



Verification and Certification Report

of
Chumporn applied biogas technology for
advanced waste water management

GLC Report No: 002, Rev. 03

Verification and Certification Report

GLC Report No: 002, Rev. 03



Organisational Unit Germanischer Lloyd Certification GmbH (GLC), Greenhouse Gas Services		
Client Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH		Client reference person Mr. Roger Wolf
Summary:		
UNFCCC Ref.	"2148"	
Project Name:	Chumporn applied biogas technology for advanced waste water management	
Project Country:	Thailand	
Sectoral Scope, Technical Area	CDM Sectoral Scope: 13, Technical Area: 13.1	
Methodology(ies) / Version(s):	AM0013, Version 4.0	
Project Size:	<input checked="" type="checkbox"/> Large Scale	<input type="checkbox"/> Small Scale
Number of verification:	1 st	
Dates of monitoring period (incl. both days)	2009-02-09 to 2010-08-31	
Verified emission reductions	34,893 t CO ₂	
Included post registration changes	<input type="checkbox"/> yes <input checked="" type="checkbox"/> no	
Project Assessment Team:	Technical Review Team:	Approval by:
Mr. Markus Weber Mr. Stephen P Etheridge Mr. Karunakar Avuram	Ms. Anu Chaudhary	Mr. Jose-Emilio Moreno
Date of this revision:	Revision No.	Number of pages
2015-02-11	03	97
Mode of Distribution:		
<input checked="" type="checkbox"/> No distribution without permission from the client or responsible organisational unit <input type="checkbox"/> Limited distribution <input type="checkbox"/> Unrestricted distribution		

Verification and Certification Report

GLC Report No: 002, Rev. 03



History of report revisions:

Rev.	Date	Person (short sign or name)	Function	Action
01	2015-02-05	Markus Weber / Karunakar Avuram / Stephen P Etheridge	Assessment team leader / Auditor / Technical expert	Draft report
02	2015-02-09	Anu Chaudhary	Technical Reviewer	Review of draft documents
03	2015-02-11	Jose-Emilio Moreno	Final Reviewer and Approver	Final reviewed and approved

Verification and Certification Report

GLC Report No: 002, Rev. 03



Abbreviations

CAR	Corrective Action Request
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CH ₄	Methane
CO ₂ e	Carbon dioxide equivalent
COD	Chemical Oxygen Demand
CL	Clarification Request
CPI	Chumporn Palm Oil Industry
CSTR	Completely Stirred Tank Reactor
EB	UNFCCC's Executive Board
ER	Emission Reduction
FAR	Forward Action Request
GHG	Greenhouse gas(es)
GLC	Germanischer Lloyd Certification GmbH
MP	Monitoring Plan
MR	Monitoring Report
NA	Not Applicable
NCV	Net Calorific Value
PDD	Project Design Document
PP	Project Participant
QA/QC	Quality Assurance / Quality Control
SCADA	Supervisory Control And Data Acquisition
UASB	Up-flow Anaerobic Sludge Blanket
UNFCCC	United Nations Framework Convention on Climate Change
VVS	Validation and Verification Standard

Verification and Certification Report

GLC Report No: 002, Rev. 03



Table of Contents	Page
1 INTRODUCTION.....	6
1.1 Objective.....	6
1.2 Scope	6
2 VERIFICATION TEAM	8
2.1 Assessment Team.....	8
2.2 Technical Review Team and Approval	9
3 METHODOLOGY	10
3.1 Verification Process.....	10
3.2 Desk review	10
3.3 On-site assessment.....	10
3.4 Resolution of Findings and Reporting.....	13
4 VERIFICATION REPORTING	14
4.1 Verification of Compliance.....	14
4.1.1 Compliance of the Project implementation in accordance with the Registered Project Design Document	14
4.1.2 Compliance of the Monitoring Plan with the Monitoring Methodology Including Applicable Tools.....	17
4.1.3 Compliance of Monitoring Activities with the Registered Monitoring Plan	18
4.1.4 Assessment of Data and Calculation of Emission Reductions	60
4.2 Post Registration Changes.....	63
5 VERIFICATION STATEMENT.....	65
6 REFERENCES.....	67
ANNEX A: RESOLUTION OF CORRECTIVE ACTION AND CLARIFICATION REQUESTS (LIST OF FINDINGS).....	72

Verification and Certification Report

GLC Report No: 002, Rev. 03



1 INTRODUCTION

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH has commissioned Germanischer Lloyd Certification GmbH (GLC) to carry out the 1st verification of the project, **"Chumporn applied biogas technology for advanced waste water management"**, registered by the UNFCCC as CDM project "2148" with regard to the relevant requirements for CDM project activities. The verifiers have reviewed the implementation of the monitoring plan (MP) as described in the approved revised PDD^{1/2/} and the Monitoring Report^{4/}.

The project was registered with UNFCCC on 2009-02-09. This is the 1st verification of the project which covers the period from 2009-02-09 to 2010-08-31.

GHG data for the monitoring period was verified in detailed manner applying the set of requirements, audit practices and principles as required under the Validation and Verification Standard^{1/} of the UNFCCC. This report summarizes the findings and conclusions of the 1st verification of the above mentioned UNFCCC registered project activity.

1.1 Objective

The objective of the verification is the review and ex-post determination by an independent entity of the GHG emission reductions. It includes the verification

- that the project activity has been implemented and operated as per the approved revised PDD and that all physical features (technology, project equipment, and monitoring and metering equipment) of the project are in place;
- that the monitoring report and other supporting documents provided are complete and verifiable and in accordance with applicable CDM requirements;
- that actual monitoring systems and procedures comply with the monitoring systems and procedures described in the monitoring plan and the approved methodology;
- that the data is recorded and stored as per the monitoring methodology.

1.2 Scope

The verification of this registered project is based on the approved revised project design document^{2/}, the monitoring report^{4/}, emission reduction calculation spread sheet^{5/}, supporting documents made available to the verifier and information collected through performing interviews and during the on-site assessment. Furthermore publicly available information was considered as far as available and required.

The verification is carried out on the basis of the following requirements, applicable for this project activity:

¹ It is to be noted that the Project Design Document (PDD) was revised for post registration changes and the revised PDD was approved by the CDM-EB on 2014-12-28. Therefore, the PDD referred in the report refers to the approved revised PDD, version 10, dated 2014-11-20.

Verification and Certification Report

GLC Report No: 002, Rev. 03



- Article 12 of the Kyoto Protocol ^{/8/},
- Guidelines for the implementation of Article 12 of the Kyoto Protocol as presented in the Marrakech Accords under decision 3/CMP.1^{/9/} and subsequent decisions made by the Executive Board and COP/MOP,
- Other relevant rules, including the host country legislation,
- CDM Validation and Verification Standard ^{/1/},
- Monitoring plan as given in the approved revised PDD ^{/2/},
- Approved CDM Methodology; AM0013 (Version 04) ^{/10/}

Verification and Certification Report

GLC Report No: 002, Rev. 03



2 VERIFICATION TEAM

2.1 Assessment Team

A competent team with relevant knowledge and experience in the specific Sectoral scopes and project activity was appointed by GLC. Furthermore the appointment of the team takes into account the required knowledge of the host country and general project activity knowledge requirements for verifying the project activity design and the relevant emission reduction achieved. The assessment team can be composed of an Assessment Team Leader (ATL), auditors (A) and host country or technical expert (E). Table 2-1 below shows the composition of the assessment team, the qualification of the team members and their functions.

Table 2-1: Verification team

Name	Function ¹⁾	Sectoral scope specific knowledge	Technical area specific knowledge	Local knowledge	Type of involvement				
					Desk review	On-site visit / Interviews	Reporting	Supervision of work	Expert input
Markus Weber	ATL	X			X			X	
Srikanth Meesa	A				X	X			
Karunakar Avuram	A			X	X	X	X		
Stephen P Etheridge	TE/ LE	X	X	X	X	X	X		X

1) A Auditor
ATL Assessment team leader

FE Financial expert
LE Local expert

T-ATL Trainee ATL
T-A Trainee auditor
TE Technical expert

Verification and Certification Report

GLC Report No: 002, Rev. 03



2.2 Technical Review Team and Approval

Before submission of the final verification report to the CDM EB of the UNFCCC, a technical review of the whole verification and the draft report was carried out by an appointed technical review (TR) team. The TR team is composed of persons competent to the technical area the project activity falls under. Each person involved in the reviewer is independent to the verification assessment.

The complete assessment prepared by the verification team is checked, if required adjusted and finally confirmed by the TR process.

The TR team and the person responsible for approval of the report are found in the table below:

Table 1-2: Technical review team and approval

Name	Function ²⁾	Technical area specific knowledge	Sectoral scope specific knowledge	Supervision of work
Anu Chaudhary	R	X	X	X
Jose-Emilio Moreno	TE/FR/AP	X	X	X

2) AP Approver
FR Final reviewer

TE Technical expert
T-R Trainee reviewer
R Reviewer

Verification and Certification Report

GLC Report No: 002, Rev. 03



3 METHODOLOGY

3.1 Verification Process

The verification process is based on the guidelines described in the Validation and Verification Standard. In addition to that standard auditing techniques have been applied. The verification team performed first a desk review, followed by an on-site visit to review the project realisation. Based on the document review and onsite assessment, verification findings were raised and sent to project participant (PP) for resolving. The next step was to close out the findings based on the response, evidence documents and through direct communication with the PP. Finally the verification report is prepared. This verification report and other supporting documents then undergo a technical review by the "GLC GmbH" prior to the submission to the CDM-EB.

3.2 Desk review

From 2010-11-11 to 2010-11-19, GLC conducted a desk review of all documents initially provided by the client and publicly available documents relevant for the verification. The main documents reviewed during the course of the verification are listed below:

- The PDD including the monitoring plan ^{/2/}
- Validation report^{/3/}
- The revised PDD and the corresponding validation opinion (after the approval of the revised PDD)^{/2/}
- The applied monitoring methodology ^{/10/}
- The monitoring report ^{/4/}
- The monitored data and the corresponding emission reduction calculations ^{/5/}
- Relevant decisions, clarifications and guidance from the CMP and the CDM Executive Board
- Any other information and references relevant to the project activity's resulting emission reductions (e.g., IPCC reports ^{/7/}, data on electricity generation in the national grid or laboratory analysis and national regulations)
- Addressing of FARs identified during the validation

The total list of the documents reviewed and referred during the course of the verification are provided in section 6 References

3.3 On-site assessment

From 2010-11-23 to 2010-11-25, Mr. Srikanth Meesa, Mr. Karunakar Avuram and Dr. Stephen P Etheridge of GLC's verification team carried out an on-site visit.

The main tasks covered during the on-site visit included, but were not limited to:

Verification and Certification Report

GLC Report No: 002, Rev. 03



- The on-site assessment included an investigation of whether all relevant equipment was installed and operated as described in the PDD^{/2/};
- The operating staff was interviewed and observed in order to check the risks of inappropriate operation and data collection procedures;
- Assessing the competency levels of the operating team to implement and monitor the project activity as described in the PDD;
- Information processes for generating, aggregating and reporting the selected monitored parameters were reviewed;
- The monitoring processes, routines and documentations were audited to check their proper application;
- The monitoring data were checked completely ^{/14/15/21/};
- The data aggregation trails were checked;
- The duly calibration of all metering equipment was checked ^{/23...31/}.

The interviewed persons during the site visit are summarized in the Table 3-1. The main topics of the interviews were:

- General aspects of the project
- Technical equipment and operation
- Changes since validation
- Monitoring and measurement equipment
- Open issues from the validation
- Calibration procedures
- Quality management system
- Involved personnel and responsibilities
- Training and practice of the operational personnel
- Implementation of the monitoring plan
- Monitoring data management
- Data uncertainty and residual risks
- GHG calculation
- Procedural aspects of the verification
- Maintenance

Verification and Certification Report

GLC Report No: 002, Rev. 03



➤ Environmental aspects

Table 3-1: Interviewed persons

Name	Organization/Function
Song Ridth Nimatti Sawong	Project Director, Chumporn Palm Oil Industry (CPI)
Chupak Prachayam Speecha	Executive Director, CPI
Prance Pituorajinda	Asst. Factory Director, CPI
Somchay Chantaramanee	Asst. Manager, Process, CPI
Rattapong otakharn	Production Supervisor (Refinery), CPI
Chumpon Thaindan	Production Planner, CPI
Wirarat Wiwattanatinul	Company Secretary, CPI
Wichsiya Ritnam	Secretary of Administrative Officer, CPI
Bundit Natauplu	Project Consultant, PNP
Jens Radschinshi	Project Consultant, PNP
Supalerk Kanasook	GIZ Thailand
Aneng Sanyuman	ADMT, CPI
Hritsana Sommart	Engineer, CPI
Narankorn kamrahong	Head of Section Biogas, CPI
Nachehayanon Manomnan	Quality Control, CPI
Warunyoo Mitreeehit	Asst. Section Head – Mechanical, CPI
Ohusak Sangaroon	Instrumentation Engineer, CPI
Winian Singdom	Project Engineer, CPI
Saksan Perpogsa	Instrumentation Engineer, CPI
Somchai Imtramamee	Project Section Head, CPI
Sampon	Analyst Authority, CPI

Verification and Certification Report

GLC Report No: 002, Rev. 03



Chalipat Sangmana	Admin CDM, Local expert
Jiradech Sirisom	MIS, CPI
Kritsada Maksiri	Production Engineer, CPI
Ropeeporn Silanoi	Human Resources, CPI
Praneet Khowsam	Human Resources, CPI

3.4 Resolution of Findings and Reporting

On the basis of the desk review, the on-site visit, follow-up interviews and further background investigation the verification findings were prepared in a separate document and sent to PP for resolving the issues. In case any inconsistencies or lack of clarity were identified during the verification the team has raised a

Corrective Action Requests (CARs), if:

- the project participants have made mistakes that will influence the ability of the project activity to achieve real, measurable additional emission reductions;
- the CDM requirements have not been met;
- there is a risk that emission reductions cannot be monitored or calculated.
- Clarification Request (CL), if:
 - information is insufficient or not clear enough to determine whether the applicable CDM requirements have been met.

In case the team has identified essential risks for further verifications or the actual status requires a special focus on this item for the next consecutive verification, or an adjustment of the monitoring plan is recommended a Forward Action Request (FAR) was raised.

All CARs, CLs and FARs raised have been sent to the client with the request to address the findings. After the findings have been answered by the client in an appropriate manner, the CARs, and CLs were closed out.

For a detailed list of all CARs, CLs and FARs raised in the course of the verification please refer to Annex A of this report.

The verification team also reviewed validation report ^{/3/} to find out if there are any open issues or FARs to be addressed. There are no pending issues or FARs from the validation.

Verification and Certification Report

GLC Report No: 002, Rev. 03



4 VERIFICATION REPORTING

4.1 Verification of Compliance

4.1.1 Compliance of the Project implementation in accordance with the Registered Project Design Document

During the verification an on-site visit was carried out. Based on this on-site visit and the reviewed project documentation, the verification team confirms that the realized technology, the project equipment, as well as the monitoring and metering equipment were implemented and operated as described in the approved revised PDD ^[2].

The project activity involves installation of wastewater treatment system that captures methane rich biogas and utilisation of biogas at onsite boilers at Chumporn Palm Oil Industry. The treatment system consists of a combination of Completely Stirred Tank Reactors (CSTR) and Upflow Anaerobic Sludge Blanket (UASB) reactors for wastewater treatment produced out of the palm oil industry. The project activity was implemented at an existing wastewater treatment plant replacing conventional anaerobic open lagoon wastewater treatment system which was in the baseline scenario. The project treatment system i.e. combination of CSTR and UASB facilitates capturing of methane (or biogas) produced from the wastewater treatment which would have been released into the atmosphere in the baseline scenario. The captured biogas is utilised as fuel in onsite boilers replacing bunker fuel oil and biomass (palm shells).

The commissioning and testing of the project was started in March 2007 and it was in full operation since July 2007 after complete commissioning. The project activity was registered with UNFCCC on 2009-02-09 and the crediting period (fixed) corresponds to the period from 2009-02-09 to 2019-02-08. The first monitoring period corresponds to the period from 2009-02-09 to 2010-08-31. It is confirmed that the information has been correctly mentioned in the monitoring report (MR).

Technical Project Description:

Wastewater is produced in the factory from two sections called CPO (Crude Palm Oil) production and Refinery plant. Though it was not explicitly mentioned in the registered PDD, it was planned to treat the wastewater produced from CPO as well as Refinery in the project treatment system. Nevertheless, it was observed during the verification site visit that the wastewater from CPO only is treated in the project system while the wastewater from Refinery is directly treated in open lagoons. It is assessed from the onsite interviews that, during the early stage of project operation it became clear to the operating team that the treatment of refinery waste water was difficult due to strong fluctuation in waste water composition such as quick changes in COD and pH values. Moreover, the COD load from refinery wastewater accounts to only 1.6% of the total estimated COD load. Therefore, the PP decided to bypass the wastewater of refinery section from the project treatment system and treat directly in open lagoon system i.e. same as baseline scenario. The wastewater only from CPO is treated in the project treatment system.

During the project design stage, it was planned to utilize the biogas produced from the project treatment system in biomass boilers at CPO section and the same was described in the registered PDD. However, during the verification site visit it was observed that the biogas is also utilized in two high pressure boilers (HP boilers) at Refinery. From the onsite interviews it is assessed that in order to make the

Verification and Certification Report

GLC Report No: 002, Rev. 03



project activity financially more attractive it was decided post-registration, after proven reliable operation of the biogas system, to divert a part of the biogas to be utilized in two HP boilers at CPI's refinery plant although it required an additional investment to facilitate the use of biogas at refinery boilers.

The post-registration changes were addressed in the revised PDD (version 10)^{2/} and the revised PDD was approved by the EB on 2014-12-28. The verification team confirms that the implemented project is in accordance with the revised PDD.

The brief process flow of the project as observed onsite is explained below:

The wastewater from CPO goes to cooling pond from where it is sent to collection tank or distribution tank. From the distribution tank, the wastewater is pumped to CSTR and from CSTR it goes to UASB. CSTR and UASB constitute project treatment system. Post treatment, the treated wastewater goes to open lagoons from where it is used for plantation (it is a common practice in the host country to use treated water for irrigation or plantation). Biogas is collected from CSTR and UASB and utilized in boilers at CPO and Refinery after removing Hydrogen Sulfide (H₂S) through a biogas filter. Excess biogas, if any, is flared in an open flare. Sludge produced from CSTR and UASB is treated in sludge treatment system that uses sand bed filter or belt press. Filtered effluent after dewatering is sent to open lagoons and dried sludge is used as fertilizer. However, during the onsite interviews it was revealed that no sludge was removed during the monitoring period. The assessment team also could not find any traces of sludge onsite.

The assessment team confirms that the project description provided in the monitoring report (MR) is appropriate.

Involved Parties and Project Participants:

The following parties to the Kyoto Protocol and project participants are involved in this project activity.

Table 4-1: Project Parties and project participants

Characteristic	Party	Project Participant
Host party	Thailand	Chumporn Palm Oil Public Company Limited, Bangkok, Thailand
Other involved party	Germany	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Eschborn, Germany

Project Location:

The details of the project location are given in table 4-2:

Verification and Certification Report

GLC Report No: 002, Rev. 03



Table 4-2: Project Location

Item	Location
Host Country:	Thailand
Region:	South East region, Chumporn Province
Project location address:	296, Moo2 Phetchkasem Road, Tambol Salui, Ampur Tasae, Chumporn
Latitude:	10°50'38.98"N (10.844161)
Longitude:	99°13'2.55"E (99.217375)

GLC's verification team, based on the onsite verification, can confirm that the project activity was implemented as per the PDD and is in operation as described in the approved revised PDD^{2/}. It is further confirmed that the information provided in the final version of the MR^{4/} is correct.

The emission reductions being claimed during this monitoring period are nearly 20% less than the estimated emission reductions in the PDD, as given in the table below:

Table 4-3: Emission reduction comparison

1 st monitoring period (From 2009-02-09 to 2010-08-31)	As per PDD	Monitoring report
Emission Reduction (tCO ₂ e)	43,857	34,893
% Deviation (+/-)	X	(-) 20.4%

(The estimated average annual emission reduction as per the registered PDD is 28,133 tCO₂e, which corresponds to 43,857 tCO₂e for the length of the 1st monitoring period which is 569 days)

As presented in the table above, the reported emission reductions during the verification period are lower than the estimated emission reductions. Though justification is not required since the achieved emission reduction is less than the estimated value, PP has provided the reasons for lower emission reduction. The reasons provided in section E.6 of the monitoring report are assessed to be appropriate based on the document verification. The main reasons are as below:

- Amount of biogas flared was higher during the monitoring period compared to the estimated value. Besides, the flare efficiency was assumed zero as against to ex-ante value of 50%.
- Changes in the amount of wastewater, COD concentration and methane concentration in biogas which depend on the quality of raw material

Verification and Certification Report

GLC Report No: 002, Rev. 03



- Conservative assumptions in calculating the emission reductions

Based on the technical expertise of the assessment team, the reasons are assessed to be appropriate. Therefore, the actual emission reductions can be accepted by GLC.

4.1.2 Compliance of the Monitoring Plan with the Monitoring Methodology Including Applicable Tools

During the document review and furthermore during the on-site visit the verification team has reviewed the monitoring plan of the PDD and compared it with the monitoring methodology to verify their compliance. Based on this review the verification team confirms that the monitoring plan of the approved revised PDD^{2/} is in compliance with the monitoring methodology.

As per the applied monitoring methodology, AM0013 (version 04)^{10/}, the following parameters are required to be monitored:

- Flow rate of organic wastewater
- COD of wastewater before and after treatment
- Biogas flow rate
- Methane concentration in biogas
- Temperature and depth of lagoon
- Parameters related to fossil fuel replacement
- Parameters related to flare
- Electricity consumption for project activity

Furthermore,

- The flow rate of organic wastewater, the amount of amount of methane recovered, fuelled and flared shall be monitored continuously

The methodology, AM0013 (version 04) also refers to the *“Tool to determine project emissions from flaring gases containing Methane”*. It is confirmed that the requirement of the tool has also been sufficiently considered in the monitoring plan in determining the efficiency of open flare and thereby project emissions due to flaring of biogas. *It is worth to mention that the tool was updated during EB 68 meeting to cover additional options for flare efficiency and to expand the scope to flaring gases that also contain ammonium and hydrogen sulfide. Besides, the title was revised to “Project emissions from flaring”. In other words, “Tool to determine project emissions from flaring gases containing Methane” (version 1) was replaced with “Project emissions from flaring” (version 2.0.0). However, the approach to determine the flare efficiency in case of open flare was not changed. The approach defined in the monitoring plan is inline with the latest tool.*

The monitoring plan of the approved revised PDD sufficiently covers all the requirements of the monitoring methodologies including applicable tools and hence, the verification team confirms that the monitoring plan is in compliance with the applied monitoring methodologies.

Verification and Certification Report

GLC Report No: 002, Rev. 03



4.1.3 Compliance of Monitoring Activities with the Registered Monitoring Plan

The PDD was revised during the verification to incorporate changes in the project design and the monitoring plan. The revised PDD was approved by the EB on 2014-12-28 (<https://cdm.unfccc.int/Projects/DB/TUEV-SUED1218620986.14/view>).

The application of the monitoring plan of the approved revised PDD^{2/} for the 1st verification period is summarized in this section. The information flow and the values in the monitoring report were verified as below.

Table 4-4: Assessment of monitoring parameters

Verification / Assessment of Data/Parameters	
Data / Parameter (as per monitoring plan in the PDD):	T2 Ambient temperature (Kelvin) for the climate Data unit: K
Measuring / recording / reporting frequency:	The parameter was not measured by the PP but by Chumporn weather station ^{17/} . The required information was received from Thai Meteorological Department, Ministry of Information and Communication Technology of Thailand. Monthly average values recorded by Chumporn weather station were obtained annually. However, the GLC assessment team confirms based on sectoral and local expertise that the temperature data is monitored on a continuous basis by meteorological department as a common practice. Daily average is recorded based on the continuously measured data and monthly average values can be obtained from the daily values.
Is measuring / recording / reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes. The monitoring methodology states, "daily average is monitored and monthly average is used in the calculation" and the monitoring plan of the PDD states, "monthly averages are obtained from the weather station at least annually". Therefore, the monitoring frequency can be confirmed to be in accordance with the applied monitoring methodology and the monitoring plan.
Verification of data generation, recording and reporting:	The data was not recorded by the PP but obtained from the meteorological department ^{17/} as mentioned in the monitoring plan. The reported data has been verified from the source document that was obtained from the Meteorological Department. The values in the source document were mentioned °C. The values in the Emission Reduction

Verification and Certification Report

GLC Report No: 002, Rev. 03



	calculation spreadsheet (ER sheet) ^{/5/} were mentioned in K as required by converting the °C to K. The reported data is confirmed to be correct.
Type of monitoring equipment:	Not Applicable (NA) The parameter was not measured by the PP
Is accuracy of the monitoring equipment as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practise?	NA
Calibration frequency /interval:	NA
Is the calibration interval in line with the monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practise?	NA
Company performing the calibration:	NA
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	NA
Is (are) calibration(s) valid for the whole reporting period?	NA
Verification of data aggregation and calculation:	The reported values in the ER sheet have been verified with the average monthly temperature data of the source document that was obtained from the Meteorological Department ^{/17/} . The values in the source document were mentioned °C. The values in the Emission Reduction calculation spreadsheet (ER sheet) were mentioned in K as required by converting the °C to K. The reported data is confirmed to be correct.
How were the values in the monitoring report verified?	The reported values in the monitoring report / ER sheet were verified from the Chumporn weather station data ^{/17/} . The GLC verification team can confirm that the reported values of the parameter are correct.
If applicable, has the reported data been cross-checked with other available data?	Not applicable
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting	Yes. The verification team, based on the document review and onsite verification, confirms that the data management (from monitoring equipment to emission

Verification and Certification Report

GLC Report No: 002, Rev. 03



of emission reductions and are necessary QA/QC processes in place?	<p>reduction calculation) ensure correct transfer of data and reporting of emission reductions and necessary QA/QC procedures are in place.</p> <p>Further description of the monitoring management is provided at the end of the section 4.1.3.</p>
--	--

Verification / Assessment of Data/Parameters	
Data / Parameter (as per monitoring plan in the PDD):	<p>F_{Dig}</p> <p>Flow rate of organic wastewater into the digester</p> <p>Data unit: m³/year</p>
Measuring / recording / reporting frequency:	<p>The parameter was measured continuously with a magnetic flow meter. Values were continuously transferred online and recorded through SCADA system.</p> <p>The flow meter measures the parameter on a continuous basis. The cumulative value of the parameter (or totalised value) is always displayed on the meter screen and also on the SCADA system^{19/}. The totalised reading is recorded manually from the meter by the Data Management Team member (usually the operator) everyday into the log sheet and submitted to Management Information Team member (usually the supervisor of the corresponding department). The Supervisor conducts quality check of the recorded data, updates it into monitoring database and generates monitoring reports on monthly basis. The monitoring data is reported to the Plant Manager on a monthly basis.</p> <p>Since the totalised value is recorded in log sheets, any doubtful reading can easily be crosschecked by the Supervisor.</p>
Is measuring / recording / reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	<p>Yes. As per the monitoring plan and as per the monitoring methodology, the parameter shall be measured continuously and aggregated monthly. The verification team can confirm based on onsite verification and monitoring records that the parameter was monitored in line with the requirements of the applied methodology and the monitoring plan.</p>
Verification of data generation, recording and	<p>GLC's verification team observed during the on onsite verification that a flow meter was installed on the</p>

Verification and Certification Report

GLC Report No: 002, Rev. 03



reporting:	<p>pipeline that carries wastewater to digesters. The verification team also checked the meter display and observed that the totalised value is appropriately indicated.</p> <p>It is to be noted that the flow meter was installed before the cooling pond which is an integral part of the project treatment system. From the interview with the project's operating team it is assessed that measurement of wastewater between the cooling pond and the first biogas digester would be difficult and require a design change of the system. The sectoral expertise of the verification team confirms that it is a common practice and appropriate to install the flow meter before the cooling pond, because of low retentions times (approximately 1 day). The evaporation and precipitation effects of the cooling pond are negligible under the climatic conditions of Chumporn.</p> <p>From the onsite verification, review of the monthly monitoring data sheets^{/14/} and the interview with the operating team, the verification team can confirm that the data generation, recording and reporting are appropriate.</p>
Type of monitoring equipment:	<p>Type: Magnetic Liquid Flow Meter</p> <p>Make: Yokogawa</p> <p>Model: AXFA14C</p> <p>Serial No: S5H904107 834</p> <p>Tag No: FTBG001</p> <p>Accuracy: +/- 0.35% of full scale ^{/22/}</p>
Is accuracy of the monitoring equipment as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practise?	<p>Yes, as per the monitoring plan of the PDD, the accuracy should be less than +/-1%. The verification team confirms that the monitoring equipment possesses good accuracy.</p>
Calibration frequency /interval:	<p>The calibration of the meter was conducted on the following dates ^{/23/}:</p> <p>2008-09-15</p> <p>2009-09-17</p> <p>2010-10-01</p>
Is the calibration interval in line with the	<p>As per the monitoring plan of the PDD, 'frequency of</p>

Verification and Certification Report

GLC Report No: 002, Rev. 03



monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practise?	subsequent calibration will be appropriate to the application, but not less than half-yearly'. As per the calibration report of 2008-09-15, the due date for next calibration was 2009-09-15. However, from the above mentioned dates, it is clear that there was a delay in calibration.
Company performing the calibration:	The calibration was conducted by KANES Co., Ltd. (Authorised dealer of Yokogawa) ^{/23/} .
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Though the flow meter was functioning normally, the error identified during the calibration conducted on 2010-10-01 was 3.9% ^{/23/} .
Is (are) calibration(s) valid for the whole reporting period?	As mentioned above, there was a delay in calibration of the monitoring equipment. Therefore, PP applied the error conservatively in accordance with Para 282-284 of VVS (version 07.0) ^{/1/} . Please refer to Table 4-5 below for further assessment on conservative approach followed due to delay in calibration.
Verification of data aggregation and calculation:	All the monthly monitoring reports (excel spreadsheets) that contain daily values of the parameters have been submitted to the verification team. These monthly reports were printed and submitted to the Plant Manager by the supervisor. Signed copies of these reports were stored in hard format at the project site, which were also checked by the verification team during the onsite verification. Monthly aggregate value has been mentioned in the emission reduction calculation spread sheet (ER sheet) ^{/5/} submitted along with the monitoring report (MR) ^{/4/} . The daily values were further crosschecked from the log sheets during the onsite verification. From the review of the ER sheet and the monthly monitoring records, the data aggregation is confirmed to be correct. The total measured value of the parameter for the monitoring period is 227,004 m ³ . The calculation was transparently provided by the project participant (PP) in the ER sheet and submitted to GLC along with the MR. The calculation has been reproduced by the verification team and all the formulae have been verified with the PDD and the applied methodology.

Verification and Certification Report

GLC Report No: 002, Rev. 03



	The verification team can, therefore, confirm that the calculation is appropriate and correct.
How were the values in the monitoring report verified?	The values reported in the monitoring report ^{4/} and the corresponding ER sheet ^{5/} were verified with the monthly monitoring records approved by the plant manager. It is confirmed that the values reported in the final MR and the ER sheet are correct.
If applicable, has the reported data been cross-checked with other available data?	Yes, the reported data was crosschecked with the daily log sheets during the onsite verification. The reported data in the ER sheet is confirmed to be appropriate.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	<p>Yes. The verification team, based on the document review and onsite verification, confirms that the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and necessary QA/QC procedures are in place.</p> <p>Further description of the monitoring management is provided at the end of the section 4.1.3.</p>

Verification / Assessment of Data/Parameters	
Data / Parameter (as per monitoring plan in the PDD):	<p>F_{Dig_out}</p> <p>Flow rate of organic wastewater out of the digester</p> <p>Data unit: m³/year</p>
Measuring / recording / reporting frequency:	<p>The flow rate of organic wastewater out of the digester (F_{Dig_out}) is assumed equal to the flow rate of organic wastewater into the digester (F_{Dig}). In the applied methodology (page 17 and 21) also, both F_{Dig} and F_{Dig_out} are described as the flow rate of organic wastewater into the digester. Besides, there was no sludge removed from the digesters (as assessed in later part of the report) during the monitoring report. Therefore, it is deemed appropriate to consider $F_{Dig_out} = F_{Dig}$.</p> <p>The parameter was measured continuously with a magnetic flow meter. Values were continuously transferred online and recorded through SCADA system.</p> <p>The flow meter measures the parameter on a continuous basis. The cumulative value of the parameter (or totalised value) is always displayed on the meter screen</p>

Verification and Certification Report

GLC Report No: 002, Rev. 03



	<p>and also on the SCADA system. The totalised reading is recorded manually from the meter by the Data Management Team member (usually the operator) everyday into the log sheet and submitted to Management Information Team member (usually the supervisor of the corresponding department). The Supervisor conducts quality check of the recorded data, updates it into monitoring database and generates monitoring reports on monthly basis. The monitoring data is reported to the Plant Manager on a monthly basis.</p> <p>Since the totalised value is recorded in log sheets, any doubtful reading can easily be crosschecked by the Supervisor.</p>
Is measuring / recording / reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	<p>Yes. As per the monitoring plan and as per the monitoring methodology, the parameter shall be measured continuously and aggregated monthly. The verification team can confirm based on onsite verification and monitoring records that the parameter was monitored in line with the requirements of the applied methodology and the monitoring plan.</p>
Verification of data generation, recording and reporting:	<p>GLC's verification team observed during the on onsite verification that a flow meter was installed on the pipeline that carries wastewater to digesters. The verification team also checked the meter display and observed that the totalised value is appropriately indicated.</p> <p>It is to be noted that the flow meter was installed before the cooling pond which is an integral part of the project treatment system. From the interview with the project's operating team it is assessed that measurement of wastewater between the cooling pond and the first biogas digester would be difficult and require a design change of the system. The sectoral expert of the verification team confirms that it is a common practice and appropriate to install the flow meter before the cooling pond, because of low retentions times (approximately 1 day). The evaporation and precipitation effects of the cooling pond are negligible under the climatic conditions of Chumporn.</p> <p>From the onsite verification, review of the monthly monitoring data sheets^{14/} and the interview with the operating team, the verification team can confirm that the data generation, recording and reporting are</p>

Verification and Certification Report

GLC Report No: 002, Rev. 03



	appropriate.
Type of monitoring equipment:	Type: Magnetic Liquid Flow Meter Make: Yokogawa Model: AXFA14C Serial No: S5H904107 834 Tag No: FTBG001 Accuracy: +/- 0.35% of full scale ^{/22/}
Is accuracy of the monitoring equipment as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practise?	Yes, as per the monitoring plan of the PDD, the accuracy should be less than +/-1%. The verification team confirms that the monitoring equipment possesses good accuracy.
Calibration frequency /interval:	The calibration of the meter was conducted on the following dates ^{/23/} : 2008-09-15 2009-09-17 2010-10-01
Is the calibration interval in line with the monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practise?	As per the monitoring plan of the PDD, 'frequency of subsequent calibration will be appropriate to the application, but not less than half-yearly'. As per the calibration report of 2008-09-15, the due date for next calibration was 2009-09-15. However, from the above mentioned dates, it is clear that there was a delay in calibration.
Company performing the calibration:	The calibration was conducted by KANES Co., Ltd. (Authorised dealer of Yokogawa) ^{/23/} .
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Though the flow meter was functioning normally, the error identified during the calibration conducted on 2010-10-01 was 3.9% ^{/23/} .
Is (are) calibration(s) valid for the whole reporting period?	As mentioned above, there was a delay in calibration of the monitoring equipment. Therefore, PP applied the error conservatively in accordance with Para 282-284 of VVS (version 07.0) ^{/1/} . Please refer to Table 4-5 below for further assessment on conservative approach followed due to delay in calibration.
Verification of data aggregation and calculation:	All the monthly monitoring reports (excel spreadsheets) that contain daily values of the parameters have been submitted to the verification team. These monthly reports were printed and submitted to the Plant Manager

Verification and Certification Report

GLC Report No: 002, Rev. 03



	<p>by the supervisor. Signed copies of these reports were stored in hard format at the project site, which were also checked by the verification team during the onsite verification. Monthly aggregate value has been mentioned in the emission reduction calculation spread sheet (ER sheet) ^{/5/} submitted along with the monitoring report (MR)^{/4/}. The daily values were further crosschecked from the log sheets during the onsite verification.</p> <p>From the review of the ER sheet and the monthly monitoring records, the data aggregation is confirmed to be correct.</p> <p>The total measured value of the parameter for the monitoring period is 227,004 m³.</p> <p>The calculation was transparently provided by the project participant (PP) in the ER sheet and submitted to GLC along with the MR. The calculation has been reproduced by the verification team and all the formulae have been verified with the PDD and the applied methodology.</p> <p>The verification team can, therefore, confirm that the calculation is appropriate and correct.</p>
How were the values in the monitoring report verified?	The values reported in the monitoring report ^{/4/} and the corresponding ER sheet ^{/5/} were verified with the monthly monitoring records approved by the plant manager. It is confirmed that the values reported in the final MR and the ER sheet are correct.
If applicable, has the reported data been cross-checked with other available data?	Yes, the reported data was crosschecked with the daily log sheets during the onsite verification. The reported data in the ER sheet is confirmed to be appropriate.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	<p>Yes. The verification team, based on the document review and onsite verification, confirms that the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and necessary QA/QC procedures are in place.</p> <p>Further description of the monitoring management is provided at the end of the section 4.1.3.</p>

Verification and Certification Report

GLC Report No: 002, Rev. 03



Verification / Assessment of Data/Parameters	
Data / Parameter (as per monitoring plan in the PDD):	<p>COD_c, baseline</p> <p>COD - concentration of organic wastewater into the digester</p> <p>Data unit: kg COD / m³</p>
Measuring / recording / reporting frequency:	<p>The COD analysis of wastewater entering the digesters was conducted twice a week by internal laboratory and once a month by external laboratory.</p> <p>For COD analysis at internal laboratory, two samples collected in the same hour were mixed together for improved results each time when the COD was determined.</p>
Is measuring / recording / reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	<p>As per the monitoring plan, the COD analysis shall be conducted weekly. 4 samples per hour and total 12 samples (weekly same day, same times) shall be taken for COD analysis.</p> <p>It is assessed during the course of the verification that PP wrongly understood the requirement of the registered monitoring plan (12 samples per day, weekly same day, were understood as 12 daily samples, every day, and this of all COD sampling points) and therefore the PP found it was not possible to comply with the registered monitoring plan completely. As a result samples were taken as mentioned above (2 samples were collected and mixed together and it was done twice a week) and as a crosscheck with the internal laboratory data, samples were taken and analysed by an external laboratory additionally once a month.</p> <p>PP adjusted the sampling procedure to the description in the registered monitoring plan after the onsite verification. Therefore, a temporary deviation was requested by the PP for the first monitoring period at the time when the revised PDD was submitted for approval of PRC. The temporary deviation was approved by the EB.</p> <p>As per the applied methodology, the COD shall be recorded monthly. Therefore, it is confirmed that the monitoring frequency complies with the methodology.</p>
Verification of data generation, recording and reporting:	<p>The COD analysis was conducted by the internal laboratory staff using Close Reflux Method (APHA 5220 D). The laboratory staff was interviewed by the sectoral expert of the assessment team during the onsite visit. It</p>

Verification and Certification Report

GLC Report No: 002, Rev. 03



	<p>was found that the team was competent and the procedure followed was appropriate. The spectrometer used in the laboratory for COD measurement was also checked by the verification team and found that it was functioning properly.</p> <p>The COD was conducted weekly twice by the laboratory staff and recorded in log sheets. The recorded data is submitted to Quality Control supervisor on weekly basis. The supervisor checks the data updates into monthly monitoring records (excel spreadsheets). The monthly monitoring records are submitted to the plant manager on monthly basis. The monthly monitoring records approved by the plant manager and the log sheets prepared by the laboratory were checked by the verification team to confirm that the reported data is correct. Besides, monthly COD analysis reports from the external laboratory^{/15/} were also submitted to the verification team.</p> <p>The verification team upon reviewing the ER sheet, internal laboratory records and external laboratory reports confirms that lowest of the values for the month was taken for ER calculation in order to be conservative which is deemed appropriate.</p> <p>From the onsite verification, review of the monthly monitoring data records^{/14/15/} and the interview with the operating team, the verification team confirms that the data generation, recording and reporting are appropriate.</p>
Type of monitoring equipment:	<p>Type: Spectrophotometer</p> <p>Make: HACH</p> <p>Model: DR 3800</p> <p>Serial No: 070790C64568</p> <p>Accuracy: 0.605 ± 0.05 ^{/22/}</p>
Is accuracy of the monitoring equipment as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practise?	<p>Yes, as per the monitoring plan of the PDD, the accuracy should be less than +/-3%. The verification team confirms that the monitoring equipment possesses good accuracy.</p>
Calibration frequency /interval:	<p>The calibration of the meter was conducted on the following dates ^{/35/}:</p>

Verification and Certification Report

GLC Report No: 002, Rev. 03



	<p>2008-07-15</p> <p>2009-05-18</p> <p>2010-03-23</p> <p>2010-10-20</p>
Is the calibration interval in line with the monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practise?	From the above mentioned dates, it is clear that the defined calibration frequency of 6 months was not followed. Nevertheless, it is to be noted that the COD meter calibrated before every measurement (automatic wavelength calibration). Besides, PP has considered the most conservative value between the internal laboratory measurement and the external laboratory measurement. Therefore, though there is a delay in external calibration of COD meter, its impact on emission reductions is deemed negligible.
Company performing the calibration:	The calibration was conducted by Envi Science Company Limited ^{/35/} .
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	From the review of the calibration reports, it is confirmed that the equipment was functioning normally ^{/35/} .
Is (are) calibration(s) valid for the whole reporting period?	As mentioned above, there was a delay in calibration of the monitoring equipment. Therefore, PP followed conservative approach.
Verification of data aggregation and calculation:	<p>All the monthly monitoring records (excel spreadsheets). These monthly reports were printed and submitted to the Plant Manager by the supervisor. Signed copies of these reports were stored in hard format at the project site, which were also checked by the verification team during the onsite verification. Besides, monthly COD reports provided by external laboratory were also checked by the verification team. It is confirmed that lowest of the values between internal laboratory data and external laboratory data has been mentioned in the emission reduction calculation spread sheet (ER sheet)^{/5/} for the sake of conservativeness. The approach followed by the PP is deemed appropriate as it results in conservative emission reductions.</p> <p>From the review of the ER sheet and the monthly monitoring records, the data aggregation is confirmed to be correct.</p> <p>The calculation was transparently provided by the project participant (PP) in the ER sheet and submitted to GLC along with the MR. The calculation has been reproduced by the verification team and all the formulae</p>

Verification and Certification Report

GLC Report No: 002, Rev. 03



	<p>have been verified with the PDD and the applied methodology.</p> <p>The verification team can, therefore, confirm that the calculation is appropriate and correct.</p>
How were the values in the monitoring report verified?	The values reported in the monitoring report ^{4/} and the corresponding ER sheet ^{5/} were verified with the monthly monitoring records approved by the plant manager and the external laboratory reports. It is confirmed that the values reported in the final MR and the ER sheet are correct.
If applicable, has the reported data been cross-checked with other available data?	Yes, the reported data was crosschecked with the laboratory log sheets during the onsite verification. The reported data in the ER sheet is confirmed to be appropriate.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	<p>Yes. The verification team, based on the document review and onsite verification, confirms that the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and necessary QA/QC procedures are in place.</p> <p>Further description of the monitoring management is provided at the end of the section 4.1.3.</p>

Assessment of COD_{a,in} (COD that enters the lagoon) and COD_{a,out} (COD that leaves lagoon with effluent):

It shall be noted that the parameters COD_{a,in} (COD that enters the lagoon) and COD_{a,out} (COD that leaves lagoon with effluent) relate to the baseline parameters which should be taken based on the historical data as per the methodology. These parameters were mentioned in section B.6.2 of the PDD appropriately. Nevertheless, these two parameters were also mentioned in section B.7.1 of the PDD by-mistakenly. Therefore, PP mentioned these parameters in section D.2 also besides D.1 in order to be consistent with the monitoring plan of the PDD. Since these parameters are not applicable for monitoring, they were not monitored and therefore no further assessment is provided here.

Verification / Assessment of Data/Parameters	
Data / Parameter (as per monitoring plan in the PDD):	<p>T_{Ing}</p> <p>Temperature of the lagoon</p> <p>Data unit: K</p>
Measuring / recording / reporting frequency:	Temperature of the lagoon is assumed same as that of the ambient temperature in accordance with the applied

Verification and Certification Report

GLC Report No: 002, Rev. 03



	<p>methodology.</p> <p>Temperature of the lagoon was measured by the PP and the ambient temperature measured by Chumporn weather station was obtained from Thai Meteorological Department, Ministry of Information and Communication Technology of Thailand. For emission reduction calculation, ambient temperature obtained from the weather station was considered.</p> <p>Monthly average values recorded by Chumporn weather station were obtained annually. However, the GLC assessment team confirms based on sectoral and local expertise that the temperature data is monitored on a continuous basis by meteorological department as a common practice. Daily average is recorded based on the continuously measured data and monthly average values can be obtained from the daily values.</p>
Is measuring / recording / reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	<p>Yes. The monitoring methodology states, "daily average is monitored and monthly average is used in the calculation" and the monitoring plan of the PDD states, "monthly averages are obtained from the weather station at least annually".</p> <p>Therefore, the monitoring frequency can be confirmed to be in accordance with the applied monitoring methodology and the monitoring plan.</p>
Verification of data generation, recording and reporting:	<p>The data was not recorded by the PP but obtained from the meteorological department as mentioned in the monitoring plan.</p> <p>The reported data has been verified from the source document that was obtained from the Meteorological Department. The values in the source document were mentioned °C. The values in the Emission Reduction calculation spreadsheet (ER sheet) were mentioned in K as required by converting the °C to K. The reported data is confirmed to be correct.</p>
Type of monitoring equipment:	<p>Not Applicable (NA)</p> <p>The parameter was not measured by the PP</p>
Is accuracy of the monitoring equipment as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practise?	<p>NA</p>

Verification and Certification Report

GLC Report No: 002, Rev. 03



Calibration frequency /interval:	NA
Is the calibration interval in line with the monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practise?	NA
Company performing the calibration:	NA
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	NA
Is (are) calibration(s) valid for the whole reporting period?	NA
Verification of data aggregation and calculation:	The reported values in the ER sheet have been verified with the average monthly temperature data of the source document that was obtained from the Meteorological Department. The values in the source document were mentioned °C. The values in the Emission Reduction calculation spreadsheet (ER sheet) were mentioned in K as required by converting the °C to K. The reported data is confirmed to be correct.
How were the values in the monitoring report verified?	The reported values in the monitoring report / ER sheet were verified from the Chumporn weather station data ^{17/} . The GLC verification team can confirm that the reported values of the parameter are correct.
If applicable, has the reported data been cross-checked with other available data?	Not applicable
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Yes. The verification team, based on the document review and onsite verification, confirms that the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and necessary QA/QC procedures are in place. Further description of the monitoring management is provided at the end of the section 4.1.3.

Verification and Certification Report

GLC Report No: 002, Rev. 03



Verification / Assessment of Data/Parameters	
Data / Parameter (as per monitoring plan in the PDD):	D _{Ing} Depth of the lagoons Data unit: m
Measuring / recording / reporting frequency:	The parameter was measured and recorded monthly during the monitoring period.
Is measuring / recording / reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	<p>As per the monitoring plan, the proposed monitoring frequency was "daily measurements; calculation of monthly average".</p> <p>However, the parameter was measured monthly during the monitoring period. Therefore, PP applied for temporary deviation while submitting the revised PDD for PRC approval. The revised PDD was approved by the EB. It was proposed in the revised PDD that a conservative approach would be followed for the first monitoring period.</p> <p>Therefore, for the calculation of emission reduction for the lagoon, deepest measured depth during the monitoring period (2.70 m in January 2010) was applied, which coincidences with a depth factor of (fd) = 0.5 for medium depth (1-5 m). This is conservative as all measured values are well below 5 m and sometimes even values lower than 1 m was measured.</p>
Verification of data generation, recording and reporting:	The parameter was measured by the operators once a month and recorded in log books and reported to supervisor. The supervisor updates the measured values into excel monitoring records and submits to the plant manager once a month. From the review of the monitoring records and the interview with the operating team, it is confirmed that the reported data is correct.
Type of monitoring equipment:	Standard depth meter
Is accuracy of the monitoring equipment as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practise?	NA
Calibration frequency /interval:	NA
Is the calibration interval in line with the monitoring plan of the PDD? If the PDD does not specify the frequency of	NA

Verification and Certification Report

GLC Report No: 002, Rev. 03



calibration, does the selected frequency represent good monitoring practise?	
Company performing the calibration:	NA
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	NA
Is (are) calibration(s) valid for the whole reporting period?	NA
Verification of data aggregation and calculation:	<p>The reported values in the ER sheet have been verified with the monthly records which confirm correct transformation of the data. From the review of the ER sheet and the monthly monitoring records, the data aggregation is confirmed to be correct.</p> <p>The calculation was transparently provided by the PP in the ER sheet and submitted to GLC along with the MR. The calculation has been reproduced by the verification team and all the formulae have been verified with the PDD and the applied methodology.</p> <p>The verification team can, therefore, confirm that the calculation is appropriate and correct.</p>
How were the values in the monitoring report verified?	<p>The reported values in the monitoring report / ER sheet were verified from the monthly records^{14/}.</p> <p>The GLC verification team can confirm that a conservative depth factor of 0.5 which corresponds to medium depth of 1 – 5 m as all the measured values are below 5 m. This is deemed appropriate and conservative as some of the measured values are below 1 m.</p>
If applicable, has the reported data been cross-checked with other available data?	Not applicable
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	<p>Yes. The verification team, based on the document review and onsite verification, confirms that the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and necessary QA/QC procedures are in place.</p> <p>Further description of the monitoring management is provided at the end of the section 4.1.3.</p>

Verification and Certification Report

GLC Report No: 002, Rev. 03



Assessment of HG_{BI} :

The parameter HG_{BI} (Quantity of [additional] thermal energy that would be consumed in year y at the project site in the absence of the project activity (MJ) using fossil fuel) is calculated based on the biogas consumption for CPO boilers. As per the PDD, it was proposed that the biogas would replace 15% of heavy fuel oil and 85% of palm shells in CPO boilers. Post registration, as explained in the revised PDD, part of the biogas was also utilised in Refinery boilers. However, the emission reduction on account of fossil fuel replacement in Refinery boilers is not considered for claiming emission reductions. Therefore, the parameter HG_{BI} was calculated based on the biogas consumption for CPO boilers and considering 15% of it would replace heavy fuel oil. The calculation has been correctly provided in the ER sheet. For further assessment, please refer to the assessment of $FR_{e,inlet}$ (Flow rate of the biogas entering the heat generation equipment) in the report.

Verification / Assessment of Data/Parameters	
Data / Parameter (as per monitoring plan in the PDD):	COD_{c,dig_out} COD-concentration in discharged effluent from digester Data unit: kg COD / m ³
Measuring / recording / reporting frequency:	The COD analysis of discharged effluent from the digesters was conducted twice a week by internal laboratory and once a month by external laboratory. For COD analysis at internal laboratory, two samples collected in the same hour were mixed together for improved results each time when the COD was determined.
Is measuring / recording / reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	As per the monitoring plan, the COD analysis shall be conducted weekly. 4 samples per hour and total 12 samples (weekly same day, same times) shall be taken for COD analysis. It is assessed during the course of the verification that PP wrongly understood the requirement of the registered monitoring plan (12 samples per day, weekly same day, were understood as 12 daily samples, every day, and this of all COD sampling points) and therefore the PP found it was not possible to comply with the registered monitoring plan completely. As a result samples were taken as mentioned above (2 samples were collected and mixed together and it was done twice a week) and as a crosscheck with the internal laboratory data, samples were taken and analysed by an external laboratory additionally once a month. PP adjusted the sampling procedure to the description in the registered monitoring plan after the onsite verification. Therefore, a temporary deviation was

Verification and Certification Report

GLC Report No: 002, Rev. 03



	<p>requested by the PP for the first monitoring period at the time when the revised PDD was submitted for approval of PRC. The temporary deviation was approved by the EB.</p> <p>As per the applied methodology, the COD shall be recorded monthly. Therefore, it is confirmed that the monitoring frequency complies with the methodology.</p>
Verification of data generation, recording and reporting:	<p>The COD analysis was conducted by the internal laboratory staff using Close Reflux Method (APHA 5220 D). The laboratory staff was interviewed by the sectoral expert of the assessment team during the onsite visit. It was found that the team was competent and the procedure followed was appropriate. The spectrometer used in the laboratory for COD measurement was also checked by the verification team and found that it was functioning properly.</p> <p>The COD was conducted weekly twice by the laboratory staff and recorded in log sheets. The recorded data is submitted to Quality Control supervisor on weekly basis. The supervisor checks the data updates into monthly monitoring records (excel spreadsheets). The monthly monitoring records are submitted to the plant manager on monthly basis. The monthly monitoring records approved by the plant manager and the log sheets prepared by the laboratory were checked by the verification team to confirm that the reported data is correct. Besides, monthly COD analysis reports from the external laboratory^{15/} were also submitted to the verification team.</p> <p>The verification team upon reviewing the ER sheet, internal laboratory records and external laboratory reports confirms that highest of the values for the month was taken for ER calculation in order to be conservative which is deemed appropriate.</p> <p>From the onsite verification, review of the monthly monitoring data records^{14/} and the interview with the operating team, the verification team confirms that the data generation, recording and reporting are appropriate.</p>
Type of monitoring equipment:	<p>Type: Spectrophotometer</p> <p>Make: HACH</p> <p>Model: DR 3800</p>

Verification and Certification Report

GLC Report No: 002, Rev. 03



	<p>Serial No: 070790C64568</p> <p>Accuracy: 0.605 ± 0.05 ^{/22/}</p>
<p>Is accuracy of the monitoring equipment as stated in the PDD?</p> <p>If the PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practise?</p>	<p>Yes, as per the monitoring plan of the PDD, the accuracy should be less than +/-3%. The verification team confirms that the monitoring equipment possesses good accuracy.</p>
<p>Calibration frequency /interval:</p>	<p>The calibration of the meter was conducted on the following dates ^{/35/}:</p> <p>2008-07-15</p> <p>2009-05-18</p> <p>2010-03-23</p> <p>2010-10-20</p>
<p>Is the calibration interval in line with the monitoring plan of the PDD?</p> <p>If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practise?</p>	<p>From the above mentioned dates, it is clear that the defined calibration frequency of 6 months was not followed. Nevertheless, it is to be noted that the COD meter calibrated before every measurement (automatic wavelength calibration). Besides, PP has considered the most conservative value between the internal laboratory measurement and the external laboratory measurement. Therefore, though there is a delay in external calibration of COD meter, its impact on emission reductions is deemed negligible.</p>
<p>Company performing the calibration:</p>	<p>The calibration was conducted by Envi Science Company Limited^{/35/}.</p>
<p>Did calibration confirm proper functioning of monitoring equipment? (Yes / No):</p>	<p>From the review of the calibration reports, it is confirmed that the equipment was functioning normally ^{/35/}.</p>
<p>Is (are) calibration(s) valid for the whole reporting period?</p>	<p>As mentioned above, there was a delay in calibration of the monitoring equipment. Therefore, PP followed conservative approach.</p>
<p>Verification of data aggregation and calculation:</p>	<p>All the monthly monitoring records (excel spreadsheets). These monthly reports were printed and submitted to the Plant Manager by the supervisor. Signed copies of these reports were stored in hard format at the project site, which were also checked by the verification team during the onsite verification. Besides, monthly COD reports provided by external laboratory were also checked by the verification team. It is confirmed that highest of the values between internal laboratory data and external laboratory data has been mentioned in the emission</p>

Verification and Certification Report

GLC Report No: 002, Rev. 03



	<p>reduction calculation spread sheet (ER sheet)^{5/} for the sake of conservativeness. The approach followed by the PP is deemed appropriate as it results in conservative emission reductions.</p> <p>From the review of the ER sheet and the monthly monitoring records, the data aggregation is confirmed to be correct.</p> <p>The calculation was transparently provided by the project participant (PP) in the ER sheet and submitted to GLC along with the MR. The calculation has been reproduced by the verification team and all the formulae have been verified with the PDD and the applied methodology.</p> <p>The verification team can, therefore, confirm that the calculation is appropriate and correct.</p>
How were the values in the monitoring report verified?	The values reported in the monitoring report ^{4/} and the corresponding ER sheet ^{5/} were verified with the monthly monitoring records approved by the plant manager and the external laboratory reports. It is confirmed that the values reported in the final MR and the ER sheet are correct.
If applicable, has the reported data been cross-checked with other available data?	Yes, the reported data was crosschecked with the laboratory log sheets during the onsite verification. The reported data in the ER sheet is confirmed to be appropriate.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	<p>Yes. The verification team, based on the document review and onsite verification, confirms that the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and necessary QA/QC procedures are in place.</p> <p>Further description of the monitoring management is provided at the end of the section 4.1.3.</p>

Verification / Assessment of Data/Parameters	
Data / Parameter (as per monitoring plan in the PDD):	<p>EL_{P,y}</p> <p>Amount of electricity in the year y that is consumed at</p>

Verification and Certification Report

GLC Report No: 002, Rev. 03



	<p>the project site for the project activity</p> <p>Data unit: MWh/year</p>
Measuring / recording / reporting frequency:	<p>The parameter was measured continuously with a standard electricity meter. The cumulative value of the parameter (or totalised value) is always displayed on the meter screen and also on the SCADA system. The totalised reading is recorded manually from the meter by the Data Management Team member (usually the operator) everyday into the log sheet and submitted to Management Information Team member (usually the supervisor of the corresponding department). The Supervisor conducts quality check of the recorded data, updates it into monitoring database and generates monitoring reports on monthly basis. The monitoring data is reported to the Plant Manager on a monthly basis.</p> <p>Since the totalised value is recorded in log sheets, any doubtful reading can easily be crosschecked by the Supervisor.</p>
Is measuring / recording / reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	<p>Yes. As per the monitoring plan and as per the monitoring methodology, the parameter shall be monitored continuously. The verification team can confirm based on onsite verification and monitoring records that the parameter was monitored in line with the requirements of the applied methodology and the monitoring plan.</p>
Verification of data generation, recording and reporting:	<p>GLC's verification team observed during the on onsite verification that an electricity meter was installed at the incoming point to the wastewater treatment plant i.e. the project treatment system. The verification team also checked the meter display and observed that the totalised value is appropriately indicated. The verification confirms that the meter indicates the total electricity consumption for the project activity.</p> <p>From the onsite verification, review of the monthly monitoring data records^{14/} and the interview with the operating team, the verification team can confirm that the parameter is recorded into log sheets daily and updated into monitoring data records (excel data sheets). The monitoring records are printed and submitted to the plant manager on a monthly basis. The approved monitoring records by the plant manager are stored in hard format. The verification team checked the</p>

Verification and Certification Report

GLC Report No: 002, Rev. 03



	reported data with the monthly monitoring records and found that the reported data was appropriate. A copy of the electronic data sheets were also submitted to the verification team by the PP. Therefore, the verification team confirms that the data generation, recording and reporting are appropriate.
Type of monitoring equipment:	The details of the monitoring equipment as checked during the onsite verification are as below: Type: Electricity Meter Make: Schneider Electric Model: Power Logic PM710 Serial No: 63230-501-209A1 Accuracy: +/- 1.0% of full scale ^{/22/}
Is accuracy of the monitoring equipment as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practise?	Yes, as per the monitoring plan of the PDD, the accuracy should be +/-1%. The verification team confirms that the monitoring equipment possesses good accuracy.
Calibration frequency /interval:	The calibration is subject to external quality control by the electricity provided, PEA (Provincial Electricity Authority). No calibration information is made available by PEA.
Is the calibration interval in line with the monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practise?	NA
Company performing the calibration:	NA
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	NA
Is (are) calibration(s) valid for the whole reporting period?	NA
Verification of data aggregation and calculation:	Monthly aggregate values have been mentioned in the emission reduction calculation spread sheet (ER sheet) ^{/5/} submitted along with the monitoring report (MR) ^{/4/} . The reported values of the parameter were verified with the monthly monitoring records (electronic spreadsheets) that contain daily values of the

Verification and Certification Report

GLC Report No: 002, Rev. 03



	<p>parameter. The data aggregation is confirmed to be correct. The total measured value of the parameter for the monitoring period is 290,473 kWh.</p> <p>The calculation was transparently provided by the project participant (PP) in the ER sheet and submitted to GLC along with the MR. The calculation has been reproduced by the verification team and all the formulae have been verified with the PDD and the applied methodology.</p> <p>The verification team can, therefore, confirm that the calculation is appropriate and correct.</p>
How were the values in the monitoring report verified?	The values reported in the monitoring report ^{4/} and the corresponding ER sheet ^{5/} were verified with the monthly monitoring records approved by the plant manager. It is confirmed that the values reported in the final MR and the ER sheet are correct.
If applicable, has the reported data been cross-checked with other available data?	Yes, the reported data was crosschecked with the daily log sheets during the onsite verification. The reported data in the ER sheet is confirmed to be appropriate.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	<p>Yes. The verification team, based on the document review and onsite verification, confirms that the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and necessary QA/QC procedures are in place.</p> <p>Further description of the monitoring management is provided at the end of the section 4.1.3.</p>

Parameters related sludge:

It shall be noted that the sludge was not removed from the digesters during the monitoring period. This is confirmed based on the onsite interviews with the plant's operating team and verification of the monitoring records. Therefore, the below mentioned parameters related to sludge were not recorded during the monitoring period.

Parameter	Description
F _{la}	Quantity of sludge used for land application after dewatering (kg/year)
COD _{la}	COD of the sludge used for land application after dewatering (kg COD/m ³)

Verification and Certification Report

GLC Report No: 002, Rev. 03



$F_{c,dw}$	Flow rate of organic wastewater from the dewatering process (m ³ /year)
$COD_{c,dw}$	COD of the wastewater from the dewatering process (kg COD/year)
Sa	Amount of sludge applied to land (kg/year)
NC	Nitrogen content in the sludge (kg N/kg sludge)

Nevertheless, it is assessed and confirmed that required monitoring equipment and monitoring procedures are in place to monitor whenever sludge is removed and dewatering takes place. Therefore, no further assessment of the above mentioned parameters is provided in the report.

Verification / Assessment of Data/Parameters	
Data / Parameter (as per monitoring plan in the PDD):	FR_{Bio} Biogas flow rate at digester outlet Data unit: m ³ /year
Measuring / recording / reporting frequency:	The parameter was measured continuously with a gas flow meter. The cumulative value of the parameter (or totalised value) is always displayed on the meter screen and also on the SCADA system. The totalised reading is recorded manually from the meter by the operator everyday into the log sheet and submitted to the biogas supervisor. The Supervisor conducts quality check of the recorded data, updates it into monitoring database and generates monitoring reports on monthly basis. The monitoring data is reported to the Plant Manager on a monthly basis. Since the totalised value is recorded in log sheets, any doubtful reading can easily be crosschecked by the Supervisor.
Is measuring / recording / reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes. As per the monitoring plan the monitoring frequency is "continuously" and as per the applied monitoring methodology the recording frequency is "continuously". The methodology further states 'parameter is monitored continuously but aggregated annually for calculations'. The verification team can confirm based on onsite verification and monitoring records that the parameter was monitored in line with the requirements of the applied methodology and the monitoring plan.
Verification of data generation, recording and reporting:	GLC's verification team observed during the on onsite verification that the biogas is collected from all the

Verification and Certification Report

GLC Report No: 002, Rev. 03



	<p>digesters (two CSTRs and two UASBs) into one common pipeline and the biogas is cleaned through a biogas cleaner to remove H₂S. A biogas flow meter was installed on the biogas pipeline after the biogas cleaner. The verification team also checked the meter display and observed that the totalised value is appropriately indicated. The verification confirms that the meter appropriately indicates the total biogas flow rate at digester outlet.</p> <p>It shall be noted that the monitoring equipment automatically corrects for temperature and pressure to indicate the flow rate in Nm³/hour. It also displays the cumulative flow in Nm³.</p> <p>From the onsite verification, review of the monthly monitoring data records^{14/} and the interview with the operating team, the verification team can confirm that the parameter is recorded into log sheets daily and updated into monitoring data records (excel data sheets). The monitoring records are printed and submitted to the plant manager on a monthly basis. The approved monitoring records by the plant manager are stored in hard format. The verification team checked the reported data with the monthly monitoring records and found that the reported data was appropriate. A copy of the electronic data sheets were also submitted to the verification team by the PP. Therefore, the verification team confirms that the data generation, recording and reporting are appropriate.</p>
Type of monitoring equipment:	<p>The details of the monitoring equipment as checked during the onsite verification are as below:</p> <p>Type: Thermal Mass Flow meter Make: FOX Thermal Instruments, Inc Model: FT2 Serial No: 6511 Tag No: FTBG004 Accuracy: +/- 1.0% ^{122/}</p>
Is accuracy of the monitoring equipment as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good	<p>Yes, the monitoring plan states the accuracy as +/-1% of reading. The verification team confirms that the monitoring equipment possesses good accuracy.</p>

Verification and Certification Report

GLC Report No: 002, Rev. 03



monitoring practise?	
Calibration frequency /interval:	The calibration of the meter was conducted on the following dates ^{/25/} : 2008-08-22 2010-10-01
Is the calibration interval in line with the monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practise?	As per the monitoring plan of the PDD, it was proposed to conduct the calibration of the monitoring equipment half-yearly. However, from the above mentioned dates, it is clear that there was a delay in calibration.
Company performing the calibration:	The calibration was conducted by Miracle International Technology Co., Ltd., Bangkok
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Though the monitoring equipment was found functioning, the error identified during the calibration on 2010-10-01 was 4.4% ^{/25/} .
Is (are) calibration(s) valid for the whole reporting period?	As mentioned above, there was a delay in calibration of the monitoring equipment. However, the parameter is not directly used in the emission reduction calculation and therefore, it has no impact on emission reductions.
Verification of data aggregation and calculation:	<p>Monthly aggregate value has been mentioned in the emission reduction calculation spread sheet (ER sheet)^{/5/} submitted along with the monitoring report (MR)^{/4/}.</p> <p>The reported values of the parameter were verified with the monthly monitoring records (electronic spreadsheets) that contain daily values of the parameter. The data aggregation is confirmed to be correct. The total measured value of the parameter for the monitoring period is 6,597,371 Nm³.</p> <p>The calculation was transparently provided by the project participant (PP) in the ER sheet and submitted to GLC along with the MR. The calculation has been reproduced by the verification team and all the formulae have been verified with the PDD and the applied methodology.</p> <p>The verification team can, therefore, confirm that the calculation is appropriate and correct.</p>
How were the values in the monitoring report verified?	The values reported in the monitoring report ^{/4/} and the corresponding ER sheet ^{/5/} were verified with the monthly monitoring records approved by the plant manager. It is

Verification and Certification Report

GLC Report No: 002, Rev. 03



	confirmed that the values reported in the final MR and the ER sheet are correct.
If applicable, has the reported data been cross-checked with other available data?	Yes, the reported data was crosschecked with the daily log sheets during the onsite verification. The reported data in the ER sheet is confirmed to be appropriate.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	<p>Yes. The verification team, based on the document review and onsite verification, confirms that the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and necessary QA/QC procedures are in place.</p> <p>Further description of the monitoring management is provided at the end of the section 4.1.3.</p>

Verification / Assessment of Data/Parameters	
Data / Parameter (as per monitoring plan in the PDD):	<p>$P_{CH_4, bio}$</p> <p>Biogas CH_4 content at digester outlet</p> <p>Data unit: %</p>
Measuring / recording / reporting frequency:	<p>The parameter was measured hourly with portable gas analyser and recorded in log books. The log books are submitted to the biogas supervisor on daily basis. The Supervisor conducts quality check of the recorded data, calculates daily average of the parameter and updates it into electronic spreadsheets. The electronic spreadsheets i.e. the monitoring records are printed and submitted to the Plant Manager on a monthly basis for his approval.</p> <p>Since the hourly frequency for measurement was not followed on all days, the PP applied 95% confidence level to the measured values and considered it conservatively in the emission reduction calculation.</p>
Is measuring / recording / reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	<p>Yes. As per the monitoring plan the monitoring frequency is "continuous measurement with at least hourly reading or periodical measurement at 95% confidence level using portable analyser" and as per the applied monitoring methodology the recording frequency is "at least quarterly". The verification team can confirm based on onsite verification and monitoring records that the parameter was monitored in line with the</p>

Verification and Certification Report

GLC Report No: 002, Rev. 03



	requirements of the applied methodology and the monitoring plan.
Verification of data generation, recording and reporting:	<p>GLC's verification team observed a sampling point for measurement of biogas methane content on the biogas pipeline at the outlet of digesters. Further from the interview of the operating team it is confirmed that methane content (%CH₄) is usually measured on hourly basis with the portable gas analyser and recorded in log books. The measurement was also demonstrated in presence of the verification team during the onsite verification. The verification team confirms the value indicated by the analyser appropriately represents the biogas CH₄ content at digester outlet.</p> <p>From the onsite verification, review of the monthly monitoring data records^{14/} and the interview with the operating team, the verification team can confirm that the parameter is recorded into log books whenever it is measured. The log books are submitted to the supervisor on daily basis and the supervisor calculates the daily average and updates the data into monitoring data records (excel spreadsheets). The monitoring records are printed and submitted to the plant manager on monthly basis. The approved monitoring records by the plant manager are stored in hard format. The verification team checked the reported data with the monthly monitoring records and found that the reported data was appropriate. A copy of the electronic spreadsheets was also submitted to the verification team by the PP. Therefore, the verification team confirms that the data generation, recording and reporting are appropriate.</p>
Type of monitoring equipment:	<p>The details of the monitoring equipment as checked during the onsite verification are as below:</p> <p>Type: 4 Channel Handheld Gas Analyser</p> <p>Make: Gasboard</p> <p>Model: GA-m2</p> <p>Serial No: 10830</p> <p>Accuracy: +/- 1.0% of reading</p>
Is accuracy of the monitoring equipment as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good	<p>Yes, the monitoring plan states the accuracy as less than +/-1% at full scale. The verification team confirms that the monitoring equipment possesses good accuracy.</p>

Verification and Certification Report

GLC Report No: 002, Rev. 03



monitoring practise?	
Calibration frequency /interval:	The calibration of the meter was conducted on the following dates ^{/29/} : 2008-10-21 2010-09-21
Is the calibration interval in line with the monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practise?	As per the monitoring plan of the PDD, it was proposed to conduct the calibration of the monitoring equipment half-yearly. However, from the above mentioned dates, it is clear that there was a delay in calibration.
Company performing the calibration:	The calibration was conducted by Binder Group
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes, the calibration report confirms proper functioning of the gas analyser.
Is (are) calibration(s) valid for the whole reporting period?	As mentioned above, there was a delay in calibration of the monitoring equipment. Therefore, PP applied the error conservatively in accordance with Para 282-284 of VVS (version 07.0) ^{/1/} . Please refer to Table 4-5 below for further assessment on conservative approach followed due to delay in calibration.
Verification of data aggregation and calculation:	<p>Monthly aggregate value has been mentioned in the emission reduction calculation spread sheet (ER sheet)^{/5/} submitted along with the monitoring report (MR)^{/4/}.</p> <p>The reported values of the parameter were verified with the monthly monitoring records (electronic spreadsheets) that contain daily values of the parameter. The data aggregation is confirmed to be correct.</p> <p>The calculation was transparently provided by the project participant (PP) in the ER sheet and submitted to GLC along with the MR. The calculation has been reproduced by the verification team and all the formulae have been verified with the PDD and the applied methodology.</p> <p>The verification team can, therefore, confirm that the calculation is appropriate and correct.</p>
How were the values in the monitoring report verified?	The values reported in the monitoring report ^{/4/} and the corresponding ER sheet ^{/5/} were verified with the monthly monitoring records approved by the plant manager. It is confirmed that the values reported in the final MR and

Verification and Certification Report

GLC Report No: 002, Rev. 03



	the ER sheet are correct.
If applicable, has the reported data been cross-checked with other available data?	Yes, the reported data was crosschecked with the daily log sheets during the onsite verification. The reported data in the ER sheet is confirmed to be appropriate.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	<p>Yes. The verification team, based on the document review and onsite verification, confirms that the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and necessary QA/QC procedures are in place.</p> <p>Further description of the monitoring management is provided at the end of the section 4.1.3.</p>

Verification / Assessment of Data/Parameters	
Data / Parameter (as per monitoring plan in the PDD):	<p>FR_{f,inlet}</p> <p>Biogas flow rate at flare inlet</p> <p>Data unit: m³/hour</p>
Measuring / recording / reporting frequency:	<p>The parameter was measured continuously with a gas flow meter. The values are continuously transferred online and recorded. The cumulative value of the parameter (or totalised value) is always displayed on the meter screen and also on the SCADA system. The totalised reading is recorded manually from the meter by the operator everyday into the log sheet and submitted to the biogas supervisor. The Supervisor conducts quality check of the recorded data, updates it into monitoring database and generates monitoring reports on monthly basis. The monitoring data is reported to the Plant Manager on a monthly basis.</p>
Is measuring / recording / reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	<p>Yes. As per the monitoring plan the monitoring frequency is "continuously" and as per the applied monitoring methodology the recording frequency is "continuously". The methodology further states 'parameter is monitored continuously but aggregated annually for calculations'. The verification team can confirm based on onsite verification and monitoring records that the parameter was monitored in line with the requirements of the applied methodology and the monitoring plan.</p>

Verification and Certification Report

GLC Report No: 002, Rev. 03



Verification of data generation, recording and reporting:	<p>GLC's verification team observed during the on onsite verification that a biogas flow meter was installed on the biogas pipeline before the flare. The verification team also checked the meter display and observed that the totalised value is appropriately indicated. It is also confirmed from the onsite interviews that the value is continuously transferred online and recorded through SCADA system. Besides, it is manually recorded by the operator into log sheets every day.</p> <p>The log sheets are submitted to the biogas supervisor on daily basis and the supervisor conducts quality check of the data and updates the data into electronic spreadsheets (monitoring records). The monitoring records are printed and submitted to the plant manager on monthly basis for approval. The approved monitoring records by the plant manager are stored in hard format. The verification team checked the reported data with the monthly monitoring records and found that the reported data was appropriate. A copy of the electronic data sheets were also submitted to the verification team by the PP.</p> <p>It shall be noted that the monitoring equipment automatically corrects for temperature and pressure to indicate the flow rate in Nm³/hour. It also displays the cumulative flow in Nm³.</p> <p>Therefore, the verification team confirms that the data generation, recording and reporting are appropriate.</p>
Type of monitoring equipment:	<p>The details of the monitoring equipment as checked during the onsite verification are as below:</p> <p>Type: Thermal Mass Flow meter Make: FOX Thermal Instruments, Inc Model: FT2 Serial No: 6510 Tag No: FTBG005 Accuracy: +/- 1.0% ^{/22/}</p>
Is accuracy of the monitoring equipment as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good	<p>Yes, the monitoring plan states the accuracy as +/-1% of reading. The verification team confirms that the monitoring equipment possesses good accuracy.</p>

Verification and Certification Report

GLC Report No: 002, Rev. 03



monitoring practise?	
Calibration frequency /interval:	The calibration of the meter was conducted on the following dates ^{/26/} : 2008-08-21 2010-10-01
Is the calibration interval in line with the monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practise?	The monitoring plan of the PDD states the minimum re-calibration interval is 2 years. From the above mentioned calibration dates, it is understood that there is a slight delay in re-calibration.
Company performing the calibration:	The calibration was conducted by Miracle International Technology Co., Ltd., Bangkok
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Though the monitoring equipment was found functioning, the error identified during the calibration on 2010-10-01 was 3%.
Is (are) calibration(s) valid for the whole reporting period?	As mentioned above, there was a delay in calibration of the monitoring equipment. Therefore, PP applied the error conservatively in accordance with Para 282-284 of VVS (version 07.0) ^{/1/} . Please refer to Table 4-5 below for further assessment on conservative approach followed due to delay in calibration.
Verification of data aggregation and calculation:	<p>Monthly aggregate value has been mentioned in the emission reduction calculation spread sheet (ER sheet)^{/5/} submitted along with the monitoring report (MR)^{/4/}.</p> <p>The reported values of the parameter were verified with the monthly monitoring records (electronic spreadsheets) that contain daily values of the parameter. The data aggregation is confirmed to be correct. The total measured value of the parameter for the monitoring period is 845,878 Nm³.</p> <p>The calculation was transparently provided by the project participant (PP) in the ER sheet and submitted to GLC along with the MR. The calculation has been reproduced by the verification team and all the formulae have been verified with the PDD and the applied methodology.</p> <p>The verification team can, therefore, confirm that the calculation is appropriate and correct.</p>
How were the values in the monitoring report	The values reported in the monitoring report ^{/4/} and the

Verification and Certification Report

GLC Report No: 002, Rev. 03



verified?	corresponding ER sheet ^{5/} were verified with the monthly monitoring records approved by the plant manager. It is confirmed that the values reported in the final MR and the ER sheet are correct.
If applicable, has the reported data been cross-checked with other available data?	Yes, the reported data was crosschecked with the daily log sheets during the onsite verification. The reported data in the ER sheet is confirmed to be appropriate.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	<p>Yes. The verification team, based on the document review and onsite verification, confirms that the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and necessary QA/QC procedures are in place.</p> <p>Further description of the monitoring management is provided at the end of the section 4.1.3.</p>

Assessment of $T_{comb,f}$ (fraction of time gas is combusted in the flare):

The parameter is measured based on the readings of gas flow meter installed to monitor $FR_{f,inlet}$ (Biogas flow rate at flare inlet) assessed above. The gas flow to the flare is controlled by a pressure control system. If gas flow to the boiler is stopped, pressure in biogas storage bag will raise. If this pressure exceeds a certain level, a signal is sent to gas blower which switches on gas pumping to the flare.

As assessed above, the parameter $FR_{f,inlet}$ is continuously measured and transferred online. The readings are captured every minute by the SCADA system and stored in soft format. Therefore, fraction of time gas is combusted in the flare ($T_{comb,f}$) in minutes is determined based on the online recorded data of $FR_{f,inlet}$. The parameter is further calculated in hours. The verification team confirms that the reported values of the parameter $T_{comb,f}$ in the ER sheet are correct based on the verification of monitored data for $FR_{f,inlet}$.

Assessment of $PE_{flare,y}$ (Project emissions from flaring of the residual gas stream in year y):

The parameter is calculated based on the above assessed parameters $FR_{f,inlet}$, $P_{CH4,bio}$, and $T_{comb,f}$ and the default parameters (density of methane, efficiency of flare and GWP of methane). The verification team upon reviewing the ER sheet confirms that the calculation is correct.

It is also confirmed based on onsite verification that an open flare was installed. As per the tool to calculate project emissions from flaring, "in the case of open flares, the flare efficiency in the minute m is 50% when the flame is detected in the minute m , otherwise the flare efficiency is 0%". Though the flare was determined to be operational, the flame detection was not monitored sufficiently. Therefore, in response to a CAR (please refer to Annex A), the PP considered the flare efficiency as 0% and calculated the project emissions conservatively. The approach is deemed appropriate.

Verification / Assessment of Data/Parameters

Verification and Certification Report

GLC Report No: 002, Rev. 03



Data / Parameter (as per monitoring plan in the PDD):	FR_{e,inlet} Flow rate of the biogas entering the heat generation equipment Data unit: m ³ /year
Measuring / recording / reporting frequency:	The parameter was measured continuously with a gas flow meter. The values are continuously transferred online and recorded. The cumulative value of the parameter (or totalised value) is always displayed on the meter screen and also on the SCADA system. The totalised reading is recorded manually from the meter by the operator everyday into the log sheet and submitted to the biogas supervisor. The Supervisor conducts quality check of the recorded data, updates it into monitoring database and generates monitoring reports on monthly basis. The monitoring data is reported to the Plant Manager on a monthly basis.
Is measuring / recording / reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes. As per the monitoring plan the monitoring frequency is "continuously" and as per the applied monitoring methodology the recording frequency is "continuously". The methodology further states 'parameter is monitored continuously but aggregated annually for calculations'. The verification team can confirm based on onsite verification and monitoring records that the parameter was monitored in line with the requirements of the applied methodology and the monitoring plan.
Verification of data generation, recording and reporting:	GLC's verification team observed during the on onsite verification that biogas flow meters were installed on the biogas pipelines that feed boilers. It was observed during the onsite verification that there were two boilers for CPO (Boiler 2 and Boiler 3) and two boilers for Refinery sections (RF1 and RF2). A common gas flow meter was installed for CPO boilers; however Boiler 2 was not working. Separate gas flow meters were installed each for RF1 boiler and RF2 boiler. Therefore, in total 3 gas flow meters together measure the parameter FR_{e,inlet} (flow rate of the biogas entering the heat generation equipment). The verification team also checked the meter display and observed that the totalised value is appropriately indicated. It is also confirmed from the onsite interviews that the value is continuously transferred online and recorded through SCADA system. Besides, it is manually recorded by the operator into log sheets every

Verification and Certification Report

GLC Report No: 002, Rev. 03



	<p>day.</p> <p>The log sheets are submitted to the biogas supervisor on daily basis and the supervisor conducts quality check of the data and updates the data into electronic spreadsheets (monitoring records). The monitoring records are printed and submitted to the plant manager on monthly basis for approval. The approved monitoring records by the plant manager are stored in hard format. The verification team checked the reported data with the monthly monitoring records and found that the reported data was appropriate. A copy of the electronic data sheets were also submitted to the verification team by the PP.</p> <p>It shall be noted that the monitoring equipment automatically corrects for temperature and pressure to indicate the flow rate in Nm³/hour. It also displays the cumulative flow in Nm³.</p> <p>Therefore, the verification team confirms that the data generation, recording and reporting are appropriate.</p>
Type of monitoring equipment:	<p>The details of the monitoring equipment as checked during the onsite verification are as below:</p> <p>For CPO boiler:</p> <p>Type: Thermal Mass Flow meter Make: FOX Thermal Instruments, Inc Model: FT2 Serial No: 7714 Tag No: FTBG006 Accuracy: +/- 1.0% ^{/22/}</p> <p>For RF1 boiler:</p> <p>Type: Thermal Mass Flow meter Make: FOX Thermal Instruments, Inc Model: FT2 Serial No: 7715 Tag No: FTBG007 Accuracy: +/- 1.0% ^{/22/}</p> <p>For RF2 boiler:</p>

Verification and Certification Report

GLC Report No: 002, Rev. 03



	<p>Type: Thermal Mass Flow meter</p> <p>Make: FOX Thermal Instruments, Inc</p> <p>Model: FT2</p> <p>Serial No: 6509</p> <p>Tag No: FTBG008</p> <p>Accuracy: +/- 1.0% ^{/22/}</p>
Is accuracy of the monitoring equipment as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practise?	Yes, the monitoring plan states the accuracy as +/-1% of reading. The verification team confirms that the monitoring equipment possesses good accuracy.
Calibration frequency /interval:	<p>The calibration of all the three meters was conducted on the following dates ^{/27/}:</p> <p>2008-08-22</p> <p>2009-06-25</p> <p>2010-10-01</p>
Is the calibration interval in line with the monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practise?	The monitoring plan of the PDD states the minimum re-calibration interval is 2 years. From the above mentioned calibration dates, it is understood that the calibration was conducted on time.
Company performing the calibration:	The calibration was conducted by Miracle International Technology Co., Ltd., Bangkok ^{/27/}
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes, it is confirmed from the review of the calibration reports that the monitoring equipment was found functioning properly.
Is (are) calibration(s) valid for the whole reporting period?	Yes, the calibrations are valid for the whole monitoring period.
Verification of data aggregation and calculation:	<p>Monthly aggregate value has been mentioned in the emission reduction calculation spread sheet (ER sheet)^{/5/} submitted along with the monitoring report (MR)^{/4/}.</p> <p>The reported values of the parameter were verified with the monthly monitoring records (electronic spreadsheets) that contain daily values of the parameter. The data aggregation is confirmed to be correct. The total measured value of the parameter for</p>

Verification and Certification Report

GLC Report No: 002, Rev. 03



	<p>the monitoring period is 5,090,900 Nm³.</p> <p>The calculation was transparently provided by the project participant (PP) in the ER sheet and submitted to GLC along with the MR. The calculation has been reproduced by the verification team and all the formulae have been verified with the PDD and the applied methodology.</p> <p>The verification team can, therefore, confirm that the calculation is appropriate and correct.</p>
How were the values in the monitoring report verified?	<p>The values reported in the monitoring report^{4/} and the corresponding ER sheet^{5/} were verified with the monthly monitoring records approved by the plant manager. It is confirmed that the values reported in the final MR and the ER sheet are correct.</p>
If applicable, has the reported data been cross-checked with other available data?	<p>Yes, the reported data was crosschecked with the daily log sheets during the onsite verification. The reported data in the ER sheet is confirmed to be appropriate.</p>
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	<p>Yes. The verification team, based on the document review and onsite verification, confirms that the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and necessary QA/QC procedures are in place.</p> <p>Further description of the monitoring management is provided at the end of the section 4.1.3.</p>

Assessment of FR_{e,s} (Flow rate of the heat generation equipment stack gases) and P_{CH₄,e,s} (Methane content in stack gas of heat generation stack gases):

The two parameters were measured as part of environmental monitoring and reported to Department of Industry half-yearly. The parameters were measured by a certified third party company, Advanced Thai Testing Co., Ltd.^{36/} The reports provided by the company were submitted to the verification team and the values were mentioned in the ER sheet by the PP. The PP revised the monitoring plan with reference to monitoring frequency for these two parameters. The monitoring plan was revised in the PDD along with the post registration changes (PRC) and the revised PDD was approved by the EB on 2014-12-28. Monitoring of these two parameters is confirmed to be in accordance with the approved revised PDD. As assessed in the validation opinion of PRC it is deemed appropriate for the following reasons:

1. The continuous measurement of stack gas emissions requires huge financial effort for the installation of flow meter with the radius of the stacks of the boilers

Verification and Certification Report

GLC Report No: 002, Rev. 03



2. The combustion efficiency of boilers using gaseous fuel is close to 100%. (It was also clarified by small scale working group that combustion efficiency of heat / electricity generation equipment can be considered 100% for small scale projects. Though the project is not a small scale project, the technical reason is still valid)
3. The determination of project emissions from the stack gas of heat generation equipment is deemed conservative, because only a small percentage of combusted material is biogas in the boilers and the remaining is baseline fuel (biomass). The chance of incomplete combustion of biomass is more compared to biogas. Therefore the methane content in the stack gas results in higher project emissions.

Assessment of $T_{comb,e}$ (Fraction of time gas is combusted in the heat generation equipment):

The parameter is measured based on the readings of gas flow meter installed to monitor $FR_{e,inlet}$ (Flow rate of the biogas entering the heat generation equipment) assessed above. The gas flow meters measure and transfer the data online continuously. The SCADA system records the data every minute. Therefore, the parameter in hours per year is determined based on the data signals of gas flow meter to CPO boiler (serial no. 7714). The verification team confirms that the reported values of the parameter $T_{comb,e}$ in the ER sheet are correct based on the verification of monitored data for $FR_{e,inlet}$. The technical expert of the assessment team is of the opinion that the combustion efficiency of boilers for gaseous fuels is closed to 100%.

Assessment of E_{Gy} (Amount of electricity in the year y that would be consumed at the project site in the absence of the project activity):

The parameter should be taken from the historic consumption before implementation of the project activity. The historic consumption was determined as 78.225 MWh; nevertheless, it is assumed as zero for the sake of emission reduction calculation as mentioned in the PDD. Therefore, the emission reduction has not been accounted for baseline electricity consumption at the project site in order to be conservative during the monitoring period. The approach is deemed appropriate. Therefore, no further assessment is required in this regard.

Assessment of NCV_BG (Net calorific value of biogas (dry)):

The parameter is used to determine HG_{BI} (Quantity of [additional] thermal energy that would be consumed in year y at the project site in the absence of the project activity (MJ) using fossil fuel). The parameter is a default value of 23 MJ/m³ which was determined by PTT Public Limited Company. The same value was used for ex-ante calculation (please refer to Table 9 of the PDD). It is deemed appropriate to consider 23 MJ/m³ as NCV of biogas.

Assessment of T_{FI} (Temperature of Flare):

The PP informed during the onsite interviews that an S type thermocouple was installed to monitor flare temperature. However, it was acknowledged that the parameter was not recorded properly during the monitoring period. Therefore, the project emissions from flaring have been calculated conservatively by assuming the flare efficiency as zero. The ER calculation is deemed conservative.

Verification and Certification Report

GLC Report No: 002, Rev. 03



Thus GLC confirms that

- the monitoring activities comply with the monitoring plan of the approved revised PDD;
- all parameters that are baseline, project and leakage emission parameters are monitored as described in the monitoring plan;
- the frequency of monitoring and the accuracy of the measurement equipments are in line with the monitoring plan.

Monitoring management and QA/QC procedures:

All the roles and responsibilities for monitoring and reporting have been clearly defined. The organisation chart, QA/QC procedures and Roles & Responsibilities provided in the MR were checked during the verification site visit and found to be correct.

The PP developed a procedure for monitoring and reporting of various parameters. The monitoring procedures were verified during the site visit. It was understood from the monitoring procedures and the interview with the operating team that the data is collected by the trained operators and recorded in the log sheets under the supervision of respective heads of department. The recorded data is checked by the Supervisor and reported to the Plant Manager. The approved log sheets^{21/} are filed and stored. Once the log sheet data is checked and approved by the Supervisor, the data is also transferred into electronic format (excel sheets). The electronic files are printed on monthly basis and reported to the Plant Manager. The Plant Manager checks the data and approves the monthly reports. The approved monthly records are stored in separate files in hard and soft format.

The approved log sheets (signed by the Operator and the Supervisor) and approved monthly reports (signed by the Supervisor and the Plant Manager) are stored separately. Both sets of data were presented to the verification team during the onsite verification. Besides, the data in electronic format is primarily stored in the biogas plant computer on a daily basis and backed up into external hard disk on monthly basis. The operating team answered during the onsite interviews that the data would be stored for 2 years after the end of the crediting period or the last issuance whichever would be later.

It was assessed that regular training programmes on safety, operation and maintenance of the wastewater treatment plant are conducted on-site. Some of the operating team members were also sent for trainings organised by Industrial Factory Department, Technology Promotion Association (Thailand – Japan), etc. Copies of the job descriptions and all training records have been provided to the verification team^{37/}. The verification team interviewed the plant's operating team (i.e. staff of wastewater treatment plant) during the on-site assessment. The team was found to be technically competent with respect to project operation, maintenance, safety and monitoring of parameters.

Though the monitoring parameters are recorded manually in log sheets, the parameters such as wastewater flow, biogas generation, biogas sent to boilers, biogas sent to flare and electricity

Verification and Certification Report

GLC Report No: 002, Rev. 03



consumption are measured continuously with appropriate measuring equipment. The meters always display the totalised value which is recorded by the operators in the log sheets. Therefore, any doubtful reading could easily be crosschecked with the totalised value. The COD values are analysed under the supervision of experienced QC Supervisor. Furthermore, all the measuring equipments possess good level of accuracy.

It is worth to note that for any calibration delay over defined calibration frequency, PP has applied the error and calculated the measured values so as to result in conservative estimation of emission reduction. The information and the calculation have been transparently provided in the final version of the ER sheet. It is confirmed that the PP has applied maximum permissible error or the error identified during the calibration whichever was higher. The approach is confirmed to be correct according to Para 282 – 284 of VVS (version 07.0)^{/1/}.

Hence, the verification team is of the opinion that the monitoring management system and QA/QC procedures reflect good practice. From the review of validation report^{/3/}, it is confirmed that there are no open or pending issues.

Upon successful closure of the raised CARs and based on the on-site observations and the reviewed project documentation, the verification team confirms that there are no remaining non-conformities related to the application of the monitoring plan and no further improvements in terms of monitoring or reporting are needed. Moreover GLC also confirms that as per the latest version of the Monitoring Report, no mistakes or mismatches have been made in applying assumptions, data or calculations of emission reductions which would impair the estimate of emission reductions. As a conclusion, GLC thus confirms that the project implementation, as per the PDD, is correct and transparent.

It can be confirmed from the onsite verification that the monitoring management and monitoring procedures followed during the monitoring period are in accordance with the monitoring plan description provided in section B.7.2 of the approved revised PDD. The procedures related to Monitoring management, Data storage and filing, Roles and responsibilities, Emergency procedures for the monitoring system and Uncertainty in data were fully complied with. Description of the monitoring system has been transparently and correctly provided in section C of the monitoring report^{/4/}.

Addressing the calibration delay of monitoring equipment and accounting the error in conservative manner is assessed in the below table.

Table 4-5: Delayed calibrations

Parameter	Parameter Description	Measured value	Maximum permissible error	Error identified during delayed calibration	Comment
F _{Dig} F _{Dig,out}	Flow rate of organic wastewater into the digester	227,004 m ³	± 1.0% ^{/22/}	0.15% during Sept. 2009 and 3.9% during Oct. 2009 ^{/20/}	The calibration dates were: 2008-09-15 2009-09-17 2010-10-01

Verification and Certification Report

GLC Report No: 002, Rev. 03



Parameter	Parameter Description	Measured value	Maximum permissible error	Error identified during delayed calibration	Comment
					<p>In the emission reduction calculation spreadsheet (ER sheet), monthly values are presented although daily values are provided in separate excel documents. Therefore, since the error identified during Sept 2009 calibration is lower than the maximum permissible error, 1% maximum permissible error^{/2/} was applied for the measured values from March 2009 to September 2009 (including both months) conservatively. Similarly, the identified error of 3.9% during Oct 2010 calibration was applied from April 2010 to August 2010. It was transparently presented in separate columns in the ER sheet ^{/5/}.</p> <p>It shall be noted that the parameter is used to calculate both baseline emissions (by COD approach) and project emissions. The baseline emissions are estimated by two approaches; COD approach and Biogas approach. It was noticed from the ER calculation that the baseline emissions by COD approach are higher (76,019 tCO₂e) compared to biogas approach (48,410 tCO₂e). The baseline emissions by biogas approach are considered as per the methodology. Therefore, the calibration error does not have any impact on baseline emissions, but on project emissions. Therefore, the error has been added to the measured values as transparently presented in the ER sheet in order to determine the project emissions.</p> <p>While the measured value of the parameter is 227,004 m³, the value considered to determine project emissions is 230,802 m³.</p> <p>The approach is deemed appropriate and conservative.</p>
P _{CH4,bio}	Biogas CH ₄ content at digester	48.2%	± 2% ^{/2/}	<1% ^{/29/}	The calibration dates were: 2008-10-21

Verification and Certification Report

GLC Report No: 002, Rev. 03



Parameter	Parameter Description	Measured value	Maximum permissible error	Error identified during delayed calibration	Comment
	outlet				<p>2010-09-21</p> <p>The PP has applied the maximum permissible error of 2% as stated in the monitoring plan in order to be conservative for the whole monitoring period. Since the parameter would affect the baseline emissions mainly, the error has been deducted from the measured value.</p> <p>While the average measured value of the parameter for the monitoring period is 48.2%, the value applied for baseline emissions is 47.2% and the value applied for project emissions due to flare is 53.2%. The assessment team confirms that the approach results in conservative emission reductions.</p>
FR _{f,inlet}	Biogas flow rate at flare inlet	845,878 Nm ³	± 1.0% ^{/22/}	8.97% ^{/26/}	<p>The calibration dates were:</p> <p>2008-08-21</p> <p>2010-10-01</p> <p>The verification team confirms that the identified error of 8.97% was applied for the period from March 2009 to August 2010 (i.e. for the whole monitoring period as the biogas was not flared during February 2009). Since the parameter is used to calculate the project emissions from flaring, the error was added conservatively. It is transparently presented in the ER sheet ^{/5/}.</p> <p>While the measured value of the parameter is 845,878 Nm³, the value considered for project emissions is 921,753 Nm³.</p>

4.1.4 Assessment of Data and Calculation of Emission Reductions

The document review and the site visit revealed that a complete set of data for the specified monitoring period is available. The correctness of information provided in the monitoring report^{/4/} has been verified

Verification and Certification Report

GLC Report No: 002, Rev. 03



by crosschecking with other sources such as log books^{/21/}, calibration reports^{/23...31/}, COD analysis reports by external laboratory^{/15/}, equipment specifications^{/22/}, etc. Besides, monthly plant reports approved by the Plant Manager were also checked for consistency of the data^{/14/}. Default values (parameters validated ex-ante) are used as mentioned in the PDD. All the parameters required to calculate the baseline and project emissions were monitored appropriately as assessed in section 4.1.3 above.

The verification team observed some inconsistencies and some errors in the webhosted MR and draft ER sheet initially submitted to the verification team. Therefore, the GLC's verification team raised CARs and CLs as relevant and provided to PP for resolving. As assessed in Annex A of this report, it is confirmed that all the CARs and CLs were appropriately addressed by the PP. Therefore, the CARs and CLs were successfully closed. It is confirmed that the information reported in the final version of the MR and the corresponding ER sheet is correct.

By checking publicly available sources it was verified that the applied emission factors, IPCC default values^{/7/} and other reference values were applied correctly. It is confirmed that the fixed values reported in section B.6.2 of the PDD were correctly applied in the calculation of emission reduction. The fixed ex-ante parameters were correctly reported in section D.1 of the final MR^{/4/}.

The emission reduction due to methane capturing and utilisation in onsite boilers was correctly calculated by measuring the required parameters using appropriate monitoring equipment. The formulae described in the applied methodology (AM0013, version 04)^{/10/} and the approved revised PDD^{/2/} were correctly used to calculate the baseline and project emissions. The emission reductions were calculated as the difference of baseline emissions and project emissions as there were no leakage emissions associated with the project activity.

As per the PDD, $ER_y = BE_y - PE_y$

Where:

ER_y : Emission reductions in the year "y" (tCO₂e).

BE_y : Baseline emissions in the year "y" (tCO₂e).

PE_y : Project activity emissions in the year "y" (tCO₂e).

$$\begin{aligned} BE_y &= BE_{\text{lagoon},y} + BE_{\text{heat},y} \\ &= \text{MIN} \{ BE_{\text{lagoon,theoretical},y} : BE_{\text{lagoon,monitored},y} \} + BE_{\text{heat},y} \end{aligned}$$

Where,

$BE_{\text{lagoon},y}$: Lagoon baseline emissions

$BE_{\text{heat},y}$: Baseline emissions from thermal energy displacement

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

1. Baseline methane emission less the physical leakage, " $BE_{\text{lagoon,theoretical},y}$ ", and

Verification and Certification Report

GLC Report No: 002, Rev. 03



2. Actual methane captured and flared/used for energy generation, "BE_{lagoon,monitored, y}"

Lagoon Baseline Emissions – theoretical:

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 (Bo) and a methane conversion factor (MCF) that expresses what proportion of the effluent would be anaerobically digested in the open lagoons:

$$\begin{aligned}\text{CH}_4 \text{ emissions} &= \text{Total COD}_{\text{available,m}} \times \text{Bo} \times \text{MCF}_{\text{baseline}} \\ &= 3\,619\,961 \text{ kg CH}_4\end{aligned}$$

In line with AM0013 (version 04), the total baseline CH₄ emissions are translated into CO₂ equivalent emissions by multiplying by its global warming potential (GWP) of 21

$$\begin{aligned}\text{BE}_L &= 76\,019 \text{ t CO}_2\text{e} \\ \text{BE}_{\text{lagoon,theoretical,y}} &= \text{BE}_L - \text{PE}_{\text{leakage digester}} \\ &= 69\,734 \text{ t CO}_2\text{e}\end{aligned}$$

Lagoon Baseline Emissions – monitored:

$$\begin{aligned}\text{BE}_{\text{lagoon, monitored,y}} &= (\text{BE}_{\text{biogas,boiler,y}} + \text{BE}_{\text{biogas,flare,y}}) - \text{PE}_{\text{flare}} \\ &= 48\,410 \text{ t CO}_2\text{e}\end{aligned}$$

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:

$$\text{BE}_{\text{heat}} = \text{HG}_{\text{Bl,y}} \times \text{CEF}_{\text{Bl,therm,y}}$$

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 CO₂ emissions intensity for thermal energy generation (tCO₂ e/MJ).

$$\begin{aligned}\text{BE}_{\text{heat}} &= 14.93 \text{ TJ} \times 77.37 \text{ tCO}_2 / \text{TJ} \\ &= 1\,155 \text{ t CO}_2\text{e}\end{aligned}$$

The actual methane captured and flare used for energy generation (BE_{lagoon,monitored,y}) is lower and therefore it has been taken as baseline methane emission from open lagoon.

Verification and Certification Report

GLC Report No: 002, Rev. 03



$$BE_{\text{lagoon}, y} = BE_{\text{lagoon,monitored}, y} = 48\,410 \text{ t CO}_2\text{e}$$

Therefore, total baseline emissions are:

$$\begin{aligned} BE_y &= BE_{\text{lagoon}, y} + BE_{\text{heat}, y} \\ &= 48\,410 \text{ t CO}_2\text{e} + 1\,155 \text{ t CO}_2\text{e} \end{aligned}$$

$$BE_y = 49\,565 \text{ t CO}_2\text{e}$$

Similarly, project emissions are calculated as below:

$$PE_y = PE_{\text{lagoon}, y} + PE_{\text{leakage_digester}, y} + PE_{\text{flare}, y} + PE_{\text{stack}, y} + PE_{\text{elec/heat}, y} + PE_{\text{sludge}, y} + PE_{\text{dewatering}, y}$$

Where,

PE_y	Project activity emissions in the year "y" (tCO ₂ e)
$PE_{\text{lagoon}, y}$	Methane emissions from lagoon in year "y"
$PE_{\text{leakage_digester}, y}$	Physical leakage from digesters in the year "y"
$PE_{\text{flare}, y}$	Emissions from flare operation in year "y"
$PE_{\text{stack}, y}$	Stack emissions of energy use generation in year "y"
$PE_{\text{elec/heat}, y}$	Emissions from heat use and electricity use due to the project activity in year "y"
$PE_{\text{sludge}, y}$	Emissions from land application of sludge in year "y"
$PE_{\text{dewatering}, y}$	Emissions from wastewater removed in the dewatering process in year "y"

Total project emissions have been determined as **14 671 tCO₂e**.

The calculation is transparently presented by the PP in the ER sheet^{5/}. The emission reduction calculation is confirmed to be correct.

4.2 Post Registration Changes

This assessment:

- ☒ Does not include any post registration changes and therefore this section is not applicable to this project activity.
- ☐ Includes changes as part of the request for issuance. The assessment of the changes is done in a separated document.

Verification and Certification Report

GLC Report No: 002, Rev. 03



- ☐ Includes changes that required prior approval of the Board. The assessment of the changes was done in a separated document.

Verification and Certification Report

GLC Report No: 002, Rev. 03



5 VERIFICATION STATEMENT

Germanischer Lloyd Certification GmbH (GLC) has performed the 1st verification of the project: **“Chumporn applied biogas technology for advanced waste water management”**, with regard to the relevant requirements for CDM project activity. The project reduces GHG emissions due to capturing of methane from wastewater treatment through a combination of CSTR and UASB technology and utilising it as a fuel in onsite boilers.

This verification covers the period from 2009-02-09 to 2010-08-31 (including both days).

Chumporn Palm Oil Public Company Limited is responsible for the collection of data in accordance with the approved revised monitoring plan and the reporting of GHG emissions reductions from the project.

It is GLC's responsibility to express an independent verification statement on the reported GHG emission reductions from the project. GLC does not express any opinion on the selected baseline scenario or on the registered PDD.

GLC conducted the verification on the basis of the monitoring methodology AM0013 (version 04)^{/10/}, the approved revised PDD ^{/2/} of the project and the monitoring report^{/4/} dated 2015-02-02. The verification included:

- i) Checking whether the design of the project was implemented and installed as planned and described in the PDD^{/2/};
- ii) Checking whether the provisions of the monitoring methodologies^{/10/} and the monitoring plan in the PDD were consistently and appropriately applied;
- iii) The collection of evidence supporting the reported data;
- iv) Checking whether the installed monitoring equipments were calibrated appropriately.

GLC's verification approach draws on an understanding of the risks associated with reporting of GHG emission data and the controls in place to mitigate these. GLC planned and performed the verification by obtaining evidence and other information and explanations that GLC considers necessary to give reasonable assurance that reported GHG emission reductions are fairly stated.

In GLC's opinion, the GHG emission reductions for the “Chumporn applied biogas technology for advanced waste water management” project as reported in the final version of the Monitoring Report^{/4/} are calculated in a conservative and appropriate manner.

The GHG emission reductions were correctly calculated on the basis of the approved monitoring methodology mentioned above and the monitoring plan contained in the approved revised Project Design Document for the project.

Verification and Certification Report

GLC Report No: 002, Rev. 03



Germanischer Lloyd Certification GmbH herewith confirms that the project has achieved emission reductions in the above mentioned reporting period as follows:

Total emission reductions during the monitoring period:
(from 2009-02-09 to 2010-08-31) 34,893 t CO₂e

Hamburg, 2015-02-11

Markus Weber

Germanischer Lloyd
Certification

Verification and Certification Report

GLC Report No: 002, Rev. 03



6 REFERENCES

Reference	Author: Title, version, date of issue
/1/	CDM-EB: CDM validation and verification standard, (Version 07.0)
/2/	Revised Project Design Document of "Chumporn applied biogas technology for advanced waste water management" (version 10, dated 2014-11-20) approved on 2014-12-28 GLC: Validation opinion on Post-Registration Changes of Registered CDM Project Activity, "Chumporn applied biogas technology for advanced waste water management" (Revision 09, dated 2014-11-24)
/3/	TUV SUD Industrie Service GmbH: Validation report of " Chumporn applied biogas technology for advanced waste water management " (Report No. 703911), dated 2008-07-06
/4/	Draft Monitoring Report (webhosted) of "Chumporn applied biogas technology for advanced waste water management", (version 01, dated 2010-10-31) Final Monitoring Report of "Chumporn applied biogas technology for advanced waste water management", (version 04, dated 2015-02-02)
/5/	Draft Emission Reduction calculation spreadsheet of the project activity for the 1 st monitoring period (version 01, dated 2010-11-08) Final Emission Reduction calculation spreadsheet of the project activity for the 1 st monitoring period, (version 04, dated 2015-02-02)
/6/	Germanischer Lloyd Certification GmbH CDM GHG Services Manual (incl. procedures and forms)
/7/	IPCC: 2006 IPCC Guidelines for National Greenhouse Gas Inventories: work book
/8/	UNFCCC: Kyoto Protocol to the United Nations Framework Convention on Climate Change (1998)

Verification and Certification Report

GLC Report No: 002, Rev. 03



/9/	UNFCCC: Decision 3/CMP. 1 (Marrakesh – Accords)
/10/	CDM-EB: Approved baseline methodology AM0013 (Version 04): "Avoided methane emissions from organic waste-water treatment"
/11/	CDM-EB: Methodological "Tool to determine project emissions from flaring gases containing methane" (Version 1) - EB 28, Annex 13 CDM-EB: Methodological tool "Project emissions from flaring" (Version 02.0.0) – EB 68, Annex 15
/12/	CDM-EB: Monitoring report form (Version 04.0) and Instructions for filling out the monitoring report form (2014-06-25)
/13/	Schneider Electric: Reference Manual of Power Meter 710
/14/	CPI: Monthly monitoring reports containing daily values from February 2009 to August 2010
/15/	Saint Envir Co., Ltd.: Water Analysis Reports for the months from February 2009 to August 2010
/16/	CPI: Organisation Structure with Roles and Responsibilities
/17/	Chumporn weater station data excel spreadsheet (m517201_Chumporn meteo data.xls)
/18/	Weighbridge Inspection Certificate issued by the local government authorities, Certificate date: 2013-02-21
/19/	CPI: SCADA screenshots of biogas monitoring
/20/	GLC: Onsite photographs
/21/	CPI: Daily log sheets of monitoring parameters CPI: Daily reports of biogas monitoring during emergency

Verification and Certification Report

GLC Report No: 002, Rev. 03



/22/	<p><u>Specifications of monitoring equipment</u></p> <p>HACH: Key Specifications of Spectrometers and Colorimeters</p> <p>Yokogawa: User Manual of Magnetic Flow Meter (IM 01E20D01-01E)</p> <p>FOX: User Manual of Thermal Mass Flowmeter & Temperature Transmitter (Model FT2)</p> <p>Geotech: Portable Biogas Analyser</p>
/23/	<p><u>Calibration reports of organic wastewater flow meter (FTBG001) – Serial No. S5H904107 834</u></p> <p>YOKOGAWA: Calibration Certificate dated 2008-09-15 (due date: 2009-09-15)</p> <p>KANES Co., Ltd.: Flow rate measurement accuracy test certificate (Certificate No. F2009-28II) Issued on 2009-09-17</p> <p>Miracle International Technology Co., Ltd.: Calibration Certificate (Certificate No. L1010-23) Issued on 2010-10-08; Calibration date: 2010-10-01</p>
/24/	<p><u>Calibration reports of sludge pond flow meter (FTBG003) – Serial No. S5H904109 834</u></p> <p>YOKOGAWA: Calibration Certificate dated 2008-09-15 (due date: 2009-09-15)</p> <p>KANES Co., Ltd.: Flow rate measurement accuracy test certificate (Certificate No. F2009-28II) Issued on 2009-09-17</p> <p>Miracle International Technology Co., Ltd.: Calibration Certificate (Certificate No. L1010-23) Issued on 2010-10-08; Calibration date: 2010-10-01</p>
/25/	<p><u>Calibration reports of biogas flow meter at digester outlet (FTBG004), Serial No. 6511</u></p> <p>FOX: Calibration Certificate, dated 2008-08-22 (Calibration date: 2008-08-22; due date: 2009-08-22)</p> <p>Miracle International Technology Co., Ltd.: Calibration Certificate (Certificate No. L1010-025) Issued on 2010-10-08; Calibration date: 2010-10-01</p>
/26/	<p><u>Calibration reports of biogas flow meter to flare (FTBG005), Serial No. 6510</u></p> <p>FOX: Calibration Certificate, dated 2008-08-21 (Calibration date: 2008-08-21; due date: 2009-08-21)</p> <p>Miracle International Technology Co., Ltd.: Calibration Certificate (Certificate No. L1010-029) Issued on 2010-10-08; Calibration date: 2010-10-01</p>

Verification and Certification Report

GLC Report No: 002, Rev. 03



/27/	<p><u>Calibration reports of biogas flow meter to boiler (FTBG006), Serial No. 7714</u></p> <p>FOX: Calibration Certificate, dated 2009-06-25 (Calibration date: 2009-06-25; due date: 2010-06-25)</p> <p>Miracle International Technology Co., Ltd.: Calibration Certificate (Certificate No. L1010-026) Issued on 2010-10-08; Calibration date: 2010-10-01</p> <p><u>Calibration reports of biogas flow meter to boiler (FTBG007), Serial No. 7715</u></p> <p>FOX: Calibration Certificate, dated 2009-06-25 (Calibration date: 2009-06-25; due date: 2010-06-25)</p> <p>Miracle International Technology Co., Ltd.: Calibration Certificate (Certificate No. L1010-027) Issued on 2010-10-08; Calibration date: 2010-10-01</p> <p><u>Calibration reports of biogas flow meter to boiler (FTBG008), Serial No. 6509</u></p> <p>FOX: Calibration Certificate, dated 2008-08-22 (Calibration date: 2008-08-22; due date: 2009-08-22)</p> <p>Miracle International Technology Co., Ltd.: Calibration Certificate (Certificate No. L1010-028) Issued on 2010-10-08; Calibration date: 2010-10-01</p>
/28/	<p><u>Calibration reports of portable gas analyser (ATBG003), Serial No. C080801 059</u></p> <p>Wuhan Cubic Optoelectronics Co., Ltd.: Test and calibration report, dated 2008-08-01</p> <p>Techtronic Co., Ltd.: Test and Calibration Report (Report No. C30/09), dated 2009-08-08</p>
/29/	<p><u>Calibration reports of portable gas analyser (ATBG004), Serial No. C081021-074</u></p> <p>Wuhan Cubic Optoelectronics Co., Ltd.: Test and calibration report, dated 2008-10-21 (calibration date: 2008-10-21; due date: 2009-10-21)</p> <p><u>Calibration reports of portable gas analyser (ATBG004), Serial No. 10830</u></p> <p>Binder Group: Calibration report (PO no. B100249) dated 2010-09-21</p>
/30/	<p><u>Calibration reports of temperature sensor of cooling pond (TTBG001)</u></p> <p>KANES Co., Ltd.: Calibration Certificate (Certificate No. F2009-284I); Calibration date: 2008-09-15 (due date: 2009-09-15)</p> <p>Miracle International Technology Co., Ltd.: Calibration Certificate (Certificate No. C1009-584) Issued on 2010-10-07; Calibration date: 2010-09-30</p>

Verification and Certification Report

GLC Report No: 002, Rev. 03



/31/	<p><u>Calibration reports of temperature sensor of flare (TTBG003)</u></p> <p>KANES Co., Ltd.: Calibration Certificate (Certificate No. F2009-286I); Calibration date: 2008-09-15 (due date: 2009-09-15)</p> <p>Miracle International Technology Co., Ltd.: Calibration Certificate (Certificate No. C1011-234) Issued on 2010-11-20; Calibration date: 2010-11-19</p>
/32/	TUV SUD: ISO 9001: 2008 Certificate issued for CPI on 2009-07-02 (valid until 2012-07-01)
/33/	<p>CPI: Field Instrument Calibration Yearly Schedule – Year 2010 approved by the heads of the sections on 2010-10-19</p> <p>CPI: Field Instrument Calibration Monthly Schedule – Year 2010 approved by the heads of the sections on 2010-10-19</p>
/34/	<p><u>Calibration reports of Spectrophotometer (Serial No. 1308841)</u></p> <p>SPC Calibration Centre Co., Ltd.: Certificate of Calibration (Certificate No. C06100224) issued on 2010-11-02; Calibration date: 2010-11-01</p>
/35/	<p><u>Calibration reports of Colorimeter (Serial No. 070790C64568)</u></p> <p>Envi Science Company Limited: Test Report; Date of test: 2008-07-15</p> <p>Envi Science Company Limited: Test Report; Date of test: 2009-05-18</p> <p>Envi Science Company Limited: Test Report; Date of test: 2010-03-23</p> <p>Envi Science Company Limited: Test Report of Preventive Maintenance; Date of test: 2010-10-20</p>
/36/	Advanced Thai Testing Co., Ltd.: Environmental Monitoring Report, 2009-07-24
/37/	<p>CPI: Job Description of operating team</p> <p>CPI: Training records of operating team</p>

Verification and Certification Report

GLC Report No: 002, Rev. 03



ANNEX A: RESOLUTION OF CORRECTIVE ACTION AND CLARIFICATION REQUESTS (LIST OF FINDINGS)

Verification and Certification Report

GLC Report No: 002, Rev. 03



Resolution of Corrective Action and Clarification Requests including list of Forward Action Requests

Description of Finding (CAR, CL, FAR) <i>Describe the finding in a transparent manner i.e. state clearly what is required and why; address the context (e.g. section)</i>	Project Participants Response <i>This section shall be filled by the PP. The finding shall be addressed with suitable arguments and evidence</i>	GLC's Assessment <i>The assessment shall include how the finding is closed i.e. how it is found that the response is assessed to be appropriate and meeting the specific requirement of the finding. In case the response is not satisfactory, additional response and DOE assessments (#2, #3, etc.) shall be sought.</i>	Final Conclusion (OK or OPEN)
<p>CAR 1 (2010-12-22)</p> <p>GLC has carried out a site visit at Chumporn Palm Oil Industry (CPI) for verification of the CDM project. A few differences in the implementation of the project activity compared to the project description provided in section A.4.3 of the registered PDD have been observed as follows :</p> <p>As per the registered PDD,</p> <ol style="list-style-type: none"> 1. Figure 2: wastewater from palm oil factory would be sent to solid trap to remove the solids. However, it was not found implemented as per the registered PDD. 2. The effluent from completely Stirred Tank Reactors (CSTR) digester and effluent from sand 	<p>2011-07-21 (1st round):</p> <p>The registered PDD has been revised according to this finding and is submitted to the verification team for assessment. The DOE is requested to submit the revised PDD to UNFCCC for approval of the changes.</p> <p>1+2) The figure (Fig.2) has been revised according to actual design. Wastewater from the palm oil factory is sent to the cooling ponds, there is no separate solid trap. Solids are not removed from the cooling ponds, but instead by flushes of new waste water it is assured that now sedimentation is occurring and all solids enter the digester. Furthermore the UASB-digesters are included as part of the biogas system. "Sludge pond" has been changed to "Sludge treatment" as it is still the expressed goal of CPI to treat the sludge, but may in the future use a different treatment system. For</p>	<p>2012-02-22 (1st round):</p> <p>The PP has submitted the revised PDD to the verification team.</p> <ol style="list-style-type: none"> 1. OK. Fig-2 is revised to represent the implemented project activity appropriately. The verification team will prepare a validation opinion with reference to the changes and submit to UNFCCC upon addressing all the changes in the PDD in a transparent manner. 2 & 3. Not OK. This is a clear inconsistency in the registered PDD. PP shall address the change in the revised PDD and provide a table in the project description transparently showing the changes from the registered PDD. 	<p>OK</p>

Verification and Certification Report

GLC Report No: 002, Rev. 03



<p>bed filter is further treated in existing open pond system. However, as per the actual site conditions, there are two Upflow Anaerobic Sludge Blanket (UASBs) reactors after CSTRs to further treat the waste water. UASBs were not mentioned in the PDD.</p> <p>3. The wastewater from Crude Palm Oil (CPO) processing and Refinery Process operations (RPO) are treated in the CSTRs. However, it was found only wastewater from the CPO is treated in the CSTRs.</p> <p>4. That the biogas would be utilised in two steam boilers. As per the actual site conditions, biogas is also utilised for other two boilers at Refinery section apart from the two boilers in CPO.</p> <p>5. Dewatering and separation of wastewater and land application of sludge is stated in section B.3 of the PDD. During the site visit, it was found that the sludge is</p>	<p>reasons of consistency Fig. 3 (project boundary) has also be adjusted accordingly.</p> <p>3) It was planned and has been implemented as such that refinery waste water is 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 Tab.8 in the registered PDD). The resulting changes in the potential emission reduction are almost negligible and the essential project activity is not affected.</p> <p>Changes in the PDD for this point are not necessary and possible, as the refinery waste water is not mentioned in the PDD, except in Tab.8 where it serves as an example for historic data about the baseline situation. Refinery wastewater is only mentioned in the</p>	<p>4. Not OK. Excel sheet indicating the true additional costs incurred on the project due to the installation of boilers is required to be submitted to the verification team. PP shall also substantiate how the benchmark applied during the validation is relevant after consideration of the changes that happened after registration of the project activity. It is required that PDD should contain a transparent description of the same. Besides, submit the translated copy of the provided evidences of the project cost for assessment.</p> <p>The CAR is not closed.</p>	
---	--	---	--

Verification and Certification Report

GLC Report No: 002, Rev. 03



<p>stored in the sludge ponds and not sent for land application as on date of the verification site visit.</p> <p>As per the available guidelines EB 48, Annex 66 and 67, these changes have to be notified to UNFCCC and seek the approval. In case of these changes raise concerns with respect to the project scale, baseline situation, applicability of the methodology and/or the additionality of the project, the project should be re-assessed. Hence, the Project Participant (PP) shall make necessary changes in the PDD and submit the revised documents to verification team for assessment.</p>	<p>Appendix 1 (ER calculation spread sheet) where it would be regarded "0".</p> <p>4) Regarding the utilization of biogas, the project was implemented as described in the registered PDD, with biogas utilised in the 2 CPO boilers. In January 2010, the utilisation of biogas in the two high pressure boilers was added to the project activity. Further information have been attached in the separate documents ("CAR01_Explanations on the revised IRR calculation sheet.docx" and "CPI_Appendix 2_Enclosure 1 to reg.PDD_rev.2011-07-19.xls")</p> <p>5) Dewatering and separation of wastewater and land application of sludge is stated in section B.3 of the registered PDD. Whereas it is mentioned in other parts of the PDD that no dewatering of sludge is taking place (e.g. section B.6.1, B.6.2, B.6.3, and B.7.1).</p> <p>To remove this inconsistency (for avoidance of complications of future verifications) and to adjust the descriptions and monitoring procedures to the actual system operation, the</p>		
--	--	--	--

Verification and Certification Report

GLC Report No: 002, Rev. 03



	<p>PDD has been revised as follows:</p> <ul style="list-style-type: none">• Formulas for estimation of project emissions from wastewater removed in the dewatering process are included under section B.6.1 of the revised PDD• Parts which indicate that no dewatering takes place have been revised in the registered PDD. <p>Furthermore a calculation table has been added to the ER calculation sheet to account for project emissions from dewatering (for completeness; all values of sludge, COD, and wastewater from dewatering are "0" for the 1st monitoring period).</p> <p>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. Surprisingly the treatment of solid residues, with the aim to produce dry sludge in working very slow, so that for the first monitoring period no dewatering and land application of sludge was occurring. This can be regarded as a technical problem at project start which the</p>		
--	---	--	--

Verification and Certification Report

GLC Report No: 002, Rev. 03



	<p>project owner is continuously trying to improve.</p> <p>In order to make the generation of sludge more feasible, CPI is planning to install a different solid treatment component in the future (e.g. a bell press). This should guarantee a improved result compared to the original sand beds. Therefore the "sand bed filter" in the original PDD has now been revised to "sludge treatment system" to allow for different technical solutions.</p> <p>Nevertheless it may not be possible to treat the full amount of solids at all time, therefore the project owner has taken provisions to discharge solid residues (which are still highly diluted with >95 % water content) into open ponds and to monitor and account for possibly resulting project emissions from methane generation in these ponds.</p>		
--	--	--	--

Verification and Certification Report

GLC Report No: 002, Rev. 03



	<p>2012-04-16 (2nd round):</p> <p>Issue 2: The changes to the registered PDD have been transparently provided in a track change version. Additionally an overview of the changes are now provided in a separate document ("table of changes to the registered PDD.doc"). The treatment or non-treatment of refinery waste water does not adversely impact the additionality or scale of the project nor the applicability of the methodology, therefore the project proponent request the DOE to accept the changes made in the revised PDD.</p> <p>Issue 3 & 4: As written in the first response to this finding, the revised IRR calculation sheet "CPI_Appendix 2_Enclosure 1 to reg.PDD_rev.2011-07-19.xls" and further information to the calculation ("CAR01_Explanations on the revised IRR calculation sheet.docx") have been submitted to the verification team. The original demonstration of additionality was based on investment analysis; for the demonstration that the prove of additionality of the project is still valid after the changes to the project activity as described in the revised PDD, only the key parameter of the calculation affected by the</p>	<p>2012-06-11 (2nd round):</p> <p>Issue 2: Not OK. In the first response it is stated that the wastewater treatment system may be revised in the future. PP is required to clarify how and why there would be a change in the system is anticipated. If there is a change it is required to be notified to UNFCCC.</p> <p>For the sake of transparency a table indicating the changes made to the PDD is required to be included in section A.2 of the PDD.</p> <p>It is to be noted that as per the earlier response the emission reductions due to RPO wastewater treatment are not considered and the value is taken as '0' in the appendix 1. However, it was found that an emission reduction of 30 tCO₂e is included in the appendix 1 of the submitted PDD. This inconsistency needs to be addressed in the PDD. This would also result in the reduction of estimated emission reductions which are not transparent in either in the PDD or in the ER sheet.</p> <p>Issue 3 & 4: Not OK. There is no clear explanation on the incorporation of gas</p>	
--	---	---	--

Verification and Certification Report

GLC Report No: 002, Rev. 03



	<p>changes were modified. Consequently the same IRR benchmark as for the registered PDD is applicable.</p> <p>The explanations provided to the verifying DOE in the separate document in the 1st finding answer round have now been incorporated in the PDD. Furthermore documented evidence of related cost are provided ("copies of cost for HP boiler", "evidence for changes in cost due to the fuel change")</p> <p>Issue 5 : The proposed actual changes regarding dewatering of sludge do not adversely impact the additionality or scale of the project nor the applicability of the methodology, therefore the project proponent request the DOE to accept the changes made in the revised PDD.</p>	<p>engine in the project activity description.</p> <p>Sensitivity analysis is not found illustrated in the submitted IRR sheet.</p> <p>It is required to demonstrate how the project scale, baseline applicability conditions of the methodology are not affected by the changes made to the project activity.</p> <p>The impact of post-registration changes made to the registered PDD needs to be transparently described w.r.t. project scale and baseline in section B.4 and additionality in section B.5.</p> <p>As illustrated in the submitted PDD, PP has invested in the gas engine after the project's registration. It is not clear how the calculated benchmark during the validation is relevant for the investment made after its registration. PP is required to demonstrate the conservativeness of the benchmark w.r.t. the post-registration changes.</p> <p>It is noted that the figure presented in section B.3 on the project boundary does not include the thermal energy utilities and the gas engine which are required for the sake of transparency.</p> <p>Issue 5: Though it is stated that the sludge</p>	
--	--	---	--

Verification and Certification Report

GLC Report No: 002, Rev. 03



		<p>treatment system includes a new bell process, it is not clear whether it is implemented or in the planning stage. It has to be noted that all the post –registration changes observed during the site visit need to be transparently presented in the revised PDD. Nevertheless, inclusion of bell process is not informed to the verification team during the site visit.</p> <p>This finding would be closed upon the adequate addressing of all the above referred points.</p> <p>The CAR is open</p>	
	<p>2014-09-30 (3rd round):</p> <p>Issue 2: The first response said that the system to treat the sludge (meaning sludge produced during the treatment of waste water in the biogas digesters), may in the future be different. This does not mean that the wastewater treatment system (the biogas system) is planned to undergo changes. Reasons for this statement are the difficulties with the current sludge treatments system as explained under point 5 of the first response. So far the sludge treatment system is the same status as verified</p>	<p>2014-10-01 (3rd round):</p> <p>Issue 2: Verification team acknowledges the fact that the wastewater treatment system faced difficulties during implementation. In order to treat the wastewater, it is anticipated that PP may install a new system later. Such changes to the registered or revision to the approved PDD would be notified to the UNFCCC as part of post registration changes and will be addressed satisfactorily. However, this change did not occur during the current verification period. Hence, this is acceptable</p>	

Verification and Certification Report

GLC Report No: 002, Rev. 03



	<p>by the DOE during the site visit. Any possible changes, if they should happen at all in the future, will be notified to the UNFCCC. The adjustment made to Fig. 3 (with regard to sludge treatment mentioned in the first response) is the change in wording from "sludge pond" to "sludge treatment".</p> <p>For the sake of transparency a table indicating the changes made to the PDD has been included in "Appendix 6. Summary of post registration changes" of the PDD.</p> <p>The emission reduction of 30 tCO₂e included in the appendix 1 of the submitted PDD have now been removed in this section, together with the whole tables for baseline and project emissions from RPO wastewater treatment.</p> <p>The resulting decrease of estimated emission reductions is now also addressed in other parts of the PDD and in the revised registered ER sheet (Appendix 1_Enclosure to reg.PDD_CPI_rev) and has never been included in the actual used and submitted ER calculation sheet.</p> <p>Issue 3 &4 :</p> <p>The PDD has been revised to reflect changes</p>	<p>to the verification team.</p> <p>A revised PDD mentioning all the changes in Appendix 6 in a transparent manner has been submitted to GLC's verification team. It is confirmed that the revised PDD sufficiently addresses all the changes and therefore is deemed appropriate.</p> <p>Thus, the issue 2 is considered to be closed.</p>	
--	--	---	--

Verification and Certification Report

GLC Report No: 002, Rev. 03



	<p>in the project activities with relevance to the 1st monitoring period under verification and status of the site audit. Possible later changes will be notified to the UNFCCC at the time of future verifications; therefore the DOE is being asked to assess the project activity with status of the site audit. Possible incorporation of gas engine in the project activity is not relevant for the monitoring period here under verification.</p> <p>The figure 3 in section B.3 on the project boundary includes "Energy conversion units for thermal power", which includes two high pressure boiler in the palm oil refinery and together with the revised description of project technology transparently describes the project activity. A gas engine is not included in the figure for reasons explained above.</p> <p>A sensitivity analysis has been conducted using the scenario that represents the implemented changes to the project activity and it is now illustrated in the submitted IRR sheet and include in the relevant section of the PDD (CPI_Appendix 2_Enclosure 1 to reg.PDD_rev._IRR incl. higher biogas production_v02).</p> <p>References to the possible purchase of a gas engine at the time of verification of the 1st</p>	<p>Issue 3 & 4: As addressed in the issue 1, PP has included all the post registration changes in the PDD.</p> <p>The response addresses the findings adequately. The information related to the gas engine is removed as it is not relevant to the current verification period of the project activity. Hence, this point is closed.</p> <p>All the changes, including the reason for the consumption of the gas in the two high pressure boilers for the requirement of refinery oil operations are deemed appropriate.</p> <p>The additionality along with the sensitivity analysis has been demonstrated in the PDD for the revised scenario. It is confirmed that the revised project IRR is much below the benchmark.</p>	
--	--	--	--

Verification and Certification Report

GLC Report No: 002, Rev. 03



	<p>monitoring period have been removed from the PDD and IRR calculation, since they were only supposed to present the option, but are in fact not relevant for the project situation at that time and were a cause for confusion.</p> <p>With respect to the IRR calculation of the project scenario after implementation of changes, it was agreed to adjust the financial benchmark to the country specific default values) for Thailand: 11.2 %. The main changes in the calculation origin from the increased construction cost compared to the original plan. The inclusion of the HP boiler in the project (by adjustments to have the option to utilize biogas) in the year 2008 (CostEvidentsList_HP boiler to LPG use.xls) has been decided 3 years after the start initial project investment decision. The decision to include the HP boiler was taken with the effect of lifting the project IRR from 1.2 % (actual investment cost with CDM) to 5.0 % (inclusion of HP boilers with CDM, please see scenarios in the PDD, section B.5). Regardless of the IRR benchmark, the project without the inclusion of biogas utilisation in the HP boilers would not even recover investment cost (without CDM) and be of not financial interest (IRR 1.2 %) even with CDM.</p>	<p>It is also deemed appropriate that the benchmark provided in the registered PDD (14.95%) has been revised to default required rate of return (11.2%) provided in the investment analysis guidelines. It is further assessed in the validation opinion submitted to CDM EB for prior approval of changes in the PDD.</p> <p>It is, therefore, confirmed that the issue has been sufficiently addressed by the PP.</p> <p>Issue 5: OK. Kindly refer to issue 1 above.</p> <p>Therefore, the CAR can be considered as closed.</p>	
--	--	--	--

Verification and Certification Report

GLC Report No: 002, Rev. 03



	<p>The impact of post registration changes have been transparently described in section B.5 (additionality). The project is registered under a large scale methodology and therefore does not have any limitations in project size; the scale of the project is therefore not impacted by the post-registration changes.</p> <p>For reasons of conservativeness and avoidance of added complexity the PP has decides not to include emission reduction claims for replacement of fossil fuel in the HP boiler into the project activity and is continuing to only account for methane avoidance. Therefore the baseline constitutes the same options as discussed in the original registered PDD. Nevertheless the activity of heat generation with biogas is covered under the applicability of the baseline methodology (and has actually been applied in the biomass boilers from the beginning of the project).</p> <p>During revision of the PDD to include post registration changes the known increase of biogas production, as monitored in the first monitoring period, has been included as a separate scenario to demonstrate that the additionality of the project is not impacted by this increase.</p>		
--	--	--	--

Verification and Certification Report

GLC Report No: 002, Rev. 03



	<p>Issue 5</p> <p>It has been explained in the first response to CAR1 issue 5 that due to a technical problem at project start, CPI is planning to install a different solid treatment component in the future (e.g. a bell press). This needs to be more understood as an option CPI has been investigating to improve the system for sludge treatment.</p> <p>This possible change in the future is not implemented and therefore not relevant to the 1st monitoring period under verification and status of the site audit. Possible later changes will be notified to the UNFCCC at the time of future verifications.</p>		
<p>CAR 2 (2010-12-22)</p> <p>The following differences in the monitoring parameters compared to the registered monitoring plan (MP) have been observed:</p> <ol style="list-style-type: none"> Monitoring of COD_{c, baseline} is not line with the registered MP. As per the MP, 4 samples per hour, 12 samples per day (weekly same say, same time) are collected for COD measurement. 	<p>2011-07-21</p> <p>1) Due to a misunderstanding of the MP (12 samples per day, weekly same day, were understood as 12 daily samples, every day, and this of all COD sampling point), the PP found it impossible to comply with the MP completely. As a result samples were taken as described in the auditor's findings (CAR 2). As a crosscheck with the own laboratory data, additionally once a month samples were taken and analysed by an external laboratory. According to the</p>	<p>2012-02-22</p> <p>1. Not OK. As per the CDM requirements that the proposed revision of the monitoring plan should not result in the reduction of the accuracy of the registered monitoring plan. Refer to para 217 of latest version of the VVM.</p>	<p>OK</p>

Verification and Certification Report

GLC Report No: 002, Rev. 03



<p>Actually, 2 samples per time mixed together and 2 times a week are collected for COD measurement by internal laboratory. Samples are sent once in a month to an external laboratory.</p> <p>2. Amount of sludge applied to land would be monitored as per the MP. It was understood that no sludge is removed and hence no sludge is applied to land.</p> <p>3. As per the monitoring methodology and monitoring plan, flow rate of organic waste water into digesters (CSTR) is monitored. The installed flow meter reading does not represent the flow rate of waste water into the digesters but indicates the flow rate into cooling ponds from CPO. Cooling ponds are provided before the digesters.</p> <p>Therefore, PP shall provide the reason for the changes in the monitoring plan (MP). It is also required to update the MP</p>	<p>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. Furthermore, due to clarification, the PP has now adjusted the sampling procedure to the description in the registered PDD.</p> <p>2) As described under CAR01, no sludge application was taking place in the 1st monitoring period. Treatment of solid residues from the digester system, which the aim to produce dry sludge is ongoing and not completed.</p> <p>3) For technical reasons the flow meter to monitor the wastewater from the palm oil production, which is to be treated in the new biogas digester system was installed before the cooling pond, which is an integrated part of the biogas system. Measurement of wastewater between the cooling pond and the first biogas digester would be difficult and require a design change of the system. The biogas system by Natural Power Co., Ltd. (Thailand) is designed with free gravity flow. This makes the system very economic (little electricity use) and avoids moving parts (pumps), which need more maintenance and can be broken, causing</p>	<p>2. Not OK. The description provided for the chosen sampling plan is still not clear.</p> <p>3. OK. Based on the technical expert's opinion, the verification team confirms that cooling ponds are part of the project treatment system and it is more appropriate to measure the organic wastewater flow before the cooling ponds.</p> <p>Issue no: 1 & 2 are not closed. Issue no: 3 is closed.</p>	
--	--	---	--

Verification and Certification Report

GLC Report No: 002, Rev. 03



<p>as per the actual implementation in the PDD along with the changes described in CAR 1 above. Address the impact on the quality of emission reductions due to the changes in the MP.</p>	<p>system downtime. These were initial arguments for the project owner deciding for this design. Because of gravity flow design (low flow velocities and low pressure), a flow meter between cooling pond and CSTR digester would need an additional pump, thereby altering the design and eliminate the advantages of the system.</p> <p>The project owner has decided to install the flow meter before the cooling pond, because of low retentions times (approx. 1 day) and little to no influence by the cooling pond.</p> <p>Further information on the climatic balance of Chumporn (evaporation and precipitation effects of the cooling pond) are given in the separate file CAR02_Chumporn Climatic Balance.xls), which demonstrates the very small effect of the cooling pond. If at all the impact of the cooling pond will lead to a slight underestimate of COD into the digester (which is conservative).</p>	<p>The CAR is open</p>	
	<p>2012-04-16 (2nd round)</p> <p>The project proponent does not request a change to the registered monitoring plan with regard to the parameter COD_{c, baseline}. As described in the first response, due to a misunderstanding of the monitoring</p>	<p>2012-06-11 (2nd round)</p> <p>Verification team has noted that the sampling is required at least monthly as per the applied methodology. Hence, the proposed change of sampling plan is acceptable.</p>	

Verification and Certification Report

GLC Report No: 002, Rev. 03



	<p>requirements the project proponent had adopted a different procedure during the first monitoring period and is requesting a deviation of the monitoring plan for this period of time. As written in the first response above, the PP has now adjusted the sampling procedure to the description in the registered PDD.</p> <p>There is no conflict with para 217 of the VVM which is related to "Request for revision of the monitoring plan"</p> <p>The adopted procedure contains more sampling days per week as the original procedure and additional external laboratory sample and analysis. For conservativeness the lower monthly data are used for emission reduction calculation. (The source of conservative COD data are contained in "External&InternalLab_2009-02_2010-09")</p>	<p>Nevertheless, it is contradictory to say that it does not request for a change to the registered MP pertaining to sampling of COD and revising the description of the sampling referred in the registered PDD. If PP does not like to seek the revision of the MP, the explanation provided in the PDD regarding this point should be in line with the registered PDD. PP is required to revise the response and address it transparently.</p> <p>The CAR is not closed.</p>	
	<p>2014-09-30 (3rd round)</p> <p>There has been a little bit of confusion and misunderstanding in previous answers to this finding.</p> <p>The PP does not request a permanent change to the registered PDD with regard to the "sampling procedure" of COD in waste water (in COD_{c, baseline}). The sampling procedure,</p>	<p>2014-10-01 (3rd round)</p> <p>OK. From the provided response, it is clear that the PP would like to seek a temporary deviation for the current monitoring period. It is also noticed that there won't be any permanent changes pertaining to the sampling approach and its frequency throughout the crediting period. Therefore, the verification team agrees to submit this as</p>	

Verification and Certification Report

GLC Report No: 002, Rev. 03



	<p>especially the frequency and number of samples per day had not been followed correctly during the 1st monitoring period. Meanwhile CPI has adjusted the procedure to what is written in the registered PDD. These deviations, which have been identified by the verification team, can be addressed as temporary deviations for the 1st monitoring period. The PDD and MR have been revised accordingly and submitted to DOE. Nevertheless there are changes in the laboratory analysis with regard to the analysis method and equipment, which are permanent and included in the revised PDD in track changes. For these permanent "post-registration changes" will be requested by the PP.</p>	<p>temporary deviation along with other changes in the PDD for prior approval of the Board.</p> <p>By and large, the response needs to be addressed as per the latest guidelines i.e. project standard. Furthermore, it needs to be demonstrated in the PDD with respect to the latest guidelines in order to seek the approval from the board.</p> <p>This CAR is therefore closed.</p>	
<p>CAR 3 (2010-12-22)</p> <p>The estimated emission reduction as per the registered PDD is 23,448 t CO₂e per annum which is equal to 37,126 tCO₂e for the current monitoring period. The achieved emission reduction as per the monitoring report (MR) is 41,177 t CO₂e. The reasons provided in section E.6 of the MR does not justify the increase in emission reduction.</p>	<p>2011-07-21</p> <p>The calculation of CERs have been revised according to the received findings. Accordingly section E.6 of the monitoring report has been revised.</p>	<p>2012-02-22</p> <p>This would be assessed after the approval of notification of changes and approval of the revised monitoring plan.</p> <p>2015-01-24</p> <p>The PDD was revised and submitted to UNFCCC for PRC. The revised was approved by the EB on 2014-12-28. As per the revised PDD, the ex-ante estimated emission reduction is 28,133 t CO₂e per annum which</p>	<p>OK</p>

Verification and Certification Report

GLC Report No: 002, Rev. 03



		is equal to 43,857 t CO ₂ e for the monitoring period while the achieved emission reduction as per the revised MR is 25,370 t CO ₂ e. The reasons for achieving lower emission reductions have been mentioned in the MR, which are deemed appropriate. Therefore, the CAR is closed.	
CAR 4 (2010-12-22) As per the applied methodology, AM0013 version 04, f_{monthly} , anaerobic degradation factor due to temperature should be calculated by taking the monthly average temperature for the area available from the published national weather service information. While reviewing the emission reduction spread sheet, it was found that internally measured monthly average temperatures were used to calculate f_{monthly} . Hence, PP shall calculate the f_{monthly} as per the methodology.	2011-07-21 The monthly average temperature data used in the emission reduction calculation spreadsheet has been corrected to the published national weather service information. (CAR04_Data-517-2008-2010.xls)	2012-02-22 OK. It was found that the monthly average temperature values are applied in the calculation of F_{monthly} in the submitted emission reduction sheet. The CAR is closed.	OK
CAR 5 (2010-12-22) Efficiency of the open flare is taken as	2011-07-21 As it was not yet possible to demonstrate the	2012-02-22 OK. The flare efficiency of 0 % is considered	OK

Verification and Certification Report

GLC Report No: 002, Rev. 03



50% to determine the emission reductions in the provided spread sheet. As per the flare tool, EB 28, annex 13: In case of open flares a default efficiency of 50% is to be used provided it can be demonstrated that the flare is operational (through a flame detection system reporting electronically on continuous basis). Though flare was operational, it was not demonstrated how continuously it was operating. Hence, PP shall justify the conservativeness of emission reduction calculation.	continuous operation of the flare, necessary to demonstrate the destruction of methane, 0% flare efficiency has been chosen consequently to determine emission reductions conservatively.	in order to determine the emission reductions as per the actual situation on site. Hence, the CAR is closed.	
CAR 6 (2010-12-22) Verification team has verified the calibration reports of the measuring instruments to determine the calibration frequency and the accuracy of the meters. The defined calibration frequency of waste water flow meters, biogas flow meters and gas analyser is half year as per the registered MP. However, for these meters, calibration	2011-07-21 The calibration gap has been addressed in the re-calculation of emission reduction and will be presented accordingly in the revised monitoring report (The re-calculation of emission reduction "CPI_CERcalculation_200902-201009(Internal-ExternalLab)_CalibrationError" and the related data source are submitted separately in the folder "CER_Calculation_1stPeriod").	2012-02-22 This CAR will be closed after submission of the documents and the revised ER sheet.	OK

Verification and Certification Report

GLC Report No: 002, Rev. 03



<p>gap of more than 1 year has been observed. Moreover, the actual error of the instruments at the time of delayed calibration (before adjustment) has been observed to be more than the maximum permissible value for some of the meters.</p> <p>PP is requested to address the calibration gap and consider the error in estimating the wastewater and biogas flow rates so as to result in conservative emission reduction.</p>	<p>2014-09-30</p> <p>The re-calculation of emission reduction is based on correction with regard to the calibration gap and has been submitted already. The revised monitoring report was submitted ("CPI_Monitoring Report 1st period_rev2014-09-29")</p>	<p>2014-10-01</p> <p>OK. The calibration gap has been addressed appropriately in line with the guidelines of the VVS. The revised MR and the ER calculation spreadsheet have been submitted.</p> <p>Therefore, the CAR is closed.</p>	
<p>CAR 7 (2010-12-22)</p> <p>As per the applied methodology AM0013 version 04, "percentage of methane should be measured either with continuous analyser or alternatively with periodical measurement at 95% confidence level using calibrated portable gas meters taking a statistically valid number of samples." During the site visit, it was found that the methane percentage was measured using a portable gas analyser as continuous gas analyser was not functioning. However methane percentage is not calculated at a 95% confidence level as required. Hence, PP shall determine the methane</p>	<p>2011-07-21</p> <p>The monthly methane concentration (in percentage of biogas) has been adjusted by applying the lower level of the 95% confidence interval of the samples to the ER calculation spread sheet ("MR CPI 1st period_CER Calculation_rev.2011-07-21.xls"). The calculation is shown in the separate file: "CAR07_percentCH4at95confident.xlsx"</p>	<p>2012-02-22</p> <p>OK. PP has submitted the relevant data on the methane concentration and the 95% confidence level is correctly applied to determine the methane content as per the applied methodology. The data was checked and found correct.</p> <p>Hence the CAR is closed.</p>	OK

Verification and Certification Report

GLC Report No: 002, Rev. 03



percentage as per the applied methodology.			
<p>CL 1 (2010-12-22)</p> <p>During the verification site visit, COD values of the CPO i.e. the inlet source to the CSTRs and the outlet of CSTRs were verified. Internal COD data is used to determine the emission reductions. It was found that the internal data on COD (average monthly) is not consistent with monthly data of COD provided by the external laboratory. Hence PP is requested to justify the reliability of the considered COD data.</p>	<p>2011-07-21 (1st round)</p> <p>The internal laboratory data is regarded reliable, as explained under CAR2. Using the external laboratory data as a cross check, it is found that there is a discrepancy, which should mainly be due to the reason, that the external laboratory data are only measures once a month, and therefore depend on a single sample (of a quite variable parameter), while the internal laboratory data are a monthly average determinate from many mixed samples.</p> <p>For both measurements (digester inlet and discharge), the external concentration values are a bit lower than the internal ones.</p> <p>Now that two sets of analysis data are available, PP is choosing the more conservative for emission reduction calculation, which is the internal data set for the project emissions, and the external data set for the baseline emissions.</p> <p>(CL01_CPI_COD_monthly_ExternalLab_2009.pdf and CL02_CPI_COD_monthly_ExternalLab_2010.p</p>	<p>2012-02-22 (1st round)</p> <p>Not OK. The provided approach in the response is conservative approach. However, PP to clarify that this approach would be proposed for the whole crediting period or the respective current monitoring period. Accordingly PP to seek the revision or deviation of the monitoring plan.</p> <p>The CL is not closed</p>	<p>OK</p>

Verification and Certification Report

GLC Report No: 002, Rev. 03



	df)		
	<p>2014-09-30</p> <p>The project proponent is requesting a deviation of the monitoring plan for this monitoring period (also see CAR 2).</p>	<p>2014-10-01</p> <p>OK. As assessed under CAR2, a temporary deviation is proposed by the PP for COD monitoring.</p> <p>Therefore, the CL is closed.</p>	
<p>CL 2 (2010-12-22)</p> <p>During the verification site visit, verification team has crosschecked the provided data in the spreadsheet with monitoring software generated log sheets on a sample basis. However, the values provided by the software are not found consistent with other sheets generated by the software itself. Thus it appears that the stated data is not reliable. Hence PP is requested to justify the reliability of the provided data in the spread sheet which is used to determine the emission reductions. Moreover it was not clear who will be reviewing the data.</p>	<p>2011-07-21 (1st round)</p> <p>The monitoring team from CPI is using two types of auto generated spread sheets (see "CL02_CPI Data Management.pptx" right side) The spread sheet generated by the monitoring software (sheet 2, see example "CL02_example spread sheet.xls") is only used in the exceptional cases, that the generations of the preferably used auto generated spread sheet (sheet 1) encounters problems (as sometimes after power blackout). During site visit it was found that some columns had been mixed up in sheet 2. This problem has been solved during updating of the auto generation template of this sheet.</p> <p>Please find the data management structure, showing responsibilities of recording, reporting</p>	<p>2012-02-22 (1st round)</p> <p>Not OK. Verification team is not able to verify as it is related to the monitoring system existing on site.</p> <p>The CL is not closed.</p>	OK

Verification and Certification Report

GLC Report No: 002, Rev. 03



	and review/approval of the all data ("CL02_CPI Data Management.pptx"). This structure is guaranteeing the best possible reliability of the monitoring data.		
	<p>2012-04-16 (2nd round)</p> <p>The inconstancies found by the verification team are related to the mix up of column headers in sheets no. 2, e.g. by comparison to wrongly named columns in this sheet. CPI monitoring and reporting staff used information from this sheet only in the exceptional case of problems with the preferably used sheets no. 1 (e.g. short power black outs, which can happen occasionally, but generally less than 10 times per year). Since the mix up is only caused by column headers, this was a systematic problem and it was possible and rather easy to recapitulate the correct data column needed to complete missing data in sheet no. 1 during the reporting of monitoring data, e.g. the copying of data into the reporting excel table.</p> <p>This mix up in column header does not affect the reliability of recorded and reported data.</p>	<p>2012-06-11 (2nd round)</p> <p>Not OK.</p> <p>Verification team reviewed the revised response from the PP. From the response it appears that it is a minor error /discrepancy in the monitoring management system (software) and which may happen occasionally. Though it appears minor and occasional error, verification team is unable to assess the reliability of the whole monitoring system.</p> <p>The CL is not closed</p>	
	<p>2014-09-30 (3rd round)</p> <p>As explained in the answer of the 2nd response round (see above), the mistakes are related to</p>	<p>2014-10-01 (3rd round)</p> <p>OK. It is assessed that the mistakes in the data sheets are due to mix up of column</p>	

Verification and Certification Report

GLC Report No: 002, Rev. 03



	<p>the mix up of column headers in sheets no. 2 (see file "CL02_responsibilities and quality assurance.pptx"). As previous answers regarding the reconstruction of data was found not satisfactory, the PP has decided to omit all data from times when sheet no. 2 has been used for emission reduction calculation, from the monitoring daily monitoring excel data sheet.</p> <p>Further the protocol sheets 2 are submitted on the times when data from sheet 1 was not available and for which reason ("DataSheet_emergency").</p> <p>Due to this omitting of monitoring data (in total 53 days), the calculated ER for the 1st monitoring period are reduced.</p>	<p>headers in the excel files. Omission of data for the period when this inconsistency took place is deemed appropriate. This resulted in reduction in emission reductions. Therefore, the approach taken by the PP to address the issue is deemed appropriate and it results in conservative emission reductions.</p> <p>Therefore, the CL is closed.</p>	
<p>CL 3 (2010-12-22)</p> <p>The COD is measured at the lab inside the CPI and measuring method was not clear pertaining to the following point. It was observed that the maximum measuring limit of the COD measuring equipment was 150,000 mg/l. Whereas the measured COD was found more than 150,000 mg/l for a few days. Hence PP is requested to clarify, how the COD was measured during those days when the</p>	<p>2011-07-21</p> <p>The procedure to analyse COD, especially how samples are treated and diluted is explained in the separate file document: CL03_Dilution_factor_COD_CPI.xls.</p> <p>The reason for a high COD concentration (higher than the expected 100,000 mg/l) can in some exceptional cases be that some palm oil accidentally leaves the CPO mill with the wastewater. This is, as it can be seen from the</p>	<p>2012-02-22</p> <p>OK. The response is satisfactory. The provided excel sheet clearly indicates how the COD values are measured when the measured value exceeds the threshold limits of the measuring equipment by making more dilutions.</p> <p>Hence, the CL is closed.</p>	OK

Verification and Certification Report

GLC Report No: 002, Rev. 03



COD was more than 150,000 mg/l and reason for high COD than the designed or estimated (100,000 mg/l) COD in the PDD.	data, a very rare case which 1) is an economic loss to the palm mill and is therefore always avoided as good as possible, and 2) would also have occurred under the baseline situation (without the biogas system).		
---	---	--	--