Monitoring report form
(Version 05.1)

Complete this form in accordance with the Attachment "Instructions for filling out the monitoring report form" at the end of this form.

MONITORING REPORT		
Title of the project activity	Chumporn applied biogas technology for advanced waste water management	
UNFCCC reference number of the project activity	UNFCCC Ref. No. 2148	
Version number of the monitoring report	Version 01	
Completion date of the monitoring report	27/10/2016	
Monitoring period number and duration of this monitoring period	Monitoring period no.2; Duration: 01/09/2010 to 30/09/2011 (first and last days included)	
Project participant(s)	Private entity: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Eschborn, Germany Private entity: Chumporn Palm Oil Public Company Limited, Bangkok, Thailand	
Host Party	Thailand	
Sectoral scope(s)	Sectoral Scope: 13. Waste handling and disposal	
Selected methodology(ies)	AM0013: Avoided methane emissions from organic waste-water treatment --- Version 4.0	
Selected standardized baseline(s)	n.a.	
Estimated amount of GHG emission reductions or net GHG removals by sinks for this monitoring period in the registered PDD	45,079	
Total amount of GHG emission reductions or net GHG removals by sinks achieved in this monitoring period	GHG emission reductions or net GHG removals by sinks reported up to 31 December 2012	GHG emission reductions or net GHG removals by sinks reported from 1 January 2013 onwards
	45,079	-

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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(a) Purpose of the project activity and the measures taken for GHG emission reductions or net GHG removals by sinks;

The purpose of the "*Chumporn applied biogas technology for advanced waste water management"* is to treat the wastewater generated in the production of palm oil and to use the organic matter removed from the wastewater to produce heat from clean, renewable energy (biogas). The planned project activity consists of a wastewater treatment facility, i.e. a combination of anaerobic tank digesters, as well as a combustion system to generate heat from the produced biogas. Biogas is produced by the anaerobic digestion of organic matter in the tank reactors. The project activity involves the design, construction, installation, start-up and operation of the wastewater treatment and heat generation facilities.

Hence, the project leads to a shift from traditional waste water treatment in open, anaerobic ponds with uncontrolled release of methane to the atmosphere to a closed tank digester system with biogas capture and utilization. The ultimate purpose of the project activity is to reduce greenhouse gas emissions to the atmosphere and contribute to an environmentally and socially sustainable development of palm oil production at Chumporn Palm Oil Industry (CPI).

(b) Brief description of the installed technology and equipment;

Two CSTR and two UASB-reactors have been constructed to treat wastewater from the palm oil production at CPI, before being released to the conventional open-pond post treatment process. Biogas is being utilised in the palm oil production process and palm oil refinery for heat production. Biogas that can for any reason not be utilized is being flared in an open flare. A treatment system for sludge produced in the biogas digesters is in place, consisting 4 concrete ponds with sand bed filter.

(c) Relevant dates for the project activity (e.g. construction, commissioning, continued operation periods, etc.);

Construction of the project began in February 2006
Commissioning and testing of the project began in March 2007
Project had started its operation from May 2007
Full operation since July 2007
Project was registered on 09/02/2009

(c) Total GHG emission reductions or net GHG removals by sinks achieved in this monitoring period.

Monitoring period: 01 September 2010 to 30 Sept 2011
Number of days during this monitoring period: 395 Days
Total Emission Reduction achieved during this monitoring period: **45,079 tCO_2e**

A.2. Location of project activity

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The project activity is located in the host country of Thailand.

CPI is located in Chumporn province in the uppermost part of the Southern region. The Gulf of Thailand is in the east, while the Union of Myanmar is in the west. The location is approximately 463 km south-south-west from Bangkok, close to the Tha Sae intersection about 15 km north of Chumporn City. The project activity is located within the existing site of the Chumporn Palm Oil Industry Complex, therefore no additional area is required.

The address of the project activity is:
296, Moo 2 Phetchkasem Road, Tambol Salui, Ampur Tasae, Chumporn.

The coordinates of the project activity (control room) are:
Latitude: 10°50'38.98"N and Longitude: 99°13'2.55"E.

Figure 1 visualizes the physical location of the project activity in Thailand.

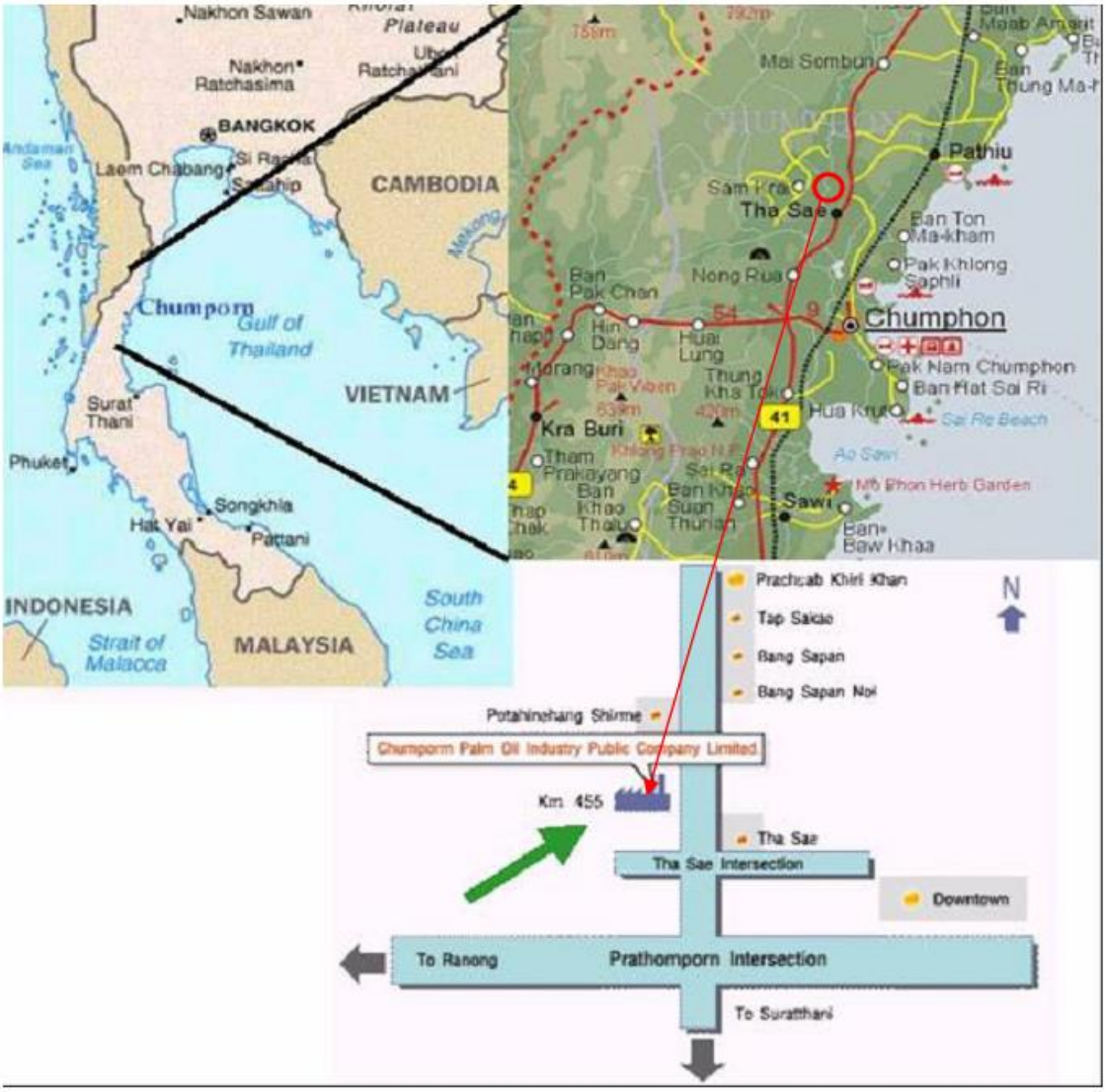

Figure 1: Physical location of the project activity

Chumporn Palm Oil Industry PCL (CPI) has been registered in Thailand in 1979. CPI had 748 employees in 2003 and 755 in 2004 (CPI Annual Report, 2004).

A.3. Parties and project participant(s)

Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate whether the Party involved wishes to be considered as project participant (yes/no)
Thailand (host)	Private entity: Chumporn Palm Oil Public Company Limited, Bangkok, Thailand	No
Germany	Private entity: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Eschborn, Germany	No

A.4. Reference of applied methodology and standardized baseline

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Approved Methodology AM0013 “Avoided methane emissions from organic waste-water treatment”, version 4, as of December 22nd, 2006 is applied. This methodology is based on the baseline approach from paragraph 48 of the CDM modalities and procedures “Existing actual or historical emissions as applicable”.

The calculation of the Thai grid emissions factor is based on the Approved Consolidated Methodology ACM002, version 6, as of May 19th, 2006 is applied.

The methodology also refers to the “Tool to determine project emissions from flaring gases containing Methane” (version as of December 2006) is applied. In addition, the “Tool for the demonstration and assessment of additionality” (version 03) is applied.

A.5. Crediting period of project activity

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10-years fixed crediting period, starting date is the 09/02/2009

A.6. Contact information of responsible persons/entities

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This draft of the CDM-MR-Form was completed by:

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Mr. Werner Kossmann provides carbon advisory services for CDM projects and is not a project participant listed in Appendix 1.

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

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The project started in February 2006 by constructing the Anaerobic Digester System by Natural Power Co., Ltd. The construction period took 1 year and 1 month with the start of commissioning and testing in March 2007. The Project started up in May 2007 and came in to full operation in July 2007.The monitoring of the CDM process started February 2009 with the registration of the project.

A modern waste water treatment technology was implemented at CPI. The existing simple wastewater treatment system in open, anaerobic lagoons has been replaced by a closed tank digester system to recover methane and produce biogas. The latter is being utilized in the production process at CPI to generate heat.
The building and operation of a completely stirred tank reactor (CSTR) is the central part of the project activity. A combined system of each CSTR and two UASB-reactors has been chosen as it is best suited for the underlying situation. Two tank reactors with a utilizable volume of 6,000 m^3 were established and operated. This allows a maximum daily load of approx. 800 m^3 waste water. The system was designed to produce approximately 12,700 m^3 of biogas per day, which is used to substitute the utilization of heavy oil and of palm shells for heat generation. Due to an increase of wastewater from the CPO, the system has in the monitoring period been able to produce an average of 15,531 m^3 of biogas per day. The methane content of the biogas reached an average of 59%, which is a bit lower than estimated before the start of the project (65%).
The two CSTR-tank reactors are composed of reinforced concrete in a half capsule channel shape that is partly underground. An outlet pipe is installed at the bottom of hopper shapes in the tank to drain digested sludge to the sludge treatment system. An overflow system allows the discharge of digested effluent with low COD and SS content. COD content in the effluent is reduced by about 80% and enters UASB reactors, before being released to the conventional open-pond post treatment process.

Biogas is being utilised in the 2 CPO boilers and since January 2010, the utilisation of biogas in two high pressure boilers at the palm oil refinery was added to the project activity.

CPI has a treatment system for solid residues from the biogas digester system (called sludge treatment system), which consists of 4 concrete ponds with sand bed filter. It has been implemented and was planned to be operated as described in the registered PDD. The treatment of solid residues, with the aim to produce dry sludge in working very slow, so that for this monitoring period no dewatering and land application of sludge was occurring.

No particular events or situations occurred during the monitoring period that impacted the applicability of the applied methodology.

Corrections, in the revised PDD (version 10), permanent changes from registered monitoring plan and changes to project design have been approved on 28/12/2014, during the course of the verification of the first monitoring period.
http://cdm.unfccc.int/PRCContainer/DB/prcp738485857/view

Table 1: Previously approved changes to the registered PDD

	Changes compared to registered PDD	Comment / Explanation
1)	**Change in PP name**	The name of the project participant has changed from GTZ (Gesellschaft fuer Technische Zusammenarbeit) to GIZ (Gesellschaft fuer Internationale Zusammenarbeit). A revised MoC has been submitted accordingly.
2)	***Baseline***	
	Old: Waste water from refinery and CPO. New: Waste water from CPO only (not from refinery)	It was planned and had been implemented as such that refinery waste water was supposed to be treated in the new biogas system. During the early stage of biogas system operation it became clear that the treatment of refinery waste water was difficult due to strong fluctuation in waste water composition, e.g. quickly changing COD and pH values. It was thereafter decided to abandon the treatment of refinery waste water and treat only CPO process waste water. The COD amount from refinery waste water makes up only 1.6% of the total estimated COD load to the new biogas system, or the baseline system respectable (please compare Table 10). The resulting changes in the potential emission reduction are almost negligible and the essential project activity is not affected. Only small changes in the PDD are necessary, as the refinery waste water was not directly mentioned in the registered PDD, except in Tab.8 were it serves as an example for historic data about the baseline situation. Refinery wastewater is further only mentioned in the Appendix 1 (ER calculation spread sheet) which is completely revised and Annex 3 (Baseline Information) where it is now deleted.
	old: utilization of biogas in biomass boiler in the CPO new: utilization of biogas in biomass boiler in the CPO and HP boilers in the palm oil refinery	Besides the biomass in the boilers of the CPO, bunker fuel in the HP boilers of the refinery has become another baseline under the adjusted project activity. The HP boilers have been included under technology description in section A.4.3 (Combustion systems). The baseline information have been adjusted in section B.4. Further information on the impact on project additionality (IRR calculation) are given in section B.5. For conservative reasons emission reductions for fossil fuel replacement from HP boilers have not been included in the project activity.
3)	***Technology design***	
	a) System design The registered PDD mentioned two anaerobic tank digesters; the PDD has been revised to describe more generally "a combination of anaerobic tank digesters"	The 2 CSTR digesters are the main biogas generation process reactors, whereas the following 2 UASB digesters have a post-treatment function of the low strength treated wastewater leaving the CSTRs. Contribution of the UASB digesters to the total biogas generation is low and had been included in the original biogas generation prediction of the technology provider. While the 2 CSTR digesters were originally seen as the main components of the biogas system, the whole system is now explicitly described as a combination of (different) anaerobic digesters

	Changes compared to registered PDD	Comment / Explanation
	b) Gas utilization (use in refinery burner) p.9 (of the registered PDD): The cleaned biogas will be utilized in the steam boilers to generate heat. Two boilers are operated: a mid/high pressure boiler (60-90 bar, boiler type NUK-HP 930, dual-fuel burner type RGMS7/1-D ZMD, DN50) and a low pressure boiler (30 bar, AWG Series II dual-fuel burner from Hamworthy (AWG 15)).	added: Post-registration, after proven reliable operation of the biogas system, some parts of the biogas have started to be diverted to be used in 2 high pressure boilers in CPI's palm oil refinery.
	c) Effluent/sludge handling: Sand Bed Filter Separation of solid and liquid parts of digested sludge from the bottom of the digester.	New: Sludge Treatment system "Separation of solid and liquid parts of digested sludge from the bottom of the digester. The treatment system will consist of sand bed filters or other technical solution (e.g. belt press), either way with the intention to produce sludge dry enough for transportation and land application." This paragraph has been added to the revised PDD as a result of difficulties with the original treatment system, implemented as per registered PDD. Since the sand bed filter so far did not deliver the expected dry sludge, to be used for land application, the addition simply reflects the intention to introduce a new technical solution for the treatment of sludge if needed and should therefore give the project owner some flexibility in sludge treatment, without other changes to the project activity.

The flow diagram in **Error! Reference source not found.** summarizes the described process.

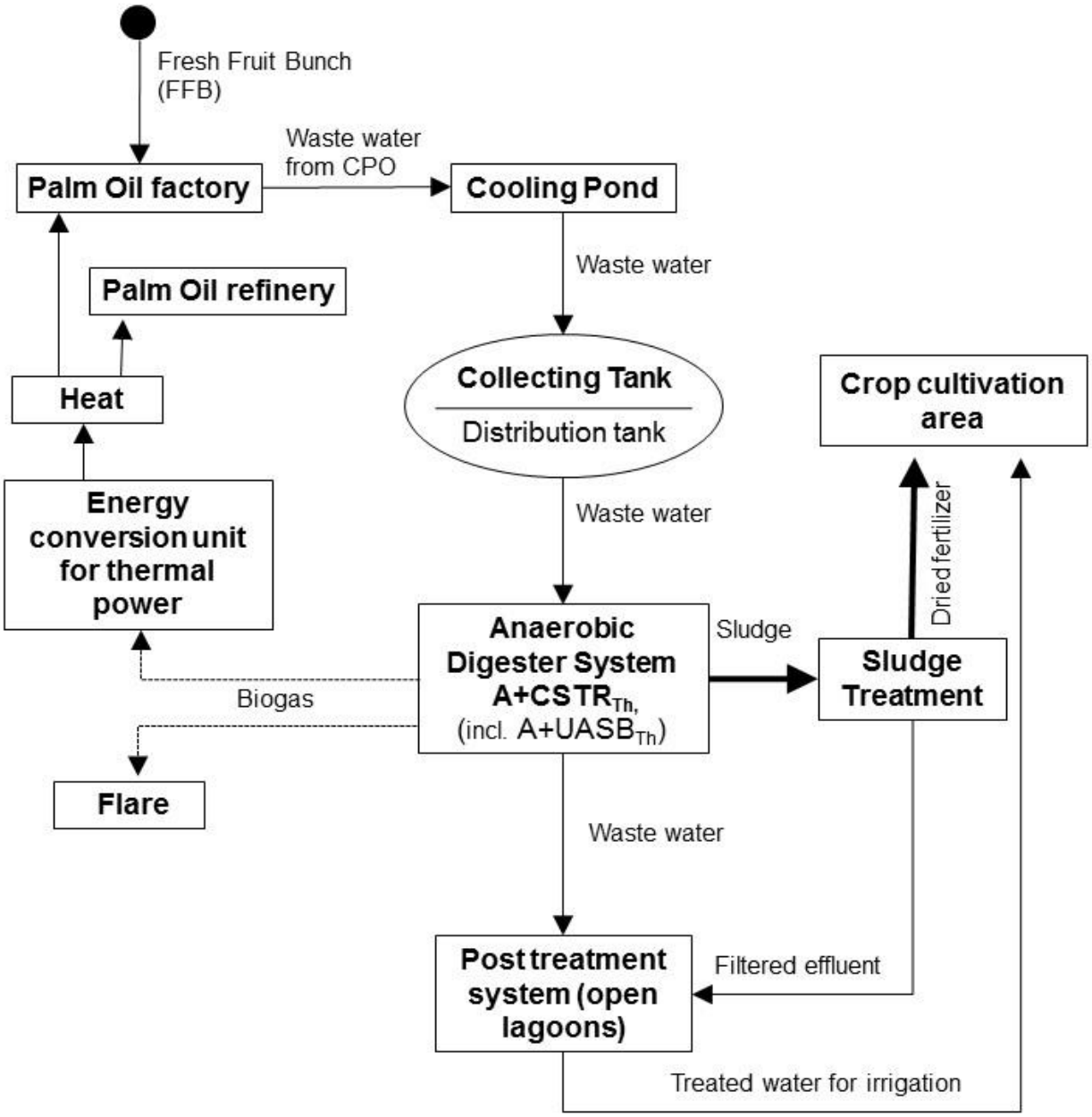

Figure 2: Flow diagram of improved waste water management system after project implementation

Main project equipment

Equipment	Type	Manufacturer
Biogas digester	2 CSTR digesters 2 A+ UASB digesters	Natural Power Co., Ltd
Energy conversion units (biogas boiler)	2 biomass boiler (CPO): 30 bar, AWG Series II dual-fuel burner from (AWG 15) 2 mid/high pressure boiler (60-90 bar, boiler type NUK-HP 930, dual-fuel burner type RGMS7/1-D ZMD, DN50)	Hamworthy GekaKonus GmbH Weishaupt
Flare	open flare system	

B.2. Post-registration changes

B.2.1. Temporary deviations from registered monitoring plan, applied methodology or applied standardized baseline

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n.a.

B.2.2. Corrections

>>
n.a.

B.2.3. Changes to start date of crediting period

>>
n.a.

B.2.4. Inclusion of a monitoring plan to the registered PDD that was not included at registration

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n.a.

B.2.5. Permanent changes from registered monitoring plan, applied methodology or applied standardized baseline

>>
n.a.

B.2.6. Changes to project design of registered project activity

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n.a.

B.2.7. Types of changes specific to afforestation or reforestation project activity

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n.a.

SECTION C. Description of monitoring system

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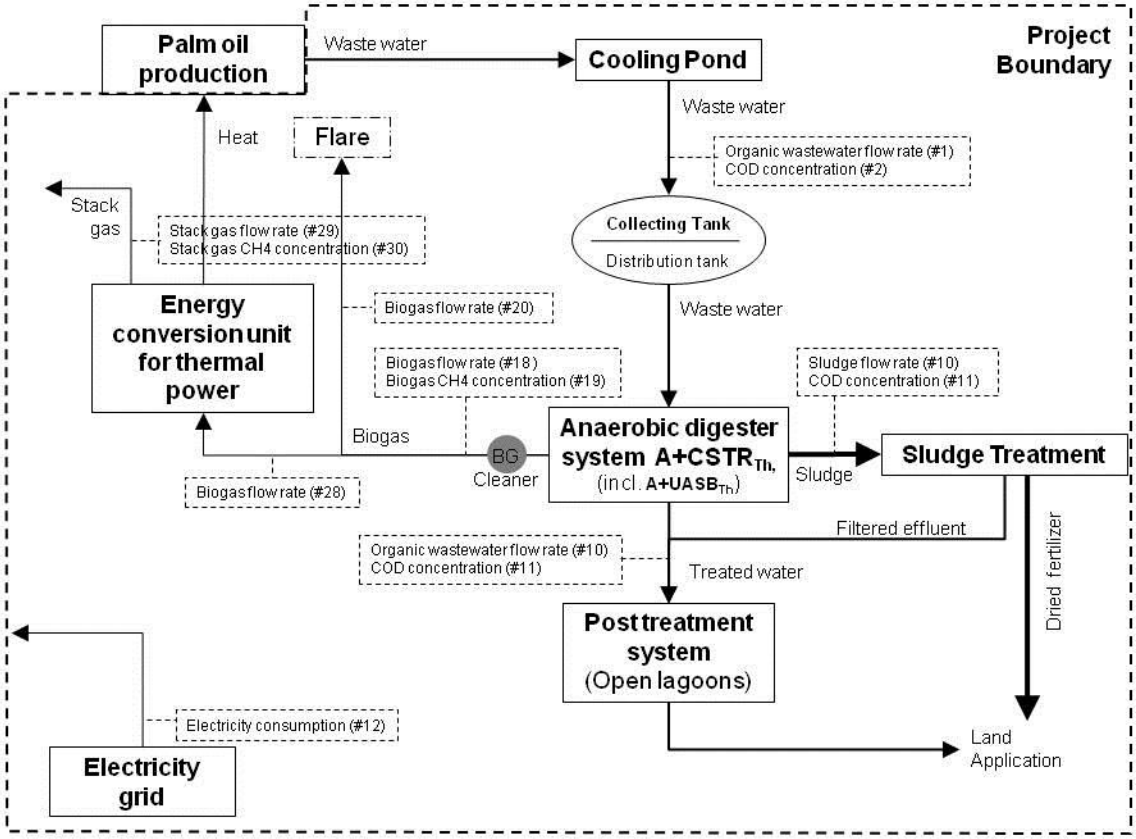
All data will be kept for at least two years following the end of the crediting period or the last issuance of CERs (whatever is the later). For all monitoring supervision, maintenance, data storage, data handling and plausibility check measures, standard operation procedures (SOP) are followed. These SOPs are integrated into the existing ISO 9001:2008 System.

Data Storage and processing

The control room for the biogas digester, adjacent to the Biogas plant is used for monitoring data record and processing facilities. The room is ventilated through AC system and provides shelter for the computer equipment and peripheral equipment (printer, modem).



Organizational and management structures

The management structure as well as implementation and operation management of the efficient monitoring system is as follows:

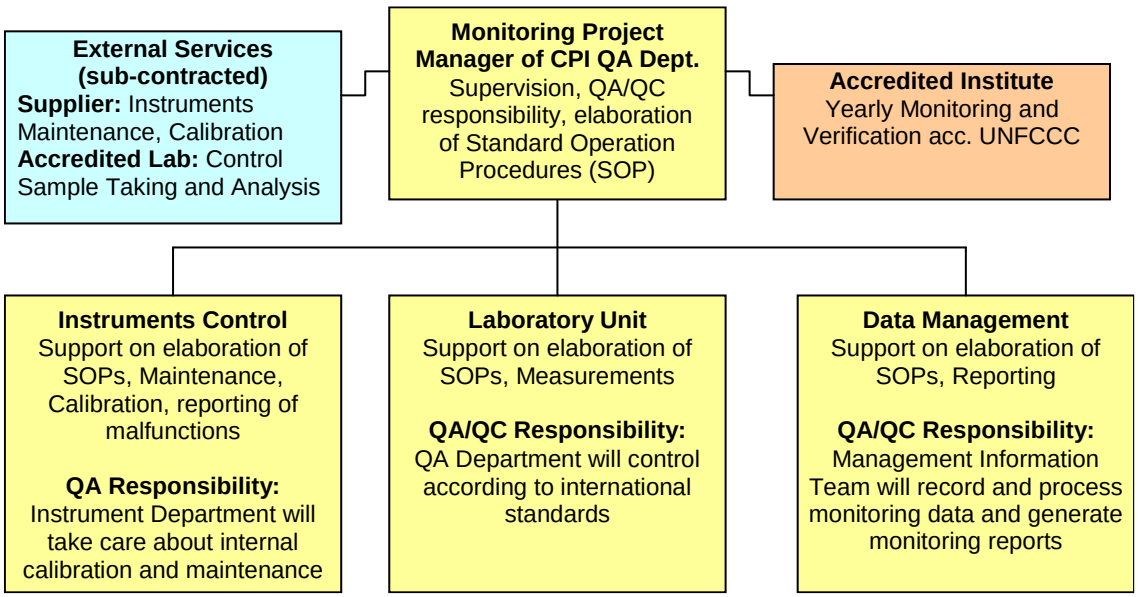
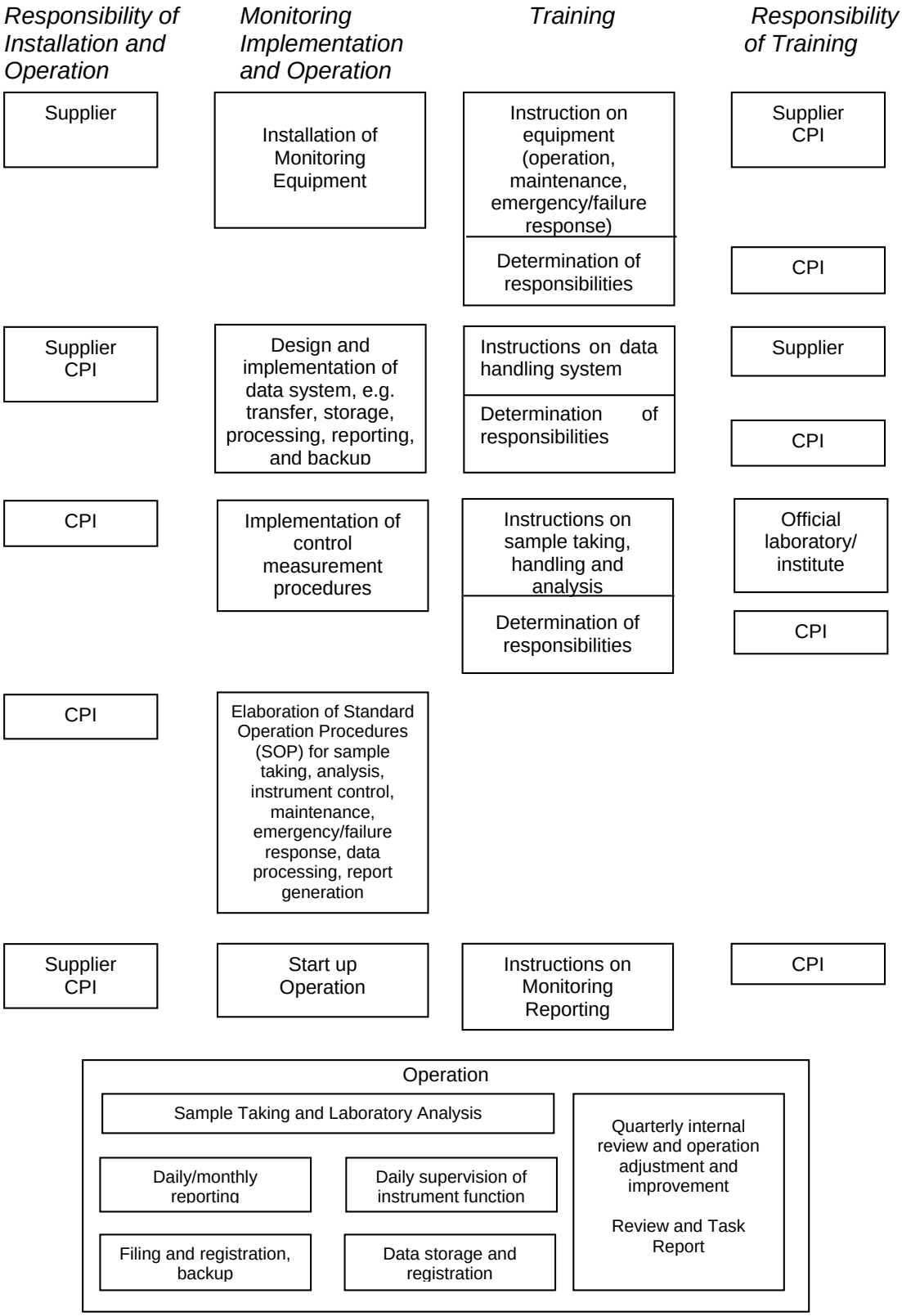


Figure 3: **Management Structure of Monitoring System**

Monitoring implementation and operation management and procedure

In order to implement, operate, maintain and control the monitoring system appropriately, the following operation procedure was implemented:

Figure 4: Monitoring Operation Procedure



Reconstruction/calculation of data in case of instrument failure

Missing monitoring data derived from instrument failure and during replacement of broken instruments will be reconstructed from former and subsequent series of measurement. Within the first month of monitoring, missing data will not be reconstructed and losses accepted accordingly.
After one month of monitoring and one month data record respectively, missing data will be reconstructed from the average of the lowest measured values of the previous and the following month, if the monitoring interruption is longer than one week
This method is appropriate and conservative, since the flow rates of waste water and biogas as well as the COD content in the waste water and CH_4 content in the biogas are not subject to huge variations in such production processes. To avoid suspicion referring bridging of complete production interruptions, corresponding data from parallel instruments and proved production data from the same period of the instrument failure will be recorded and documented in order to prove the continuity of the production process. Reconstructed values will be marked in the record and monitoring reports accordingly.

Training

To assure the correct handling of the equipment, correct monitoring, a comprehensive training of local stuff was organized. 16 staff members, which are responsible for operating and managing the system, were trained. Out of these 16 staff members, 8 staffs are from the operational level, 4 staffs (engineers) from the mid-management level and 4 staffs from the supervisory level. The training focused on:

- general knowledge about the applied equipment at the digesters and biogas utilization units;
- reading, recording and processing data and elaboration of monitoring reports;
- inspection and maintenance of equipment
- calibration methodology;
- emergency situation (complete exchange of equipment).

A first training phase already took place from February to May 2007 – focus: principals of anaerobic digestion and design parameters. A second training phase followed from May to July 2007, with a focus on start-up and operating procedure including gas utilization. A third phase currently takes place and will last until one year after the finalisation of construction – it focuses on the M&E concept and procedure.

The main course of the training were carried out by staff of the monitoring equipment supplier. CPI staff attended the installation of the equipment, calibration and start-up operation.

Guidebooks for the monitoring system and a handbook of the digester operation were provided in local or English language by the suppliers. The operator and the monitoring management team can find information about:

- operation and maintenance of the monitoring instruments
- operation manual of the digester;
- design parameters of the biogas composition, temperature, pressure, flow rate, etc..
- drawings;
- inspection, maintenance and simple emergency repair instructions;
- description of parts of the equipment;

The training was done in accordance with the already implemented ISO9001:2008 procedures at CPI and considered the above presented Monitoring Management Organization and staff assigned to the positions within this organization structure.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante or at renewal of crediting period

(Copy this table for each piece of data and parameter)

Data/parameter:	**Bo**
Unit	%
Description	Biogas producing capacity
Source of data	Default value as specified in AM0013, based on IPCC default values
Value(s) applied)	0.21 kg CH_4/kg COD
Choice of data or measurement methods and procedures	
Purpose of data	Calculation of baseline and project emissions
Additional comments	

Data/parameter:	**Hu_PS**
Unit	
Description	Calorific value of palm shells
Source of data	Desk Study on Palm Oil Industry in Thailand
Value(s) applied)	13.8 MJ/kg
Choice of data or measurement methods and procedures	
Purpose of data	Calculation of baseline emissions
Additional comments	

Data/parameter:	**Hu_HeavyOil**
Unit	MJ/litre
Description	Calorific value of heavy oil
Source of data	Standard default value: IPCC (1996), Module 1, Table 1-3.
Value(s) applied)	35.1 MJ/litre (40.19 MJ/t @ 0.86 t/litre)
Choice of data or measurement methods and procedures	
Purpose of data	Calculation of baseline emissions
Additional comments	

Data/parameter:	**GWP_CH_4**
Unit	Number
Description	Global warming potential of CH_4
Source of data	UNFCCC
Value(s) applied)	21
Choice of data or measurement methods and procedures	

Purpose of data	Calculation of baseline and project emissions
Additional comments	

Data/parameter:	**$CEF_{BI, elec,y}$**
Unit	t CO_2/MWh
Description	CO_2 emission factor for electricity consumed at the project site in the absence of the project activity
Source of data	Electricity Generation Authority of Thailand (EGAT), own calculations based on ACM0002 (simple operating margin, refer to PDD)
Value(s) applied)	0.523
Choice of data or measurement methods and procedures	
Purpose of data	Calculation of baseline and project emissions
Additional comments	

Data/parameter:	**D_{lng}**
Unit	M
Description	Depth of lagoon
Source of data	Measurement at CPI
Value(s) applied)	> 5
Choice of data or measurement methods and procedures	
Purpose of data	Calculation of baseline and project emissions
Additional comments	

Data/parameter:	**F_d**
Unit	%
Description	Fraction of anaerobic degradation due to depth as per table 1 of AM0013
Source of data	AM0013
Value(s) applied)	70%
Choice of data or measurement methods and procedures	
Purpose of data	Calculation of baseline and project emissions
Additional comments	

Data/parameter:	**E**
Unit	Cal/mol
Description	Activation energy constant
Source of data	AM0013
Value(s) applied)	15,175
Choice of data or measurement methods and procedures	

Purpose of data	Calculation of baseline and project emissions
Additional comments	

Data/parameter:	**$COD_{a,in}$**
Unit	kg COD/yr
Description	COD that enters the lagoon
Source of data	Laboratory tests at CPI (Method AWWA 5220B.,P5-14,1998)
Value(s) applied)	Monthly values as per table 8 of the revised registered PDD: Results of wastewater analysis 2006
Choice of data or measurement methods and procedures	
Purpose of data	Calculation of baseline and project emissions
Additional comments	

Data/parameter:	**$COD_{a,out}$**
Unit	kg COD/yr
Description	COD that leaves lagoon with the effluent
Source of data	Laboratory tests at CPI
Value(s) applied)	Monthly values, as per table 8 of the revised registered PDD: Results of wastewater analysis 2006

Month	Value	Month	Value
January	6,016	July	5,338
February	9,856	August	13,777
March	27,826	September	4,530
April	18,466	October	29,630
May	5,800	November	3,383
June	14,574	December	16,461

Choice of data or measurement methods and procedures	
Purpose of data	Calculation of baseline and project emissions
Additional comments	

Data/parameter:	**$COD_{available}$**
Unit	kg COD
Description	Monthly COD available for conversion which is equal to the monthly COD entering the digester or directed to land application $COD_{baseline,m\ plus}$ COD carried on from the previous month
Source of data	Calculated in line with AM0013
Value(s) applied)	Monthly values, see table "COD Avail" in spread sheet "MR CPI 1st period_CER Calculation_rev_03"
Choice of data or measurement methods and procedures	
Purpose of data	Calculation of baseline and project emissions
Additional comments	

Data/parameter:	Uncertainty conservativeness factor
Unit	
Description	Uncertainty conservativeness factor
Source of data	AM0013
Value(s) applied)	0.89
Choice of data or measurement methods and procedures	
Purpose of data	Calculation of baseline and project emissions
Additional comments	

Data/parameter:	T1
Unit	Kelvin
Description	Temperature
Source of data	AM0013
Value(s) applied)	303.16
Choice of data or measurement methods and procedures	
Purpose of data	Calculation of baseline and project emissions
Additional comments	

Data/parameter:	R
Unit	Cal/K mol
Description	Ideal gas constant
Source of data	AM0013
Value(s) applied)	1.987
Choice of data or measurement methods and procedures	
Purpose of data	Calculation of baseline and project emissions
Additional comments	

Data/parameter:	EGy
Unit	MWh
Description	Electricity consumption of existing waste water treatment system
Source of data	CPI
Value(s) applied)	0
Choice of data or measurement methods and procedures	
Purpose of data	Calculation of baseline emissions
Additional comments	

Data/parameter:	$CEF_{BI,therm}$
Unit	CO_2 e/TJ

Description	CO_2 emissions intensity for thermal energy generation
Source of data	IPCC 1996 Guidelines – Residual Fuel Oil, Table 1-1
Value(s) applied)	77.37
Choice of data or measurement methods and procedures	
Purpose of data	Calculation of baseline emissions
Additional comments	

Data/parameter:	**HG_{BI}**
Unit	MJ
Description	Quantity of [additional] thermal energy that would be consumed in year y at the project site in the absence of the project activity using fossil fuel
Source of data	Information provided by CPI, calculation on the basis of energy content of the produced biogas.
Value(s) applied)	11,172,825
Choice of data or measurement methods and procedures	
Purpose of data	Calculation of baseline emissions
Additional comments	

Data/parameter:	**HGp,y**
Unit	MJ
Description	Quantity of thermal energy that is consumed in year y at the project site due to the project activity using fossil fuel
Source of data	Planning data of installation
Value(s) applied)	0
Choice of data or measurement methods and procedures	
Purpose of data	Calculation of project emissions
Additional comments	

Data/parameter:	**$CEF_{Pr,therm,y}$**
Unit	tCO_2e/TJ
Description	CO_2 emissions intensity for thermal energy generation
Source of data	AM0013
Value(s) applied)	0
Choice of data or measurement methods and procedures	
Purpose of data	Calculation of baseline and project emissions
Additional comments	

Data/parameter:	**EF_{N2O}**
Unit	Kg N_2O/ Kg N

Description	Emission factor of nitrogen from sludge applied to land
Source of data	AM0013
Value(s) applied)	0.016
Choice of data or measurement methods and procedures	
Purpose of data	Calculation of project emissions
Additional comments	

Data/parameter:	**COD_{dw}**
Unit	kg COD/yr
Description	Chemical Oxygen Demand in the wastewater from the dewatering process
Source of data	Installation design
Value(s) applied)	0 (Not applicable for ex-ante)
Choice of data or measurement methods and procedures	
Purpose of data	Calculation of project emissions
Additional comments	Is applicable at times when sludge treatment and dewatering takes place.

D.2. Data and parameters monitored

(Copy this table for each piece of data and parameter)

Data / Parameter:	**T2**
Unit:	K
Description:	Ambient temperature (Kelvin) for the climate
Measured/ Calculated / Default:	Measured.
Source of data:	Weather station Chumporn Information received upon request to the service of Thai Meteorological Department, Ministry of Information and Communication Technology of Thailand (info_service@tmd.go.th)
Value(s) of monitored parameter:	See table below

Month	**Value (Kelvin)**	**Month**	**Value (Kelvin)**
September-10		January-11	
October-10		February-11	
November-10		March-11	
December-10		April-11	
		May-11	
		June-11	
		July-11	
		August-11	
		September-11	

Please also see “MR CPI 2nd period_CER Calculation_v01, table “Monitoring Data”

Monitoring equipment:	n.a.
Measuring/ Reading/ Recording frequency:	Monthly averages are obtained from the weather station at least annually.
Calculation method (if applicable):	n.a.
QA/QC procedures:	Internal double-check of using the correct values.
Purpose of data:	Calculation of baseline and project emissions
Additional comment:	According to the monitoring methodology in AM0013 vers.04, the temperature of the lagoon is monitored to calculate the proportion of organic matter that are biologically available for conversion to methane based upon the temperature of the system. The assumed temperature is equal to the ambient temperature.

Data / Parameter:	**$F_{Dig,in}$**
Unit:	m^3 / yr
Description:	Flow rate of organic wastewater into the digester
Measured/ Calculated / Default:	Measured.
Source of data:	Measurement

Value(s) of monitored parameter:

Month	Value (m^3)	Month	Value (m^3)
September-10	17,819	January-11	2,668
October-10	15,261	February-11	7,811
November-10	13,079	March-11	12,858
December-10	3,106	April-11	10,150
		May-11	12,446
		June-11	15,560
		July-11	14,305
		August-11	13,776
		September-11	15,018
Total 2010 (Sept-Dec.)	49,265	Total 2011 (Jan.-Sept.)	104,591

Please also see table “Monitoring Data” in the spread sheet “MR CPI 2nd period_CER Calculation_v01”

Monitoring equipment:	Flow rates are continuously recorded with a Magnetic Flow Meter. Continuously values are transferred online and recorded. Meter: Liquid flow meter Manufacturer: Yokogawa Model: AXFA14C Serial No.: S5H904107 834 ID No./Tag No.: FTBG001 Calibration date: 01/10/2010; 14/04/2011 due date: 14/10/2011; (6 month validity of calibration); Accuracy: +/- 0.35 % of full scale
Measuring/ Reading/ Recording frequency:	Measured continuously and recorded daily.
Calculation method (if applicable):	n.a.

QA/QC procedures:	Calibration: Calibration due date | Actual calibration date | measured error April 2010 | 1/10/2010 | 3.9% 01/04/2011 | 14/04/2011 | -0.41 % Permissible error of +/- 1%. Calibration frequency: 6 month Each time the meter is calibrated, an On-Site-Calibration-Report is submitted to CPI. Inspection and Maintenance: The Meter is installed such to enable easy inspection at least half-yearly and in a way installed where it may not be submerged. Installation also facilitates separation valves for meter removal and repair and recalibration. For this purpose, a spare meter is held on stock, to avoid long time loss of data record. O&M staff of the digester was trained to maintain the meters in accordance with the manufacturer's requirements. Meters are daily inspected by CPI staff and repaired as necessary by a service provider approved by the manufacturer. Laboratory and QA/QC staff trained O&M staff for data reading in parallel to online data transfer. Data storage: Online transfer to computer. Monthly data backup to external data storage. Data Preparation and reporting: Aggregation to 24 hrs average, weekly, monthly and quarterly rates by routines. Monthly aggregated reports are printed and filed at factory and headquarters respectively.
Purpose of data:	Calculation of baseline and project emissions
Additional comment:	-

Data / Parameter:	F_{Dig_out}
Unit:	m^3 / yr
Description:	Flow rate of organic wastewater out of the digester
Measured/ Calculated / Default:	Measured.
Source of data:	Measurement. $F_{Dig\_out} = F_{Dig,}$

Value(s) of monitored parameter:

Month	**Value (m^3)**	**Month**	**Value (m^3)**
September-10	17,819	January-11	2,668
October-10	15,261	February-11	7,811
November-10	13,079	March-11	12,858
December-10	3,106	April-11	10,150
		May-11	12,446
		June-11	15,560
		July-11	14,305
		August-11	13,776
		September-11	15,018
Total 2010 (Sept-Dec.)	49,265	Total 2011 (Jan.-Sept.)	104,591

Please also see table “Monitoring Data” in the spread sheet “MR CPI 2nd period_CER Calculation_v01”

Monitoring equipment:	Flow rates are continuously recorded with a Magnetic Flow Meter. Continuously values are transferred online and recorded. Meter: Liquid flow meter Manufacturer: Yokogawa Model: AXFA14C Serial No.: S5H904107 834 ID No./Tag No.: FTBG001 01/10/2010; 14/04/2011 due date: 14/10/2011; (6 month validity of calibration); Accuracy: +/- 0.35 % of full scale
Measuring/ Reading/ Recording frequency:	Measured continuously and recorded daily.
Calculation method (if applicable):	n.a.
QA/QC procedures:	See description $F_{Dig,in}$
Purpose of data:	Calculation of project emissions
Additional comment:	For this monitoring period, FDig,out = FDig,in (in line with the applied methodology). This value may be monitored separately in later monitoring periods, in the case sludge is removed from the digester for separate treatment.

Data / Parameter:	**$COD_{c,baseline}$**
Unit:	kg COD/m^3
Description:	COD - concentration of organic wastewater into the digester
Measured/ Calculated / Default:	Measured.
Source of data:	Laboratory tests at CPI (monthly) – Method: APHA 5220 D
Value(s) of monitored parameter:	See table below
Monitoring equipment:	Manufacturer: HACH LANGE Model: DR 3800 Serial No.: 1308841
Measuring/ Reading/ Recording frequency:	Samples were taken as follows: 2 samples per time mixed together and 2 times a week were collected for COD measurement by internal laboratory. As a cross check with the own laboratory data, additionally once a month samples were taken and analysed by an external laboratory. According to the methodology (AM0013 vers.4) COD measurements are to be taken at least monthly. PP believes that the current practice more than fulfils the required COD measurement frequency in the reported monitoring period.

Month	Value (kg COD/m3)	Month	Value (kg COD/m3)
September-10	80.2	January-11	82.8
October-10	70.0	February-11	113.7
November-10	90.8	March-11	134.0
December-10	56.8	April-11	128.4
		May-11	116.2
		June-11	123.3
		July-11	119.6
		August-11	93.6
		September-11	129.1

Please also see “MR CPI 2nd period_CER Calculation_v01”, table “Monitoring Data”

Calculation method (if applicable):	n.a.
QA/QC procedures:	Sampling was carried out adhering to internationally recognized procedures: Manual sample and laboratory analysis. CPI runs its own laboratory with appropriate sampling and analysis equipment. CPI and its laboratory are certified ISO 9001:2008. CPI elaborates standard operation procedures (SOP) and QC/QA instructions according to ISO9001:2008 for sampling taking and laboratory practice. Equipment supplier and internal laboratory staff and QA staff provided training to O&M staff to take samples according international standard requirements. Sample and analyzing accuracy is < ± 3 %. Calibration: Automatic wavelength calibration. Each time the meter is calibrated, a Calibration-Report is submitted to CPI. Calibration date: 20/10/2009, 01/11/2010 and 04/05/2011 due date: 04/05/2012; (12 month validity of calibration); Data capture/storage: Monthly data backup on external data storage of CDM specific data was carried out by data management (MIS) staff. Data will be stored for 10 years of CDM project duration and 2 years afterwards. Data backup procedure valid for the overall monitoring. Data Preparation and reporting: Data plausibility routines check data reliability and data comparison automatically. Aggregation to 24 hrs average, weekly, monthly and quarterly rates by routines. Monthly aggregated reports are printed – two copies are filed at factory and headquarters respectively. Monthly control sampling and analysis by accredited laboratory.
Purpose of data:	Calculation of baseline emissions
Additional comment:	n.a.

Data / Parameter:	**$COD_{a,in}$**
Unit:	kg COD/yr
Description:	COD that enters the lagoon
Measured/ Calculated / Default:	1 year historic data.
Source of data:	Laboratory tests at CPI, Method: APHA 5220 D
Value(s) of monitored parameter:	

Month	**Value (kg COD)**
January	343,148
February	8,934
March	1,478,409
April	1,656,264
May	1,648,690
June	1,189,790
July	224,000
August	596,973
September	59,598
October	818,316
November	744,237
December	678,075
Total	**9,446,434**

Ex ante date in the registered PDD.

Monitoring equipment:	n.a.
Measuring/ Reading/ Recording frequency:	n.a.
Calculation method (if applicable):	n.a.
QA/QC procedures:	n.a.
Purpose of data:	Calculation of baseline emissions (ex ante)
Additional comment:	-

Data / Parameter:	**$COD_{a,out}$**
Unit:	kg COD/yr
Description:	COD that leaves the lagoon
Measured/ Calculated / Default:	1 year historic data.
Source of data:	Laboratory tests at CPI, Method: APHA 5220 D
Value(s) of monitored parameter:	**Month** / **Value (kg COD)** January 6,016 February 9,856 March 27,826 April 18,466 May 5,800 June 14,574 July 5,338 August 13,777 September 4,530 October 29,630 November 3,383 December 16,461 **Total** **155,657** Ex ante date in the registered PDD.
Monitoring equipment:	n.a.
Measuring/ Reading/ Recording frequency:	n.a.
Calculation method (if applicable):	n.a.
QA/QC procedures:	n.a.
Purpose of data:	Calculation of project emissions (ex ante)
Additional comment:	-

Data / Parameter:	**T_{lng}**
Unit:	K
Description:	Temperature of the lagoon
Measured/ Calculated / Default:	Measured.
Source of data:	Measurements by CPI.

Value(s) of monitored parameter:	

Month	Value (Kelvin)	Month	Value (Kelvin)
September-10	296.7	January-11	301.1
October-10	296.7	February-11	301.4
November-10	299.8	March-11	301.1
December-10	300.7	April-11	302.4
		May-11	303.3
		June-11	301.3
		July-11	302.4
		August-11	301.7
September-10	296.7	September-11	296.8

(Please see also "MR CPI 2nd period_CER Calculation_v01"

Monitoring equipment:	Standard industrial temperature meter.
Measuring/ Reading/ Recording frequency:	Daily measurements; calculation of monthly average.
Calculation method (if applicable):	n.a.
QA/QC procedures:	
Purpose of data:	Calculation of project emissions (for plausibility check against ambient temperature data.
Additional comment:	That ambient temperature obtained from weather station will be used for the calculation.

Data / Parameter:	**COD_{c,dig_out}**
Unit:	kg COD/m^3
Description:	COD-concentration in discharged effluent from digester
Measured/ Calculated / Default:	Measured.
Source of data:	Measurements by CPI (monthly)
Value(s) of monitored parameter:	

Month	Value (kg COD/m3)	Month	Value (kg COD/m3)
September-10	14.52	January-11	4.33
October-10	13.06	February-11	18.83
November-10	13.50	March-11	23,.7
December-10	9.27	April-11	22.32
		May-11	20.32
		June-11	27.49
		July-11	25.00
		August-11	23.32
		September-11	23.69

Please see "MR CPI 2nd period_CER Calculation_v01", table "Monitoring Data"

Monitoring equipment:	Manufacturer: HACH LANGE Model: DR 3800 Serial No.: 1308841
Measuring/ Reading/ Recording frequency:	Samples were taken as follows: 2 samples per time mixed together and 2 times a week were collected for COD measurement by internal laboratory. As a cross check with the own laboratory data, additionally once a month samples were taken and analysed by an external laboratory. According to the methodology (AM0013 vers.4) COD measurements are to be taken at least monthly. PP believes that the current practice more than fulfils the required COD measurement frequency in the reported monitoring period.
Calculation method (if applicable):	n.a.
QA/QC procedures:	Sampling was carried out adhering to internationally recognized procedures: Manual sample and laboratory analysis. CPI runs its own laboratory with appropriate sampling and analysis equipment. CPI and its laboratory are certified ISO 9001:2008. CPI elaborates standard operation procedures (SOP) and QC/QA instructions according to ISO9001:2008 for sampling taking and laboratory practice. Equipment supplier and internal laboratory staff and QA staff provided training to O&M staff to take samples according international standard requirements. Sample and analyzing accuracy is < ± 3 %. Calibration: Automatic wavelength calibration. Each time the meter is calibrated, a Calibration-Report is submitted to CPI. Calibration date: 20/10/2009, 01/11/2010 and 04/05/2011 due date: 04/05/2012; (12 month validity of calibration); Data capture/storage: Monthly data backup on external data storage of CDM specific data was carried out by data management (MIS) staff. Data will be stored for 10 years of CDM project duration and 2 years afterwards. Data backup procedure valid for the overall monitoring. Data Preparation and reporting: Data plausibility routines check data reliability and data comparison automatically. Aggregation to 24 hrs average, weekly, monthly and quarterly rates by routines. Monthly aggregated reports are printed – two copies are filed at factory and headquarters respectively. Monthly control sampling and analysis by accredited laboratory.
Purpose of data:	Calculation of project emissions
Additional comment:	-

Data / Parameter:	**$EL_{P,y}$**
Unit:	MWh/yr
Description:	Amount of electricity in the year y that is consumed at the project site for the project activity
Measured/ Calculated / Default:	Measured.
Source of data:	Measurements at CPI

Value(s) of monitored parameter:	<table><tr><th>Month</th><th>Value (kWh)</th><th>Month</th><th>Value (kWh)</th></tr><tr><td>September-10</td><td>18,318</td><td>January-11</td><td>10,534</td></tr><tr><td>October-10</td><td>19,691</td><td>February-11</td><td>13,146</td></tr><tr><td>November-10</td><td>17,467</td><td>March-11</td><td>14,841</td></tr><tr><td>December-10</td><td>10,117</td><td>April-11</td><td>11,010</td></tr><tr><td></td><td></td><td>May-11</td><td>12,982</td></tr><tr><td></td><td></td><td>June-11</td><td>17,090</td></tr><tr><td></td><td></td><td>July-11</td><td>27,184</td></tr><tr><td></td><td></td><td>August-11</td><td>27,601</td></tr><tr><td></td><td></td><td>September-11</td><td>27,412</td></tr><tr><td>Total 2010 (Sept-Dec.)</td><td>65,593</td><td>Total 2011 (Jan.-Sept.)</td><td>161,800</td></tr></table> Please also see “MR CPI 2nd period_CER Calculation_v01”, table “Monitoring Data”
Monitoring equipment:	Standard electricity meter (separate meter for waste water plant); An officially calibrated electric meter (GENIUS power meter) is connected to the main electricity supply of the overall biogas plant. The data is recorded by the Provincial Electricity Authority (PEA). Calibration of this meter is in the responsibility of PEA. The data is cross checked with a separate measurement by CPI, for plausibility. The internal meter is: Schneider Electric, Power Logic PM710 (63230-501-209A1).
Measuring/ Reading/ Recording frequency:	Measured continuously and recorded daily.
Calculation method (if applicable):	n.a.
QA/QC procedures:	Yearly calibration by official organization or authorized company. No further steps are applicable due to external quality control (electricity provider). The instrument has the measurement accuracy of ±1%.
Purpose of data:	Calculation of project emissions
Additional comment:	-

Data / Parameter:	**F_{la}**
Unit:	kg/yr
Description:	Quantity of sludge used for land application after dewatering
Measured/ Calculated / Default:	Measured.
Source of data:	Measurements by CPI

Value(s) of monitored parameter:	<table><tr><th>Month</th><th>Value (kg)</th><th>Month</th><th>Value (kg)</th></tr><tr><td>September-10</td><td>0.0</td><td>January-11</td><td>0.0</td></tr><tr><td>October-10</td><td>0.0</td><td>February-11</td><td>0.0</td></tr><tr><td>November-10</td><td>0.0</td><td>March-11</td><td>0.0</td></tr><tr><td>December-10</td><td>0.0</td><td>April-11</td><td>0.0</td></tr><tr><td></td><td></td><td>May-11</td><td>0.0</td></tr><tr><td></td><td></td><td>June-11</td><td>0.0</td></tr><tr><td></td><td></td><td>July-11</td><td>0.0</td></tr><tr><td></td><td></td><td>August-11</td><td>0.0</td></tr><tr><td></td><td></td><td>September-11</td><td>0.0</td></tr><tr><td>Total 2010 (Sept-Dec.)</td><td>0.0</td><td>Total 2011 (Jan.-Sept.)</td><td>0.0</td></tr></table> Please also see “MR CPI 2nd period_CER Calculation_v01”, table “Monitoring Data”
Monitoring equipment:	Weighing of trucks with standard industrial weighbridge. Quantity of sludge is measured on demand. Meter: Weight bridge Methler Toledo Model: 8530 coupr. Serial No.: 5159588-51413 and 4373963-4qw ID No./Tag No.: Weight bridge no.1 and no.2 Accuracy: +/- 10 kg Calibration dates (both scales): 19/03/2010 (Truck Scale)
Measuring/ Reading/ Recording frequency:	Continuously when applicable. Not applicable during this monitoring period.
Calculation method (if applicable):	n.a.
QA/QC procedures:	QS/QA procedures according to ISO 9000:2008 scheme set up by CPI. The minimum calibration frequency of the instrument is biannually (every 2 years). The accuracy is ±10 kg.
Purpose of data:	Calculation of project emissions
Additional comment:	-

Data / Parameter:	**COD_{la}**
Unit:	kg COD/m^3
Description:	COD of the sludge used for land application after dewatering
Measured/ Calculated / Default:	Measured.
Source of data:	Measurements by CPI (laboratory), Method: APHA 5220 D
Value(s) of monitored parameter:	Please see “MR CPI 2nd period_CER Calculation_v01”, table “Monitoring Data”

Monitoring equipment:	Manufacturer: HACH LANGE Model: DR 3800 Serial No.: 1308841
Measuring/ Reading/ Recording frequency:	Samples were taken as follows: 2 samples per time mixed together and 2 times a week were collected for COD measurement by internal laboratory. As a cross check with the own laboratory data, additionally once a month samples were taken and analysed by an external laboratory. According to the methodology (AM0013 vers.4), COD measurements are to be taken at least monthly. PP believes that the current practice more than fulfils the required COD measurement frequency in the reported monitoring period.
Calculation method (if applicable):	n.a.
QA/QC procedures:	Sampling was carried out adhering to internationally recognized procedures: Manual sample and laboratory analysis. CPI runs its own laboratory with appropriate sampling and analysis equipment. CPI and its laboratory are certified ISO 9001:2008. CPI elaborates standard operation procedures (SOP) and QC/QA instructions according to the ISO9001:2008 for sampling taking and laboratory practice. Equipment supplier and internal laboratory staff and QA staff provided training to O&M staff to take samples according international standard requirements. Sample and analyzing accuracy is < ± 3 %. Calibration: Automatic wavelength calibration. Each time the meter is calibrated, a Calibration-Report is submitted to CPI Calibration date: 20/10/2009, 01/11/2010 and 04/05/2011 due date: 04/05/2012; (12 month validity of calibration);. Data capture/storage: Monthly data backup on external data storage of CDM specific data was carried out by data management (MIS) staff. Data will be stored for 10 years of CDM project duration and 2 years afterwards. Data backup procedure valid for the overall monitoring. Data Preparation and reporting: Data plausibility routines check data reliability and data comparison automatically. Aggregation to 24 hrs average, weekly, monthly and quarterly rates by routines. Monthly aggregated reports are printed – two copies are filed at factory and headquarters respectively. Monthly control sampling and analysis by accredited laboratory.
Purpose of data:	Calculation of project emissions
Additional comment:	-

Data / Parameter:	**$Fc_{,dw}$**
Unit:	m^3/yr
Description:	Flow rate of organic wastewater from the dewatering process
Measured/ Calculated / Default:	Measured.
Source of data:	Measurement by CPI (reading of flow meter and recording)

Value(s) of monitored parameter:	<table><tr><th>Month</th><th>Value (m^3)</th><th>Month</th><th>Value (m^3)</th></tr><tr><td>September-10</td><td>0.0</td><td>January-11</td><td>0.0</td></tr><tr><td>October-10</td><td>0.0</td><td>February-11</td><td>0.0</td></tr><tr><td>November-10</td><td>0.0</td><td>March-11</td><td>0.0</td></tr><tr><td>December-10</td><td>0.0</td><td>April-11</td><td>0.0</td></tr><tr><td></td><td></td><td>May-11</td><td>0.0</td></tr><tr><td></td><td></td><td>June-11</td><td>0.0</td></tr><tr><td></td><td></td><td>July-11</td><td>0.0</td></tr><tr><td></td><td></td><td>August-11</td><td>0.0</td></tr><tr><td></td><td></td><td>September-11</td><td></td></tr><tr><td>Total 2010 (Sept-Dec.)</td><td>0.0</td><td>Total 2011 (Jan.-Sept.)</td><td>0.0</td></tr></table> Please also see “MR CPI 2nd period_CER Calculation_v01”, table “Monitoring Data”
Monitoring equipment:	Flow rates are continuously recorded with Magnetic Flow Meter AXFA14C from Yokogawa .
Measuring/ Reading/ Recording frequency:	Continuously when applicable.
Calculation method (if applicable):	n.a.
QA/QC procedures:	Calibration: Each time the meter is calibrated, an On-Site-Calibration-Report is submitted to CPI. <table><tr><td>Calibration due date</td><td>Actual calibration date</td><td>measured error</td></tr><tr><td></td><td>14/04/2011</td><td>0.03 %</td></tr></table>Permissible error of +/- 1%. Calibration frequency: 6 month Each time the meter is calibrated, an On-Site-Calibration-Report is submitted to CPI Inspection and Maintenance: The Meter is installed such to enable easy inspection at least half-yearly and in a way installed where it may not be submerged. Installation also facilitates separation valves for meter removal and repair and recalibration. For this purpose, a spare meter is held on stock, to avoid long time loss of data record. O&M staff of the digester was trained to maintain the meters in accordance with the manufacturer's requirements. Meters are daily inspected by CPI staff and repaired as necessary by a service provider approved by the manufacturer. Laboratory and QA/QC staff trained O&M staff for data reading in parallel to online data transfer. Data storage: Online transfer to computer. Monthly data backup to external data storage. Data Preparation and reporting: Aggregation to 24 hrs average, weekly, monthly and quarterly rates by routines. Monthly aggregated reports are printed and filed at factory and headquarters respectively.
Purpose of data:	Calculation of project emissions
Additional comment:	Is applicable at times when sludge treatment and dewatering takes place.

Data / Parameter:	**$COD_{c,dw}$**
Unit:	kg COD/yr
Description:	COD of the wastewater from the dewatering process
Measured/ Calculated / Default:	Measured.
Source of data:	Measurements by CPI (laboratory), Method: APHA 5220 D

<table>
<tr><td>Value(s) of monitored parameter:</td><td>
<table>
<tr><th>Month</th><th>Value (kg COD)</th><th>Month</th><th>Value (kg COD)</th></tr>
<tr><td>September-10</td><td>0.0</td><td>January-11</td><td>0.0</td></tr>
<tr><td>October-10</td><td>0.0</td><td>February-11</td><td>0.0</td></tr>
<tr><td>November-10</td><td>0.0</td><td>March-11</td><td>0.0</td></tr>
<tr><td>December-10</td><td>0.0</td><td>April-11</td><td>0.0</td></tr>
<tr><td></td><td></td><td>May-11</td><td>0.0</td></tr>
<tr><td></td><td></td><td>June-11</td><td>0.0</td></tr>
<tr><td></td><td></td><td>July-11</td><td>0.0</td></tr>
<tr><td></td><td></td><td>August-11</td><td>0.0</td></tr>
<tr><td></td><td></td><td>September-11</td><td>0.0</td></tr>
<tr><td>Total 2010 (Sept-Dec.)</td><td>0.0</td><td>Total 2011 (Jan.-Sept.)</td><td>0.0</td></tr>
</table>

Please also see “MR CPI 2nd period_CER Calculation_v01”, table “Monitoring Data”
</td></tr>
<tr><td>Monitoring equipment:</td><td>Manufacturer: HACH LANGE
Model: DR 3800
Serial No.: 1308841</td></tr>
<tr><td>Measuring/ Reading/ Recording frequency:</td><td>Samples were taken as follows: 2 samples per time mixed together and 2 times a week were collected for COD measurement by internal laboratory.
As a cross check with the own laboratory data, additionally once a month samples were taken and analysed by an external laboratory. According to the methodology (AM0013 vers.4) COD measurements are to be taken at least monthly. PP believes that the current practice more than fulfils the required COD measurement frequency in the reported monitoring period.</td></tr>
<tr><td>Calculation method (if applicable):</td><td>n.a.</td></tr>
<tr><td>QA/QC procedures:</td><td><u>Sampling</u> was carried out adhering to internationally recognized procedures: Manual sample and laboratory analysis. CPI runs its own laboratory with appropriate sampling and analysis equipment. CPI and its laboratory are certified ISO 9001:2008. CPI elaborates standard operation procedures (SOP) and QC/QA instructions according to ISO9001:2008 for sampling taking and laboratory practice. Equipment supplier and internal laboratory staff and QA staff provided training to O&M staff to take samples according international standard requirements. Sample and analyzing accuracy is < ± 3 %.

<u>Calibration:</u> Automatic wavelength calibration.
Each time the meter is calibrated, a Calibration-Report is submitted to CPI.
Calibration date:
20/10/2009, 01/11/2010 and 04/05/2011
due date: 04/05/2012; (12 month validity of calibration);

<u>Data capture/storage:</u> Monthly data backup on external data storage of CDM specific data was carried out by data management (MIS) staff. Data will be stored for 10 years of CDM project duration and 2 years afterwards. Data backup procedure valid for the overall monitoring.
<u>Data Preparation and reporting:</u> Data plausibility routines check data reliability and data comparison automatically. Aggregation to 24 hrs average, weekly, monthly and quarterly rates by routines. Monthly aggregated reports are printed – two copies are filed at factory and headquarters respectively.
Monthly control sampling and analysis by accredited laboratory.</td></tr>
<tr><td>Purpose of data:</td><td>Calculation of project emissions</td></tr>
<tr><td>Additional comment:</td><td>Is applicable at times when sludge treatment and dewatering takes place.</td></tr>
</table>

<table>
<tr><td>Data / Parameter:</td><td>FR_{Bio}</td></tr>
<tr><td>Unit:</td><td>m^3/yr</td></tr>
<tr><td>Description:</td><td>Biogas flow rate at digester outlet.</td></tr>
<tr><td>Measured/
Calculated /
Default:</td><td>Measured.</td></tr>
<tr><td>Source of data:</td><td>Measurements</td></tr>
<tr><td>Value(s) of monitored parameter:</td><td>
<table>
<tr><th>Month</th><th>Value (m^3)</th><th>Month</th><th>Value (m^3)</th></tr>
<tr><td>September-10</td><td>533,898</td><td>January-11</td><td>74,692</td></tr>
<tr><td>October-10</td><td>496,471</td><td>February-11</td><td>283,724</td></tr>
<tr><td>November-10</td><td>459,890</td><td>March-11</td><td>527,060</td></tr>
<tr><td>December-10</td><td>56,876</td><td>April-11</td><td>427,546</td></tr>
<tr><td></td><td></td><td>May-11</td><td>558,660</td></tr>
<tr><td></td><td></td><td>June-11</td><td>617,358</td></tr>
<tr><td></td><td></td><td>July-11</td><td>676,476</td></tr>
<tr><td></td><td></td><td>August-11</td><td>712,648</td></tr>
<tr><td></td><td></td><td>September-11</td><td>709,328</td></tr>
<tr><td>Total 2010 (Sept-Dec.)</td><td>1,547,134</td><td>Total 2011 (Jan.-Sept.)</td><td>4,587,491</td></tr>
</table>
Please also see “MR CPI 2nd period_CER Calculation_v01”, table “Monitoring Data”
</td></tr>
<tr><td>Monitoring equipment:</td><td>Measurement at the outlet of the biogas system, after the biogas cleaner, before utilization of the gas. Continuously values are transferred online and recorded.
Meter: Thermal Mass Flowmeter
Manufacturer: Fox
Model: FT2
Serial No.: 6511
ID No./Tag No.: FTBG004
Calibration date: 01/10/2010; 14/04/2011
Due date: 14/10/2011;
Accuracy: ± 1% of reading, ± 0.2 % of full scale</td></tr>
<tr><td>Measuring/
Reading/
Recording frequency:</td><td>Continuously</td></tr>
<tr><td>Calculation method (if applicable):</td><td>n.a.</td></tr>
</table>

QA/QC procedures:	Regular Calibration of Thermal Mass flow meter or similar by manufacturer or approved company (half-yearly) – calibration report to CPI. QC staffs of CPI are trained on calibration control and on malfunction recognition. Subsequent calibration control every month is appropriate to the application to assure accuracy of ± 2%. Each time the meter is calibrated by approved companies, an On-Site-Calibration-Report will be supplied to CPI. Calibration control and adjustments by CPI-QC staff will be recorded. From September to October 2010 the measured error of 4.4% was applied. QC of meter function: One main flow meter for both outlet 1 and 2 is installed. Data of the meter is sent to a computer. Computer program cross-checks total digester outlet with Sum of flow to flare and energy conversion units. Flow meter malfunction or leakages can thus be detected. Daily flow meter function inspection. Cross-check accuracy set to ± 2 %. A spare flow meter is held on stock for immediate change if needed at any place of gas pipes. Separation valves allow deviation of gas flow through second line during exchange of meter. Range of meter allows to measure full flow. Data recording and storage: Online transfer to computer. Monthly data backup to external data storage. Data preparation and reporting: Aggregation to 24 hrs average, weekly, monthly and quarterly rates by routines. Monthly aggregated reports will be printed and filed at factory
Purpose of data:	Calculation of project emissions
Additional comment:	-

Data / Parameter:	$P_{CH4,bio}$
Unit:	Ppm
Description:	Biogas CH_4 content at digester outlet
Measured/ Calculated / Default:	Measured.
Source of data:	Measurement (quarterly)
Value(s) of monitored parameter:	Please see “MR CPI 2nd period_CER Calculation_v01”, table “Monitoring Data”
Monitoring equipment:	CH_4 content is determined through electronic probe and analysis: Non-Dispersion Infrared method (NDIR). Preferably application of portable analyzer (range 0 -100vol%). Meter: 4 Channel Handheld Gas Analyzer Manufacturer: Gasboard Model: GA-m2 Serial No.: 10830 Calibration date 21/09/2010; 15/04/2011 Due date: 15/10/2011; Accuracy: ± 1% of reading, ± 0.2 % of full scale
Measuring/ Reading/ Recording frequency:	Measurements and recording at 1 hr frequency (portable analyzer).
Calculation method (if applicable):	n.a.

QA/QC procedures:	Accuracy of equipment < ± 1 % at full scale. Accuracy of Method (portable analyzer): < ± 2 % due to relatively stable production process and low variation of CH_4 production. Regular calibration by manufacturer or by approved company (half-yearly or before each measurement period, if portable equipment are used) – calibration report to CPI. QC staff of CPI will be trained on calibration control and on malfunction recognition. The calibration was delayed for approximately 26 days, therefore for April 2010 the maximum permissible error of 2% was applied (measured -1.7%). Data recording/storage: Data logger reading or online transfer to computer. Monthly data backup to external data storage.
Purpose of data:	Calculation of project emissions
Additional comment:	-

Data / Parameter:	**$FR_{f,inlet}$**
Unit:	m^3/hr
Description:	Biogas flow rate at flare inlet
Measured/ Calculated / Default:	Measured.
Source of data:	Measurement / calculation
Value(s) of monitored parameter:	See table below Please also see "MR CPI 2nd period_CER Calculation_v01", table "Monitoring Data"
Monitoring equipment:	Meter: Thermal Mass Flowmeter Manufacturer: Fox Model: FT2 Serial No.: 6510 ID No./Tag No.: FTBG005 Calibration date: 01/10/2010 and 15/04/2011 Due date: 15/10/2011; Accuracy: ± 1% of reading, ± 0.2 % of full scale
Measuring/ Reading/ Recording frequency:	Continuously values are transferred online and recorded.
Calculation method (if applicable):	n.a.
QA/QC procedures:	See description at $FR_{Bio..}$ The minimum re-calibration interval is 2 years. From the first calibration in September 2008, there was a delay of calibration, which should have been performed in March 2009. For September 2010 the maximum measured error of 8,97 % was applied.
Purpose of data:	Calculation of project emissions

Month	**Value (m^3)**	**Month**	**Value (m^3)**
September-10	42,977	January-11	2,819
October-10	19,671	February-11	3,162
November-10	576	March-11	41,084
December-10	2,271	April-11	45,386
		May-11	135,837
		June-11	156,159
		July-11	132,284
		August-11	131,436
		September-11	83,056
Total 2010 (Sept-Dec.)	65,494	Total 2011 (Jan.-Sept.)	731,223

Additional comment:	-

Data / Parameter:	$T_{comb,f}$
Unit:	hrs/yr
Description:	Fraction of time gas is combusted in the flare
Measured/ Calculated / Default:	Measured.
Source of data:	Measurement

Value(s) of monitored parameter:

Month	Value (hrs)	Month	Value (hrs)
September-10	122.8	January-11	0.0
October-10	357.1	February-11	7.6
November-10	0.0	March-11	102.4
December-10	8.8	April-11	176.1
		May-11	369.4
		June-11	424.3
		July-11	481.5
		August-11	464.0
		September-11	294.4
Total 2010 (Sept-Dec.)	489	Total 2011 (Jan.-Sept.)	2,320

Please also see “MR CPI 2nd period_CER Calculation_v01”, table “Monitoring Data”.

Monitoring equipment:	Measured using a run time meter connected to a flame continuous temperature controller (Thermocouple transmitter 4-20mA). Signals of the transmitter are recorded by the electronic data logging system and show run time of the flare. The gas flow to the flare is controlled by a pressure control system: If gas flows to the boiler stops, pressure in biogas storage bag will raise. If this pressure exceeds a certain level, a signal will be send to gas blower which will switch on pump. This starts gas pumping to the flare. The ignition of the flare is being controlled by pressure. If pressure increases, a signal will be send to switch to ignite the flame. Thermal Mass Flow Meter Accuracy ± 1% of reading, ± 0.2 % of full scale. Tag.no. TTB003(TEMP out flare) Calibration dates: 15/09/2008, 15/04/2011
Measuring/ Reading/ Recording frequency:	Continuously.
Calculation method (if applicable):	n.a.
QA/QC procedures:	QS/QA procedures according to ISO 9000:2008 scheme set up by CPI. The minimum re-calibration interval of the gas flow meter is 2 years. A. Electronic logging data system of the flare will record: 1. Date and time when flare 2. Amount of biogas to be flared/burnt 3. Temperature at burning. B. External Lab (MIT) is coming annually to measure the above parameters by using their own equipment and compare the values of those parameters whether there is any different out of the acceptable range/accuracy or not. If in the acceptable range, then the electronic logging values of the flare system are accepted. If not, then the recording of flare system has to be calibrated by the external lab.
Purpose of data:	Calculation of project emissions

Additional comment:	-

Data / Parameter:	**$PE_{flare, y}$**
Unit:	t CO_{2e}
Description:	Project emissions from flaring of the residual gas stream in year y
Measured/ Calculated / Default:	Calculated.
Source of data:	Calculation based on $FR_{f,inlet,}$,$PCH_{4,f,s,}$ and $T_{comb,f}$
Value(s) of monitored parameter:	3,596 t CO_{2e} Please see “MR CPI 2nd period_CER Calculation_v01”, table “Monitoring Data”
Monitoring equipment:	-
Measuring/ Reading/ Recording frequency:	-
Calculation method (if applicable):	$PE_{flare, y}$ will be calculated as the annual amount of CH_4 being utilized in the flare [t/yr] times the standard flare efficiency of 0.5 times the GWP of CH_4 (21): $PE_{flare, y} = (M_{CH4, flare} * 0.5 * 21)/1000$ in [t/yr] The annual amount of CH_4 being utilized in the flare ($M_{CH4, flare}$) will be calculated as: $M_{CH4, flare} = V_{Bio, flare} * \rho_{Bio, flare} * P_{CH4,bio}$ in [kg/yr] Where $V_{Bio, flare}$ = Annual volumetric flow of biogas at norm conditions = ($FR_{f,inlet}$ * $T_{comb,f}$) * (1+27.3°C[1] / 273.15°C) $\rho_{Bio, flare}$ = Density of biogas at norm conditions = $P_{CH4,bio}$ * 0.717 kg/m³ + (1-$P_{CH4,bio}$) * 1.251 kg/ m³ Remarks: ▪ The calculation of the density of the biogas is based on the simplified assumption that the biogas consists of CH_4 and N_2 only. This is in line with the TME, page 5. ▪ 0.717 kg/m³ is the density of CH_4 at norm conditions, 1.251 kg/ m³ is the density of N_2 at norm conditions (http://www.biologie.de/biowiki/Liste_der_Dichte_gasf%C3%B6rmiger_Stoffe)

[1] 27.3 °C is the average annual temperature at the project site.

QA/QC procedures:	For $T_{comb,f}$ QS/QA procedures according to ISO 9000:2008 scheme set up by CPI. The minimum re-calibration interval of the gas flow meter is 2 years. A. Electronic logging data system of the flare will record: 1. Date and time when flare 2. Amount of biogas to be flared/burnt 3. Temperature at burning. B. External Lab (MIT) is coming annually to measure the above parameters by using their own equipment and compare the values of those parameters whether there is any different out of the acceptable range/accuracy or not. If in the acceptable range, then the electronic logging values of the flare system are accepted. If not, then the recording of flare system has to be calibrated by the external lab. For $FR_{f,inlet.}$ Regular Calibration of Thermal Mass flow meter or similar by manufacturer or approved company (half-yearly) – calibration report to CPI. QC staffs of CPI are trained on calibration control and on malfunction recognition. Subsequent calibration control every month is appropriate to the application to assure accuracy of ± 2%. Each time the meter is calibrated by approved companies, an On-Site-Calibration-Report will be supplied to CPI. Calibration control and adjustments by CPI-QC staff will be recorded. QC of meter function: One main flow meter for both outlet 1 and 2 is installed. Data of the meter is sent to a computer. Computer program cross-checks total digester outlet with Sum of flow to flare and energy conversion units. Flow meter malfunction or leakages can thus be detected. Daily flow meter function inspection. Cross-check accuracy set to ± 2 %. A spare flow meter is held on stock for immediate change if needed at any place of gas pipes. Separation valves allow deviation of gas flow through second line during exchange of meter. Range of meter allows to measure full flow. Data recording and storage: Online transfer to computer. Monthly data backup to external data storage. Data preparation and reporting: Aggregation to 24 hrs average, weekly, monthly and quarterly rates by routines. Monthly aggregated reports will be printed and filed at factory The originally stated minimum re-calibration interval is 2 years. Actual requirement for re-calibration is stated on the on-side-calibration reports (next due date) and was for the monitoring period stated as ½ year. From the first calibration in September 2008 (25/09/2008), there was a delay of calibration, which should have accordingly been performed in March 2009. For September 2010 the maximum measured error of 8,97 % was applied.
Purpose of data:	Calculation of project emissions
Additional comment:	-

Data / Parameter:	**$FR_{e,inlet}$**
Unit:	m^3/yr
Description:	Flow rate of the biogas entering the heat generation equipment
Measured/ Calculated / Default:	Measured.
Source of data:	Measurement

<table>
<tr><td>Value(s) of monitored parameter:</td><td>
<table>
<tr><th>Month</th><th>Value (m³ / yr)</th><th>Month</th><th>Value (m³ / yr)</th></tr>
<tr><td>September-10</td><td>483,143.0</td><td>January-11</td><td>72,859.9</td></tr>
<tr><td>October-10</td><td>548,838.0</td><td>February-11</td><td>260,718.0</td></tr>
<tr><td>November-10</td><td>462,335.0</td><td>March-11</td><td>445,233.0</td></tr>
<tr><td>December-10</td><td>44,966.0</td><td>April-11</td><td>336,677.9</td></tr>
<tr><td></td><td></td><td>May-11</td><td>415,986.0</td></tr>
<tr><td></td><td></td><td>June-11</td><td>461,172.0</td></tr>
<tr><td></td><td></td><td>July-11</td><td>532,582.0</td></tr>
<tr><td></td><td></td><td>August-11</td><td>563,626.0</td></tr>
<tr><td></td><td></td><td>September-11</td><td>629,075.0</td></tr>
<tr><td>Total 2010 (Sept-Dec.)</td><td>1,539,282</td><td>Total 2011 (Jan.-Sept.)</td><td>3,717,930</td></tr>
</table>

Please also see “MR CPI 2nd period_CER Calculation_v01”, table “Monitoring Data”
</td></tr>
<tr><td>Monitoring equipment:</td><td>The valve at the biogas burner is controlled by UV detector (flame control) and/or pressure drop at gas storage. Thermal mass flow meter is installed at each biogas utilisation unit.

1) CPO boiler 2+3
Meter: Thermal Mass Flowmeter
Manufacturer: Fox
Model: FT2
Serial No.: 7714
ID No./Tag No.: FTBG006
Calibration date: 01/10/2010; 14/04/2011; due date: 14/10/2011;
Accuracy: ± 1% of reading, ± 0.2 % of full scale

2) Burner RF1 at the High pressure boiler of the Refinery RF1
Meter: Thermal Mass Flowmeter
Manufacturer: Fox
Model: FT2
Serial No.: 7715
ID No./Tag No.: FTBG007
Calibration date: 01/10/2010; 14/04/2011; due date: 14/10/2011;
Accuracy: ± 1% of reading, ± 0.2 % of full scale
Start of utilization: January 2010

3) Burner RF2 at the High pressure boiler of the Refinery RF2
Meter: Thermal Mass Flowmeter
Manufacturer: Fox
Model: FT2
Serial No.: 6509
ID No./Tag No.: FTBG008
Calibration date: 01/10/2010; 14/04/2011; due date: 14/10/2011;
Accuracy: ± 1% of reading, ± 0.2 % of full scale
Start of utilization: January 2010 (with 1 test month in July 2009)</td></tr>
<tr><td>Measuring/ Reading/ Recording frequency:</td><td>Continuously values are transferred online and recorded.</td></tr>
<tr><td>Calculation method (if applicable):</td><td>n.a.</td></tr>
</table>

QA/QC procedures:	Regular Calibration of Thermal Mass flow meter or similar by manufacturer or approved company (yearly) – calibration report to CPI. QC staffs of CPI are trained on calibration control and on malfunction recognition. Subsequent calibration control every month is appropriate to the application to assure accuracy of ± 2%. Each time the meter is calibrated by approved companies, an On-Site-Calibration-Report will be supplied to CPI. Calibration control and adjustments by CPI-QC staff will be recorded. QC of meter function: Data of the meter is sent to a computer. Computer program cross-checks total digester outlet with Sum of flow to flare and energy conversion units. Flow meter malfunction or leakages can thus be detected. Daily flow meter function inspection. Cross-check accuracy set to ± 2 %. A spare flow meter is held on stock for immediate change if needed at any place of gas pipes. Separation valves allow deviation of gas flow through second line during exchange of meter. Range of meter allows to measure full flow. Data recording and storage: Online transfer to computer. Monthly data backup to external data storage. Data preparation and reporting: Aggregation to 24 hrs average, weekly, monthly and quarterly rates by routines. Monthly aggregated reports will be printed and filed at factory The minimum re-calibration interval is 1 year.
Purpose of data:	Calculation of project emissions
Additional comment:	-

Data / Parameter:	**$FR_{e,s}$**
Unit:	m^3/yr
Description:	Flow rate of the heat generation equipment stack gases
Measured/ Calculated / Default:	Measured/Calculated
Source of data:	Measurement
Value(s) of monitored parameter:	5.257.212 m^3 (2010 (Sept-Dec): 1.539.282 m3, and 2011 (Jan-Sept): 3.717.930 m^3) Please see "MR CPI 2nd period_CER Calculation_v01", table "PE SEEG"
Monitoring equipment:	The stack gas emission flow rates (m3/s) are measured for the environmental monitoring for Industrial department half yearly under normal operating conditions of the boilers (full load) by a certified company Sample dates: 19/10/2010; 04/05/2011 Emission rate: 44.69 and 56.26 m^3/s (see reference to report below)
Measuring/ Reading/ Recording frequency:	Half yearly.
Calculation method (if applicable):	Based on the measured flow rate and the operation time of the boiler (which is continuously logged), the yearly flow of stack gas (m3/yr) is calculated. For conservativeness not an average, but the higher stack gas emission rate measured in the monitoring period is used for calculations (56.26 m^3/s). The flow rate of heat generation equipment is calculated by multiplying the monthly hours of gas combustion in the heat generation equipment (see $\mathbf{T_{comb,e}}$) with the emission rate of 202.536 m^3/hr (calculated from the emission rate in m3/s * 3600)
QA/QC procedures:	Measurements done by external certified contractor. (see Report: Environmental Monitoring for Chumporn Palm Oil Industries Public Company Ltd., prepared by Advanced Thai Testing Co., Ltd., file: "3_BL3-190102010_stack boiler3" and "4_BL3-04052011")

Purpose of data:	Calculation of project emissions
Additional comment:	

Data / Parameter:	**$P_{CH4,e,s}$**
Unit:	Ppm
Description:	Methane content in stack gas of heat generation stack gases.
Measured/ Calculated / Default:	Measured.
Source of data:	Measurement (half yearly) – average of two measurements
Value(s) of monitored parameter:	2.35 ppm
Monitoring equipment:	CH_4 content is determined through measurement for the environmental monitoring for Industrial department half-yearly by a certified company. Sample date: 19/10/2010; 04/05/2011
Measuring/ Reading/ Recording frequency:	Half yearly
Calculation method (if applicable):	n.a.
QA/QC procedures:	CH_4 content in stack gas of heat generation equipment is determined through measurement for the environmental monitoring for Industrial department half-yearly by a certified contracted company.
Purpose of data:	Calculation of project emissions Please see “MR CPI 2nd period_CER Calculation_v01”, table “PE SEEG”
Additional comment:	-

Data / Parameter:	**$T_{comb,e}$**
Unit:	hrs/yr
Description:	Fraction of time gas is combusted in the heat generation equipment.
Measured/ Calculated / Default:	Measured.
Source of data:	Measurement
Value(s) of monitored parameter:	See table below

Month	**Value (hrs)**	**Month**	**Value (hrs)**
September-10	626.4	January-11	356.9
October-10	687.7	February-11	510.2
November-10	709.7	March-11	717.0
December-10	173.3	April-11	608.0
		May-11	694.9
		June-11	665.9
		July-11	722.2
		August-11	692.0
		September-11	710.7
Total 2010 (Sept-Dec.)	2,197	Total 2011 (Jan.-Sept.)	5,678

Please also see “MR CPI 2nd period_CER Calculation_v01”, table “Monitoring Data”

Monitoring equipment:	Measured using a run time meter connected to a flame continuous temperature controller (Thermocouple transmitter 4-20mA). Signals of the transmitter are recorded by the electronic data logging system and show run time of the boiler. The valve at the biogas burner is controlled by UV detector (flame control) and/or pressure drop at gas storage. .
Measuring/ Reading/ Recording frequency:	Continuously
Calculation method (if applicable):	n.a.
QA/QC procedures:	QS/QA procedures according to ISO 9000:2000 scheme set up by CPI. A. Electronic logging data system of the heat generation equipment "boiler" will record: 1. Date and time when combustion 2. Amount of biogas to be burnt 3. Temperature at burning. B. External Lab (MIT) is coming annually to measure the above parameters by using their own equipment and compare the values of those parameters whether there is any different out of the acceptable range/accuracy or not. If in the acceptable range, then the electronic logging values of the heat generation equipment *boiler" are accepted. If not, then the recording of boiler system has to be calibrated by the external lab.
Purpose of data:	Calculation of project emissions
Additional comment:	-

Data / Parameter:	**Sa**
Unit:	kg/yr
Description:	Amount of sludge applied to land
Measured/ Calculated / Default:	Measured.
Source of data:	Measurement
Value(s) of monitored parameter:	0 (zero) Please also see "MR CPI 2nd period_CER Calculation_v01", table "Data (processing)"
Monitoring equipment:	Weighing of trucks with standard industrial weighbridge. Quantity of sludge is measured on demand. Meter: Weight bridge Methler Toledo Model: 8530 coupr. Serial No.: 5159588-51413 and 4373963-4qw ID No./Tag No.: Weight bridge no.1 and no.2 Accuracy: +/- 10 kg 29/07/2008, 19/03/2010 Furthermore, no sludge applied to land, therefore not relevant for this monitoring period.
Measuring/ Reading/ Recording frequency:	Continuously when applicable. Not applicable during this monitoring period.
Calculation method (if applicable):	n.a.

QA/QC procedures:	QS/QA procedures according to ISO 9000:2008 scheme set up by CPI. The minimum calibration frequency of the instrument is biannually (every 2 years). The accuracy is ±10 kg.
Purpose of data:	Calculation of project emissions
Additional comment:	-

Data / Parameter:	**NC**
Unit:	kg N/kg sludge
Description:	Nitrogen content in the sludge
Measured/ Calculated / Default:	Measured.
Source of data:	Monthly measurements
Value(s) of monitored parameter:	Not applicable for the monitoring period. Not measured as no sludge was used for land application. Please also see "MR CPI 2nd period_CER Calculation_v01", table "Data (processing)"
Monitoring equipment:	Is not applicable for this monitoring period. CPI used an external lab to measure the value monthly (when applicable). The external lab calibrates the equipment by themselves.
Measuring/ Reading/ Recording frequency:	When applicable. Not applicable in this monitoring period, as a result of difficulties with the original treatment system. The sand bed filter so far did not deliver the expected dry sludge, to be used for land application,
Calculation method (if applicable):	n.a.
QA/QC procedures:	Is not applicable for this monitoring period. CPI used an external lab to measure the value from time to time (when applicable). The external lab calibrates the equipment by themselves.
Purpose of data:	Calculation of project emissions
Additional comment:	-

Data / Parameter:	**EGy**
Unit:	MWh
Description:	Amount of electricity in the year y that would be consumed at the project site in the absence of the project activity
Measured/ Calculated / Default:	Default.
Source of data:	Historical data provided by CPI
Value(s) of monitored parameter:	0 (zero); (the historic consumption is 78.2225 MWh, but no emission reduction are claimed for this)
Monitoring equipment:	Standard industrial electrical metering meters (accuracies: Power ± 0.5%, Current± 0.3, %Energy ± 1%, Power factor± 0.5%,Frequency± 0.1%)
Measuring/ Reading/ Recording frequency:	n.a.
Calculation method (if applicable):	n.a.
QA/QC procedures:	External control by electricity provider.
Purpose of data:	Calculation of baseline emissions
Additional comment:	-

Data / Parameter:	NCV_BG
Unit:	MJ/m^3
Description:	Net calorific value of biogas (dry)
Measured/ Calculated / Default:	Default.
Source of data:	Measurement by PTT chemical public company limited.
Value(s) of monitored parameter:	23 MJ/m^3 Please also see “MR CPI 2nd period_CER Calculation_v01” table “BE heat”
Monitoring equipment:	Laboratory tests at PTT chemical public company limited Methane Method ASTM D 1945-91 Total Hydrocarbons(C2-C5) Method ASTM D 2712-91
Measuring/ Reading/ Recording frequency:	-
Calculation method (if applicable):	n.a.
QA/QC procedures:	n.a.
Purpose of data:	Calculation of project emissions
Additional comment:	-

Data / Parameter:	T_{FI}
Unit:	K
Description:	Temperature of Flare
Measured/ Calculated / Default:	Measured.
Source of data:	Automatic measurement
Value(s) of monitored parameter:	“MR CPI 2nd period_CER Calculation_v01”
Monitoring equipment:	Measurement temperature by Thermocouple transmitter type “K”, range 0 to 1200 °C. Accuracy ± 1, Temperature sensor TC “K” ID No./Tag No.: TTBG003 Calibration date: and 30/09/2010 and 15/04/2011; due date: 15/10/2011; Accuracy: ± 1% of reading
Measuring/ Reading/ Recording frequency:	Continuously
Calculation method (if applicable):	n.a.
QA/QC procedures:	Annual calibration by certified external company.
Purpose of data:	Calculation of project emissions
Additional comment:	n.a.

D.3. Implementation of sampling plan

>>

No sampling plan applied.

SECTION E. Calculation of emission reductions or GHG removals by sinks

E.1. Calculation of baseline emissions or baseline net GHG removals by sinks

>>

Emission reductions are calculated as the difference between baseline emissions and project emissions strictly in line with the provisions and formulas defined in AM0013.

Baseline emissions include:

- Lagoon baseline emissions
- Electricity/heat baseline emissions

Baseline emission is calculated in the following manner:

$BE_y = BE_{lagoon,y} + BE_{heat,y}$

$= MIN \{BE_{lagoon,theoretical,y} : BE_{lagoon,monitored,y}\} + BE_{heat\_oil,y}$

A) $BE_{lagoon,y}$

As described in AM0013 version 04, the lower of the two shall be assumed as the baseline emissions:

(i) baseline methane emission less the physical leakage, hereafter referred as "$BE_{lagoon,theoretical,y}$"; and

(ii) actual methane captured and flared/used for energy generation, hereafter referred as "$BE_{lagoon,monitored,y}$"

(i) Lagoon Baseline Emissions - theoretical

$$\text{CH}_4 \text{ emissions (kg/yr)} = \text{Total } COD_{available,m} \text{ (kg COD/month)} \times B_o \text{ (kg } CH_4\text{/kg COD)} \times MCF_{baseline}$$

where:

$COD_{available,m}$	Is the monthly Chemical Oxygen Demand available for conversion which is equal to the monthly COD entering the digester or directed to land application $COD_{baseline,m}$ plus COD carried on from the previous month.
$COD_{baseline,m}$	Is the monthly Chemical Oxygen Demand of effluent entering lagoons or directed to land application (measured)
B_o	Is the maximum methane producing capacity
$MCF_{baseline}$	Is the monthly methane conversion factor (fraction)

As there is effluent from the lagoons in the baseline, $COD_{baseline}$ is multiplied by the factor AD:

$$AD = 1 - \left(\frac{COD_{a,out}}{COD_{a,in}} \right)$$

where:

$COD_{a,out}$	is the COD that leaves the lagoon with the effluent
$COD_{a,in}$	is the COD that enters the lagoon

Lagoon baseline emissions are calculated based on the chemical oxygen demand (COD) of the effluent that would enter the lagoon in the absence of the project activity, the maximum methane producing capacity (B_o) and a methane conversion factor (MCF) that expresses what proportion of the effluent would be anaerobically digested in the open lagoons:

CH_4 emissions = Total $COD_{available,m}$ x B_o x $MCF_{baseline}$

= 3,155,685 kg CH_4

Monthly calculation of CH_4 emissions from baseline lagoon are shown in the spreadsheet "MR CPI 2nd period_CER Calculation_v01"

In line with AM0013, the total baseline CH_4 emissions are translated into CO_2 equivalent emissions by multiplying by its global warming potential (GWP) of 21.

BE_L = 66,269 t CO_2-e

$BE_{lagoon,theoretical,y}$ = BE_L - $PE_{leakage\ digester}$

= (66,269–6,991) t CO_2-e

= 59,278 t CO_2-e

(ii) Lagoon Baseline Emissions - monitored

$BE_{lagoon,\ monitored,y}$ = ($BE_{biogas,boiler,y}$ + $BE_{biogas,flare,y}$) - PE_{flare}

= ((46.609 + 7.029) – 3.596)) t CO_2-e

= 50.042 t CO_2-e

Monthly caluculation of CH_4 emissions from baseline lagoon (biogas to boiler and flare) are shown in the spreadsheet "MR CPI 2nd period_CER Calculation_v01"

B) Electricity/heat baseline emissions

Electricity baseline emissions are not relevant for the underlying project, as it does not involve generation of electricity.

Heat baseline emissions are calculated as:

BE_{heat} = $HG_{Bl,y}$ * $CEF_{Bl,therm,y}$

where $HG_{Bl,y}$ is the quantity of thermal energy that would be consumed in year y at the project site in the absence of the project activity (MJ) using fossil fuel.
$CEF_{Bl,\,therm}$ is the CO_2 emissions intensity for thermal energy generation ($tCO_2\,e/MJ$).

BE_{heat} = 15,42 TJ * 77.37 tCO2 / TJ

BE_{heat} = 1.193 tCO_2-e

Emissions from baseline heat generation are shown in the spreadsheet "MR CPI 2nd period_CER Calculation_v01"

C) Total baseline emissions

In accordance with AM0013, a comparison between

(i) baseline methane emission less the physical leakage ($BE_{lagoon,theoretical,y}$), and

(ii) the actual methane captured and flared/used for energy generation ($BE_{lagoon,monitored,y}$)

have been made as shown in table below:

Table 2: Comparison of theoretical and monitored baseline emissions

	"$BE_{lagoon,theoretical,y}$" (t CO_2-e)	"$BE_{lagoon,monitored,\,y}$" (t CO_2-e)
Total	59,278	53.638

The actual methane captured and flare used for energy generation ($BE_{lagoon,monitored,\,y}$) is lower and therefore has to be used as baseline methane emission from open lagoon.
($BE_{lagoon,\,y} = BE_{lagoon,monitored,\,y}$ = 50.042 tCO_2-e)

$BE_{total,y}$ = $BE_{lagoon,y} + BE_{heat,y}$

= 53,638 t CO_2-e + 1,193 t CO_2-e

$BE_{total,y}$ = 54,831 tCO_2-e

E.2. Calculation of project emissions or actual net GHG removals by sinks

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E.3. Calculation of leakage

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No leakage is associated with the project activity.

E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks

Item	Baseline emissions or baseline net GHG removals by sinks (t CO_2e)	Project emissions or actual net GHG removals by sinks (t CO_2e)	Leakage (t CO_2e)	GHG emission reductions or net GHG removals by sinks (t CO_2e) achieved in the monitoring period		
				Up to 31/12/2012	From 01/01/2013	Total amount
Total	**54.831**	**9,752**	-	**45,079**	-	**45,079**

E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD

The emission reduction estimated in the registered PDD (revised with PRCs) amount to 28,133 tonnes of CO2e annually. The number of days during the monitoring period covered by this monitoring report (MP2, first monitoring period) is 395 days. Correspondingly, the total emission reduction of 30,445 tCO_2 would be estimated for this monitoring period.

Item	Values estimated in ex-ante calculation of registered PDD	Actual values achieved during this monitoring period
Emission reductions or GHG removals by sinks (t CO_2e)	30,445	45,079

E.6. Remarks on difference from estimated value in registered PDD

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Compared to the registered PDD, the actual values of achieved emission reduction are increased by 48%. The main reason for increased emission reduction is an increase of available COD compared to the reference period in the registered PDD (2006), by approximately 39 %. While in the period 2006 an average of 709,347 kgCOD/month was available in the discharged wastewater from the CPO, in the monitoring period this value reached an average of 1,257,060 kgCOD/month. The average COD was measured as 103 KgCOD/m^3 compared to 74,1 KgCOD/m^3 in 2006, which is an increase by 38 % and would result in emission reductions: 42,320 t CO_2e. The remaining difference of approximately 2,460 t CO_2e and be explained by the fact that the ex ante estimation includes hypothetical physical leakage of biogas in the system, which may in fact be smaller than assumed. The estimated emission reductions of this monitoring period are based on monitored measurement of biogas.

E.7. Actual emission reductions or net anthropogenic GHG removals by sinks during the first commitment period and the period from 1 January 2013 onwards

Item	Actual values achieved up to 31 December 2012	Actual values achieved from 1 January 2013 onwards
Emission reductions or GHG removals by sinks (t CO_2e)	**45,079**	n.a.

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Appendix 1. Contact information of project participants and responsible persons/entities responsible persons/ entities

Project participant and/or responsible person/ entity	☒ Project participant ☒ Responsible person/ entity for completing the CDM-MR-FORM
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Document information

Version	*Date*	*Description*
05.1	4 May 2015	Editorial revision to correct version numbering.

Version	*Date*	*Description*
05.0	1 April 2015	Revisions to: • Include provisions related to delayed submission of a monitoring plan; • Provisions related to the Host Party; • Remove reference to programme of activities; • Overall editorial improvement.
04.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1; • Change the reference number from *F-CDM-MR* to *CDM-MR-FORM*; • Editorial improvement.
03.2	5 November 2013	Editorial revision to correct table in page 1.
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01	28 May 2010	EB 54, Annex 34. Initial adoption.

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