FY 2009 CDM/JI Feasibility Study
Executive Summary

Title of Feasibility Study:

Methane recovery from Palm Oil Mill Effluent, North Sumatra Province, Republic of Indonesia

Main Implementing Entity:

Recycle One.Inc.

1 Summary of the project

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.

2 Summary of the study

(1) Study topics

- i) The project boundary setting
- ii) Measurement of the COD and the volume of wastewater
- iii) Confirmation of the EIA necessity for the project activity
- iv) Confirmation of the additionality of the project activity

(2) Study result

a) Findings from local visit

Five local visits were conducted in this study. The agendas for each visit are described as below;

Table 1 Agenda for local visits

Period	Agenda
1st visit 30.Aug. - 4.Sept., 2009	・ Meeting with the host company ・ Meeting with the local consulting company ・ Visiting of the project site
2nd visit 1.Oct. - 10.Oct. 2009	・ Interview with the plant manager of the project site ・ Interview with Ministry of Environment ・ Interview with environmental office of North Sumatra province
3rd visit 6.Oct. - 20.Oct., 2009	・ Interview with employee of the project site ・ Waste water sampling at the project site ・ Odor measurement at the project site
4th visit 7 Jan. - 16.Jan., 2010	・ Interview with DNPI ・ Interview with environmental office of Asahan regency ・ Conducting stakeholder meetings ・ Measurement of the volume of wastewater
5th visit 31 Jan. - 7.Feb., 2010	・ Interview with environmental office of Rokan Hilir regency ・ Interview with environmental office of Labuhan Batu Sulatan ・ Conducting stakeholder meetings

Findings from local visit are as below;

- Environmental policy in the future

According to DNA, environmental office of North Sumatra province, environmental office of Asahan regency and DNPI, there is no plan to set the new act or rule that influences the proposed project.

- Necessity of EIA

According to Ministry of Environment, environmental office of North Sumatra province, environmental office of Asahan regency and DNPI, AMDAL is not necessary for the project activity. Regarding UPL/UKL, only DNPI insisted that UPL/UKL are necessary for the project activity.

- COD of the wastewater

COD of the wastewater was measured for 10 days as per AMS-11.H. ver.13.

- Volume of the wastewater

The volume of circulated water was measured, and confirmed that the volume is almost the same as the pump capability.

- Stakeholder meeting

Stakeholder meeting was held at the project site, and comments were collected.

- Potential as co-benefit project

Leakage of waste water from the pond due to heavy rain, and odors by anaerobic treatment were expected as environmental issue other than the GHG emissions. But this study disclosed that the project site has never experienced overflow from anaerobic pond by heavy rain, nor been complained from local people due to odor from anaerobic ponds.

b) Results for study topics

i) The project boundary setting

In this study, connections of the lagoons and the surrounding situation are investigated by local visit. The project boundary were set appropriately with the information gathered by local visit.

ii) Measurement of the COD and the volume of wastewater

COD and volume of the waste water were measured at the project site. Based on this result, the volume of GHG emission is calculated as 17,738 tCO_2e per annum.

iii) Confirmation of the EIA necessity for the project activity

Interviews were held with Ministry of Environment, environmental office of North Sumatra province, environmental office of Asahan regency, and DNPI, to confirm the necessity of EIA. As a result, it was confirmed that AMDAL is not necessary for the project activity. But regarding UPL/UKL, only DNPI insisted that UPL/UKL are necessary for the project activity.

iv) Confirmation of the additionality of the project activity

Interviews were held with governmental agencies as described in iii). As a result, there was no plan of new act/rules nor revision of existing act/rules which would affect to the project activity like strengthening of effluent regulations to POME, subsidy for utilization of bio gas, etc..

Regarding power generation, it is confirmed that the project site had no demand on new electricity. And it is also confirmed that power generation with grid connection is less profitable than the combusting treatment.

Consequently, it is confirmed that the proposed project has additionality.

3 Results

(1) Baseline scenario and project boundary settings

a) Baseline scenario

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 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.

b) Project boundary

The project boundary includes the anaerobic ponds at Sei Silau POM. The boundary only includes anaerobic pond in the first row. Cooling pond, anaerobic pond in the second row, Maturation ponds are excluded. The sludge treatment is also excluded from the project boundary because the sludge treatment is not affected by the project activity. Details are figured below.

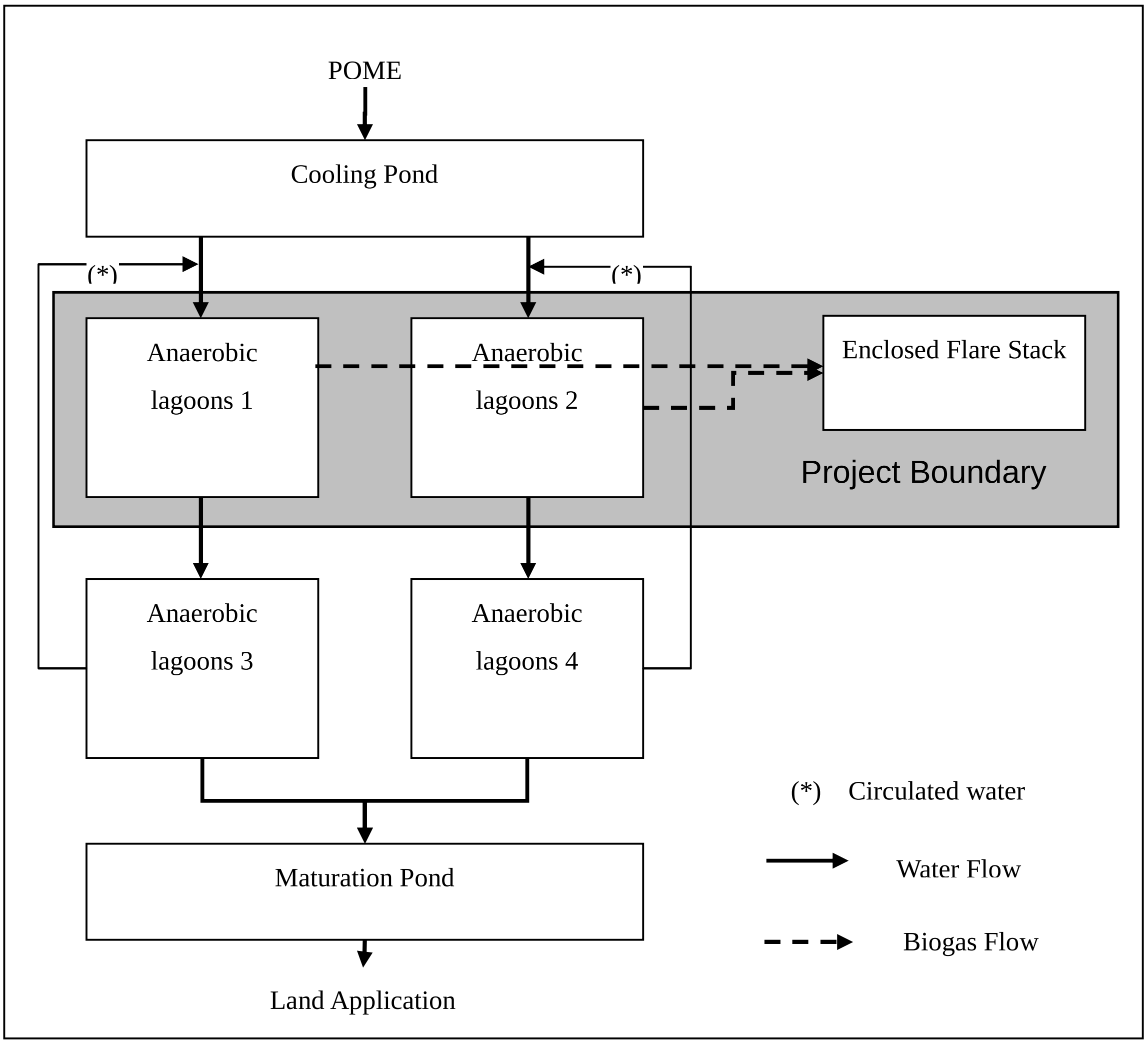

Figure 1 Project boundary

c) Applied methodology

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

This methodology comprises measures that recover biogas from biogenic organic matter in wastewaters by means of one, or a combination, of the options defined in paragraph 1. The proposed project meets "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 applicability of this methodology has also been proved as below.

Table 2 Applicability of AMS-III.H. ver.13

Topic	Condition	Result	Applicability
Depth of lagoon	More than 2 meters	5 meters	Applicable
Aeration process	None	Aeration process does not exist	Applicable
Temperature	More than 15 °C (average of one month)	22.2°C (average of the coldest month)	Applicable
Volumetric loading rate of COD	More than 0.1kg-COD/m^3・per day	1.11 kg-COD/m^3 per day	Applicable
Interval of sludge removing	More than 30 days	ca.3 years	Applicable

d) Baseline Emissions

The Baseline emission (BE_y) is calculated by the formula below,

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

Parameter	Unit	Content
$BE_{power,y}$	t-CO_2e	Baseline emissions from electricity or fuel consumption in year y
$BE_{ww,treatment,y}$	t-CO_2e	Baseline emissions of the wastewater treatment systems affected by the project activity in year y
$BE_{s,treatment,y}$	t-CO_2e	Baseline emissions of the sludge treatment systems affected by the project activity in year y
$BE_{ww,discharge,y}$	t-CO_2e	Baseline emissions from degradable organic carbon in treated wastewater discharged in to sea/river/lake in year y
$BE_{s,final,y}$	t-CO_2e	Baseline emissions from anaerobic decay of the final sludge produced in year y

In this project, *BEpower,y*、*BEs,treatment,y*、*BEww,discharge,y*、*BEs,final*, is not considered. The reasons are as below;

BEpower,y	Electricity and fossil fuel are not consumed in the wastewater treatment process
BEs,treatment,y	The project activity does not influence on the sludge treatment system
BEww,discharge,y	Treated wastewater is not discharged to river at the project site
BEs,final,y	The project activity does not influence on the sludge treatment system

Therefore, the baseline emission of the project is calculated by the formula below,

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

i) $BE_{ww,treatment,y}$

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

Parameter	Unit	Description
$Q_{ww,i,y}$	m^3	Volume of wastewater treated in baseline wastewater treatment system *i* in year *y* (m^3)
$COD_{removed,i,y}$	t/m^3	Chemical oxygen demand removed by baseline treatment system *i* in year *y*
$MCF_{ww,treatment,BL,I}$	-	Methane correction factor for baseline wastewater treatment systems *i*
$B_{o,ww}$	kg-CH_4/kg-COD	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)

e) Possibility to utilize recovered biogas

Possibility to utilize recovered biogas for power or heat generation was investigated by local interview and profitability analysis.

- **Current situation of the project site**

The current situation at the project site is confirmed by interviewing to the POM.

- ➢ Electricity is generated by in-house biomass based boiler
- ➢ POM has no demand for additional electricity nor heat

- **Profitability analysis**

The profitability was analyzed for the following three cases.

The exchange rate 1 USD = 87.2 JPY was applied for calculation.

i) The recovered biogas will be utilized as fuel for the existing biomass based boiler

(reform the existing boiler)

ii) The recovered biogas will be utilized as fuel for power generation, and electricity is sold to the grid (introduce new biogas engine)

iii) The recovered biogas will be utilized as fuel for power generation, and electricity is consumed in-house (introduce new biogas engine)

Analysis shows that ii) is the most profitable case and GHG emission reduction (2,278 t-CO_2e/year) can be expected, but analysis also shows that ii) is still unprofitable. This is mainly because the purchase price of the electricity is too low..

(2) Project emission

The project emission($PE_{,y}$) is calculated by the formula below,

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

Parameter	Unit	Description
$PE_{power,y}$	t-CO_2e	Emissions from electricity or fuel consumption in year y
$PE_{ww,treatment,y}$	t-CO_2e	Emissions from wastewater treatment systems affected by the project activity, and not equipped with biogas recovery in year y
$PE_{s,treatment,y}$	t-CO_2e	Emissions from sludge treatment systems affected by the project activity, and not equipped with biogas recovery in year y
$PE_{ww,discharge,y}$	t-CO_2e	Emissions from degradable organic carbon in treated wastewater discharged in to sea/river/lake in year y
$PE_{s,final,y}$	t-CO_2e	Emission from anaerobic decay of the final sludge produced by the project activity treatment system in year y
$PE_{fugitive,y}$	t-CO_2e	Fugitive emissions from biogas release in capture systems in year y
$PE_{flaring,y}$	t-CO_2e	Emissions due to incomplete flaring in year y
$PE_{biomass,y}$	t-CO_2e	Emissions from biogas stored under anaerobic conditions

In this project, $PEww,treatment,y$, $PEs,treatment,y$, $PEww,discharge,y$, $PEs,final,y$ 、 $PEbiomass,y$ are not considered. The reasons are as below;

$PE_{ww,treatment,y}$	The project activity will not influence on the wastewater treatment system
$PE_{s,treatment,y}$	The project activity does not influence on the sludge treatment system

$PE_{ww,discharge,y}$	Treated wastewater is not discharged to river at the project site
$PE_{s,final,y}$	The project activity does not influence on the sludge treatment system
$PE_{biomass,y}$	The project activity will not affect the biomass other than POME

Therefore, the project emission is calculated by the formula below,

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

i) $PE_{power,\ y}$

$PE_{power,y}$ contains the GHG emission from electricity consumption and GHG emission from fossil fuel consumption, as described in AMS.III.H version 13.

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

Parameter	Unit	Description
$PE_{electricity,PJ,y}$	t-CO_2e	CO_2 emission from electricity consumption by project activity in year y (tCO_2e/year)
$PE_{fossilfuel,PJ,y}$	t-CO_2e	CO_2 emission from fossil fuel consumption by project activity in year y (tCO_2e/year)

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

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

Parameter	Unit	Description
$EC_{PJ,y}$	kWh	Amount of electricity consumed by project activity in year y (kWh/year)
$EF_{electricity,CO2}$	t-CO_2e/kWh	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 CO2 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;

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

Parameter	Unit	Description
$EF_{electricity,CO2}$	t-CO_2e/kWh	CO_2 emission factor at the project site (tCO_2e/kWh)
$EG_{biomass,y}$	kWh	Amount of electricity generated with biomass in year y (kWh/year)
$EF_{electricity,CO2,biomass}$	kg-CO_2e/kWh	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)
$EG_{fossil,y}$	kWh	Amount of electricity generated with fossil fuel in year y (kWh/year)
$EF_{electricity,CO2,fossil}$	kg-CO_2e/kWh	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, the amount of $PE_{electricity,PJ,y}$ is very small because most of electricity in the palm oil mill is generated using biomass. Details are shown below.

- **CO_2 emission factor for electricity consumption at the project site**

In the proposed project, CO2 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 indicated below;

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

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

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

$$= 0.000002 (tCO_2/kWh)$$

- **Annual power consumption at the project site**

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

- **GHG emissions due to electricity consumption**

CO2 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(tCO2/kWh)

= 0.13 (tCO2e/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;

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

Parameter	Unit	Description
$PE_{fossilfuel,PJ,y}$	t-CO_2e	CO_2 emission from fossil fuel consumption by the project in year y (tCO_2e/year)
$FC_{LPG,y}$	t-LPG	LP gas consumption by the project in year y (tLPG/year)
$EF_{LPG,combust}$	kg-CO_{2e}/TJ	CO_2 emission factor combusted LP gas (kgCO_2/TJ) (63,100 as per IPCC guideline 2006)
HV_{LPG}	MJ/kg-LPG	Heat value of LP gas (MJ/kgLPG) (value of 47.3 as per IPCC guideline 2006)

ii) $PE_{fugitive,y}$

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

Parameter	Unit	Description
$PE_{fugitive,ww,y}$	t-CO_2e	Fugitive emissions through capture inefficiencies in the anaerobic wastewater treatment systems in the year y (tCO2e)
$PE_{fugitive,s,y}$	t-CO_2e	Fugitive emissions through capture inefficiencies in the anaerobic sludge treatment systems in the year y (tCO2e)

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

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

Parameter	Unit	Description
CFE_{ww}	-	Capture efficiency of the biogas recovery equipment in the wastewater treatment systems (a default value of 0.9 is used)
$MEP_{ww,treatment,y}$	t-CH_4	Methane emission potential of wastewater treatment systems equipped with biogas recovery system in year y (tCH_4)
GWP_{CH4}	t-CO_2e/kg-CH_4	Global Warming Potential for methane (value of 21)

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

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

Parameter	Unit	Description
$Q_{ww,y}$	m^3	Volume of wastewater treated in year y (m^3)
$B_{o,ww}$	kg-CH_4/kg-COD	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)
$COD_{removed,PJ,k,y}$	t/m^3	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)

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

This project will not cause any impact to the system for sludge treatment, therefore this parameter will be not considered.

iii) $PE_{flaring,y}$

According to AMS-III.H version 13, this parameter should be calculated with "Tools to determine project emissions from flaring gases containing methane" (Paragraph 26). According to this tool, project emissions from the residual gas stream are calculated by the following 7 steps:

STEP 1, 2, 3 and 4 are not used for the project because the 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

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

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

$\rho_{CH4,n}$	kg/m^3	Density of methane at normal conditions (0.716 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:

combustion efficiency	Condition
0%	if the temperature in the exhaust gas of the flare (Tflare) is below 500 °C for more than 20 minutes during the hour h
50%	if the temperature in the exhaust gas of the flare (Tflare) 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 (Tflare) 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、depend 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.

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

Parameter	Unit	Description
$PE_{flare,y}$	t-CO2e	Project emissions from flaring of the residual gas stream in year y (tCO2e)
$TM_{RG,h}$	kg/hr	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}	t-CO2e/kg-CH4	Global Warming Potential of methane valid for the

		commitment period (value of 21)

(3) Monitoring plan

The Monitoring plan was developed as per methodology AMS-III.H version 13 and AM Tool 06. Version 1, "Tool to determine project emissions from flaring gases containing methane". The monitoring points and monitoring items are as below;

Table 3 Monitoring points and items

Parameter	Description	Source of data used / Method of measurement	Monitoring frequency
$Q_{ww,i,y}$	Volume of wastewater per year (m^3)	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.	Monthly
$COD_{ww,untreated,y}$	COD of untreated wastewater (t-COD/m^3-POME)	On site sampling and accredited third party analysis	Monthly
$COD_{ww,treated,y}$	COD of treated water (t-COD/m^3-POME)	On site sampling and accredited third party analysis	Monthly
$FC_{LPG,y}$	LP gas consumption per year（tLPG）	Purchase record of LP gas	Per purchase
$f_{vi,h}$	Volumetric fraction of methane in the residual gas on dry basis (vol %)	Direct measurement by gas analyzer	Monthly
$FV_{RG,h}$	Volumetric flow rate of the residual gas on dry basis at normal (NTP) conditions (m^3/h)	Directl measurement by gas flow meter	Hourly

T_{flare}	Temperature of exhausted gas (°C)	Direct measurement by thermometer	Hourly

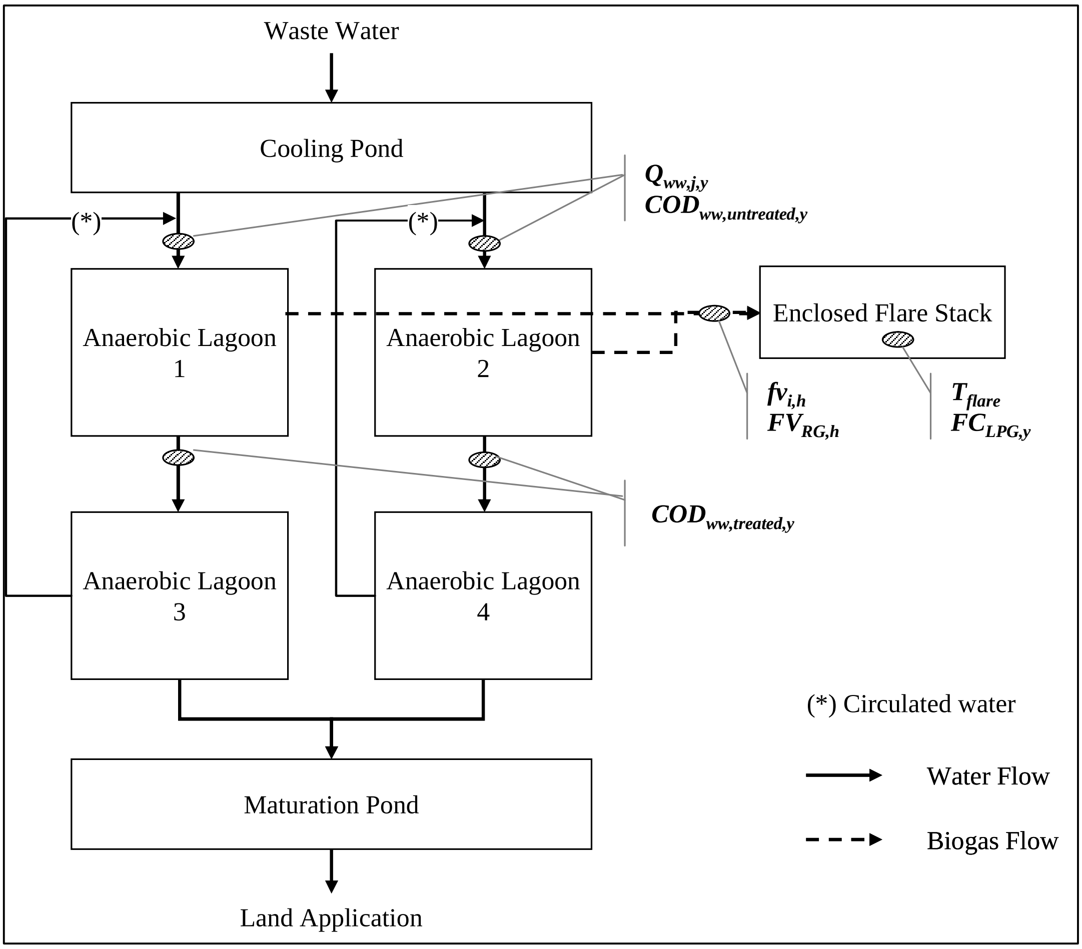

Figure 2　Monitoring points

(4) Volume of GHG emission reduction (or absorption)

The Volume of GHG emission reduction is calculated as below.

Table 4　Volume of GHG emission reduction

Year	Estimation of project activity emissions (tCO_2 e)	Estimation of baseline emissions (tCO_2 e)	Estimation of leakage (tCO_2 e)	Estimation of overall emission reductions (tCO_2 e)
2011 (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 (- Aug.)	3,771	15,597	0	11,825

(5) Duration of the project activity / Crediting period

Duration of the project activity : 1.May 2011 - 31.Aug., 2021 (10 years and 4 months)

Crediting Period : 1.Sept., 2011 - 31.Aug., 2021 (10 years)

Project starting day : date of construction contract or equipment order date

It is reasonable to set the project starting day as the construction start day because the proposed project has not been started yet. The construction works will be started immediately after the registration to UN has been completed.

(6) Environmental impact and other influences

According to Ministry of Environment, environmental office of North Sumatra province, environmental office of Asahan regency and DNPI, AMDAL is not necessary for the project activity. Regarding UPL/UKL, only DNPI insisted that UPL/UKL are necessary for the project activity.

Table 5 Comments on EIA necessity

Visited institutions	Comments
Ministry of Environment	EIA is not required. Environmental monitoring report should be submitted to the local agencies.
Environmental office of North Sumatra province	EIA and UPL/UKL is not required because EIA has already been done when building the palm oil mill. Some items should be added to the existing environmental report.
Environmental office of Asahan regency	EIA and UPL/UKL is not required because EIA has already been done when building the palm oil mill.
DNPI	EIA is not required, but UPL/UKL should be submitted.

(7) Stakeholders' Comments

Stakeholders' meeting was held in Jan. 2010. Participants to the meeting were Head of the local village, local residents, manager of the local environmental office, area manager of PTPN III, plant manager of Sei Silau palm oil mill, employees of PTPN III, officials from NGO and local media. The total number of participants was 53 persons. Comments from stakeholders are as below,

Table 6 Comments obtained by stakeholders' meeting

Speaker	Comments	Answer
Head of local village	● The explanation of emission reduction by the project was very detail and complete, but I didn't have an explanation on solid waste treatment in the project, so please explain on it. ● Solid wastes such as fiber and shell are utilized as boiler fuel. Is the emission by combusting both biomass included in the project? ● What is the benefit of this project? And how about employees needed by the project?	● The project will reduce the influences from waste water only. ● The workers will be employed for construction of the project activity, and the employee selection is responsible for the contractor.
Employee of PTPN III	● What is the economical benefit by the project?	● There is a big possibility to use a local employee in the construction stage and operational stage by the project.
Local residents	● How much odor the project activity will reduce, both odor from exhaust of the factory and odor from the waste water?	● The project activity will reduce the odor from the waste water.

(8) Business scheme of the project

IIL will be in charge of project operation and monitoring, and. Recycle One will be in charge of CER sales. The business scheme is figured as below.

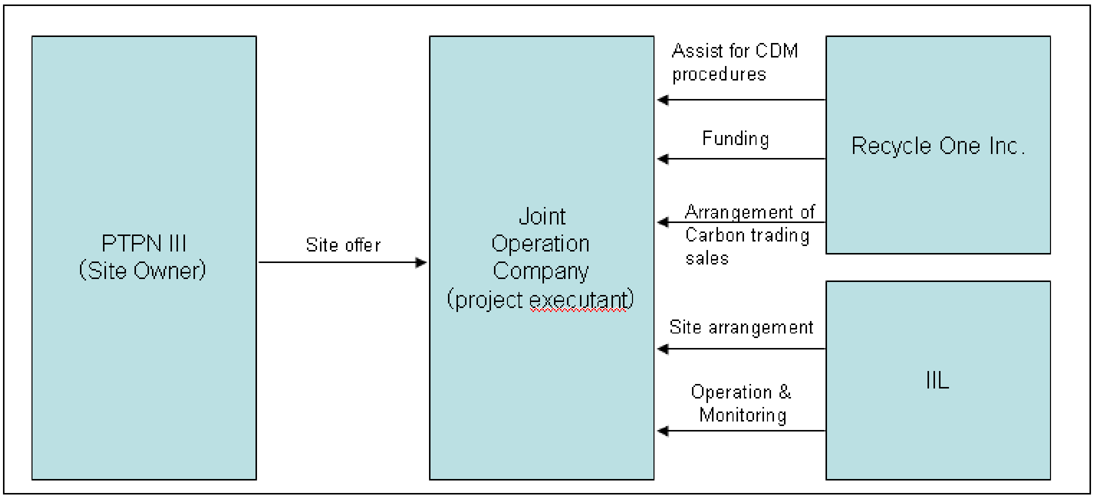

Figure 3　Business scheme of the project

(9) Cash flow

The total cost for the project activity will be 1,500,000 USD, and all the cost will be funded by the equity. The cash flow of first 5 years is as below.

Table 7　project cash flow for 5 years

(USD)			Year 1	Year 2	Year 3	Year 4	Year 5
Cash Flow Statement	2010-Aug	2011-Aug	2012-Aug	2013-Aug	2014-Aug	2015-Aug	2016-Aug
Cash flow from operating activities	-104,253	-160,326	-146,829	323,592	231,236	230,548	230,548
Cash flow from investments	0	-690,862	0	0	0	0	0
Cash flow from financing activity	500,000	1,000,000	0	0	0	0	0
Increase in cash & cash equivalent	395,747	148,812	-146,829	323,592	231,236	230,548	230,548
Balance at beginning of year	0	395,747	544,559	397,730	721,322	952,558	1,183,107
Balance at end of year	395,747	544,559	397,730	721,322	952,558	1,183,107	1,413,655
Blance check	0	0	0	0	0	0	0

(10)Financial analysis

Project IRR of the project will be 14.8%, that is higher than the benchmark of the project, the yield of Indonesian bonds, 11.6%. Detailed results of the financial analysis are as below.

Table 8　Financial analysis

(USD)				Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	
Income statement		2010-Aug	2011-Aug	2012-Aug	2013-Aug	2014-Aug	2015-Aug	2016-Aug	2017-Aug	2018-Aug	2019-Aug	2020-Aug	2021-Aug	2022-Aug
Sales	Registered ER				17,738	17,738	17,738	17,738	17,738	17,738	17,738	17,738	17,738	17,738
	Total	**0**	**0**	**0**	**319,425**	**319,425**	**319,425**	**319,425**	**319,425**	**319,425**	**319,425**	**319,425**	**319,425**	**319,425**
Expenditure	Initial Expenses	94,776	150,992											
	Operating Expense	0	3,375	84,709	95,756	88,876	88,876	88,876	88,876	88,876	88,876	88,876	88,876	44,567
	Depreciation		0	138,172	110,538	88,430	70,744	56,595	45,276	36,221	28,977	23,181	92,726	0
	Total	**94,776**	**154,367**	**222,881**	**206,294**	**177,307**	**159,621**	**145,472**	**134,153**	**125,097**	**117,853**	**112,058**	**181,602**	**44,567**
Operating Profit		**-94,776**	**-154,367**	**-222,881**	**113,130**	**142,118**	**159,804**	**173,953**	**185,272**	**194,327**	**201,572**	**207,367**	**137,822**	**274,857**
Income before taxes		**-94,776**	**-154,367**	**-222,881**	**113,130**	**142,118**	**159,804**	**173,953**	**185,272**	**194,327**	**201,572**	**207,367**	**137,822**	**274,857**
Income tax		0	0	0	0	0	0	0	0	0	0	0	0	0
Net income after tax		**-94,776**	**-154,367**	**-222,881**	**113,130**	**142,118**	**159,804**	**173,953**	**185,272**	**194,327**	**201,572**	**207,367**	**137,822**	**274,857**

(USD)				Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	
Balance Sheet		2010-Aug	2011-Aug	2012-Aug	2013-Aug	2014-Aug	2015-Aug	2016-Aug	2017-Aug	2018-Aug	2019-Aug	2020-Aug	2021-Aug	2022-Aug
Current assets		395,747	544,559	397,730	721,322	952,558	1,183,107	1,413,655	1,644,204	1,874,752	2,105,300	2,335,849	2,566,397	2,845,685
Fixed assets		0	690,862	552,690	442,152	353,721	282,977	226,382	181,105	144,884	115,907	92,726	0	0
Other assets														
Total assets		395,747	1,235,421	950,419	1,163,474	1,306,280	1,466,084	1,640,037	1,825,309	2,019,636	2,221,208	2,428,575	2,566,397	2,845,685
Current liabilities		-9,478	-15,437	-77,557	22,367	23,055	23,055	23,055	23,055	23,055	23,055	23,055	23,055	27,486
Fixed liabilities		0	0	0	0	0	0	0	0	0	0	0	0	0
Total liabilities		-9,478	-15,437	-77,557	22,367	23,055	23,055	23,055	23,055	23,055	23,055	23,055	23,055	27,486
	Common stock	500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000
	Retained earnings	-94,776	-249,142	-472,023	-358,893	-216,775	-56,971	116,982	302,254	496,581	698,153	905,520	1,043,342	1,318,200
Shareholders' equity		405,224	1,250,858	1,027,977	1,141,107	1,283,225	1,443,029	1,616,982	1,802,254	1,996,581	2,198,153	2,405,520	2,543,342	2,818,200
Total liabilities and shareholders' equity		395,747	1,235,421	950,419	1,163,474	1,306,280	1,466,084	1,640,037	1,825,309	2,019,636	2,221,208	2,428,575	2,566,397	2,845,685

(USD)				Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	
Project IRR		2010-Aug	2011-Aug	2012-Aug	2013-Aug	2014-Aug	2015-Aug	2016-Aug	2017-Aug	2018-Aug	2019-Aug	2020-Aug	2021-Aug	2022-Aug
Investment		0	-690,862	0	0	0	0	0	0	0	0	0	0	0
Cash flow from operation less interest payment		-104,253	-160,326	-146,829	323,592	231,236	230,548	230,548	230,548	230,548	230,548	230,548	230,548	279,288
Tax shield by interest payment		0	0	0	0	0	0	0	0	0	0	0	0	0
Total CF for project IRR		-104,253	-851,188	-146,829	323,592	231,236	230,548	230,548	230,548	230,548	230,548	230,548	230,548	279,288
Project IRR:	**14.8%**													

Project IRR without CER sales will be negative value because the revenue of the project is CER sales only.

(11)Verification of the Additionality

The project will apply the small-scale methodology. Thus, one of the barrier (investment barrier, technical barrier, prevailing barriers) should be proved to verify the additionality.

In the proposed project, the investment barrier makes difficult to conduct the project, and CDM can only settle this issue.

Table 9　barrier of the project

Type of barrier	Description
Investment barrier	The current waste water treatment system satisfies the wastewater regulations. Utilization of the collected methane gas as energy will be financially unprofitable, and the POM has no intension to do so. Moreover the income of the project activity will be CER sales revenue only. Therefore, it will be difficult to replace the existing waste water treatment system if the project is not formed as CDM project

(12) Feasibility

The possibility of commercialization is high at the current situation because the site owner, PTPN III, is very positive to the CDM projects, and the technologies to be applied to the project have been applied to other CDM projects already.

CER price trends and the Post-Kyoto Protocol situation can influence the commercialization of this project .

4 (Pre) Validation

(1) Outline of (Pre) Validation

PDD pre validation was undertaken from January to February, 2010. Scope of work was desk review of section A, B, and C of PDD.

(2) Interaction with DOE

The PDD was submitted to the DOE in the end of December 2009, and review had been finished at the end of February. In the pre-validation report, DOE pointed out the duration of the project activity, sludge treatment, and monitoring interval of methane fraction in the residual bio gas, etc..

5 Potential as co-benefit project

(1) Evaluation of impact to the existing environmental issues

a) Items to be evaluated

Evaluated items are as below;

i）Prevention of high COD waste water leakage by the project

ii）Prevention of odor spreading by the project

b) Definition of the baseline / project scenario

The baseline scenario is ”continuation of the current wastewater treatment by the open lagoon method”, and the project scenario is ”capture and combusting of the biogas emitted from anaerobic pond by covering with HDPE sheets”

Under the baseline scenario, It is supposed that waste water overflows due to heavy rain in case i), and the odor spreads from anaerobic pond in case ii).

c) Results of survey

i) Prevention of high COD wastewater leakage by the project

This study disclosed that project site has never experienced the overflow from anaerobic pond by heavy rain

ii) Prevention of odor spreading by the project

In this study, the odor originated from anaerobic pond was confirmed through on site measurement. but according to the plant manager , they have never get complaints from local residents due to the odor from anaerobic ponds.

Regarding working environment of factory workers, that of pond supervisor could be improved by the project activity (they are walking around along the anaerobic pond).

6 Survey results contribute to sustainable development

(Not applicable)