagoon system is being used to treat POME. In this system, the biogas containing methane is emitted from the anaerobic lagoon to atmosphere directly without any recovery at the current situation.

Therefore, the baseline scenario without project activity is a continuation of current practice, that is, the existing anaerobic wastewater treatment system without methane recovery and combustion.

The following data and parameters are applied for the baseline emission calculation.

Parameter	Description	Value	Unit	Source
-	Annual loading amount of FFB	270,235	ton/year	Mill records
-	Effluent Conversion Factor (FFB to POME)	0.65	m^3/ton	Other mill record owned by PTPN III
-	Volume of circulation water	355,824	m^3/year	Determined by multiplying ability of the pump by working hours, and adjusted by multiplying model correction factor
$Q_{ww,i,y}$	Volume of wastewater treated	531,476	m^3/year	Sum of volume of POME and volume of circulation water. The volume of POME is determined by multiplying annual FFB production by Effluent Conversion Factor.
$COD_{ww,untreated,y}$	Chemical oxygen demand (hereafter "COD") of untreated wastewater	0.020583	ton/m^3	Average of 10 days measurement campaign. Analysis had been done by the accredited laboratory. See annex 3 for result of 10 days measurement campaign.
$COD_{ww,treated,y}$	COD of treated wastewater	0.005669	ton/m^3	Average of 10 days measurement campaign. Analysis is done by the accredited laboratory. See annex 3 for result of 10 days

				measurement campaign.
$COD_{ww,removed,y}$	Amount of COD removed	0.014914	ton/m^3	Determined as a difference between the COD of untreated wastewater and the COD of treated wastewater
$MCF_{ww, treatment,BL,I}$	Methane correction factor for baseline treatment system	0.8	-	IPCC default value shown in AMS-III.H version 13 The depth of anaerobic lagoons to be covered are more than 2m. (5.0m each)
$B_{o,ww}$	Methane producing capacity of the wastewater	0.21	kg-CH_4 /kg-COD	IPCC lower value shown in AMS-III.H version 13
UF_{BL}	Model correction factor	0.94	-	FCCC/SBSTA/2003/10/Add.2, page 25 shown in AMS-III.H version 13
GWP_{CH4}	Global Warming Potential for methane	21	-	AMS-III.H version 13

The treated wastewater from the current system, which is discharged to the plantation land, complies the State Ministerial Decree No. 28/2003 regarding the Technical Manual of Waste Water application from palm oil industry to palm plantation land (maximum BOD value is 5,000 mg/litre)[2].

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:

(1) National policies and circumstances relevant to the baseline scenario
The project participants have confirmed to Environment Impact Control Board (BAPEDALDA) of North Sumatera Province and Indonesia Department of Environment that there are no regulation for biogas emission from anaerobic lagoons, such as limitation of biogas emission, requirement for biogas recovery, etc.

Most of POMs in Indonesia are utilizing open based anaerobic lagoons and it is considered the prevailing practice for POM to treat the POME. The open anaerobic lagoons system is an effective an low-tech solution that can easily meet the water discharge limits applicable to the POM.

[2] http://puu-pi.menlh.go.id/screen/09_peraturan.php?pageNum_puu=3&totalRows_puu=20&group=7&selectYear=2003&PHPSESSID=220ae90eee5a96ea0fba214e3b27d29f&PHPSESSID=220ae90eee5a96ea0fba214e3b27d29f

(2) Additionality of the proposed project

In line with the Attachment A to Appendix B of the simplified modalities and procedures for small-scale CDM project activities, the Project is deemed to be additional if it faces at least one of the following barriers:

- Financial barriers
- Technological barriers
- Barrier due to prevailing practice

The Project particularly faces financial barriers in implementation without CDM.

Financial barriers

The project activity cannot generate revenue except CER sales revenue. Therefore, PTPN III as the project owner does not have an intention to invest in this project without CDM.

In accordance with the *Non-binding best practice examples to demonstrate additionality for SSC project activities (EB35, Annex 34).* "a simple cost analysis (where CDM is the only revenue stream…)" is applied to demonstrate additionality.

Implementation of the project activity requires a significant investment in capital and operating costs to the project participants. The investment is approximately 936,000 US Dollars, and the operating and maintenance costs are projected to be approximately 89,000 US Dollars per year.

On the other hand, continuation of the existing open lagoon system requires no additional investment, therefore, it represents a financially more viable option which would lead to higher GHG emissions.

Only with CDM, the project activity will be implemented and GHG emissions will be reduced because CERs are the only potential revenues in the proposed project. Without CDM, the high development cost would have prevented PTPN III from pursuing project implementation and the current system would be kept on being used, that results in high GHG emission.

As described above, it is obvious that such a significant investment will not be carried out without CDM because technologies to be introduced by the project activity can not generate revenue except CER sales revenue.

Project proponent has calculated IRR for the proposed project with and without CDM case as below, just for reference.

Project proponent assessed Project IRR with following conditions;

No	Description	Value
1	Operation period	10 years
2	FFB through put (MT/year)	270,235
3	Investment	936,629 USD
4	CER price	12.18 EUR/tCO_2e
5	O&M cost	89,148 USD (average for 10 years)

Project IRR without CER sales revenue is as follows. Project IRR can not be calculated because project has no revenue;

Project IRR without CER revenue	Can not calculate

Project IRR with CER is as follows. Project IRR turns to positive value when CER revenue is taken into account, and shows that the project is feasible.

Project IRR with CER revenue @12.18EUR/tCO_2e	14.8%

As noted above, the proposed project has demonstrated to be additional.

(3) Prior Consideration of CDM

In the proposed project, validation process is started from January of 2010, that is earlier than the project starting day that will be the date of construction contract day or equipment order date (scheduled in 01 May 2011). This indicates that the project owner had been aware of the benefit of the CDM scheme to support its activities. Therefore, it is clear that the project owner has fully considered the revenues from CDM when decided to implement the project activity. This is illustrated in the following chronological time of events:

Table 1: Time table of the project

Date	Event
27 Nov 2008	PTPN III and PT IIL signed MOU to conduct Feasibility Study of the proposed project activity
20 Oct 2009	Project proponents concluded validation contract with DOE

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

(1) Baseline emission

The baseline scenario for wastewater treatment is the existing anaerobic lagoon system without methane recovery corresponding to AMS-III.H version 13, Paragraph 1, Section (iv).

(iv) Introduction of biogas recovery and combustion to an existing anaerobic wastewater treatment system such as anaerobic reactor, lagoon, septic tank or an on site industrial plant;

and total baseline emissions are calculated as follows;

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

Where:

Parameter	Description
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).

$<BE_{power,y}>$

This parameter will not be considered because there is no system that consumes electricity or fuel consumption.

$<BE_{s,treatment,y,}, BE_{ww,discharge,y}, BE_{s,final,y}>$

These emissions will not be considered because the project activities, introduction of biogas recovery and combustion to an existing anaerobic lagoons, does not affect sludge treatment system, and treated water is not discharged to river but plantation land at project site.

Therefore, in the proposed project, total baseline emissions are calculated as follows;

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

<$BE_{ww,treatment,y}$ >

$$BE_{ww,treatment,y} = \sum_i Q_{ww,i,y} * COD_{removed,i,y} * MCF_{ww,treatment,BL,i} * B_{o,ww} * UF_{BL} * GWP_{CH4}$$

Where:

Parameter	Description
$Q_{ww,i,y}$	Volume of wastewater treated in baseline wastewater treatment system i in year y (m^3)
$COD_{removed,i,y}$	Chemical oxygen demand removed by baseline treatment system i in year y (tonnes/m^3), measured as the difference between inflow COD and the outflow COD in system i
$MCF_{ww,treatment,BL,I}$	Methane correction factor for baseline wastewater treatment systems i (MCF values as per table III.H.1)
$B_{o,ww}$	Methane producing capacity of the wastewater (IPCC lower value of 0.21 kg CH_4/kg COD)
UF_{BL}	Model correction factor to account for model uncertainties (0.94)
GWP_{CH4}	Global Warming Potential for methane (value of 21)

In the proposed project, $MCF_{wwtreatment,BL,I}$ is determined as 0.8 (value for anaerobic deep lagoon (depth more than 2 metres)) based on the table shown AMS-III.H version 13, Paragraph 21.

In this project, the value for $COD_{removed,i,y}$ will be multiplied by 0.89, because inflow COD and outflow COD had been determined by 10 days measurement campaign, according to AMS-III.H version 13, Paragraph 18.

(2) Project emission

The project scenario is to introduce biogas recovery and combustion to an existing anaerobic wastewater treatment system corresponding to AMS-III.H version 13, Paragraph 1, Section (iv).

> *(iv) Introduction of biogas recovery and combustion to an existing anaerobic wastewater treatment system such as anaerobic reactor, lagoon, septic tank or an on site industrial plant;*

and total project emissions are calculated as follows;

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

Where:

Parameter	Description
PE_y	Project activity emissions in the year y (tCO_2e)
$PE_{power,y}$	Emissions from electricity or fuel consumption in the year y (tCO_2e).
$PE_{ww,treatment,y}$	Methane emissions from wastewater treatment systems affected by the project activity, and not equipped with biogas recovery, in year y (tCO_2e).
$PE_{s,treatment,y}$	Methane emissions from sludge treatment systems affected by the project activity, and not equipped with biogas recovery, in year y (tCO_2e).
$PE_{ww,discharge,y}$	Methane emissions from degradable organic carbon in treated wastewater in year y (tCO_2e).
$PE_{s,final,y}$	Methane emissions from anaerobic decay of the final sludge produced in year y (tCO_2e).
$PE_{fugitive,y}$	Methane emissions from biogas release in capture systems in year y (tCO_2e)
$PE_{biomass,y}$	Methane emissions from biomass stored under anaerobic conditions (tCO_2e)
$PE_{flaring,y}$	Methane emissions due to incomplete flaring in year y as per the “Tool to determine project emissions from flaring gases containing methane”(tCO_2e)

<$PE_{ww,treatment,y}$, $PE_{s,treatment,y}$, $PE_{ww,discharge,y}$, $PE_{s,final,y}$, *and* $PE_{biomass,y}$>

These emissions will not be considered because the project activities, introduction of biogas recovery and combustion to an existing anaerobic lagoons, does not affect sludge treatment system, and treated water is not discharged to river but plantation land at project site.

Therefore, in the proposed project, total project emissions are calculated as follows;

$\mathbf{PE_y = PE_{power,y} + PE_{fugitive,y} + PE_{flaring,y}}$

<$PE_{power,y}$>

$PE_{power,y}$ contains both GHG emission from electricity consumption and emission from fossil fuel consumption, as described in AMS.III.H version 13 (paragraph 26 & 19).

GHG emission from electricity consumption will be determined as per the procedures described in AMS.I.D version 15, and GHG emission from fossil fuel consumption will be determined using emission factor for the fossil fuel.

In the proposed project, both electricity and fossil fuel will be consumed by the equipments to be introduced. GHG emission from electricity consumption and from fossil fuel consumption is calculated as follows.

$PE_{power,y} = PE_{electricity,PJ,y} + PE_{fossilfuel,PJ,y}$

Where:

Parameter	Description
$PE_{electricity,PJ,y}$	CO_2 emission from electricity consumption by project activity in year y (tCO_2e/year)
$PE_{fossilfuel,PJ,y}$	CO_2 emission from fossil fuel consumption by project activity in year y (tCO_2e/year)

<$PE_{electricity,PJ,y}$>

$PE_{electricity,PJ,y} = EC_{PJ,y} * EF_{electricity,CO2}$

Where:

Parameter	Description
$EC_{PJ,y}$	Amount of electricity consumed by project activity in year y (kWh/year)
$EF_{electricity,CO2}$	CO_2 emission factor at the project site (tCO_2e/kWh)

At the project site, the plant is not connected to the grid, and electricity is generated in-house by biomass based boiler and diesel generator. Biomass based boiler is working at normal operation, and diesel generator is working when the plant is stopped due to emergency condition or interval. Therefore, weighted average of CO_2 emission factor should be applied for $EF_{electricity,CO2}$ in the proposed project, as described in AMS.III.H version 13 (paragraph 26 & 19) and AMS.I.D version 15 (paragraph 10 & 11), as below;

$$EF_{electricity,CO2} = \frac{EG_{biomass,y} * EF_{electricity,CO2,biomass} + EG_{fossil,y} * EF_{electricity,CO2,fossil}}{EG_{biomass,y} + EG_{fossil,y}} * \frac{1}{1{,}000}$$

Where:

Parameter	Description
$EF_{electricity,CO2}$	CO_2 emission factor at the project site (tCO_2e/kWh)
$EG_{biomass,y}$	Amount of electricity generated with biomass in year y (kWh/year)
$EF_{electricity,CO2,biomass}$	CO_2 emission factor for biomass generator in year y ($kgCO_2e$/kWh) (value of 0, as per AMS.III.H version 13 (paragraph 19)

$EG_{fossil,y}$	Amount of electricity generated with fossil fuel in year y (kWh/year)
$EF_{electricity,CO2,fossil}$	CO_2 emission factor for fossil fuel generator in year y (kgCO_2e/kWh) (value of 0.8, default value for with a capacity > 200kW as per AMS I.D version 15 table I.D.1)

In the proposed project, CO_2 emission factor at the project site is very small because most of electricity is generated with biomass. The amount of electricity generated in POM is as follows;

- Amount of electricity generated with biomass 4,278,013 kWh/year (2008)
- Amount of electricity generated with fossil fuel is 10,550 kWh/year (2008)

$$EF_{electricity,CO2} = \frac{4,278,013 * 0 + 10,550 * 0.8}{(4,278,013 + 10,550)} * \frac{1}{1,000}$$

$$= \frac{8,440}{4,288,563} * \frac{1}{1,000}$$

$$= 0.000002 (tCO_2/kWh)$$

Amount of electricity consumed by project activity($EC_{PJ,y}$) is 68,328kWh/year as per quotation below;

Equipments consuming electricity in project activity are as follows;

Transfer pump (1.5kW/unit) * 2 unit/pond * 2 ponds= 6.0kW

Agitation pump (0.4kW/unit) *2 unit/pond * 2 ponds = 1.6kW

Enclosed flare stack (0.2kW) * 1 unit/site = 0.2kW

Therefore electricity consumption by project activity is calculated as below;

(6.0+1.6+0.2)kW * 24 hours * 365 days = 68,328kWh/year

CO_2 emission from electricity consumption by project activity ($PE_{electricity,PJ,y}$) will be very small as below;

$$PE_{electricity,PJ,y} = EC_{PJ,y} * EF_{electricity,CO2}$$

$$= 68,328 (kWh/year) * 0.000002 (tCO_2/kWh)$$

$$= 0.13 (tCO_2e/year)$$

Therefore, CO2 emission from electricity consumption ($PE_{electricity,PJ,y}$) will not be considered in the proposed project because the value is very small and negligible in comparison to total GHG emission in project scenario.

Emissions from electricity or fuel consumption($PE_{power,y}$) is calculated as below in the proposed project.

$PE_{power,y} = PE_{fossilfuel,PJ,y}$

<$PE_{fossilfuel,PJ,y}$>

In the proposed project, LP gas will be consumed as supporting gas for biogas combustion by enclosed flare stack. GHG emission from fossil fuel combustion is calculated as follows;

$$PE_{fossilfuel,PJ,y} = FC_{LPG,y} * \frac{EF_{LPG,\ combust}}{1{,}000{,}000} * HV_{LPG}$$

Where:

Parameter	Description
$PE_{fossilfuel,PJ,y}$	CO_2 emission from fossil fuel consumption by the project in year y (tCO_2e/year)
$FC_{LPG,y}$	LP gas consumption by the project in year y (tLPG/year)
$EF_{LPG,combust}$	CO_2 emission factor combusted LP gas ($kgCO_2$/TJ) (63,100 as per IPCC guideline 2006)
HV_{LPG}	Heat value of LP gas (MJ/kgLPG) (value of 47.3 as per IPCC guideline 2006)

<$PE_{fugitive,y}$>

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

Where:

Parameter	Description
$PE_{fugitive,ww,y}$	Fugitive emissions through capture inefficiencies in the anaerobic wastewater treatment systems in the year y (tCO2e)
$PE_{fugitive,s,y}$	Fugitive emissions through capture inefficiencies in the anaerobic sludge treatment systems in the year y (tCO2e)

<$PE_{fugitive,s,y}$ >

This parameter will not be considered because the project activities does not affect sludge treatment system.

<$PE_{fugitive,ww,y}$ >

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

Where:

Parameter	Description
CFE_{ww}	Capture efficiency of the biogas recovery equipment in the wastewater

	treatment systems (a default value of 0.9 is used)
$MEP_{ww,treatment,y}$	Methane emission potential of wastewater treatment systems equipped with biogas recovery system in year y (tCH_4)
GWP_{CH4}	Global Warming Potential for methane (value of 21)

<$MEP_{ww,treatment,y}$>

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

Where:

Parameter	Description
$Q_{ww,y}$	Volume of wastewater treated in year y (m^3)
$B_{o,ww}$	Methane producing capacity of the wastewater (IPCC lower value of 0.21 kg CH_4/kg COD)
UF_{PJ}	Model correction factor to account for model uncertainties (1.06)
$COD_{removed,PJ,k,y}$	The chemical oxygen demand removed by the treatment system k of the project activity equipped with biogas recovery in the year y (tonnes/m3)
$MCF_{ww,treatment,PJ,k}$	Methane correction factor for the project wastewater treatment system k equipped with biogas recovery equipment (MCF values as per table III.H.1) (0.8, value for anaerobic deep lagoon (depth more than 2 metres) based on the table shown AMS-III.H version 13, Paragraph 27)

<$PE_{flaring,y}$>

According to AMS-III.H version 13, this parameter shall be calculated with “Tools to determine project emissions from flaring gases containing methane” (Paragraph 26).

According to this tools, project emissions from flaring of the residual gas stream are calculated by the following 7 steps.

STEP 1, 2, 3 and 4 are not used for the project because default value(90%) will be applied as the flare efficiency. (these STEPs are only applicable in case of continuous monitoring of the flare efficiency)

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

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

Where:

Parameter	Description
$TM_{RG,h}$	Mass flow rate of methane in the residual gas in the hour h (kg/h)
$FV_{RG,h}$	Volumetric flow rate of the residual gas in dry basis at normal

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

STEP 6: Determination of the hourly flare efficiency

In case of enclosed flares and use of the default value for the flare efficiency, the flare efficiency in the hour h ($\eta_{flare,h}$) is:

- 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.

The value applied for calculation varies depending on the monitoring result of the temperature in the exhaust gas of the flare.

STEP 7: Calculation of annual project emissions from flaring based on measured hourly values or based on default flare efficiencies.

$$PE_{flare,y} = \sum_{h=1}^{8760} TM_{RG,h} * (1-\eta_{flare,h}) * \frac{GWP_{CH4}}{1000}$$

Where:

Parameter	Description
$PE_{flare,y}$	Project emissions from flaring of the residual gas stream in year y (tCO_2e)
$TM_{RG,h}$	Mass flow rate of methane in the residual gas in the hour h (kg/h)
$\eta_{flare,h}$	Flare efficiency in hour h (0.9 as default flare efficiency)
GWP_{CH4}	Global Warming Potential of methane valid for the commitment period (value of 21)

(3) Leakage

Leakage calculations are not required to this project because the technology being applied to the project is not transferred from or to another activity.

(4) Estimated emission reduction

In case of the proposed project, emission reductions shall be estimated ex ante in the PDD using the equations provided in the baseline, project and leakage emissions sections above.

Emission reductions shall be estimated ex ante as follows;

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

Where:

Parameter	Description
$ER_{y,ex\ ante}$	Ex ante emission reduction in year y (tCO2e)
$BE_{y,ex\ ante}$	Ex ante leakage emissions in year y (tCO2e)
$PE_{y,ex\ ante}$	Ex ante project emissions in year y (tCO2e)
$LE_{y,ex\ ante}$	Ex ante baseline emissions in year y (tCO2e)

(5) Calculation of emission reductions during the crediting period (ex post calculation)

According to paragraph 30 in AMS III.H version 13, ex post calculation is required to the proposed project. Ex ante emission reductions are calculated based on the equation shown above, and ex post emission reductions shall be determined based on the lowest value of the following;

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

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

Therefore, the emission reductions achieved will be the lowest value of the following equation;

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

Where:

Parameter	Description
$ER_{y,ex\ post}$	Emission reductions achieved by the project activity based on monitored values for year y (tCO2e)
$BE_{y,ex\ post}$	Baseline emissions calculated using ex post monitored values (tCO2e)
$PE_{y,ex\ post}$	Project emissions calculated using ex post monitored values (tCO2e)
$LE_{y,ex\ post}$	Leakage emission calculated using ex post monitored values (tCO2e)
MD_y	Methane captured and destroyed/gainfully used by the project activity in

	the year y (tCO2e)
$PE_{power,y}$	Emissions from electricity or fuel consumption in the year y (tCO2e).
$PE_{biomass,y}$	Methane emissions from biomass stored under anaerobic conditions (tCO2e)

When calculating the baseline emission ex post, the COD removed by baseline treatment system will be estimated using the monitored value of the COD inflow and the removal efficiency of the baseline treatment systems that was measured ex ante.
And the removal efficiency will be multiplied by 0.89 as per paragraph 17 and 18 because the value is obtained by measurement campaign.
Removal Efficiency = 72.5% * 0.89 = 64.5%

See Annex 3 for detail information.

<MD_y>

$MD_y = BG_{burnt,y} * w_{CH4,y} * D_{CH4} * FE * GWP_{CH4}$

Where:

Parameter	Description
$BG_{burnt,y}$	Biogas flared/combusted in year y (m^3)
$w_{CH4,y}$	Methane content in the biogas in the year y (mass fraction)
D_{CH4}	Density of methane at the temperature and pressure of the biogas in the year y (tonnes/m3)
FE	Flare efficiency in year y (fraction)
GWP_{CH4}	Global Warming Potential for methane (value of 21)

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

Data / Parameter:	$MCF_{ww,treatment,BL,i}$
Data unit:	-
Description:	Methane correction factor for baseline wastewater treatment systems i (MCF values as per table III.H.1)
Source of data used:	IPCC default value shown in AMS-III.H version 13
Value applied:	0.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	The current type of wastewater treatment and discharge pathway or system to which this project will be applied from Table III.H.1 is “Anaerobic deep lagoon (depth more than 2 metres) ”. The depth of all the anaerobic lagoons to be covered are 5.0m.

Any comment:	-

Data / Parameter:	$B_{o,ww}$
Data unit:	$kgCH_4/kgCOD$
Description:	Methane producing capacity of the wastewater
Source of data used:	IPCC lower value shown in AMS-III.H version 13
Value applied:	0.21
Justification of the choice of data or description of measurement methods and procedures actually applied :	In accordance with the parameter definition in AMS-III.H version 13
Any comment:	-

Data / Parameter:	UF_{BL}
Data unit:	-
Description:	Model correction factor to account for model uncertainties
Source of data used:	FCCC/SBSTA/2003/10/Add.2, page 25 shown in AMS-III.H version 13
Value applied:	0.94
Justification of the choice of data or description of measurement methods and procedures actually applied :	In accordance with the parameter definition in AMS-III.H version 13
Any comment:	-

Data / Parameter:	GWP_{CH4}
Data unit:	-
Description:	Global Warming Potential for methane
Source of data used:	AMS-III.H version 13
Value applied:	21
Justification of the choice of data or description of measurement methods and procedures actually applied :	-
Any comment:	-

Data / Parameter:	$EF_{Electricity,CO2,fossil}$
Data unit:	tCO2e/MWh
Description:	CO_2 emission factor for diesel generator in year y
Source of data used:	AMS-I.D version 15

Value applied:	0.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default value of 0.8 will be applied.
Any comment:	-

Data / Parameter:	***$EF_{LPG,combust}$***
Data unit:	$kgCO_2/TJ$
Description:	CO_2 emission factor combusted LP gas
Source of data used:	IPCC guideline 2006
Value applied:	63,100
Justification of the choice of data or description of measurement methods and procedures actually applied :	-
Any comment:	-

Data / Parameter:	***HV_{LPG}***
Data unit:	MJ/kgLPG
Description:	Heat value of LP gas
Source of data used:	IPCC guideline 2006
Value applied:	47.3
Justification of the choice of data or description of measurement methods and procedures actually applied :	-
Any comment:	-

Data / Parameter:	***CFE_{ww}***
Data unit:	-
Description:	Capture efficiency of the biogas recovery equipment in the wastewater treatment
Source of data used:	AMS-III.H version 13
Value applied:	0.9
Justification of the choice of data or description of measurement methods and procedures	-

actually applied :	
Any comment:	-

Data / Parameter:	***UF_{PJ}***
Data unit:	-
Description:	Model correction factor to account for model uncertainties
Source of data used:	AMS-III.H version 13
Value applied:	1.06
Justification of the choice of data or description of measurement methods and procedures actually applied :	-
Any comment:	-

Data / Parameter:	***$MCF_{ww,treatment,PJ,k}$***
Data unit:	-
Description:	Methane correction factor for the project wastewater treatment system k equipped with biogas recovery equipment
Source of data used:	IPCC default value shown in AMS-III.H version 13
Value applied:	0.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	The project will propose to introduce lagoon cover to the existing anaerobic lagoon. The depth of anaerobic lagoons to be covered are 5.0m. Therefore, 0.8, that is the value for "anaerobic deep lagoon (depth more than 2 metres) " is applied to this parameter..
Any comment:	IPCC default value shown in AMS-III.H version 13

B.6.3 Ex-ante calculation of emission reductions:

(1) Baseline emission

As per formula shown in Section B.6.1 and input values listed in Section B.6.2, the baseline emission associated with wastewater treatment are calculated as follows;

$$BE_{y,ex\ ante} = \sum_{i} Q_{ww,i,y} * COD_{removed,i,y} * MCF_{wwtreatment,BL,i} * B_{o,ww} * UF_{BL} * GWP_{CH4}$$

<$Q_{ww,i,y}$>

In the proposed project, the volume of wastewater into anaerobic lagoon is sum of the volume of POME and the volume of circulated water, which is circulated by 2 pumps.

The volume of POME is calculated using annual loading amount of FFB, and Conversion Factor from FFB to POME.

- Annual loading amount of FFB: 270,235 tons/year
- Conversion Factor from FFB to POME: 0.65

The volume of circulated water is calculated using working ability of circulation pump.

- Working ability of circulation pump: 30 m^3/hr
- Working hours of circulation pump: 8,472 hrs/year
  (working 24 hours a day, and stopped once a month for maintenance)
- Model correction factor for uncertainty of the pump efficiency: 0.70

Therefore, $Q_{ww,i,y}$ is calculated as follows;

$Q_{ww,i,y}$ = 270,235(tons-FFB/year) * 0.65(m^3/ton-FFB)
+ 2 * {30(m^3/hr) * 8,472 (hrs) * 0.7}
= 531,476 (m^3/year)

And $BE_{y,ex\ ante}$ is calculated as follows;

$BE_{y,ex\ ante}$ = 531,476 (m^3/y) * {0.014914(t-COD/m^3)*0.89} * 0.8 * 0.21(kg-CH_4/kg-COD) * 0.94 * 21
= 23,395(tCO_2e)

(2) Project emissions

As per formula shown in Section B.6.1 and input values listed in Section B.6.2, the project emission associated with wastewater treatment are calculated as follows;

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

a) $PE_{power,y}$

$PE_{power,y} = PE_{fossilfuel,PJ,y}$
= 1.0(kgLPG/hr) /1,000 * 8,760(hrs/year)* 63,100(kgCO_2/TJ) / 1,000,000 * 47.3 (MJ/kg)
= 26(tCO_2e)

b) $PE_{fugitive,y}$

$PE_{fugitive,y} = PE_{fugitive,ww,y} + PE_{fugitive,s,y}$
$= (1-CFE_{ww}) * MEP_{ww,treatment,y} * GWP_{CH4}$

$$= (1\text{-}CFE_{ww}) * Q_{ww,y} * B_{o,ww} * UF_{PJ} * \sum_{i} COD_{removed,PJ,k,y} * MCF_{ww,treatment,PJ,k} * GWP_{CH4}$$

= (1-0.9) * 531,476(m^3/y) * 0.21(kg-CH_4/kg-COD) * 1.06 * 0.014914(t-COD/m^3) * 0.8 *21

= 2,964(tCO_2e)

c) $PE_{flaring,y}$

$$PE_{flare,y} = \sum_{h=1}^{8760} TM_{RG,h} * (1-\eta_{flare,h}) * \frac{GWP_{CH4}}{1000}$$

$TM_{RG,h}$ and $\eta_{flare,h}$ are not available for ex ante calculation (these are measured ex post). Therefore, assumptions described below are applied.

<$TM_{RG,h}$ >

$$\sum_{h=1}^{8760} TM_{RG,h} = (MEP_{ww,treatment,y} - \frac{PE_{fugitive,ww,y}}{GWP_{CH4}}) * 1000$$

Where:

Parameter	Description
$MEP_{ww,treatment,y}$	Methane emission potential of wastewater treatment systems equipped with biogas recovery system in year y (tonCH_4)
$PE_{fugitive,ww,y}$	Methane emissions from biogas release in capture systems in year y
GWP_{CH4}	Global Warming Potential for methane (value of 21)

<$\eta_{flare,h}$ >

$\eta_{flare,h}$ = 0.9

(default value if the temperature in the exhaust gas of the flare is above 500 °C for more than 40 minutes during the hour h and the manufacturer's specifications on proper operation of the flare are met continuously during the hour h)

Substituting assumption into the equation, $PE_{flare,y}$ can be calculated as follows.

$$PE_{flare,y} = \sum_{h=1}^{8760} TM_{RG,h} * (1-\eta_{flare,h}) * \frac{GWP_{CH4}}{1000}$$

$$= (MEP_{ww,treatment,y} - \frac{PE_{fugitive,ww,y}}{GWP_{CH4}}) * 1000 * (1-\eta_{flare,h}) * \frac{GWP_{CH4}}{1000}$$

$$= (MEP_{ww,treatment,y} - \frac{(1-CFE_{ww}) * MEP_{ww,treatment,y} * GWP_{CH4}}{GWP_{CH4}}) * (1-\eta_{flare,h}) * GWP_{CH4}$$

$$= CFE_{ww} * MEP_{ww,treatment,y} * (1-\eta_{flare,h}) * GWP_{CH4}$$

$$= 0.9 * Q_{ww,y} * B_{o,ww} * UF_{PJ} * \sum_{i} COD_{removed,PJ,k,y} * MCF_{ww,treatment,PJ,k} * (1-0.9) * 21$$

$$= 0.9 * 531,476(m^3/y) * 0.21(kg\text{-}CH_4/kg\text{-}COD) * 1.06 * 0.014914(t\text{-}COD/m^3) * 0.8 * (1-0.9) * 21$$

$$= 2,667(tCO_2e)$$

Consequently, project emission is calculated as follows;

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

$$= 26(tCO_2e) + 2,964(tCO_2e) + 2,667(tCO_2e)$$

$$= 5,657(tCO_2e)$$

(3) Leakage

As described in Section B.6.1., there is no leakage in the proposed project.

(4) Emission reduction

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

$$= 23,395(tCO_2e) - (5,657(tCO_2e) + 0)$$

$$= 17,738(tCO_2e)$$

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

Ex-ante estimation of emission reduction

Year	Estimation of project activity emissions (tCO2 e)	Estimation of baseline emissions (tCO2 e)	Estimation of leakage (tCO2 e)	Estimation of overall emission reductions (tCO2 e)
2011 (from 1 Sept)	1,886	7,798	0	5,913
2012	5,657	23,395	0	17,738
2013	5,657	23,395	0	17,738
2014	5,657	23,395	0	17,738
2015	5,657	23,395	0	17,738
2016	5,657	23,395	0	17,738
2017	5,657	23,395	0	17,738
2018	5,657	23,395	0	17,738
2019	5,657	23,395	0	17,738

2020	5,657	23,395	0	17,738
2021 (till 31 Aug)	3,771	15,597	0	11,825

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

B.7.1 Data and parameters monitored:

Data / Parameter:	$Q_{ww,j,y}$
Data unit:	m^3/year
Description:	Volume of wastewater in year y
Source of data to be used:	The value is sum of POME and circulated water. The volume of POME is determined by multiplying the loading amount of FFB by the conversion factor for FFB to POME. The conversion factor is determined by on-site field measurement using flow meter. The volume of circulated water is determined by on-site field measurement.
Value of data	531,476
Description of measurement methods and procedures to be applied:	The loading amount of FFB is recorded by the mill. Volume of wastewater will be measured once a month by field measurement, and data will be recorded and saved electronically in a data log file. The conversion factor for FFB to POME is calculated by dividing the volume of wastewater by corresponding loading amount of FFB.
QA/QC procedures to be applied:	The flow meter will be calibrated regularly based on manufacturer’s specification.
Any comment:	-

Data / Parameter:	$COD_{ww,untreated,y}$
Data unit:	tonnes/m^3
Description:	Chemical oxygen demand of wastewater entering the covered anaerobic treatment system in the year y
Source of data to be used:	On site sampling and accredited third party analysis
Value of data	0.020583
Description of measurement methods and procedures to be applied:	Monthly sampling and accredited third party analysis.
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	$COD_{ww,treated,y}$

Data unit:	$tonnes/m^3$
Description:	Chemical oxygen demand of the treated effluent from covered anaerobic lagoon in the year y
Source of data to be used:	On site sampling and accredited third party analysis
Value of data	0.005669
Description of measurement methods and procedures to be applied:	Monthly sampling and accredited third party analysis.
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	$FC_{LPG,y}$
Data unit:	tLPG
Description:	LP gas consumption by the project in year y
Source of data to be used:	Purchase record of LP gas
Value of data	To be monitored
Description of measurement methods and procedures to be applied:	The amount of LP gas consumption will be monitored by the purchase record of LP gas.
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	$fv_{i,h}$
Data unit:	-
Description:	Volumetric fraction of methane in the residual gas on dry basis in hour h
Source of data to be used:	Directly and continuously measurement by gas analyzer
Value of data	To be monitored
Description of measurement methods and procedures to be applied:	Volumetric fraction of methane in the residual gas on dry basis will be measured once a month by field measurement, and data will be recorded and saved electronically in a data log file.
QA/QC procedures to be applied:	The gas analyzer will be calibrated regularly based on manufacturer's specification.
Any comment:	-

Data / Parameter:	$FV_{RG,h}$
Data unit:	m^3/h
Description:	Volumetric flow rate of the residual gas on dry basis at normal (NTP) conditions

	in the hour h
Source of data to be used:	Directly and continuously measurement by gas flow meter
Value of data	To be monitored
Description of measurement methods and procedures to be applied:	Volumetric flow rate of the residual gas in dry basis will be monitored continuously by gas analyzer. Data will be recorded hourly, and saved electronically in a data log file.
QA/QC procedures to be applied:	The gas flow meter will be calibrated regularly based on manufacturer's specification.
Any comment:	-

Data / Parameter:	T_{flare}
Data unit:	°C
Description:	Temperature of the exhaust gas at the flare
Source of data to be used:	Directly and continuously measurement by thermometer
Value of data	To be monitored
Description of measurement methods and procedures to be applied:	Temperature of the exhaust gas will be monitored continuously by thermometer. Data will be recorded hourly, and saved electronically in a data log file.
QA/QC procedures to be applied:	The thermometer will be calibrated regularly based on manufacturer's specification.
Any comment:	-

B.7.2 Description of the monitoring plan:

Monitoring data of the project activity is performed according to AM Tool 06. Version 1, (Annex 13, EB 28): Methodological " Tool to determine project emissions from flaring gases containing methane".

A monitoring plan for the project activity is designed to ensure accurate and valid monitoring data for the purpose of CER verification and certification during the whole crediting period. The followings describe the monitoring plan for the project activity:

Monitoring organization and management structure

PT Indonesia Indah Lestari will form a team, which will be responsible for the management and operation of the project activity which includes the monitoring of the parameters required for emission reduction calculation. The team is also responsible for collecting all the monitoring data, and archiving the data for at least 2 years following the end of the crediting period.

A CDM manager is appointed as the responsible person of the team for the monitoring system of the project activity, supervise data collection and prepare internal monitoring report and annual reporting emission reduction for verification with DOE, as well as the person in charge for communicating with DOE.

The CDM manager will consolidate all monthly data gathered, on six-monthly basis, for preparing emission reduction report which also presents the implementation of the project activity as well as monitoring operation. An annual emission reduction report prepared by the CDM manager will be delivered to the project proponent for verification by DOE.

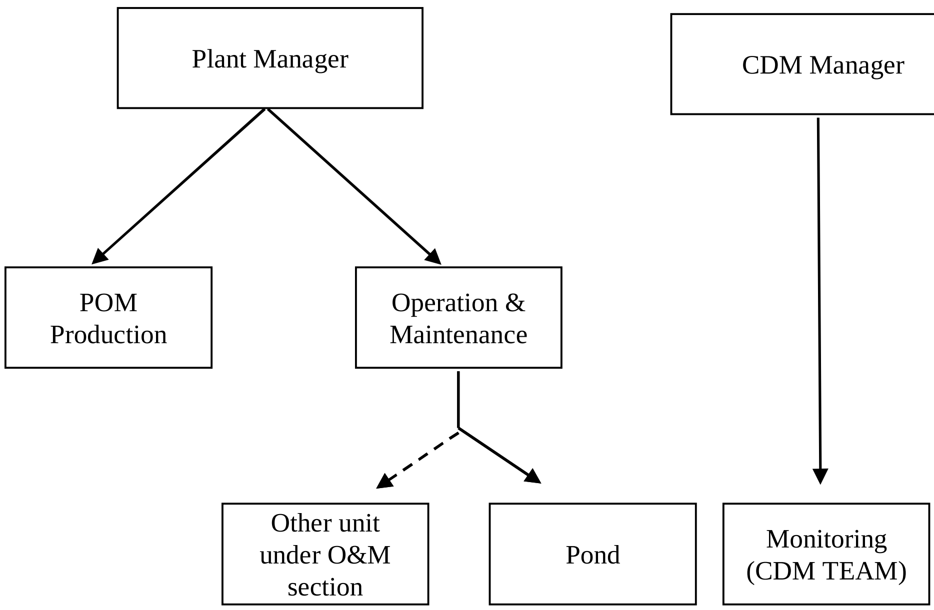


Figure 2: Monitoring Organization

The CDM team constitutes personnel from units concerned for monitoring activities. Each personnel involved in the CDM monitoring team will have defined assignment and responsibilities. Data monitored from the lagoon will be reported to the operational manager and forwarded to the plant manager and the

CDM manager. While other data, related to the monitoring from the methane avoidance and combustion to be measured by the team member will be reported directly to the CDM manager.

Prior to the start of the monitoring activities, all staffs involved in the monitoring activities will take training related to the monitoring system to ensure that the monitoring procedures required for a CDM project are satisfied.

A monitoring procedure will be prepared prior to the start of the project activity, which includes training of personnel involved in the CDM monitoring, data collection and data monitoring, data recording and archived, data Quality Control and Quality Assurance, equipment calibration, equipment maintenance.

Monitoring System

Biogas recovered will be sent to enclosed flare stack via biogas pipeline, and will be monitored as follows;

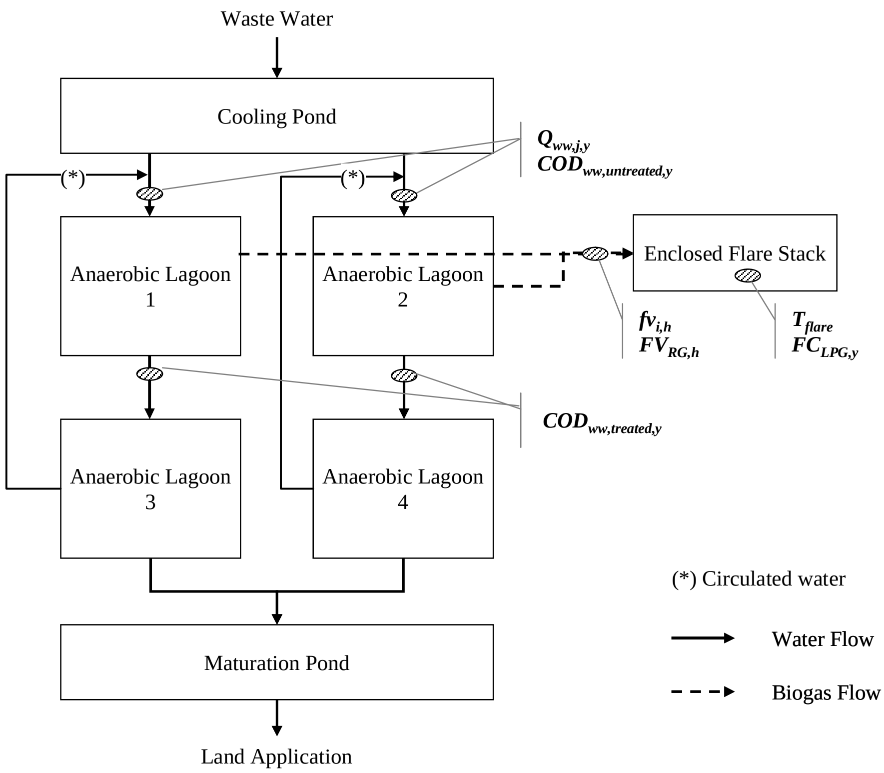


Figure 3: Monitoring Points

Parameter to be monitored

Section B 7.1 describes parameters to be monitored which includes:

- Volume of wastewater
- COD content of the wastewater entering anaerobic lagoon 1 and anaerobic lagoon 2
- COD content of the wastewater after anaerobic treatment lagoon 1 and after anaerobic lagoon 2.
- Fraction of methane in the biogas flowing to flare stack
- Flow rate of residual gas
- Temperature of the exhaust gas
- Amount of LP gas consumed by the project activity

Data collection and data monitoring

The volume of waste water is measured by a flow meter once a month (periodical measurement).

The COD content of the wastewater (entering to both anaerobic lagoon 1 and 2 and discharged to anaerobic lagoon 3 and 4) will be provided from monthly on site sampling which will be analyzed by accredited third party.

The fraction of methane in biogas is measured by a gas analyzer once a month (periodical measurement).

The flow rate of biogas to the stack will be monitored and recorded hourly using gas flow meter.

Temperature of the exhaust gas is measured continuously by thermometer.

Amount of LP gas consumed by the project activity is measured by counting bottles consumed by the project activity.

Data recording and archived

Data obtained from continuous reading will be registered in either electronic form or on paper. Any data acquisition (e.g. from sampling) that is not automatically recorded will be notified manually on log books and transferred to electronic format.

All data measured and monitored both in the form of hard copy (on paper) and electronic copy will be archived. All receipts, data and supporting documents related to the CDM monitoring required for verification will be kept during the crediting period of the project activity plus two years.

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Data Quality Control and Quality Assurance

All data recorded will be checked before being stored and archived by the CDM manager.

Review of data collected will be conducted regularly, by CDM manager and team member from whom data is collected. After being checked it will be submitted to internal audit to assure that the project activity complies with the procedure and requirement for a CDM project.

As part of the data quality control and quality assurance, data log file will be audited regularly and instrument used for monitoring data will be regularly calibrated.

Procedure for Corrective Action

Should there be any disparity data or mistakes indicated, the CDM team and the project proponent would hold a technical meeting to resolve this.

Internal audit

Regular internal audit will be performed by the CDM team to ensure that the monitoring and operational procedure are implemented according to the Monitoring plan.

Equipment calibration

Calibration of all meters will be performed regularly based on manufacturer's specification, at least every three years. The gas analyzers measuring methane fraction and residual gas will also be calibrated regularly according to manufacturer's specification.

Equipment maintenance

Regular maintenance of equipment will be performed according to manufacturer's specification to ensure quality measurement.

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

This PDD was first completed in 25/12/2009 by Recycle One who is the project developer as well as the project participant.

Contact information is shown in Annex 1.

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:

The date of construction contract day or equipment order date (scheduled in 01/05/2011)

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

10 years

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:

Not applicable.

C.2.1.2. Length of the first crediting period:

Not applicable.

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

The date when the operation starts or the date of registration of the project activity, whichever is later (scheduled in 01/09/2011)

C.2.2.2. Length:

10 years

SECTION D. Environmental impacts

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

In accordance with the Ministry of Environment Decree's No. 11/2006 concerning the Types of Businesses or Activities Required to Prepare an Environmental Impact Assessment ("Peraturan Menteri Negara Lingkungan Hidup No. 11 Tahun 2006 Tentang : Jenis Rencana Usaha Dan/Atau Kegiatan Yang Wajib Dilengkapi Dengan Analisis Mengenai Dampak Lingkungan Hidup"), the project activity does not need to perform an Environmental Impact Assessment (AMDAL) because no significant environmental impacts are identified with the project activity.

Disposal of waste water (POME) from oil palm mill is set in the Indonesian government regulations as follows;

- Water discharge falls under "Keputusan Menteri Negara Lingkungan Hidup, nomor Kep-51/MENLH/10/1995 Tentang Baku Mutu Limbah Cair Bagi Kegiatan Industri (the State Ministry of Environment Decree no Kep-51/MENLH/10/1995 on the Wastewater Standard for Industrial Activities).
- Keputusan Menteri Negara Lingkungan Hidup No. 3 Tahzzun 1998 Tentang : Baku Mutu Limbah Cair Bagi Kawasan Industri (the State Ministry of Environment Decree no Kep-3/MENLH/10/1998 on the Wastewater Standard for Industrial Area)
- Land application falls under the State Ministry of Environment Decree no. 28/2003 on the Technical Manual of Waste Water application from palm oil industry to palm plantation land.

In addition to reducing GHG emissions, the project activity will contribute to the following major positive environmental impacts:

- Improvement of local air quality. One of the major problems associated with wastewater treatment is the pungent odor arising from the open lagoons. By treating the POME in a cover reactor, this will significantly improve the air quality.
- Technology transfer to the region.

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:

No action required.

SECTION E. Stakeholders' comments

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

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E.2. Summary of the comments received:

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

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Recycle One., Inc.
Street/P.O.Box:	3-10-13, Shibuya
Building:	SHIBUYA R Sankei bldg
City:	Shibuya-ku
State/Region:	Tokyo
Postfix/ZIP:	150-0002
Country:	Japan
Telephone:	+81-3-5774-0600
FAX:	+81-3-5774-0601
E-Mail:	-
URL:	http://www.recycle1.com
Represented by:	-
Title:	-
Salutation:	Mr.
Last Name:	Sato
Middle Name:	
First Name:	Tenzo
Department:	Business Development
Mobile:	-
Direct FAX:	-
Direct tel:	-
Personal E-Mail:	tenzo@recycle1.com

Organization:	PT Indonesia Indah Lestari
Street/P.O.Box:	
Building:	
City:	
State/Region:	
Postfix/ZIP:	
Country:	
Telephone:	
FAX:	
E-Mail:	
URL:	
Represented by:	
Title:	
Salutation:	
Last Name:	
Middle Name:	
First Name:	
Department:	

Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Organization:	PT Perkebunan Nusantara III
Street/P.O.Box:	Jalan Sei Batanghari No 2/ Kotak Pos 91
Building:	
City:	Medan 20122
State/Region:	
Postfix/ZIP:	20122
Country:	Indonesia
Telephone:	
FAX:	
E-Mail:	
URL:	
Represented by:	
Title:	
Salutation:	
Last Name:	
Middle Name:	
First Name:	
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding is being provided for this project.

Annex 3

BASELINE INFORMATION

Table: Result of 10days COD measurement campaign at anaerobic lagoons

(mg/L)

DAY	Anaerobic Lagoon 1			Anaerobic Lagoon 2		
	INFLOW	OUTFLOW	Removed	INFLOW	OUTFLOW	Removed
07 Oct 2009	30,078	7,963	22,115	19,595	2,882	16,713
08 Oct 2009	28,788	8,265	20,523	13,950	2,741	11,209
09 Oct 2009	30,401	7,096	23,305	10,765	2,943	7,822
10 Oct 2009	29,111	7,660	21,451	17,982	2,802	15,180
11 Oct 2009	29,917	8,426	21,491	14,878	2,741	12,137
12 Oct 2009	23,887	10,420	13,467	7,855	2,785	5,070
13 Oct 2009	25,971	8,697	17,274	8,496	2,885	5,611
14 Oct 2009	26,283	7,659	18,624	18,973	2,955	16,019
15 Oct 2009	20,140	10,848	9,292	7,309	2,547	4,763
16 Oct 2009	31,182	8,631	22,550	16,096	2,430	13,666
Ave.	27,576	8,567	**19,009**	13,590	2,771	**10,819**

Average:

INFLOW	OUTFLOW	Removed
20,583	5,669	14,914

Removal Efficiency **72.5%**

Annex 4

MONITORING INFORMATION

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