



Verification and Certification Report

of

CYY Biopower Wastewater treatment plant including biogas reuse for thermal oil replacement and electricity generation Project, Thailand

GLC Report No: 363, Rev. 05

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Organisational Unit Germanischer Lloyd Certification GmbH (GLC), Greenhouse Gas Services		
Client South Pole Carbon Asset Management Ltd	Client reference person Mr. Santosh Kumar Singh	
Summary:		
UNFCCC Ref.	"2141"	
Project Name:	CYY Biopower Wastewater treatment plant including biogas reuse for thermal oil replacement and electricity generation Project, Thailand	
Project Country:	Thailand	
Sectoral Scope, Technical Area	CDM Sectoral Scope 13, Technical Area 13.1	
Methodology(ies) / Version(s):	AM0022, version 04	
Project Size:	<input checked="" type="checkbox"/> Large Scale	<input type="checkbox"/> Small Scale
Number of verification:	4 th	
Dates of monitoring period (incl. both days)	2013-01-01 to 2013-08-20	
Verified emission reductions	46,136 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. Karunakar Avuram Dr. Komsilp Wangyao	Ms. Anu Chaudhary	Mr. Markus Weber
Date of this revision:	Revision No.	Number of pages
2013-11-11	05	100
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History of report revisions:

Rev.	Date	Person (short sign or name)	Function	Action
01	2013-10-15	Karunakar Avuram / Komsilp Wangyao	Assessment team leader / Technical expert	Draft report
02	2013-10-22	Anu Chaudhary	TR/TE	Review with corrections and comments
03	2013-11-07	Karunakar Avuram	Assessment team leader	Revision based on TR comments
04	2013-11-08	Anu Chaudhary	TR/TE	Closure of comments
05	2013-11-11	Markus Weber	FR+FA	Final reviewed+approved

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Abbreviations

CAR	Corrective Action Request
CDM	Clean Development Mechanism
CDM-EB	CDM Executive Board (the board)
CER	Certified Emission Reduction
CL	Clarification request
CMP	Meeting of the Parties to the Kyoto Protocol
CO ₂	Carbon dioxide
CO _{2e} or CO _{2eq}	Carbon dioxide equivalent
COP/MOP	The Conference of the Parties to the United Nations Framework Convention on Climate Change serving as the Meeting of the Parties to the Kyoto Protocol
DOE	Designated Operation Entity
ER	Emission Reduction
FAR	Forward Action Request
GHG	Greenhouse gas(es)
GLC	Germanischer Lloyd Certification GmbH
HFO	Heavy Fuel Oil
IPCC	Intergovernmental Panel on Climate Change
MP	Monitoring Plan
MR	Monitoring Report
NCV	Net Calorific Value
PDD	Project Design Document
PP	Project Participant
QA/QC	Quality Assurance / Quality Control
SCADA	Supervisory Control And Data Acquisition
t CO _{2e}	Ton of Carbon dioxide equivalent
UASB	Up-flow Anaerobic Sludge Blanket
UNFCCC	United Nations Framework Convention on Climate Change
VVS	Validation and Verification Standard

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1 INTRODUCTION

“South Pole Carbon Asset Management Ltd” has commissioned the Germanischer Lloyd Certification GmbH (GLC) to carry out the 4th verification of the project, **CYY Biopower Wastewater treatment plant including biogas reuse for thermal oil replacement and electricity generation Project, Thailand**, registered by the UNFCCC as CDM project "2141" with regard to the relevant requirements for CDM project activities. The project activity was registered with UNFCCC on [2009-03-25](#). The verifiers have reviewed the implementation of the project activity as described in the Project Design Document (PDD)¹ and monitoring activities as per the monitoring plan (MP)² and as reported in the Monitoring Report ^{4/}, version 2, dated 2013-10-09.

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 4th 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 registered 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 project design document ^{2/}, the approved revised monitoring plan^{3/}, the monitoring report ^{4/}, the emission reduction calculation spread sheet ^{5/}, supporting documents made available to the verifier, the information collected during onsite verification and the interviews during the on-site assessment. Furthermore publicly available information was considered as far as available and required.

¹ It is to be noted that the Project Design Document (PDD) was revised during the 2nd verification and the revised PDD was approved by the CDM-EB on 2012-03-16. Therefore, the PDD referred in the report refers to the approved revised PDD, version 4.1, dated 2012-01-31.

² The monitoring plan (MP) was revised during the 1st verification and the revised MP was approved on 2010-08-12. Therefore, the assessment is based on the approved revised MP and the reference made to MP in the report refers to the approved revised MP.

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

- 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/},
- The PDD ^{/2/} and the monitoring plan^{/3/},
- Approved CDM Methodology AM0022, ver. 04: Avoided Wastewater and On-site Energy Use Emissions in the Industrial Sector ^{/10/}

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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
Avuram, Karunakar	ATL/ A			X	X	X	X	X	
Wangyao, Komsilp	TE/ LE	X	X	X	X	X	X		X

A Auditor
ATL Assessment team leader

FE Financial expert
LE Local expert

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

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.

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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 2-2: Technical review team and approval

Name	Function ²⁾	Technical area specific knowledge	Sectoral scope specific knowledge	Supervision of work
Chaudhary, Anu	R / TE	X	X	
Weber, Markus	FR / AP	X	X	X

AP Approver
FR Final reviewer

TE Technical expert
T-R Trainee reviewer
R Reviewer

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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 2013-09-02 to 2013-09-06, GLC conducted a desk review of all documents initially provided by the client and publicly available documents relevant for the verification. The main reviewed documents are listed below:

- The PDD^{/2/} and the corresponding validation report ^{/12/};
- The approved revised monitoring plan ^{/3/} and the corresponding validation opinion;
- Previous verification reports ^{/13/14/};
- The applied monitoring methodology ^{/10/};
- The monitoring report ^{/4/} 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 previous verification

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3.3 On-site assessment

From 2013-09-16 to 2013-09-17, Mr. Karunakar Avuram and Dr. Komsilp Wangyao of GLC's verification team carried out an on-site visit.

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

- 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 ^{/31/34/}
- The data aggregation trails were checked
- The duly calibration of all metering equipment was checked ^{/18...29/}.

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
- Remaining issues from previous verification
- Calibration procedures
- Quality management system
- Involved personnel and responsibilities
- Training and practice of the operational personnel
- Implementation of the monitoring plan
- Monitoring data management

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- Data uncertainty and residual risks
- GHG calculation
- Procedural aspects of the verification
- Maintenance
- Environmental aspects

Table 3-1: Interviewed persons

Name	Organization/Function
Mr. Santosh Kumar Singh	Head of Implementation, South Pole Carbon Asset Management Ltd.
Ms. Suwipa Rukwongtrakool	CDM Project Manager, South Pole Carbon Asset Management Ltd.
Mr. Tanapon Yuenyong	Managing Director, CYY Bio Power Co Ltd.
Ms. Yupin Amwan	Head of Quality Control, CYY Bio Power Co Ltd.
Mr. Nakorn Phaisri	Factory Manager, CYY Bio Power Co Ltd.
Ms. Karnchana Luangsoongnern	Technician – Quality Control, CYY Bio Power Co Ltd.
Mr. Chanachai Decha	Operator – Gas engines, CYY Bio Power Co Ltd.
Ms. Kanitta Chamnarnlien	Villager, Bungaor village
Mr. Saard Kaewkiew	Villager, Nhongmuang village

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;

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- 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 ^{/12/} and the previous verification reports^{/13/14/} to find out if there are any open issues or FARs to be addressed. It is confirmed that there are no pending issues or FARs from the validation or from the previous verification.

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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 registered PDD.

The project was implemented as per the description provided in the registered PDD and in operation since 2008-12-09 after successful commissioning. The date corresponds to the first day of the recording of biogas sent to gas engine which was confirmed from the log sheet information. The date was further confirmed by the commissioning certificate of gas engines (commissioning period of the gas engines was from 2008-12-02 to 2008-12-08)^{16/}. The project was under normal operation during the site visit which facilitated the verification team to verify the operation and functioning of the measuring equipments.

The project activity consists of introduction of a new biogas reactor with methane capture and utilisation for energy purposes into the existing open anaerobic lagoon based wastewater treatment system. The project activity avoids the release of methane into the atmosphere, which would have occurred due to the anaerobic digestion of the organic content in the open lagoon based wastewater treatment system.

In addition, the biogas reactor produces sufficient quantities of biogas to fuel thermal oil boiler for starch drying, replacing the use of heavy fuel oil; and to fuel gas engines for the production of electricity. The replacement of heavy fuel oil in the thermal oil boilers and displacement of electricity from the national grid, which is generated by fossil fuel fired power plants to a large extent, leads to further reduction of greenhouse gases.

Technical Description:

The wastewater from the starch factory is collected in a collection pond (or storage lagoon). From the collection pond, it flows into an equalization pond through a screen that removes coarse particles from the wastewater. The wastewater from the equalisation pond is pumped into Up-flow Anaerobic Sludge Blanket (UASB) reactors. In UASB, the wastewater rises through an expanded bed of anaerobic sludge blanket and an internal device at the top of the reactor, which results in a separation of the mixed liquor into clarified wastewater, biogas and sludge. The treated wastewater from the UASB is sent to open lagoons for further treatment which is called secondary treatment.

The biogas is used in the factory as a fuel in a thermal oil boiler for starch drying and in two gas engines each of 1.36 MW_{eI} capacity^{15/} to generate electricity. A gas storage tank (a covered lagoon) of 7000 m³ is provided in parallel to boiler and gas engines. Gas storage tank acts as a buffer to take care of the fluctuations in the gas quantity. An open flare is also provided on top of the UASB reactor in order to flare out the excess biogas, if any, into the atmosphere.

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It is confirmed from the onsite interviews and document review that no sludge was removed from UASB during the monitoring period.

The key components of the project activity are given in table 4-1:

Table 4-1: Key components of the project

Component	Design Specifications ^{/15/}
UASB	Total water volume: 6000 m ³ Active volume: 4800 m ³ COD removal efficiency: 95%
Gas engines	Capacity: 2 No's of 1.36 MW _{el} each
Thermal oil boiler with a dual fuel burner	Dual fuel burner: 80 kg/h (min) – 500 kg/h (max)
Gas storage tank	7000 m ³
Flare	Open flare with a maximum capacity of 1600 Nm ³ /h

Involved Parties and Project Participants:

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

Table 4-2: Project Parties and project participants

Characteristic	Party	Project Participant
Host party	Thailand	CYY Bio Power Co., Ltd.
Other involved parties	Switzerland	South Pole Carbon Asset Management Ltd.
	Austria	Kommunalkredit Public Consulting GmbH

Project Location:

The details of the project location are given in table 4-3:

Table 4-3: Project Location

No.	Project Location
Host Country	Thailand

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Region:	Nakhorn Ratchasima Province
Project location address:	100 Moo 5, Pongdaeng, Khamtalesor District
Latitude:	14°59'55"N (14.9986 N)
Longitude:	101°54'42"E (101.9117 E)

From the onsite verification the project location details provided in the MR are confirmed as correct.

Through document review and on site interviews GLC's verification team is able to confirm that there were no outstanding events or situations occurred during this monitoring period from 2013-01-01 to 2013-08-20 except a few days shut down of the plant during the festival holidays (new year holidays in the beginning of January and Songkran festival holidays in April). The information has been transparently provided in section B.1 of the MR^{4/}. Besides, from the onsite interviews it was understood that a problem was occurred gas storage system on 2013-05-26. However, the problem was rectified on the same day. From the provided evidence document (Operation check-sheet)^{26/} it is confirmed that this event did not cause any disturbance for the operation of the plant and no biogas leakage was detected.

The emission reductions being claimed for the 4th monitoring period from 2013-01-01 to 2013-08-20 are nearly 29% less than the estimated emission reductions in the registered PDD, as given in the table below:

Table 4-4: Emissions Reduction claimed in comparison to the estimates as per PDD

Emission Reductions (tCO ₂ e)	
As per PDD	64,979
Monitoring report	46,136
% Deviation (+/-)	(-) 28.99%

The main reason for achieving lower emission reductions, as provided in response to CL 2 (please refer to Annex A), can be attributed to lower wastewater volume, lower COD and lower biogas concentration. A comparison of data between the estimated amount in the PDD and actual data during the monitoring period is also provided in the ER sheet for the sake of transparency. The verification team is of the opinion that volume of wastewater and COD concentration of wastewater depends on the quality of raw material which is beyond the control of PP. Therefore, the achieved emission reduction is reasonable.

Since the achieved emission reductions are less than the estimated emission reductions, no justification has been provided in the MR. It is considered to be appropriate as it is inline with the guideline for "Completing the monitoring report form", version 03.2 (EB 70, Annex 11) ^{45/}.

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

As per the approved monitoring methodology AM0022 (version 04)^{/10/}, volume of wastewater treated, volume of biogas consumption, methane content of the biogas and electricity produced are to be monitored continuously and COD reduction of wastewater is to be determined on a daily basis. During the document review and furthermore during the on-site visit, the verification team has reviewed the approved revised monitoring plan and compared it with the monitoring methodology to verify their compliance. Based on this review the verification team confirms that the revised monitoring plan is in compliance with the monitoring methodology. The methodology also refers to the latest version of 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.*

4.1.3 Compliance of Monitoring Activities with the Registered Monitoring Plan

The monitoring plan was revised during the first verification and the revised monitoring plan was approved on [2010-08-12](#). The application of the monitoring plan for the verification period is summarized in this section. The information flow and the values in the monitoring report were verified as follows:

	Assessment activities	
Data / Parameter (as per monitoring plan in the PDD):	AM0022 ID 1 Wastewater flows entering the project treatment facility Unit: m ³	
Type of monitoring equipment:	Type of meter	Electromagnetic flow meter with flow converter
	Make	Krohne
	Model	IFC010D
	Serial No.	A06 42633
	Accuracy	± 0.3% ^{/17/}

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	SCADA representation	FT 100	
	Meter tag	PD-MM-001	
Verification of data generation:	<p>The parameter was monitored through the above mentioned flow meter. 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. Besides, the flow meter is connected to SCADA (Supervisory Control and Data Acquisition) system and therefore the accumulated reading of the flow is displayed on the SCADA screen. The reading is recorded from the SCADA screen by the operator everyday in the log sheet and reported to the head of Quality Control (QC) department.</p> <p>The GLC's verification during the onsite verification observed that the meter was installed on the wastewater pipeline that goes to the UASB reactor. The verification team also checked the meter display and the SCADA screen in Biogas control room and observed that the totalised value was consistently indicated.</p> <p>Therefore, the verification team can confirm that the data generation is appropriate.</p>		
Measuring frequency:	<p>Continuously</p> <p>The parameter is measured continuously with the above mentioned flow meter.</p>		
Is measuring frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	<p>Yes.</p> <p>The monitoring plan states that the parameter is measured continuously by flow meter. The monitoring methodology does not specify the measuring frequency; however, recording frequency is indicated as "Continuously".</p> <p>Since the parameter is measured and recorded continuously by the flow meter, the measuring frequency is considered to be in accordance with the monitoring plan^{/3/} and the monitoring methodology^{/10/}.</p>		
Is accuracy of the monitoring equipment as stated in the PDD? If the PDD does not specify the accuracy of	<p>The accuracy of the monitoring equipment was not defined in the monitoring plan. However, GLC's sectoral expert confirms that $\pm 0.3\%$ of accuracy represents good</p>		

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<p>the monitoring equipment, does the monitoring equipment represent good monitoring practise?</p>	<p>monitoring practice.</p>
<p>Verification of data aggregation:</p>	<p>The cumulative value of the parameter i.e. the totalised value is recorded in the daily log sheets. The same value is also indicated in the emission reduction calculation spread sheet (ER sheet) ^{/5/} submitted along with the monitoring report (MR) ^{/4/} to the verification team against the corresponding date. The daily value is calculated as the difference of the two consecutive readings.</p> <p>Therefore, by checking the totalised values, it is confirmed that the data aggregation is appropriate and free of mistakes.</p> <p>The total measured value of the parameter for the monitoring period is 489,566 m³.</p>
<p>Verification of data recording:</p>	<p>From the onsite verification and interviews with the respective operating team, it is confirmed that the parameter is continuously measured by flow meter. The totalised reading displayed on the SCADA screen is recorded by the operator on a daily basis at 8 AM into the log sheets. The daily log sheets are reported to the Head of QC. The SCADA system also captures the data every minute and stores in Biogas plant computer in the form of CSV file. The Head of QC crosschecks the log sheet data with the data recorded by the SCADA system. Since the totalised values are recorded in the log sheets, any inconsistency can easily be detected by the Head of QC.</p> <p>The verification team also checked the CSV files for one month (June 2013)^{/43/} and it was observed that the data was captured for every minute. For each day the reading starts at 8:00 AM the same day and ends at 8:00 AM the following day and each daily file has 1440 entries.</p> <p>The Head of QC transfers the data from log sheets to electronic files (MS-Excel files) on a daily basis. The electronic files^{/34/} are printed at the end of every month by the Head of QC and submitted to the Plant Manager.</p>
<p>Verification of data calculation and reporting</p>	<p>As mentioned above, the data is recorded in log sheets and reported to Head of QC everyday. The Head of QC further reports the data to the Plant Manager on a</p>

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	<p>monthly basis. The monthly reports^{34/} are signed by the Head of QC and the Plant Manager as approved. The daily log sheets and the approved monthly reports are stored in hard format. All the daily log sheets^{31/} and the monthly reports^{34/} were checked by the verification team during the onsite verification.</p> <p>Besides, it was also learnt from the onsite interviews that the Head of QC submits the monitoring data on a monthly basis to the Project Consultant (South Pole Carbon Asset Management Ltd.) for calculating emission reduction.</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 data reporting and calculation is appropriate and correct.</p>
Reporting frequency:	<p>Daily</p> <p>The monitoring data is reported to the Head of QC on a daily basis.</p>
Is reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	<p>Neither the monitoring plan nor the monitoring methodology specifies the reporting frequency. Nevertheless, the overall monitoring practice is in accordance with the monitoring plan. The verification team is of the opinion, as assessed above, that the reporting frequency represents good monitoring practice.</p>
If applicable, has the reported data been cross-checked with other available data?	<p>Yes, the reported data was crosschecked with the monthly reports^{34/} approved by the Plant Manager. The reported data in the ER sheet is consistent with the monthly reports.</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 original hand written daily log sheets^{31/}. It is confirmed that the values reported in the final MR and the ER sheet are correct.</p>
Does the data management (from monitoring equipment to emission reduction calculation)	<p>Yes. The verification team, based on the document review and onsite verification, confirms that the data</p>

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<p>ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?</p>	<p>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>
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	Assessment activities
<p>Data / Parameter (as per monitoring plan in the PDD):</p>	<p>AM0022 ID 2</p> <p>Wastewater flows leaving the project treatment facility</p> <p>Unit: m³</p>
<p>Type of monitoring equipment:</p>	<p>The parameter has been established from ID 1 assuming hydrological balance. The approach is in accordance with the monitoring plan.</p> <p>Therefore, please refer to the assessment of 'AM0022 ID 1 (Wastewater flows entering the project treatment facility)'</p>
<p>Verification of data generation:</p>	<p>Please refer to the assessment of 'AM0022 ID 1 (Wastewater flows entering the project treatment facility)'</p>
<p>Measuring frequency:</p>	<p>Please refer to the assessment of 'AM0022 ID 1 (Wastewater flows entering the project treatment facility)'</p>
<p>Is measuring frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)</p>	<p>Please refer to the assessment of 'AM0022 ID 1 (Wastewater flows entering the project treatment facility)'</p>
<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>	<p>Please refer to the assessment of 'AM0022 ID 1 (Wastewater flows entering the project treatment facility)'</p>
<p>Verification of data aggregation:</p>	<p>Please refer to the assessment of 'AM0022 ID 1 (Wastewater flows entering the project treatment facility)'</p>

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Verification of data recording:	Please refer to the assessment of 'AM0022 ID 1 (Wastewater flows entering the project treatment facility)'
Verification of data calculation and reporting	Please refer to the assessment of 'AM0022 ID 1 (Wastewater flows entering the project treatment facility)'
Reporting frequency:	Please refer to the assessment of 'AM0022 ID 1 (Wastewater flows entering the project treatment facility)'
Is reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Please refer to the assessment of 'AM0022 ID 1 (Wastewater flows entering the project treatment facility)'
If applicable, has the reported data been cross-checked with other available data?	Please refer to the assessment of 'AM0022 ID 1 (Wastewater flows entering the project treatment facility)'
How were the values in the monitoring report verified?	Please refer to the assessment of 'AM0022 ID 1 (Wastewater flows entering the project treatment facility)'
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?	Please refer to the assessment of 'AM0022 ID 1 (Wastewater flows entering the project treatment facility)'

	Assessment activities	
Data / Parameter (as per monitoring plan in the PDD):	AM0022 ID 3 Wastewater organic material concentration entering the project treatment facility Unit: kg COD / m ³	
Type of monitoring equipment:	Type of meter	Portable Colorimeter
	Make	Hach
	Model	DR/890
	Serial No.	07089C64902
	Accuracy	± 0.24% ^{1/17}
	Meter tag	PD-CL-001

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<p>Verification of data generation:</p>	<p>Data is generated from the COD (Chemical Oxygen Demand) analysis of wastewater entering the UASB reactor.</p> <p>From the onsite verification and interview with the QC laboratory staff, it is confirmed that the samples of wastewater from the inlet of UASB are collected for every two hours starting at 8 AM every day. Therefore, total 12 samples are collected. After collecting 6 samples, the samples are mixed and COD of the composite sample is analysed at onsite laboratory. COD analysis is carried out twice a day; at 8 AM and at 8 PM. The readings from the COD analysis is recorded in log sheets and reported to the Head of QC on a daily basis. During the onsite interview, the QC staff described the COD analysis procedure and the procedure was found to be in accordance with the written procedures^{32/} available at the QC lab. Besides, GLC's sectoral expert confirms that the COD analysis procedures are appropriate.</p>
<p>Measuring frequency:</p>	<p>Daily</p> <p>The COD measurement is carried out twice a day. Average of the two is considered as daily value.</p>
<p>Is measuring frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)</p>	<p>Yes.</p> <p>The monitoring plan states that COD concentration is analysed daily at project site. The monitoring methodology does not specify the measuring frequency; however, recording frequency is indicated as "Daily".</p> <p>Therefore, since the actual measuring frequency is better than the requirement, the verification team can confirm that the measuring frequency is inline with the monitoring plan and the monitoring methodology.</p>
<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>	<p>The accuracy of the monitoring equipment was not stated in the monitoring plan. However, GLC's sectoral expert confirms that $\pm 0.24\%$ of accuracy represents good monitoring practice.</p>
<p>Verification of data aggregation:</p>	<p>The COD concentration of wastewater is measured in mg/l. Since the COD measurement is carried out twice a day, average of the two is considered as daily value and</p>

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	<p>the same is reported in the ER sheet. It is then calculated into kg COD/m³. The reported data in the ER sheet was checked with the log sheets^{/31/}; the verification team found that the data and the data aggregation were correct.</p> <p>The average measured value of the parameter for the monitoring period is 21,389 mg/l which is equal to 21.389 kg COD/m³.</p>
<p>Verification of data recording:</p>	<p>As mentioned above the COD was analysed twice a day and recorded in log sheets. All the original log sheets were presented to the verification team during the onsite verification. Besides, written procedures^{/32/} available with the QC department were also checked. By interviewing the QC staff it is confirmed that the procedures were appropriately followed.</p>
<p>Verification of data calculation and reporting</p>	<p>From the onsite interviews it was understood that the Head of QC transfers the data from log sheets into electronic files. At the end of every month, the Head of QC prints out the electronic files and submits them to the Plant Manager. Furthermore, the Head of QC also prepares data and submits to Project Consultant on a monthly basis for emission reduction calculation.</p> <p>The verification team reviewed the ER sheet^{/5/} submitted along with the MR^{/4/}. Reported data was thoroughly verified with the log sheet information and the calculation provided in the ER sheet was checked and reproduced. It is confirmed that the data calculation and reporting is appropriate.</p>
<p>Reporting frequency:</p>	<p>Daily</p> <p>The COD is analysed twice in a day and recorded in log sheets by the QC staff. The log sheet data is reported to the Head of QC. The Head of QC after checking the data transfers into electronic file on a daily basis. At the end of every month, the Head of QC prints out the electronic files, signs and submits them to the Plant Manager. The Plant Manager approves the monthly reports by signing. The approved monthly reports are stored for record. All the log sheets^{/5/} and monthly reports^{/4/} were provided to the verification team during the onsite verification.</p>
<p>Is reporting frequency in accordance with the</p>	<p>Neither the monitoring plan nor the monitoring</p>

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<p>monitoring plan and monitoring methodology? (Yes / No)</p>	<p>methodology specifies the reporting frequency. Nevertheless, the overall monitoring practice is in accordance with the monitoring plan. The verification team is of the opinion, based on the above assessment, that the reporting frequency represents good monitoring practice.</p>
<p>If applicable, has the reported data been cross-checked with other available data?</p>	<p>Yes, the reported data was crosschecked with the monthly reports^{34/} approved by the Plant Manager. The reported data in the ER sheet is consistent with the monthly reports.</p>
<p>How were the values in the monitoring report verified?</p>	<p>The values reported in the monitoring report^{4/} and the corresponding ER sheet ^{5/} were verified with the original hand written daily log sheets^{31/}. It is confirmed that the values reported in the final MR and the ER sheet are correct.</p>
<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>	<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>As part of quality assurance, the PP got the COD analysis of wastewater carried out by an accredited external laboratory once in 6 months. The COD analysis by external laboratory was conducted in December 2012 and June 2013^{33/}. The corresponding reports were provided to the verification team; the COD values in the reports were found within the range of COD measured at onsite laboratory.</p> <p>Further description of the monitoring management is provided at the end of the section 4.1.3.</p>

	Assessment activities
<p>Data / Parameter (as per monitoring plan in the PDD):</p>	<p>AM0022 ID 4</p> <p>Wastewater organic material concentration leaving the project treatment facility</p> <p>Unit: kg COD / m³</p>

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Type of monitoring equipment:	Type of meter	Portable Colorimeter
	Make	Hach
	Model	DR/890
	Serial No.	07089C64902
	Accuracy	± 0.24% ^{/17/}
	Meter tag	PD-CL-001
Verification of data generation:	<p>Data is generated from the COD (Chemical Oxygen Demand) analysis of wastewater collected at the outlet of UASB reactor.</p> <p>From the onsite verification and interview with the QC laboratory staff, it is confirmed that the samples of wastewater from the outlet of UASB are collected for every two hours starting at 8 AM every day. Therefore, total 12 samples are collected. After collecting 6 samples, the samples are mixed and COD of the composite sample is analysed at onsite laboratory. COD analysis is carried out twice a day; at 8 AM and at 8 PM. The readings from the COD analysis is recorded in log sheets and reported to the Head of QC on a daily basis. During the onsite interview, the QC staff described the COD analysis procedure and the procedure was found to be in accordance with the written procedures^{32/} available at the QC lab. Besides, GLC's sectoral expert confirms that the COD analysis procedures are appropriate.</p>	
Measuring frequency:	<p>Daily</p> <p>The COD measurement is carried out twice a day. Average of the two is considered as daily value.</p>	
Is measuring frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	<p>Yes.</p> <p>The monitoring plan states that COD concentration is analysed daily at project site. The monitoring methodology does not specify the measuring frequency; however, recording frequency is indicated as "Daily".</p> <p>Therefore, since the actual measuring frequency is better than the requirement, the verification team can confirm that the measuring frequency is inline with the</p>	

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	monitoring plan and the monitoring methodology.
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?	The accuracy of the monitoring equipment was not stated in the monitoring plan. However, GLC's sectoral expert confirms that $\pm 0.24\%$ of accuracy represents good monitoring practice.
Verification of data aggregation:	<p>The COD concentration of wastewater is measured in mg/l. Since the COD measurement is carried out twice a day, average of the two is considered as daily value and the same is reported in the ER sheet. It is then calculated into kg COD/m³. The reported data in the ER sheet was checked with the log sheets^{/31/}; the verification team found that the data and the data aggregation were correct.</p> <p>The average measured value of the parameter for the monitoring period is 1,965 mg/l which is equal to 1.965 kg COD/m³.</p>
Verification of data recording:	As mentioned above the COD was analysed twice a day and recorded in log sheets. All the original log sheets were presented to the verification team during the onsite verification. Besides, written procedures ^{/32/} available with the QC department were also checked. By interviewing the QC staff it is confirmed that the procedures were appropriately followed.
Verification of data calculation and reporting	<p>From the onsite interviews it was understood that the Head of QC transfers the data from log sheets into electronic files. At the end of every month, the Head of QC prints out the electronic files and submits them to the Plant Manager. Furthermore, the Head of QC also prepares data and submits to Project Consultant on a monthly basis for emission reduction calculation.</p> <p>The verification team reviewed the ER sheet^{t/5/} submitted along with the MR^{/4/}. Reported data was thoroughly verified with the log sheet information and the calculation provided in the ER sheet was checked and reproduced. It is confirmed that the data calculation and reporting is appropriate.</p>
Reporting frequency:	<p>Daily</p> <p>The COD is analysed twice in a day and recorded in log</p>

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	<p>sheets by the QC staff. The log sheet data is reported to the Head of QC. The Head of QC after checking the data transfers into electronic file on a daily basis. At the end of every month, the Head of QC prints out the electronic files, signs and submits them to the Plant Manager. The Plant Manager approves the monthly reports by signing. The approved monthly reports are stored for record. All the data sheets^{31/} and monthly reports^{34/} were provided to the verification team during the onsite verification.</p>
<p>Is reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)</p>	<p>Neither the monitoring plan nor the monitoring methodology specifies the reporting frequency. Nevertheless, the overall monitoring practice is in accordance with the monitoring plan. The verification team is of the opinion, based on the above assessment, that the reporting frequency represents good monitoring practice.</p>
<p>If applicable, has the reported data been cross-checked with other available data?</p>	<p>Yes, the reported data was crosschecked with the monthly reports^{34/} approved by the Plant Manager. The reported data in the ER sheet is consistent with the monthly reports.</p>
<p>How were the values in the monitoring report verified?</p>	<p>The values reported in the monitoring report^{4/} and the corresponding ER sheet^{5/} were verified with the original hand written daily log sheets^{31/}. It is confirmed that the values reported in the final MR and the ER sheet are correct.</p>
<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>	<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>As part of quality assurance, the PP got the COD analysis of wastewater carried out by an external laboratory once in 6 months. The COD analysis by external laboratory was conducted in December 2012 and June 2013^{33/}. The corresponding reports were provided to the verification team; the COD values in the reports were found within the range of COD measured at onsite laboratory.</p> <p>Further description of the monitoring management is</p>

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	provided at the end of the section 4.1.3.
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	Assessment activities														
Data / Parameter (as per monitoring plan in the PDD):	<p>AM0022 ID 5</p> <p>Volume of biogas sent to facility heaters</p> <p>Unit: Nm³</p>														
Type of monitoring equipment:	<table border="1" style="width: 100%;"> <tr> <td style="width: 20%;">Type of meter</td> <td>Differential Pressure Transmitter (or Differential flow meter)</td> </tr> <tr> <td>Make</td> <td>Yokogawa</td> </tr> <tr> <td>Model</td> <td>EJX110A-EMS5G-719DN</td> </tr> <tr> <td>Serial No.</td> <td>91FA19282 639</td> </tr> <tr> <td>Accuracy</td> <td>± 0.04% ^{/17/}</td> </tr> <tr> <td>Meter representation</td> <td>FT 501</td> </tr> <tr> <td>Meter tag</td> <td>PD-DM-003</td> </tr> </table>	Type of meter	Differential Pressure Transmitter (or Differential flow meter)	Make	Yokogawa	Model	EJX110A-EMS5G-719DN	Serial No.	91FA19282 639	Accuracy	± 0.04% ^{/17/}	Meter representation	FT 501	Meter tag	PD-DM-003
Type of meter	Differential Pressure Transmitter (or Differential flow meter)														
Make	Yokogawa														
Model	EJX110A-EMS5G-719DN														
Serial No.	91FA19282 639														
Accuracy	± 0.04% ^{/17/}														
Meter representation	FT 501														
Meter tag	PD-DM-003														
Verification of data generation:	<p>The parameter was monitored through the above mentioned flow meter. 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. The reading is recorded from the meter by the operator everyday in the log sheet and reported to the Head of QC department. The Head of QC calculates the daily consumption based on the two consecutive daily readings and inputs the data into excel file.</p> <p>The GLC's verification team during the onsite verification observed that the meter was installed on the biogas pipeline that goes to the onsite boiler. The verification team also checked the meter display and observed that the totalised value was displayed in Nm³. From the technical specifications also it can be confirmed that the meter takes the temperature and pressure into account, calculates automatically and displays in normal cubic</p>														

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	<p>meter. No further correction is required.</p> <p>Therefore, the verification team can confirm that the data generation is appropriate.</p>
<p>Measuring frequency:</p>	<p>The parameter is measured continuously with the above mentioned flow meter.</p>
<p>Is measuring frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)</p>	<p>Yes.</p> <p>The monitoring plan states that the parameter is measured continuously by flow meter. The monitoring methodology does not specify the measuring frequency; however, recording frequency is indicated as "Continuously".</p> <p>Since the parameter is measured and recorded continuously by the flow meter, the measuring frequency is considered to be in accordance with the monitoring plan^{/3/} and the monitoring methodology^{/10/}.</p>
<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>	<p>The accuracy of the monitoring equipment was not stated in the revised monitoring plan. However, GLC's sectoral expert based on his industrial experience confirms that $\pm 0.04\%$ of accuracy represents good practice.</p>
<p>Verification of data aggregation:</p>	<p>The cumulative value of the parameter i.e. the totalised value is recorded in the daily log sheets. Daily consumption is calculated as the difference of the totalised readings and the same is reported in the ER sheet ^{/5/} submitted along with the MR ^{/4/} to the verification team.</p> <p>Therefore, by checking the totalised values, it is confirmed that the data aggregation is appropriate and free of mistakes.</p> <p>The total measured value of the parameter for the monitoring period is 1,809,398 Nm³.</p>
<p>Verification of data recording:</p>	<p>From the onsite verification and interviews with the respective operating team, it is confirmed that the parameter is continuously measured by flow meter. The totaliser reading displayed on the meter screen is recorded by the operator on a daily basis at 8 AM into the log sheets. The daily log sheets are reported to the</p>

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	<p>Head of QC. The Head of QC calculates the daily consumption and inputs the data into electronic file (excel file). Since the totaliser values are recorded in the log sheets, any inconsistency can easily be detected by the Head of QC.</p> <p>The verification team by verifying the log sheets can confirm that the data was appropriately recorded for the monitoring period.</p>
<p>Verification of data calculation and reporting</p>	<p>From the onsite interviews it was understood that the Head of QC transfers the data from log sheets into electronic files. At the end of every month, the Head of QC prints out the electronic files and submits them to the Plant Manager. Furthermore, the Head of QC also prepares data and submits to Project Consultant on a monthly basis for emission reduction calculation.</p> <p>The verification team reviewed the ER sheet^{4/5/} submitted along with the MR^{4/}. Reported data was thoroughly verified with the log sheet information and the calculation provided in the ER sheet was checked and reproduced. It is confirmed that the data calculation and reporting is appropriate.</p>
<p>Reporting frequency:</p>	<p>Daily</p> <p>The parameter is recorded in log sheets by the operator on a daily basis. The log sheet data is reported to the Head of QC. The Head of QC after checking the data transfers into electronic file on a daily basis. At the end of every month, the Head of QC prints out the electronic files, signs and submits them to the Plant Manager. The Plant Manager approves the monthly reports by signing. The approved monthly reports are stored for record. All the log sheets^{31/} and monthly reports^{34/} were provided to the verification team during the onsite verification.</p>
<p>Is reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)</p>	<p>Neither the monitoring plan nor the monitoring methodology specifies the reporting frequency. Nevertheless, the overall monitoring practice is in accordance with the monitoring plan. The verification team is of the opinion, based on the above assessment, that the reporting frequency represents good monitoring practice.</p>
<p>If applicable, has the reported data been</p>	<p>Yes, the reported data was crosschecked with the monthly reports^{34/} approved by the Plant Manager. The</p>

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cross-checked with other available data?	reported data in the ER sheet is consistent with the monthly reports.
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 original hand written daily log sheets ^{31/} . It is confirmed that the values reported in the final MR and the ER sheet are correct.
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 activities																				
Data / Parameter (as per monitoring plan in the PDD):	AM0022 ID 7 Electricity generated from collected biogas Unit: MWh																				
Type of monitoring equipment:	<table border="1"> <tr> <td>Type of meter</td> <td>Energy meter</td> <td>Energy meter</td> </tr> <tr> <td>Make</td> <td>DEIF</td> <td>DEIF</td> </tr> <tr> <td>Model</td> <td>Multi – Line PPU/2/GS</td> <td>Multi – Line PPU/2/GS</td> </tr> <tr> <td>Serial No.</td> <td>A010393</td> <td>A004997</td> </tr> <tr> <td>Accuracy</td> <td>Class 1, $\pm 1\%$ <small>/17/</small></td> <td>Class 1, $\pm 1\%$ <small>/17/</small></td> </tr> <tr> <td>Meter tag</td> <td>PD-PM-001</td> <td>PD-PM-002</td> </tr> </table> <p>There are two electricity generators; Generator A and Generator B. Each electricity generator is provided with a power meter (or electricity meter) to record the electricity generation separately.</p>			Type of meter	Energy meter	Energy meter	Make	DEIF	DEIF	Model	Multi – Line PPU/2/GS	Multi – Line PPU/2/GS	Serial No.	A010393	A004997	Accuracy	Class 1, $\pm 1\%$ <small>/17/</small>	Class 1, $\pm 1\%$ <small>/17/</small>	Meter tag	PD-PM-001	PD-PM-002
Type of meter	Energy meter	Energy meter																			
Make	DEIF	DEIF																			
Model	Multi – Line PPU/2/GS	Multi – Line PPU/2/GS																			
Serial No.	A010393	A004997																			
Accuracy	Class 1, $\pm 1\%$ <small>/17/</small>	Class 1, $\pm 1\%$ <small>/17/</small>																			
Meter tag	PD-PM-001	PD-PM-002																			

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<p>Verification of data generation:</p>	<p>The parameter is measured continuously with the help of the above mentioned electricity meters. The cumulative value of the parameter (or totaliser value) is always displayed on the screen of the meter panel. The reading is recorded from the meter by the operator everyday in the log sheet on a daily basis and reported to the Head of QC department. The Head of QC calculates the daily consumption based on the two consecutive daily readings and inputs the data into excel file.</p> <p>The GLC's verification team during the onsite verification observed that the meters were installed in the control room next to Generators room and connected to respective display units. Cumulative readings of the electricity generation could be read on the display located on control panel. It is further confirmed from the document review that the meters measure the net electricity generation by the generators. The meters were also calibrated at regular intervals. Further assessment on calibration is provided in below sections of the report.</p> <p>Therefore, the verification team can confirm that the data generation is appropriate.</p>
<p>Measuring frequency:</p>	<p>The parameter was measured continuously with the above mentioned energy meters.</p>
<p>Is measuring frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)</p>	<p>Yes.</p> <p>The monitoring plan states that "<i>continuous measurement using calibrated meter</i>" is carried out. The monitoring methodology does not specify the measuring frequency; however, recording frequency is indicated as "Continuously".</p> <p>Therefore, the measuring frequency is considered to be in accordance with the monitoring plan^{3/} and the monitoring methodology^{10/}.</p>
<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>	<p>The accuracy of the monitoring equipment was not stated in the revised monitoring plan. However, GLC's sectoral expert based on his industrial experience confirms that $\pm 1\%$ of accuracy represents good practice.</p>

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<p>Verification of data aggregation:</p>	<p>The cumulative value of the parameter i.e. the totaliser value was recorded in the daily log sheets. Daily generation was calculated as the difference of the totaliser readings and the same was reported in the ER sheet ^{/5/} submitted along with the MR ^{/4/} to the verification team.</p> <p>Therefore, by checking the totaliser values, it is confirmed that the data aggregation is appropriate and free of mistakes.</p> <p>The total measured value of the parameter for the monitoring period is 5910.15 MWh.</p>
<p>Verification of data recording:</p>	<p>From the onsite verification and interviews with the respective operating team, it is confirmed that the parameter is continuously measured by the electricity meters. The totaliser reading displayed on the display unit is recorded by the operator on a daily basis at 8 AM into the log sheets. The daily log sheets are reported to the Head of QC. The Head of QC calculates the daily generation and inputs the data into electronic file (excel file). Since the totaliser values are recorded in the log sheets, any inconsistency could easily be detected by the Head of QC.</p> <p>The verification team by verifying the log sheets can confirm that the data was appropriately recorded for the monitoring period.</p>
<p>Verification of data calculation and reporting</p>	<p>From the onsite interviews it was understood that the Head of QC transfers the data from log sheets into electronic files. At the end of every month, the Head of QC prints out the electronic files and submits them to the Plant Manager. Furthermore, the Head of QC also prepares data and submits to Project Consultant on a monthly basis for emission reduction calculation.</p> <p>The verification team reviewed the ER sheet^{/5/} submitted along with the MR^{/4/}. Reported data was thoroughly verified with the log sheet information and the calculation provided in the ER sheet was checked and reproduced. It is confirmed that the data calculation and reporting is appropriate.</p> <p>It is worth to note that the electricity generated by the gas engine generators was supplied to the starch factory since the approval to export to the electricity grid was</p>

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	<p>not yet obtained by the PP. Nevertheless, as stated in the PDD and the monitoring plan the electricity supplied by the generators would replace the grid electricity consumption by the starch factory. Therefore, in any case (whether it is exported to grid or consumed onsite) the electricity generated by the project activity would displace the grid electricity which is predominantly by the fossil fuels as validated. This was also validated during the validation and the assessment was provided in the validation report^{/12/}. Therefore, the verification team is of the opinion that considering the validated grid emission factor of 0.52 tCO₂/MWh (please refer to B.6.2 of the PDD) for emission reduction calculation is appropriate.</p> <p>Besides, it is confirmed from the final ER sheet that PP also deducted the power consumption of biogas plant from the net electricity generation by the generators in order to take only the electricity supplied to the starch factory into account. From the evidence document it is confirmed that the total rating of the equipments at biogas plant is 168.9 kW ^{/44/}. It was correctly taken and multiplied with total number of hours (232 days x 24 hours = 5568) for the monitoring period in the ER sheet. The verification team can confirm that the calculation approach is correct and it results in conservative estimation of emission reduction given that the equipments were not operated for 24 hours a day and for all 232 days during the monitoring period. The operating days were 220 during the monitoring period ^{/5/}.</p>
Reporting frequency:	<p>Daily</p> <p>The parameter is recorded in log sheets by the operator on a daily basis. The log sheet data is reported to the Head of QC. The Head of QC after checking the data transfers into electronic file on a daily basis. At the end of every month, the Head of QC prints out the electronic files, signs and submits them to the Plant Manager. The Plant Manager approves the monthly reports by signing. The approved monthly reports are stored for record. All the log sheets^{/31/} and monthly reports^{/34/} were provided to the verification team during the onsite verification.</p>
Is reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	<p>Neither the monitoring plan nor the monitoring methodology specifies the reporting frequency. Nevertheless, the overall monitoring practice is in accordance with the monitoring plan. The verification team is of the opinion, based on the above assessment,</p>

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	that the reporting frequency represents good monitoring practice.
If applicable, has the reported data been cross-checked with other available data?	Yes, the reported data was crosschecked with the monthly reports ^{4/} approved by the Plant Manager. The reported data in the ER sheet is consistent with the monthly reports.
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 original hand written daily log sheets ^{31/} . It is confirmed that the values reported in the final MR and the ER sheet are correct.
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 activities
Data / Parameter (as per monitoring plan in the PDD):	<p>AM0022 ID 8</p> <p>Fossil fuel volume equivalent to generate same amount of heat generated from the biogas collected in the anaerobic treatment facility</p> <p>Unit: m³</p>
Type of monitoring equipment:	<p>The parameter was calculated in m³ based on Volume of biogas sent to facility heaters (AM0022 ID 5), a conversion factor of 0.5743 kg HFO/Nm³ biogas and density of HFO (heavy fuel oil). The conversion factor of 1 Nm³ of biogas equal to 0.5743 kg HFO was established during the validation (refer to section B.6.1 of the PDD). Density of HFO was considered as 0.995 kg/l which is same as in the PDD.</p> <p>As per formula (9) of the applied methodology (AM0022, version 04) and section B.6.1 of the PDD (formula in page 27 of the approved revised PDD), the parameter is</p>

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	<p>required to be calculated in tons. It was therefore also calculated in tons based on Volume of biogas sent to facility heaters (AM0022 ID 5), Net Calorific Value (NCV) of HFO and NCV of biogas. NCV of HFO is a fixed value, 0.0404 TJ/ton, which was established based on IPCC 2006 guidelines during the validation. NCV of biogas is a monitoring parameter which is assessed in later part of the report.</p> <p>The parameter was transparently calculated and presented both in m³ and in tons in the ER sheet ^{/5/}.</p>
<p>Verification of data generation:</p>	<p>The parameter was calculated in accordance with the monitoring plan.</p> <p>The calculation was done on a daily basis. The approach and the calculation provided in the ER sheet are transparent. The calculation approach has been transparently mentioned in the MR.</p>
<p>Measuring frequency:</p>	<p>Not applicable (NA)</p> <p>The parameter was calculated</p>
<p>Is measuring frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)</p>	<p>NA</p>
<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>	<p>NA</p>
<p>Verification of data aggregation:</p>	<p>Data aggregation and calculation was checked from the ER sheet since the parameter was not directly measured but calculated. Further based on the assessment of parameter ID 5 (Volume of biogas sent to facility heaters), it is confirmed that the data aggregation is correct.</p> <p>The total calculated value of the parameter for the monitoring period is 1044.36 m³ = 1059.56 tons.</p>
<p>Verification of data recording:</p>	<p>NA</p>

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	The parameter was not recorded directly but calculated.
Verification of data calculation and reporting	The data and the calculation provided in the ER sheet was thoroughly checked and reproduced. The calculation provided for the parameter in m ³ and in tons is confirmed to be correct.
Reporting frequency:	NA The parameter is calculated based on the measured value of AM0022 ID 5 (volume of biogas sent to facility heaters) and default values of NCV. The reporting frequency is therefore not applicable.
Is reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	NA No reporting frequency was specified either in the monitoring plan or in the monitoring methodology.
If applicable, has the reported data been cross-checked with other available data?	NA
How were the values in the monitoring report verified?	The values have been verified from the reported values of biogas sent to facility heaters, NCV of HFO and NCV of biogas.
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. For further description of the monitoring management of biogas sent to facility heaters, please refer to ID 5 in the section above.

	Assessment activities
Data / Parameter (as per monitoring plan in the PDD):	AM0022 ID 9 Biogas sent to flares (V1) Unit: Nm ³

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Type of monitoring equipment:	Type of meter	Differential Pressure Transmitter (or differential flow meter)
	Make	ABB
	Model	265DS CCFA6B1
	Serial No.	265DS6600065941
	Accuracy	± 0.04% ^{17/}
	SCADA representation	FT 105
	Meter tag	PD-DM-002
Verification of data generation:	<p>The parameter was monitored through the above mentioned flow meter. The flow meter measures the parameter on a continuous basis. The cumulative value of the parameter (or totaliser value) is always displayed on the meter screen. Besides, the flow meter is connected to SCADA system^{42/} and therefore the accumulated reading of the flow is displayed on the SCADA screen. The reading is recorded from the SCADA screen by the operator everyday in the log sheet^{31/} and reported to the Head of QC department.</p> <p>The GLC's verification during the onsite verification observed that the meter was installed on the biogas pipeline that goes to the open flare. The verification team also checked the meter display and the SCADA screen in Biogas control room and observed that the totaliser value was consistently indicated.</p> <p>Therefore, the verification team can confirm that the data generation is appropriate.</p>	
Measuring frequency:	<p>Continuously</p> <p>The parameter is measured continuously with the above mentioned flow meter.</p>	
Is measuring frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	<p>Yes.</p> <p>The monitoring plan states that the parameter is measured continuously by flow meter. The monitoring methodology does not specify the measuring frequency;</p>	

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	<p>however, recording frequency is indicated as “Continuously”.</p> <p>Since the parameter is measured and recorded continuously by the flow meter, the measuring frequency is considered to be in accordance with the monitoring plan^{/3/} and the monitoring methodology^{/10/}.</p>
<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>	<p>The accuracy of the monitoring equipment was not defined in the monitoring plan. However, GLC’s Sectoral expert confirms that $\pm 0.04\%$ of accuracy represents good monitoring practice.</p>
<p>Verification of data aggregation:</p>	<p>The cumulative value of the parameter i.e. the totaliser value is recorded in the daily log sheets. The same value is also indicated in the emission reduction calculation spread sheet (ER sheet) ^{/5/} submitted along with the monitoring report (MR) ^{/4/} to the verification team against the corresponding date. The daily value is calculated as the difference of the two consecutive readings.</p> <p>Therefore, by checking the totaliser values, it is confirmed that the data aggregation is appropriate and free of mistakes.</p> <p>The total measured value of the parameter for the monitoring period is 4,286 Nm³.</p>
<p>Verification of data recording:</p>	<p>From the onsite verification and interviews with the respective operating team, it is confirmed that the parameter is continuously measured by flow meter. The totaliser reading displayed on the SCADA screen is recorded by the operator on a daily basis at 8 AM into the log sheets. The daily log sheets are reported to the Head of QC. The SCADA system also captures the data every minute and stores in Biogas plant computer in the form of CSV file. The Head of QC crosschecks the log sheet data with the data recorded by the SCADA system. Since the totaliser values are recorded in the log sheets, any inconsistency can easily be detected the Head of QC.</p> <p>The verification team also checked the CSV files for one month (June 2013) ^{/43/} and it was observed that the data was captured for every minute. For each day the reading</p>

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	<p>starts at 8:00 AM the same day and ends at 8:00 AM the following day and each daily file has 1440 entries.</p> <p>The Head of QC transfers the data from log sheets to electronic files (MS-Excel files) on a daily basis. The electronic files^{34/} are printed at the end of every month by the Head of QC and submitted to the Plant Manager.</p>
<p>Verification of data calculation and reporting</p>	<p>From the onsite verification and interviews with the operating team it is confirmed that the data is recorded in log sheets and reported to Head of QC everyday. The Head of QC further reports the data to the Plant Manager on a monthly basis. The monthly reports^{34/} are signed by the Head of QC and the Plant Manager as approved. The daily log sheets and the approved monthly reports are stored in hard format. All the daily log sheets^{31/} and the monthly reports^{34/} were checked by the verification team during the onsite verification.</p> <p>Besides, it was also learnt from the onsite interviews that the Head of QC submits the monitoring data on a monthly basis to the Project Consultant for calculating emission reduction.</p> <p>The calculation was transparently provided by the PP in the ER sheet and submitted to GLC along with the MR. The verification team reviewed the ER sheet^{5/} and the MR^{4/}. Reported data was thoroughly verified with the log sheet information. 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 data reporting and calculation is appropriate and correct.</p>
<p>Reporting frequency:</p>	<p>Daily</p> <p>The parameter is recorded in log sheets by the operator on a daily basis. The log sheet data is reported to the Head of QC everyday. The Head of QC after checking the data transfers into electronic file on a daily basis. At the end of every month, the Head of QC prints out the electronic files, signs and submits them to the Plant Manager. The Plant Manager approves the monthly reports by signing. The approved monthly reports are stored for record. All the log sheets^{31/} and monthly reports^{34/} were provided to the verification team during</p>

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	the onsite verification.
Is reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Neither the monitoring plan nor the monitoring methodology specifies the reporting frequency. Nevertheless, the overall monitoring practice is in accordance with the monitoring plan. The verification team is of the opinion, based on the above assessment, that the reporting frequency represents good monitoring practice.
If applicable, has the reported data been cross-checked with other available data?	Yes, the reported data was crosschecked with the monthly reports ^{34/} approved by the Plant Manager. The reported data in the ER sheet is consistent with the monthly reports.
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 original hand written daily log sheets ^{31/} . It is confirmed that the values reported in the final MR and the ER sheet are correct.
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.

	Assessment activities	
Data / Parameter (as per monitoring plan in the PDD):	AM0022 ID 10 Biogas sent to generation Unit: Nm ³	
Type of monitoring equipment:	Location	Generator A
	Type of meter	Differential Pressure Transmitter (or Differential flow meter)

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	Make	ABB
	Model	265DS CCFA6B1
	Accuracy	$\pm 0.04\%$ ^{/17/}
	Serial No.	265DS6600032493
	SCADA representation	FT 501A
	Meter tag	PD-DM-004
	Location	Generator B
	Type of meter	Differential Pressure Transmitter
	Make	ABB
	Model	265DS CCFA6B1
	Accuracy	$\pm 0.04\%$ ^{/17/}
	Serial No.	265DS6600028459
	SCADA representation	FT 501B
Meter tag	PD-DM-005	
<p>There are two gas engine generators. The gas consumption of each generator is monitored through a separate meter.</p>		
Verification of data generation:	<p>The parameter was monitored through the above mentioned gas flow meters. The flow meters measure the parameter on a continuous basis. The cumulative value of the parameter (or totaliser value) is always displayed on the meter screen. Besides, the flow meters are connected to SCADA system and therefore the accumulated reading of the flow is displayed on the SCADA screen. The readings are recorded from the SCADA screen by the operator everyday in the log sheet</p>	

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	<p>and reported to the Head of QC department.</p> <p>The GLC's verification during the onsite verification observed that the meters were installed on the biogas pipelines that feed generators. They are located just before the gas engine generators. The verification team also checked the meter display and the SCADA screen^{/42/} in Biogas control room and observed that the totaliser values were consistently indicated.</p> <p>Monitored data has been presented separately for each generator in the ER sheet for the sake of clarity.</p> <p>Therefore, the verification team can confirm that the data generation is appropriate.</p>
<p>Measuring frequency:</p>	<p>Continuously</p> <p>The parameter is measured continuously with the above mentioned flow meters.</p>
<p>Is measuring frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)</p>	<p>Yes.</p> <p>The monitoring plan states that the parameter is measured continuously by flow meters. The monitoring methodology does not specify the measuring frequency; however, recording frequency is indicated as "Continuously".</p> <p>Since the parameter is measured and recorded continuously by the flow meters, the measuring frequency is considered to be in accordance with the monitoring plan^{/3/} and the monitoring methodology^{/10/}.</p>
<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>	<p>The accuracy of the monitoring equipment was not defined in the monitoring plan. However, GLC's Sectoral expert confirms that $\pm 0.04\%$ of accuracy represents good monitoring practice.</p>
<p>Verification of data aggregation:</p>	<p>The cumulative value of the parameter i.e. the totaliser value is recorded in the daily log sheets. The same value is also indicated in the emission reduction calculation spread sheet (ER sheet)^{/5/} submitted along with the monitoring report (MR)^{/4/} to the verification team. The daily value is calculated as the difference of</p>

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	<p>the two consecutive readings.</p> <p>Therefore, by checking the totaliser values, it is confirmed that the data aggregation is appropriate and free of mistakes.</p> <p>The total measured value of the parameter for the monitoring period is 2,880,845 Nm³.</p>
<p>Verification of data recording:</p>	<p>From the onsite verification and interviews with the respective operating team, it is confirmed that the parameter is continuously measured by flow meter. The totaliser reading displayed on the SCADA screen is recorded by the operator on a daily basis at 8 AM into the log sheets. The daily log sheets are reported to the Head of QC. The SCADA system also captures the data every minute and stores in Biogas plant computer in the form of CSV file. The Head of QC crosschecks the log sheet data with the data recorded by the SCADA system. Since the totaliser values are recorded in the log sheets, any inconsistency can easily be detected by the Head of QC.</p> <p>The verification team also checked the CSV files for one month (June 2013)^{43/} and it was observed that the data was captured every minute. For each day the reading starts at 8:00 AM the same day and ends at 8:00 AM the following day and each daily file has 1440 entries.</p> <p>The Head of QC transfers the data from log sheets to electronic files (MS-Excel files) on a daily basis. The electronic files^{34/} are printed at the end of every month by the Head of QC and submitted to the Plant Manager.</p>
<p>Verification of data calculation and reporting</p>	<p>From the onsite verification and interviews with the operating team it is confirmed that the data is recorded in log sheets and reported to Head of QC everyday. The Head of QC further reports the data to the Plant Manager on a monthly basis. The monthly reports^{34/} are signed by the Head of QC and the Plant Manager as approved. The daily log sheets and the approved monthly reports are stored in hard format. All the daily log sheets^{31/} and the monthly reports^{34/} were checked by the verification team during the onsite verification.</p> <p>Besides, it was also learnt from the onsite interviews that the Head of QC submits the monitoring data on a monthly basis to the Project Consultant for calculating</p>

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	<p>emission reduction.</p> <p>The calculation was transparently provided by the PP in the ER sheet and submitted to GLC along with the MR. The verification team reviewed the ER sheet^{5/} and the MR^{4/}. Reported data was thoroughly verified with the log sheet information. 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 data reporting and calculation is appropriate and correct.</p>
<p>Reporting frequency:</p>	<p>Daily</p> <p>The parameter is recorded in log sheets by the operator on a daily basis. The log sheet data is reported to the Head of QC everyday. The Head of QC after checking the data transfers into electronic file on a daily basis. At the end of every month, the Head of QC prints out the electronic files, signs and submits them to the Plant Manager. The Plant Manager approves the monthly reports by signing. The approved monthly reports are stored for record. All the log sheets^{31/} and monthly reports^{34/} were provided to the verification team during the onsite verification.</p>
<p>Is reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)</p>	<p>Neither the monitoring plan nor the monitoring methodology specifies the reporting frequency. Nevertheless, the overall monitoring practice is in accordance with the monitoring plan. The verification team is of the opinion, based on the above assessment, that the reporting frequency represents good monitoring practice.</p>
<p>If applicable, has the reported data been cross-checked with other available data?</p>	<p>Yes, the reported data was crosschecked with the monthly reports^{34/} approved by the Plant Manager. The reported data in the ER sheet is consistent with the monthly reports.</p>
<p>How were the values in the monitoring report verified?</p>	<p>The values reported in the monitoring report^{4/} and the corresponding ER sheet^{5/} were verified with the original hand written daily log sheets^{31/}. It is confirmed that the values reported in the final MR and the ER sheet are correct.</p>
<p>Does the data management (from monitoring equipment to emission reduction calculation)</p>	<p>Yes. The verification team, based on the document review and onsite verification, confirms that the data</p>

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<p>ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?</p>	<p>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>
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		Assessment activities													
<p>Data / Parameter (as per monitoring plan in the PDD):</p>	<p>AM0022 ID11</p> <p>Biogas methane concentration</p> <p>Unit: %</p>														
<p>Type of monitoring equipment:</p>		<table border="1"> <tr> <td>Type of meter</td> <td>CH₄ analyser</td> </tr> <tr> <td>Make</td> <td>Drager</td> </tr> <tr> <td>Model</td> <td>Polytron IR EX</td> </tr> <tr> <td>Serial No.</td> <td>ARCC-0038</td> </tr> <tr> <td>Accuracy</td> <td>± 1% ^{/17/}</td> </tr> <tr> <td>SCADA representation</td> <td>AIT 101</td> </tr> </table>	Type of meter	CH ₄ analyser	Make	Drager	Model	Polytron IR EX	Serial No.	ARCC-0038	Accuracy	± 1% ^{/17/}	SCADA representation	AIT 101	
Type of meter	CH ₄ analyser														
Make	Drager														
Model	Polytron IR EX														
Serial No.	ARCC-0038														
Accuracy	± 1% ^{/17/}														
SCADA representation	AIT 101														
<p>Verification of data generation:</p>	<p>The parameter was monitored through an online gas analyser (CH₄ analyser) of above mentioned details. The analyser is connected to SCADA system which captures the data every minute. During the onsite verification the analyser was found to be installed in the biogas main pipeline that comes out from the UASB reactor. The SCADA system was also checked and observed that the analyser with its representation AIT101 was indicated on the SCADA screen. Recorded data by the SCADA is stored in the form of CSV files. By checking the CSV files in the Biogas plant computer^{/43/}, the verification team can confirm that the parameter was measured on a continuous basis and recorded every minute. The average of the values recorded over a day (from 8 AM to 8 AM) was calculated and recorded in the log sheet by the Head of QC. The log sheets were checked by the</p>														

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	<p>verification team during the onsite verification.</p> <p>Furthermore it is confirmed, based on onsite verification, that the analyser is located immediately after the UASB i.e. before the scrubber and dryer. Therefore, methane concentration (%CH₄) measured by the analyser is on wet basis. This is in accordance with the requirement of the applied methodology (AM0022, version 04)^{10/}.</p> <p>Therefore, the verification team confirms that the data generation is appropriate.</p>
<p>Measuring frequency:</p>	<p>Continuously</p> <p>The parameter is measured continuously by the above mentioned gas analyser and recorded every minute.</p>
<p>Is measuring frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)</p>	<p>Yes. The measuring frequency is in accordance with the monitoring plan and the monitoring methodology.</p>
<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>	<p>The accuracy of the monitoring equipment was not defined in the monitoring plan. However, GLC's sectoral expert confirms that $\pm 1\%$ of accuracy represents good monitoring practice.</p>
<p>Verification of data aggregation:</p>	<p>From the onsite verification and interview with the operating team it is confirmed that the parameter is captured and stored every minute by SCADA. Average of all the minute values over a day (8 AM to 8 AM) is calculated and recorded in the log sheets. The same values are reported in the ER sheet as daily values of the parameter. Annual average of the daily values is calculated and used in the emission reduction calculation. It is confirmed by reviewing the ER sheet that the data aggregation is correct.</p> <p>The average measured value of the parameter for the monitoring period is 63.77%.</p>
<p>Verification of data recording:</p>	<p>Data recording was verified by checking the gas analyser, SCADA system, every minute values of the parameter recorded by the SCADA and the daily log sheets during the onsite verification.</p> <p>It is confirmed that the data is recorded on a continuous</p>

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	<p>basis and the value of the parameter is captured and stored every minute. The average of the values recorded over a day is calculated and written in daily log sheets.</p>
<p>Verification of data calculation and reporting</p>	<p>From the onsite verification and interviews with the operating team it is confirmed that the data was recorded in log sheets everyday. Daily values of the parameter are indicated in the ER sheet. The reported values in the ER sheet were verified from the log sheet.</p> <p>The Head of QC further reports the data to the Plant Manager on a monthly basis. The monthly reports^{34/} are signed by the Head of QC and the Plant Manager as approved. The daily log sheets and the approved monthly reports are stored in hard format. All the daily log sheets^{31/} and the monthly reports^{34/} were checked by the verification team during the onsite verification.</p> <p>Besides, it was also learnt from the onsite interviews that the Head of QC submits the monitoring data on a monthly basis to the Project Consultant for calculating emission reduction.</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 data reporting and calculation is appropriate and correct.</p>
<p>Reporting frequency:</p>	<p>Daily</p> <p>The parameter is recorded in log sheets on a daily basis. The log sheet data is transferred into electronic file on a daily basis. At the end of every month, the Head of QC prints out the electronic files, signs and submits them to the Plant Manager. The Plant Manager approves the monthly reports by signing. The approved monthly reports are stored for record. All the log sheets^{31/} and monthly reports^{34/} were provided to the verification team during the onsite verification.</p>
<p>Is reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)</p>	<p>Neither the monitoring plan nor the monitoring methodology specifies the reporting frequency. Nevertheless, the overall monitoring practice is in accordance with the monitoring plan. The verification</p>

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	team is of the opinion, based on the above assessment, that the reporting frequency represents good monitoring practice.
If applicable, has the reported data been cross-checked with other available data?	Yes, the reported data was crosschecked with the monthly reports ^{34/} approved by the Plant Manager. The reported data in the ER sheet is consistent with the monthly reports.
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 original hand written daily log sheets ^{31/} . It is confirmed that the values reported in the final MR and the ER sheet are correct.
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.

	Assessment activities
Data / Parameter (as per monitoring plan in the PDD):	AM0022 ID 12 Project emissions from flaring of the residual gas stream (PEflare) Unit: t CO ₂ e
Type of monitoring equipment:	NA The parameter was calculated based on Biogas sent to flares (AM0022 ID 9), Biogas methane concentration (AM0022 ID11), Flare efficiency, Density of methane and GWP of methane. The parameter was according to the "Tool to determine project emissions from flaring gases containing methane" ^{11/} It is worth to mention that the tool " <i>Tool to determine</i>

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	<p><i>project emissions from flaring gases containing Methane</i> (version 1) was revised to <i>“Project emissions from flaring”</i> (version 2.0.0) during EB 68 meeting (Refer to Annex 15 of EB 68 report). 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. Moreover, PP followed conservative approach i.e. the flare efficiency was assumed as 0% for the whole monitoring period. Since the applied methodology AM0022 (version 04) and the monitoring plan refer to <i>“Tool to determine project emissions from flaring gases containing Methane”</i> (EB 28, Annex 13), the MR correctly refers to the tool.</p>
<p>Verification of data generation:</p>	<p>NA</p>
<p>Measuring frequency:</p>	<p>NA</p>
<p>Is measuring frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)</p>	<p>NA</p>
<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>	<p>NA</p>
<p>Verification of data aggregation:</p>	<p>NA</p>
<p>Verification of data recording:</p>	<p>NA</p>
<p>Verification of data calculation and reporting</p>	<p>The calculation was done on a daily basis and the calculation was transparently provided by the PP in the ER sheet. It is confirmed that the calculation was done in accordance with the “Tool to determine project emissions from flaring gases containing methane” and the approach is also inline with the monitoring plan.</p> <p>The calculation and the reported values were verified from Biogas sent to facility flares (AM0022 ID 9), Biogas methane concentration (AM0022 ID11), Flare efficiency, Density of methane and GWP of methane.</p> <p>Biogas sent to flare and Biogas methane concentration have already been assessed above in this report. Density of methane and GWP of methane are default</p>

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	<p>values fixed during the validation (please refer to B.6.2 of the PDD). It is worth to note that the flare efficiency was assumed as 0% by the PP in the calculation. It is considered to be appropriate as it results in conservative estimation of emission reduction.</p> <p>Therefore, the data calculation and reporting is confirmed to be appropriate and correct.</p> <p>The total calculated value of the parameter for the monitoring period is 48 tCO₂e.</p>
Reporting frequency:	NA
Is reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	NA
If applicable, has the reported data been cross-checked with other available data?	NA
How were the values in the monitoring report verified?	The reported values in the MR and ER sheet were verified from Biogas sent to flares (AM0022 ID 9), Biogas methane concentration (AM0022 ID11), Flare efficiency, Density of methane and GWP of methane.
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?	Please refer to the assessment of the parameters Biogas sent to flares (AM0022 ID 9) and Biogas methane concentration (AM0022 ID11).

	Assessment activities	
Data / Parameter (as per monitoring plan in the PDD):	AM0022 ID 13 Amount of chemical oxidising agents entering system boundary Unit: tonnes / m ³	
Type of monitoring equipment:	Type of meter	Portable Colorimeter
	Make	Hach

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	Model	DR/890
	Serial No.	07089C64902
	Accuracy	± 0.24% ^{117/}
	Meter tag	PD-CL-001
Verification of data generation:	<p>From the verification of log sheets and interviews with the operating team during onsite verification, it is confirmed that the parameter 'Amount of chemical oxidising agents entering system boundary' which is basically the amount of Sulphates (SO₄) present in the wastewater is measured along with the COD measurement everyday.</p> <p>From the onsite verification and interview with the QC laboratory staff, it is confirmed that the samples of wastewater from the inlet of UASB are collected for every two hours starting at 8 AM every day. Therefore, total 12 samples are collected. The samples are mixed and the composite sample is analysed at onsite laboratory. The analysis is carried out once a day at 8 AM. The readings from the laboratory analysis is recorded in log sheets and reported to the Head of QC on a daily basis. During the onsite interview, the QC staff described the Sulphate (SO₄) analysis procedure and the procedure was found to be in accordance with the written procedures^{32/} available at the QC lab. Besides, GLC's sectoral expert confirms that the analysis procedures are appropriate.</p>	
Measuring frequency:	<p>Daily</p> <p>The measurement is carried out once a day.</p>	
Is measuring frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	<p>Yes.</p> <p>The monitoring plan states that the parameter is monitored continuously. The monitoring methodology does not specify the measuring frequency.</p> <p>The verification team can confirm that the measuring frequency is inline with the monitoring plan and the monitoring methodology.</p>	
Is accuracy of the monitoring equipment as stated in the PDD?	<p>The accuracy of the monitoring equipment was not stated in the monitoring plan. However, GLC's sectoral</p>	

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<p>If the PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practise?</p>	<p>expert confirms that +0.24% of accuracy represents good monitoring practice.</p>
<p>Verification of data aggregation:</p>	<p>The parameter is measured in mg/l. It is then calculated into kg COD/m³. The reported data in the ER sheet was checked with the log sheets^{31/}; the verification team found that the data and the data aggregation are correct.</p> <p>The average measured value of the parameter for the monitoring period is 181 mg/l. However, PP considered maximum recorded value of 1506 mg/l during the monitoring period in order to be conservative. By reproducing the calculation in the ER sheet it is confirmed that considering the maximum value for the parameter results in conservative estimation of emission reduction.</p>
<p>Verification of data recording:</p>	<p>As mentioned above the parameter was analysed every day and recorded in log sheets. All the original log sheets were presented to the verification team during the verification. Besides, written procedures^{32/} available with the QC department were also checked. By interviewing the QC staff it is confirmed that the procedures were appropriately followed.</p>
<p>Verification of data calculation and reporting</p>	<p>From the onsite interviews it was understood that the Head of QC transfers the data from log sheets into electronic files. At the end of every month, the Head of QC prints out the electronic files and submits them to the Plant Manager. Furthermore, the Head of QC also prepares data and submits to Project Consultant on a monthly basis for emission reduction calculation.</p> <p>The verification team reviewed the ER sheet^{t/5/} submitted along with the MR^{4/}. Reported data was thoroughly verified with the log sheet information and the calculation provided in the ER sheet was checked and reproduced. It is confirmed that the data calculation and reporting is appropriate.</p>
<p>Reporting frequency:</p>	<p>Daily</p> <p>The parameter is measured once a day and recorded in log sheets by the QC staff. The log sheet data is reported to the Head of QC. The Head of QC after checking the data transfers into electronic file on a daily</p>

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	<p>basis. At the end of every month, the Head of QC prints out the electronic files, signs and submits them to the Plant Manager. The Plant Manager approves the monthly reports by signing. The approved monthly reports are stored for record. All the log sheets^{31/} and monthly reports^{34/} were provided to the verification team during the onsite verification.</p>
<p>Is reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)</p>	<p>Neither the monitoring plan nor the monitoring methodology specifies the reporting frequency. Nevertheless, the overall monitoring practice is in accordance with the monitoring plan. The verification team is of the opinion, based on the above assessment, that the reporting frequency represents good monitoring practice.</p>
<p>If applicable, has the reported data been cross-checked with other available data?</p>	<p>Yes, the reported data was crosschecked with the monthly reports^{34/} approved by the Plant Manager. The reported data in the ER sheet is consistent with the monthly reports.</p>
<p>How were the values in the monitoring report verified?</p>	<p>The values reported in the monitoring report^{4/} and the corresponding ER sheet^{5/} were verified with the original hand written daily log sheets^{31/}. It is confirmed that the values reported in the final MR and the ER sheet are correct.</p>
<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>	<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 activities
<p>Data / Parameter (as per monitoring plan in the PDD):</p>	<p>AM0022 ID 14</p> <p>Gen set combustion efficiency (f)</p> <p>Unit: %</p>

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Type of monitoring equipment:	<p>NA</p> <p>The combustion efficiency is determined by an external organisation</p>									
Verification of data generation:	<p>The combustion efficiency test of Gas engine generators (Gen sets) was conducted by United Analyst and Engineering Consultant Co., Ltd., Bangkok on 2012 -02-23 and 2013-03-09 ^{/25/}.</p> <p>Test reports were provided to the verification team. The test reports indicate the non-combusted methane in ppm. Therefore, PP converted the ppm into percentage of combustion efficiency. The combustion efficiency was determined as more than 99.9%.</p> <table border="1" data-bbox="772 902 1393 1182"> <thead> <tr> <th>Test date</th> <th>Combustion efficiency for Gen set A</th> <th>Combustion efficiency for Gen set B</th> </tr> </thead> <tbody> <tr> <td>2012 -02-23</td> <td>99.9857% ^{/25/}</td> <td>99.9746% ^{/25/}</td> </tr> <tr> <td>2013-03-09</td> <td>99.9961% ^{/25/}</td> <td>99.9931% ^{/25/}</td> </tr> </tbody> </table>	Test date	Combustion efficiency for Gen set A	Combustion efficiency for Gen set B	2012 -02-23	99.9857% ^{/25/}	99.9746% ^{/25/}	2013-03-09	99.9961% ^{/25/}	99.9931% ^{/25/}
Test date	Combustion efficiency for Gen set A	Combustion efficiency for Gen set B								
2012 -02-23	99.9857% ^{/25/}	99.9746% ^{/25/}								
2013-03-09	99.9961% ^{/25/}	99.9931% ^{/25/}								
Measuring frequency:	Once in a year									
Is measuring frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	<p>The monitoring plan specifies that the combustion tests would be carried out annually. However, as seen from the above mentioned dates, there was a delay by few days in conducting the test in 2013. Nevertheless, it is worth to note that the efficiency tests conducted on 2012 -02-23 and 2013-03-09 indicate the combustion efficiency of over 99.9% which is higher than the default value of 99%. Therefore, default value of 99% (refer to section B.6.2 of the PDD) was considered by the PP for calculation of emission reduction. This approach is considered to be appropriate since it results in conservative estimation of emission reduction.</p> <p>GLC's Sectoral expert also confirms that the combustion efficiency of gas engine (or Gen set) with gaseous fuels is close to 100%.</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	NA									

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monitoring practise?	
Verification of data aggregation:	NA
Verification of data recording:	NA
Verification of data calculation and reporting	NA
Reporting frequency:	Yearly
Is reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	<p>The monitoring plan specifies that the combustion tests would be carried out annually. However, as seen from the above mentioned dates, there was a delay by few days in conducting the test in 2013.</p> <p>Nevertheless, it is worth to note that the efficiency tests conducted on 2012-02-23 and 2013-03-09 indicate the combustion efficiency of over 99.9% which is higher than the default value of 99%. Therefore, default value of 99% (refer to section B.6.2 of the PDD) was considered by the PP for calculation of emission reduction. This approach is considered to be appropriate since it results in conservative estimation of emission reduction.</p>
If applicable, has the reported data been cross-checked with other available data?	NA
How were the values in the monitoring report verified?	<p>From the review of ER sheet and the provided combustion efficiency test reports it is confirmed that default value of 99% was considered for the calculation of emission reduction which is conservative compared to the value determined during the tests. Therefore, the reported value is confirmed to be appropriate and correct.</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>

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	Assessment activities						
Data / Parameter (as per monitoring plan in the PDD):	AM0022 ID 15 Heating system combustion efficiency Unit: %						
Type of monitoring equipment:	NA The combustion efficiency is determined by an external organisation						
Verification of data generation:	<p>The combustion efficiency test of heating system (Boiler) was conducted by United Analyst and Engineering Consultant Co., Ltd., Bangkok on 2012-02-24 and 2013-03-10 ^{/25/}.</p> <p>Test reports were provided to the verification team. The test reports indicate the non-combusted methane in ppm. Therefore, PP converted the ppm into percentage of combustion efficiency. The combustion efficiency was determined as more than 99.9%.</p> <table border="1" data-bbox="772 1178 1391 1391"> <thead> <tr> <th>Test date</th> <th>Combustion efficiency for Boiler</th> </tr> </thead> <tbody> <tr> <td>2012 -02-24</td> <td>99.9997% ^{/25/}</td> </tr> <tr> <td>2013-03-10</td> <td>99.9974% ^{/25/}</td> </tr> </tbody> </table>	Test date	Combustion efficiency for Boiler	2012 -02-24	99.9997% ^{/25/}	2013-03-10	99.9974% ^{/25/}
Test date	Combustion efficiency for Boiler						
2012 -02-24	99.9997% ^{/25/}						
2013-03-10	99.9974% ^{/25/}						
Measuring frequency:	Once in a year						
Is measuring frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	<p>The monitoring plan specifies that the combustion tests would be carried out annually. However, there was a delay by few days in conducting the test in 2013.</p> <p>Nevertheless, it is worth to note that the efficiency tests conducted on 2012-02-24 and 2013-03-10 indicate the combustion efficiency of over 99.9% which is higher than the default value of 98.5%. Therefore, default value of 98.5% (refer to section B.6.2 of the PDD) was considered by the PP for calculation of emission reduction. This approach is considered to be appropriate since it results in conservative estimation of emission reduction.</p> <p>GLC's Sectoral expert also confirms that the combustion efficiency of Boiler with gaseous fuels is close to 100%.</p>						

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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
Verification of data aggregation:	NA
Verification of data recording:	NA
Verification of data calculation and reporting	NA
Reporting frequency:	Yearly
Is reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	<p>The monitoring plan specifies that the combustion tests would be carried out annually. However, there was a delay by few days in conducting the test in 2013.</p> <p>Nevertheless, it is worth to note that the efficiency tests conducted on 2012-02-24 and 2013-03-10 indicate the combustion efficiency of over 99.9% which is higher than the default value of 98.5%. Therefore, default value of 98.5% (refer to section B.6.2 of the PDD) was considered by the PP for calculation of emission reduction. This approach is considered to be appropriate since it results in conservative estimation of emission reduction.</p>
If applicable, has the reported data been cross-checked with other available data?	NA
How were the values in the monitoring report verified?	<p>From the review of ER sheet and the provided combustion efficiency test reports it is confirmed that default value of 98.5% was considered for the calculation of emission reduction which is conservative compared to the value determined during the tests. Therefore, the reported value is confirmed to be appropriate and correct.</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>

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		Assessment activities	
Data / Parameter (as per monitoring plan in the PDD):	AM0022 ID 17		
	Loss of biogas from pipeline Unit: %		
Type of monitoring equipment:	Type of meter	Portable gas detector	
	Make	Industrial Scientific	
	Model	MX4	
	Serial No.	10110R4-006	
	Accuracy	± 5% ^{/17/}	
	Meter tag	PD-GD-001	
Verification of data generation:	<p>From the onsite interviews and the monitoring records, it is confirmed that the leakage tests were carried out on a weekly basis during the monitoring period.</p> <p>Using the above mentioned leak detector the following areas are checked for any potential leakage:</p> <ul style="list-style-type: none"> • Top of UASB reactor • In-front of the control room from all the biogas pipelines pass • At gas storage system • Gas engine area • Biogas pipeline fed to boiler <p>From the physical inspection, interview with the operator and reviewing the technical specifications it was understood that the leak detector gives an alarm if there is any gas leakage. The intensity of alarm will increase if the detector is moved closer to the leakage point. Therefore, based on the intensity of alarm the leakage point is identified. The PP developed internal procedures for leakage test. As per the procedures, leakage test is conducted once in a week. Whenever a leakage is detected, it is immediately informed to the maintenance team who will repair the pipeline and arrest</p>		

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	<p>the leakage.</p> <p>No event of leakage detection was recorded in the monitoring records (log sheets). This was also confirmed during the onsite interviews with the operator. Therefore, the parameter has been mentioned as zero in the ER. It is considered to be appropriate.</p>
Measuring frequency:	Leak detecting exercise was conducted once in a week
Is measuring frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Neither the monitoring plan nor the applied monitoring methodology specifies the measuring frequency. However, the monitoring approach is inline with the monitoring plan.
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>Neither the monitoring plan nor the applied monitoring methodology specifies the accuracy of monitoring equipment.</p> <p>GLC's Sectoral expert is of the opinion that the accuracy of gas detector specified in its technical specifications^{17/} is appropriate as it is only used to detect the leakage and not to quantify.</p>
Verification of data aggregation:	NA
Verification of data recording:	Weekly monitoring records were checked to confirm that the leak detecting exercise was carried out once in a week.
Verification of data calculation and reporting	It has been reported zero since no leakage was detected. This is confirmed from the monitoring records and interview with the operator.
Reporting frequency:	Weekly
Is reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Neither the monitoring plan nor the applied monitoring methodology specifies the reporting frequency. However, the monitoring approach is inline with the monitoring plan.
If applicable, has the reported data been cross-checked with other available data?	NA
How were the values in the monitoring report verified?	The value has been reported as zero in the MR. It was verified from the weekly biogas leakage reports and confirmed to be correct.

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<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>	<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>
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		Assessment activities	
<p>Data / Parameter (as per monitoring plan in the PDD):</p>	<p>AM0022 ID 18 Organic material removed from wastewater facility Unit: t COD</p>		
<p>Type of monitoring equipment:</p>	<p>Type of meter</p>	<p>Weighing machine</p>	
	<p>Make</p>	<p>Commander</p>	
	<p>Model</p>	<p>HP01</p>	
	<p>Serial No.</p>	<p>0000237</p>	
	<p>Accuracy</p>	<p>±0.02% (Load: 100,000 kg; Accuracy: ± 20 kg)¹⁷⁷</p>	
<p>Verification of data generation:</p>	<p>The weighing machine (details mentioned above) available at the starch plant is used to weigh the organic material removed. The measurement is carried out whenever the organic material (or sludge) is removed from the UASB reactors. However, from the onsite interviews, it is confirmed that there was no removal of organic material during the monitoring period.</p>		
<p>Measuring frequency:</p>	<p>The measurement is carried out whenever the organic material (or sludge) is removed from the reactors. However, there was no removal of organic material during the monitoring period.</p>		
<p>Is measuring frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)</p>	<p>Neither the monitoring plan nor the monitoring methodology defines the measuring frequency. It was stated in the monitoring plan that the removal of organic material is not expected to take place.</p>		
<p>Is accuracy of the monitoring equipment as</p>	<p>Neither the monitoring plan nor the monitoring</p>		

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stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practise?	methodology specifies the accuracy of the monitoring equipment. The above mentioned monitoring equipment was never used during the monitoring period. Nevertheless, GLC's Sectoral expert is of the opinion that the weighing machine represents good accuracy since the same machine is used at the starch factory for weighing raw material and starch.
Verification of data aggregation:	NA
Verification of data recording:	NA
Verification of data calculation and reporting	NA
Reporting frequency:	NA
Is reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	NA
If applicable, has the reported data been cross-checked with other available data?	NA
How were the values in the monitoring report verified?	NA
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?	NA

	Assessment activities
Data / Parameter (as per monitoring plan in the PDD):	AM0022 ID 19 Biogas calorific value Unit: J / Nm ³
Type of monitoring equipment:	NA

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<p>Verification of data generation:</p>	<p>The parameter was calculated based on the parameter “Biogas methane concentration (AM0022 ID11)” assessed above and NCV of methane.</p> <p>NCV of methane was considered as 35.94 MJ/Nm³, which was sourced from literature. Reference to the source was provided in the ER sheet. The source document was checked by the verification team to confirm that the value is correct.</p> <p>The calculation was done on a daily basis and was transparently provided in the ER sheet.</p> <p>The verification team is of the opinion that it results in conservative estimation of emission reduction since the NCV of biogas is calculated assuming only the methane contributes to its NCV.</p> <p>It is also stated in the monitoring plan, “<i>The calculation based on the methane content of the gas is conservative since it would lead to an underestimation of the NCV, which will result in lower baseline emissions. On-site NCV measurement of gaseous fuels would be very cost intensive and complicated to arrange since not many laboratories have the right equipment for such measurements. Therefore, the conservative alternative approach is proposed.</i>”</p> <p>Therefore, the approach followed in monitoring the parameter is considered appropriate.</p>
<p>Measuring frequency:</p>	<p>NA</p>
<p>Is measuring frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)</p>	<p>NA</p>
<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>	<p>NA</p>
<p>Verification of data aggregation:</p>	<p>NA</p>
<p>Verification of data recording:</p>	<p>NA</p>

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Verification of data calculation and reporting	<p>The calculation was made transparent by the PP in the ER sheet. It was calculated as the product of 'biogas methane concentration' and 'NCV of methane'. The calculation was reproduced by the verification team to confirm the data calculation and recording correct.</p> <p>The average calculated value of the parameter for the monitoring period is 22.62 MJ/Nm³.</p>
Reporting frequency:	NA
Is reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	NA
If applicable, has the reported data been cross-checked with other available data?	<p>The reported values of NCV of biogas were crosschecked from the measured methane concentration and the theoretical value of NCV of methane.</p> <p>The theoretical value of NCV of methane is 35.94 MJ/Nm³</p>
How were the values in the monitoring report verified?	<p>The reported values of NCV of biogas in the MR and ER sheet were verified from the measured methane concentration and the literature for NCV of methane.</p> <p>The reported values are confirmed to be correct.</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>

	Assessment activities
Data / Parameter (as per monitoring plan in the PDD):	Flame detection period Unit: min
Type of monitoring equipment:	NA

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<p>Verification of data generation:</p>	<p>The flame detection period is measured based on the flame detection signals. It is monitored on a continuous basis. The SCADA system captures the flame detection signals every minute and indicates whether the flame is 'On' or 'Off'. The flare is an automatic system which is interlocked with flame detection. If the flame is not detected, the biogas valve is shut off automatically.</p> <p>During the onsite verification, the data recorded by the SCADA system was checked; the verification team observed that the flame detection was indicated as "Off" against the column "Bool.H101_Flame"^{43/} for majority of the time.</p> <p>As per the monitoring plan, <i>"If flame is detected for less than 20 minutes in an hour (whenever biogas is sent to flare), flare efficiency is assumed to be 0%".</i> Since the amount of biogas sent for flare was very less during the monitoring period and for simplification of calculation, the flare efficiency was assumed as 0% by the PP.</p> <p>The verification team is of the opinion that the approach is in accordance with the monitoring plan and it results in conservative estimation of emission reduction.</p>
<p>Measuring frequency:</p>	<p>The parameter is monitored on a continuous basis.</p>
<p>Is measuring frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)</p>	<p>Neither the monitoring plan nor the monitoring methodology specifies the measuring frequency. However, the monitoring approach is inline with the monitoring plan.</p>
<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>	<p>NA</p>
<p>Verification of data aggregation:</p>	<p>The flame detection is captured every minute and the status is indicated 'On' or 'Off'. If the flame is detected for less than 20 minutes, the flare efficiency is assumed as 0%; otherwise it is 50%.</p> <p>For the monitoring period the flare efficiency was assumed as 0% which is conservative.</p>

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<p>Verification of data recording:</p>	<p>The parameter is monitored on a continuous basis through SCADA system and reported during the operation of flare. The flare is operated only when there is excess gas which usually happens in case of shut down of boiler or gas engines.</p> <p>During the onsite interviews, the operating team informed that the parameter was not separately recorded in log sheets and therefore, the flare efficiency was assumed as 0% for simplification. The verification team is of the opinion that the approach is appropriate since it results in conservative estimation of emission reduction.</p>
<p>Verification of data calculation and reporting</p>	<p>Though the 'On' and 'Off' signals were recorded by the SCADA system for the flame detection, the period of flame detection was not calculated and not reported in the ER sheet. Therefore, the flare efficiency was assumed as 0% in the calculation of emission reduction which is considered as appropriate.</p>
<p>Reporting frequency:</p>	<p>The parameter was monitored on a continuous basis through SCADA but not reported.</p>
<p>Is reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)</p>	<p>NA</p>
<p>If applicable, has the reported data been cross-checked with other available data?</p>	<p>NA</p>
<p>How were the values in the monitoring report verified?</p>	<p>By reviewing the ER sheet it is confirmed that the parameter was not reported separately and therefore the flare efficiency was assumed as 0%. It is further confirmed, from the onsite interviews, that the flare was rarely operated and for simplification the parameter was not separately recorded and therefore not reported.</p>
<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>	<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>

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	Assessment activities
Data / Parameter (as per monitoring plan in the PDD):	Period of biogas being sent to the flare Unit: min
Type of monitoring equipment:	NA
Verification of data generation:	<p>As assessed under the parameter Biogas sent to flares (AM0022 ID 9), the biogas flow meter of flare is connected with SCADA system. The SCADA system captures the data and records every minute. The data is stored in the form of CSV files in biogas plant computer. Since the biogas is sent only when the flare is operated and the data is recorded every minute, 'the number of minutes per hour where biogas is sent to the flare' can be calculated.</p> <p>Nevertheless, PP did not calculate the period (number of minutes per hour) of biogas sent to the flare during the monitoring period for the sake of simplicity and conservativeness and therefore the parameter was not reported during the monitoring period. GLC's verification team is of the opinion that this does not have any negative impact on the emission reduction since the flare efficiency was assumed as 0% for conservative estimation.</p>
Measuring frequency:	NA
Is measuring frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	NA
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
Verification of data aggregation:	Though the biogas sent to flare was monitored continuously through a gas flow meter (assessed under ID9) and recorded every minute by the SCADA system, 'Amount of minutes per hour where biogas is sent to the flare' was not aggregated. The verification team is of the opinion that it does not have any negative impact on emission reduction calculation since the flare efficiency

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	was assumed as 0% by the PP.
Verification of data recording:	During the onsite interviews, the operating team informed that the parameter was not separately recorded in log sheets and therefore, the flare efficiency was assumed as 0% for simplification. The verification team is of the opinion that the approach is appropriate since it results in conservative estimation of emission reduction.
Verification of data calculation and reporting	The 'Period of biogas being sent to the flare' was not calculated and not reported in the ER sheet. Therefore, the flare efficiency was assumed as 0% in the calculation of emission reduction which is considered as appropriate.
Reporting frequency:	The parameter was monitored on a continuous basis through SCADA but not reported.
Is reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	NA
If applicable, has the reported data been cross-checked with other available data?	NA
How were the values in the monitoring report verified?	By reviewing the ER sheet it is confirmed that the parameter was not reported separately and therefore the flare efficiency was assumed as 0%. It is further confirmed, from the onsite interviews, that the flare was rarely operated and for simplification the parameter was not separately recorded and therefore not reported.
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.

Thus GLC confirms that

- the monitoring activities comply with the approved revised monitoring plan;
- all parameters that are baseline, project and leakage emission parameters are monitored as described in the monitoring plan;

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- 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 CYY Bio Power plant's team developed a procedure for monitoring and reporting of various parameters. The document ^{/38/} was also submitted to the verification team during the on-site assessment. The parameters such as wastewater flow, biogas consumption, methane concentration and power generation were measured continuously using appropriate monitoring equipments. COD samples were collected for every 2 hours and the composite sample was analysed twice a day. All the monitored parameters are recorded in log sheets ^{/31/} on a daily basis by the respective departmental (Quality Control, Biogas and Power) staff. The recorded values are checked by the Head of QC. As the totaliser readings were recorded in the log sheets and any doubtful value could be crosschecked with the panel meter readings in case of power and with SCADA system readings in case of other parameters. The log sheets were approved through signature and filed by the QC head.

From the onsite interviews and by checking monitoring procedures^{/38/}, the verification team confirms that the log sheet values are also transferred into Excel sheets and stored in a QC department's computer on a daily basis. The information is backed up in hard disk on a regular basis, once a week. The data is also copied into compact discs (CDs) once in 4 months. The Head of QC prints out the monthly summary sheets and submits to the Plant Manager. The plant manager verifies the data and approves the monthly reports. The approved monthly reports (signed by the Head of QC and the Plant Manager) are stored separately which were also presented to the verification team during the onsite verification. The Head of QC further sends the monitoring data on monthly basis to the project consultant (South Pole Carbon Asset Management Ltd) for emission reduction calculation.

Frequent training programmes were organised to the plant's operating team on operation, maintenance and safety. The training records ^{/39/}, operation manual of the wastewater treatment plant ^{/40/} and emergency procedures ^{/41/} were made available to the GLC's verification team. The plant's team was also interviewed during the on-site assessment and 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 consumption of gas engines, biogas to flare and methane content are monitored continuously and the meters are connected to SCADA system. Therefore, the values of the parameters are available in SCADA system any time for crosscheck. The COD values are analysed under the supervision of experienced QC head. The power generation is also recorded using integrated meters and therefore the totalised value is available on the panel meter screen for crosscheck. Furthermore, all the measuring equipments possess good level of accuracy.

It is worth to note that no calibration frequency was specified in the monitoring plan instead it was specified that meters would undergo calibration subject to appropriate industry standards. However, since there are no industry standards available in the host country, the PP chose to calibrate the monitoring equipment annually and developed the calibration plan accordingly. Based on Sectoral and

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local expertise of GLC's assessment team it is confirmed that there are no industry standards for calibration frequency of the monitoring equipment and the calibration frequency of one year chosen by the PP is appropriate. The calibration conducted for all the monitoring equipment was valid for the entire monitoring period.

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^{/12/} and the previous verification reports^{/13/14/}, it is confirmed that there are no open or pending issues.

Based on the on-site verification 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 could be verified that the monitoring plan for the project activity is in accordance with the monitoring methodology AM0022: "Avoided Wastewater and Onsite Energy Use Emissions in the Industrial Sector" (version 04). The parameters monitored are consistent with the monitoring plan and the monitoring methodology. According to the monitoring plan the Head of QC department would be responsible for maintaining accurate measurements, adequate data collection and storage and timely calibration of monitoring equipment. It is confirmed that all the relevant data was monitored and stored appropriately. All relevant data were presented to GLC during the verification. From the onsite interviews and the monitoring procedures it is confirmed that the data will be kept for two years following the completion of the crediting period.

4.1.4 Compliance with the Calibration Frequency Requirements for Measuring Instruments

Assessment on calibration frequency requirement for the monitoring equipment is provided below. It is to be noted the assessment is provided only for those parameters which were measured using monitoring equipment. For those monitoring parameters which were calculated based on the measured parameters and/or default values, the assessment related to calibration frequency is not applicable and therefore not provided.

	Assessment activities
Data / Parameter (as per monitoring plan in the PDD):	AM0022 ID 1 Wastewater flows entering the project treatment facility
Calibration frequency /interval:	Yearly
Is the calibration interval in line with the	As per the approved revised monitoring plan, the

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<p>monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practise?</p>	<p>calibration of the monitoring equipment is subject to appropriate industry standards. However, since there are no industry standards available for calibration requirements in the host country, the project participants (PP) have chosen an appropriate calibration interval of 1 year. GLC's Sectoral and local expertise confirm that there are no industry standards available in the host country for calibration of monitoring equipment and a calibration frequency of 1 year represents good monitoring practice.</p>					
<p>Company performing the calibration:</p>	<table border="1"> <tr> <td>Calibration date</td> <td>Company name</td> </tr> <tr> <td>2012-10-19</td> <td>Miracle International Technology Co., Ltd. (MITCL) ^{18/}</td> </tr> </table>	Calibration date	Company name	2012-10-19	Miracle International Technology Co., Ltd. (MITCL) ^{18/}	<p>Based on local expertise of GLC's assessment team it is confirmed that MITCL is a well established company (www.mit.in.th) in Thailand which supplies monitoring equipment and is authorised to conduct calibration of various measuring equipment.</p>
Calibration date	Company name					
2012-10-19	Miracle International Technology Co., Ltd. (MITCL) ^{18/}					
<p>Did calibration confirm proper functioning of monitoring equipment? (Yes / No):</p>	<p>Yes. The calibration reports were verified by the verification team which confirm the proper functioning of the meter.</p>					
<p>Is(are) calibration(s) valid for the whole reporting period?</p>	<p>Yes, the calibration conducted on 2012-10-19 is valid for the whole monitoring period.</p>					

	Assessment activities
<p>Data / Parameter (as per monitoring plan in the PDD):</p>	<p>AM0022 ID 2 Wastewater flows leaving the project treatment facility</p>
<p>Calibration frequency /interval:</p>	<p>Yearly It is to be noted that the parameter is same as that of Wastewater flows entering the project treatment facility (AM0022 ID 1).</p>
<p>Is the calibration interval in line with the</p>	<p>As per the approved revised monitoring plan, the</p>

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<p>monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practise?</p>	<p>calibration of the monitoring equipment is subject to appropriate industry standards. However, since there are no industry standards available for calibration requirements in the host country, the project participants (PP) have chosen an appropriate calibration interval of 1 year. GLC's Sectoral and local expertise confirm that there are no industry standards available in the host country for calibration of monitoring equipment and a calibration frequency of 1 year represents good monitoring practice.</p>					
<p>Company performing the calibration:</p>	<table border="1"> <tr> <td>Calibration date</td> <td>Company name</td> </tr> <tr> <td>2012-10-19</td> <td>MITCL</td> </tr> </table>	Calibration date	Company name	2012-10-19	MITCL	<p>Based on local expertise of GLC's assessment team it is confirmed that MITCL is a well established company (www.mit.in.th) in Thailand which supplies monitoring equipment and is authorised to conduct calibration of various measuring equipment.</p>
Calibration date	Company name					
2012-10-19	MITCL					
<p>Did calibration confirm proper functioning of monitoring equipment? (Yes / No):</p>	<p>Yes. The calibration reports were verified by the verification team which confirm the proper functioning of the meter.</p>					
<p>Is(are) calibration(s) valid for the whole reporting period?</p>	<p>Yes, the calibration conducted on 2012-10-19 is valid for the whole monitoring period.</p>					

	Assessment activities
<p>Data / Parameter (as per monitoring plan in the PDD):</p>	<p>AM0022 ID 3 Wastewater organic material concentration entering the project treatment facility</p>
<p>Calibration frequency /interval:</p>	<p>Yearly</p>
<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?</p>	<p>As per the approved revised monitoring plan, the calibration of the monitoring equipment is subject to appropriate industry standards. However, since there are no industry standards available for calibration requirements in the host country, the project participants (PP) have chosen an appropriate</p>

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	calibration interval of 1 year. GLC's Sectoral and local expertise confirm that there are no industry standards available in the host country for calibration of monitoring equipment and a calibration frequency of 1 year represents good monitoring practice.	
Company performing the calibration:	Calibration date	Company name
	2012-10-30	EnviScience Company Limited ^{19/}
	Based on local expertise of GLC's assessment team it is confirmed that EnviScience Company Limited is a well established company (www.enviscience.co.th) in Thailand which supplies monitoring equipment and is authorised to conduct calibration of various measuring equipment.	
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes. The calibration reports were verified by the verification team which confirm the proper functioning of the meter.	
Is(are) calibration(s) valid for the whole reporting period?	Yes, the calibration conducted on 2012-10-30 is valid for the whole monitoring period.	

	Assessment activities
Data / Parameter (as per monitoring plan in the PDD):	AM0022 ID 4 Wastewater organic material concentration leaving the project treatment facility
Calibration frequency /interval:	Yearly
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 approved revised monitoring plan, the calibration of the monitoring equipment is subject to appropriate industry standards. However, since there are no industry standards available for calibration requirements in the host country, the project participants (PP) have chosen an appropriate calibration interval of 1 year. GLC's Sectoral and local expertise confirm that there are no industry standards available in the host country for calibration of monitoring equipment and a calibration frequency

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	of 1 year represents good monitoring practice.	
Company performing the calibration:	Calibration date	Company name
	2012-10-30	EnviScience Company Limited ^{/19/}
	Based on local expertise of GLC's assessment team it is confirmed that EnviScience Company Limited is a well established company (www.enviscience.co.th) in Thailand which supplies monitoring equipment and is authorised to conduct calibration of various measuring equipment.	
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes. The calibration reports were verified by the verification team which confirm the proper functioning of the meter.	
Is(are) calibration(s) valid for the whole reporting period?	Yes, the calibration conducted on 2012-10-30 is valid for the whole monitoring period.	

	Assessment activities	
Data / Parameter (as per monitoring plan in the PDD):	AM0022 ID 5 Volume of biogas sent to facility heaters	
Calibration frequency /interval:	Yearly	
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 approved revised monitoring plan, the calibration of the monitoring equipment is subject to appropriate industry standards. However, since there are no industry standards available for calibration requirements in the host country, the project participants (PP) have chosen an appropriate calibration interval of 1 year. GLC's Sectoral and local expertise confirm that there are no industry standards available in the host country for calibration of monitoring equipment and a calibration frequency of 1 year represents good monitoring practice.	
Company performing the calibration:	Calibration date	Company name

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	<table border="1"> <tr> <td data-bbox="767 324 975 405">2012-10-19</td> <td data-bbox="975 324 1418 405">MITCL /20/</td> </tr> </table>	2012-10-19	MITCL /20/
2012-10-19	MITCL /20/		
	<p>Based on local expertise of GLC's assessment team it is confirmed that MITCL is a well established company (www.mit.in.th) in Thailand which supplies monitoring equipment and is authorised to conduct calibration of various measuring equipment.</p>		
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes. The calibration reports were verified by the verification team which confirm the proper functioning of the meter.		
Is(are) calibration(s) valid for the whole reporting period?	Yes, the calibration conducted on 2012-10-19 is valid for the monitoring period.		

	Assessment activities				
Data / Parameter (as per monitoring plan in the PDD):	<p>AM0022 ID 7</p> <p>Electricity generated from collected biogas</p>				
Calibration frequency /interval:	Yearly				
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?	<p>As per the approved revised monitoring plan, the calibration of the monitoring equipment is subject to appropriate industry standards. However, since there are no industry standards available for calibration requirements in the host country, the project participants (PP) have chosen an appropriate calibration interval of 1 year. GLC's Sectoral and local expertise confirm that there are no industry standards available in the host country for calibration of monitoring equipment and a calibration frequency of 1 year represents good monitoring practice.</p>				
Company performing the calibration:	<p><u>Electricity meter of Generator A</u></p> <table border="1"> <tr> <td data-bbox="767 1805 970 1912">Calibration date</td> <td data-bbox="970 1805 1418 1912">Company name</td> </tr> <tr> <td data-bbox="767 1912 970 1986">2012-10-27</td> <td data-bbox="970 1912 1418 1986">TIP Industry Services Co., Ltd./24/</td> </tr> </table>	Calibration date	Company name	2012-10-27	TIP Industry Services Co., Ltd./24/
Calibration date	Company name				
2012-10-27	TIP Industry Services Co., Ltd./24/				

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	<p><u>Electricity meter of Generator B</u></p> <p>Based on the Sectoral and local expertise of GLC's assessment team, it is confirmed that TIP Industry Services Co., Ltd. are authorised to conduct calibration of electrical measuring equipment.</p> <table border="1" data-bbox="783 734 1386 913"> <tr> <td data-bbox="783 734 970 842">Calibration date</td> <td data-bbox="970 734 1386 842">Company name</td> </tr> <tr> <td data-bbox="783 842 970 913">2012-10-27</td> <td data-bbox="970 842 1386 913">TIP Industry Services Co., Ltd.^{/25/}</td> </tr> </table>		Calibration date	Company name	2012-10-27	TIP Industry Services Co., Ltd. ^{/25/}
Calibration date	Company name					
2012-10-27	TIP Industry Services Co., Ltd. ^{/25/}					
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes. The calibration reports were verified by the verification team which confirm the proper functioning of the meters.					
Is(are) calibration(s) valid for the whole reporting period?	Yes, the calibration conducted on 2012-10-27 is valid for the monitoring period.					

		Assessment activities	
Data / Parameter (as per monitoring plan in the PDD):	AM0022 ID 9 Biogas sent to flares (V1)		
Calibration frequency /interval:	Yearly		
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 approved revised monitoring plan, the calibration of the monitoring equipment is subject to appropriate industry standards. However, since there are no industry standards available for calibration requirements in the host country, PP has chosen an appropriate calibration interval of 1 year. GLC's Sectoral and local expertise confirm that there are no industry standards available in the host country for calibration of monitoring equipment and a calibration frequency of 1 year represents good monitoring practice.		
Company performing the calibration:	Calibration date	Company name	

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	2012-10-19	MITCL /21/
	Based on Sectoral and local expertise of GLC, it is confirmed that MITCL is a well established company and is authorised to conduct the calibration of monitoring equipment.	
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes. The calibration reports were verified by the verification team which confirm the proper functioning of the meter.	
Is(are) calibration(s) valid for the whole reporting period?	Yes, the calibration conducted on 2012-10-19 is valid for the monitoring period.	

	Assessment activities	
Data / Parameter (as per monitoring plan in the PDD):	AM0022 ID 10 Biogas sent to generation	
Calibration frequency /interval:	Yearly	
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 approved revised monitoring plan, the calibration of the monitoring equipment is subject to appropriate industry standards. However, since there are no industry standards available for calibration requirements in the host country, the project participants (PP) have chosen an appropriate calibration interval of 1 year. GLC's Sectoral and local expertise confirm that there are no industry standards available in the host country for calibration of monitoring equipment and a calibration frequency of 1 year represents good monitoring practice.	
Company performing the calibration:	Calibration date	Company name
	2012-10-19	MITCL /22/23/
It is to be noted that there are two gas flow meters one for each generator to monitor this parameter. Both the meters were calibrated on the same day by		

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	the same company. MITCL is a well established company and is authorised to conduct the calibration of monitoring equipment.
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes. The calibration reports were verified by the verification team which confirm the proper functioning of the meters.
Is(are) calibration(s) valid for the whole reporting period?	Yes, the calibration conducted on 2012-10-19 is valid for the monitoring period.

	Assessment activities				
Data / Parameter (as per monitoring plan in the PDD):	AM0022 ID11 Biogas methane concentration				
Calibration frequency /interval:	Yearly				
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 approved revised monitoring plan, the calibration of the monitoring equipment is subject to appropriate industry standards. However, since there are no industry standards available for calibration requirements in the host country, the project participants (PP) have chosen an appropriate calibration interval of 1 year. GLC's Sectoral and local expertise confirm that there are no industry standards available in the host country for calibration of monitoring equipment and a calibration frequency of 1 year represents good monitoring practice.				
Company performing the calibration:	<table border="1"> <tr> <td>Calibration date</td> <td>Company name</td> </tr> <tr> <td>2012-12-22</td> <td>MITCL ¹²⁷</td> </tr> </table> <p>Based on Sectoral and local expertise of GLC, it is confirmed that MITCL is a well established company and is authorised to conduct the calibration of monitoring equipment.</p>	Calibration date	Company name	2012-12-22	MITCL ¹²⁷
Calibration date	Company name				
2012-12-22	MITCL ¹²⁷				
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes. The calibration reports were verified by the verification team which confirm the proper				

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	functioning of the meter.
Is(are) calibration(s) valid for the whole reporting period?	Yes, the calibration conducted on 2012-12-22 is valid for the entire monitoring period.

		Assessment activities	
Data / Parameter (as per monitoring plan in the PDD):		AM0022 ID 13 Amount of chemical oxidising agents entering system boundary	
Calibration frequency /interval:		Yearly	
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 approved revised monitoring plan, the calibration of the monitoring equipment is subject to appropriate industry standards. However, since there are no industry standards available for calibration requirements in the host country, the project participants (PP) have chosen an appropriate calibration interval of 1 year. GLC's Sectoral and local expertise confirm that there are no industry standards available in the host country for calibration of monitoring equipment and a calibration frequency of 1 year represents good monitoring practice.	
Company performing the calibration:		Calibration date	Company name
		2012-10-30	EnviScience Company Limited ^{19/}
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):		Yes. The calibration reports were verified by the verification team which confirm the proper functioning of the meter.	
Is(are) calibration(s) valid for the whole reporting period?		Yes, the calibration conducted on 2012-10-30 is valid for the entire monitoring period.	

		Assessment activities	
Data / Parameter (as per monitoring plan in the PDD):		AM0022 ID 17 Loss of biogas from pipeline	

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Calibration frequency /interval:	Yearly	
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 approved revised monitoring plan, the calibration of the monitoring equipment is subject to appropriate industry standards. However, since there are no industry standards available for calibration requirements in the host country, the project participants (PP) have chosen an appropriate calibration interval of 1 year. GLC's Sectoral and local expertise confirm that there are no industry standards available in the host country for calibration of monitoring equipment and a calibration frequency of 1 year represents good monitoring practice.	
Company performing the calibration:	Calibration date	Company name
	2012-11-29	Industrial Services ^{/28/}
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes. The calibration reports were verified by the verification team which confirm the proper functioning of the meter.	
Is(are) calibration(s) valid for the whole reporting period?	Yes, the calibration conducted on 2012-11-29 is valid for the entire monitoring period.	

	Assessment activities
Data / Parameter (as per monitoring plan in the PDD):	AM0022 ID 18 Organic material removed from wastewater facility
Calibration frequency /interval:	Once in two years
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 approved revised monitoring plan, the calibration of the monitoring equipment is subject to appropriate industry standards. However, since there are no industry standards available for calibration requirements in the host country, the project participants (PP) have chosen an appropriate calibration interval of 2 years. GLC's Sectoral and local expertise confirm that there are no industry standards available in the host country for calibration of monitoring equipment and a calibration frequency

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	of 2 years represents good monitoring practice.	
Company performing the calibration:	Calibration date	Company name
	2011-03-01	Central Bureau of Weights & Measurement, Thailand ^{/29/}
	2013-01-18	Central Bureau of Weights & Measurement, Thailand ^{/29/}
	The verification certificate was issued by the Central Bureau of Weights & Measurement (Department of Weights & Measurement, Government of Thailand). The validity of the certificate was mentioned as two years i.e. the expiry date for the latest calibration is 2015-01-17.	
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes. The calibration reports were verified by the verification team which confirm the proper functioning of the meter.	
Is(are) calibration(s) valid for the whole reporting period?	Yes, the calibrations are valid for the entire monitoring period.	

4.1.5 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 has been verified by crosschecking with other sources such as log books ^{/31/}, calibration reports^{/18...29/}, test reports^{/33/35/}, equipment specifications^{/17/}, etc. Besides, monthly plant reports approved by the Plant Manager were also checked for consistency of the data ^{/34/}. Default values (parameters validated ex-ante) are used as mentioned in the registered 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 has been verified that the applied emission factors, IPCC default values ^{/7/} and other reference values were applied correctly.

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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/}. All the fixed values used in the calculation were also separately mentioned in the ER sheet document ^{5/} for the sake of transparency.

It is worth to be noted that revised Global Warming Potential (GWP) of methane has been considered for emission reduction calculation achieved for the monitoring period (from 2013-01-01 to 2013-08-20). The registered PDD indicates a GWP value of 21 in the ex-ante calculation of emission reduction. However, based on Para 66 of EB 69th meeting report (*“Based on decision 4/CMP.7, and prompted by a letter from the Project Developer Forum requesting guidance on how the decision would be implemented under the CDM, the Board agreed that the second commitment period global warming potentials (GWPs) shall apply to all calculations of emissions reductions or removals achieved from 1 January 2013 and provided details on how this shall be applied, as contained in annex 3 to this report”*) and Annex 3 of EB 69, a CAR was raised by the verification report (please refer to Annex A). In response to the CAR, PP revised the emission reduction calculation by applying latest GWP value of methane in the emission reduction calculation. The revised GWP of methane that was applied for the emission reduction achieved during the monitoring period (from 2013-01-01 to 2013-08-20) is 25. The revised calculation is confirmed to be correct and is in accordance with the guidance provided in Para 3 of EB 69 Annex 3. The revised value is confirmed to be correct based on the IPCC 4th Assessment Report (http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html). Further it is understood from Annex 3 of EB 69 that it is not required to amend the PDD. Therefore, PP was not requested to apply for post registration changes.

The emission reduction due to methane capturing and utilisation in onsite gas engines and boiler was correctly estimated by measuring the required parameters using appropriate monitoring equipment. The formulae described in the applied methodology and the PDD 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 applied methodology AM0022 (version 04),

$$ER = E_{BL} - E_{project} \dots\dots\dots (12)$$

Nevertheless it has to be verified that this equation delivers a conservative estimate of emission reductions i.e. that the emissions of CH₄ from the lagoons in the baseline situation are not higher than the total emissions of biogas from the digester and the lagoons in the project situation. Therefore calculate:

$$E_{CH_4_lagoon_BL} - (E_{CH_4_lagoon_PJ} + E_{CH_4_nawtf} + E_{CH_4_coll}) \dots\dots\dots (13)$$

Where:

E_{CH₄_coll} is the amount of methane expressed in (tCO₂e) contained in the biogas collected from the anaerobic treatment facility (i.e. the sum of the biogas sent to heaters, the biogas sent to the gen sets and the biogas sent to the flare).

If this difference is positive, it has to be deducted from the result obtained through the equation (12) in order to obtain the final estimation of the emissions reductions.”

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GLC's verification team confirms that this conservative check was conducted by the PP and transparently presented the calculation in the ER calculation spread sheet ^{15/}. The result is negative for the monitoring period and therefore the estimated emission reduction is deemed conservative.

Baseline emissions were correctly calculated using the below formula mentioned the PDD

$$E_{BL} = E_{CH4_lagoons_BL} + E_{CO2_heat_BL} + E_{CO2_power_BL}$$

Where:

E_{BL} Total Baseline Emission (tCO₂e)

$E_{CH4_lagoons_BL}$ Fugitive methane emissions from lagoons in the baseline case (tCO₂e)

$E_{CO2_heat_BL}$ CO₂ emissions from on site fossil heat and/or power generation in the baseline case (tCO₂) that are displaced by generation based on biogas collected in the anaerobic treatment facility.

$E_{CO2_power_BL}$ CO₂ emissions related electricity supplied by the grid in the baseline case (tCO₂) that are displaced by generation based on biogas collected in the anaerobic treatment facility

$$E_{CH4_lagoons_BL} = (M_{lagoon_anaerobic} * EF_{CH4} * GWP_{CH4}) / 1000$$

Where:

$M_{lagoon_anaerobic}$ Amount of organic material removed by anaerobic processes in the lagoon system (kgCOD)

EF_{CH4} Methane emission factor (kgCH₄/kgCOD) = 0.21 kgCH₄/kgCOD of COD to Methane conversion factor is used.

GWP_{CH4} Global Warming Potential of methane ($GWP_{CH4} = 25$)

Project emissions were calculated using the below formula mentioned in the PDD

$$E_{project} = E_{CH4_lagoons} + E_{CH4_NAWTF} + E_{CH4_IC + Leaks} \quad (1)$$

Where:

$E_{project}$ Total Project Emissions (tCO₂e)

$E_{CH4_lagoons}$ Fugitive methane emissions from the new anaerobic wastewater treatment facility (tCO₂e)

$E_{CH4_IC+Leaks}$ Methane emissions from inefficient combustion and leaks (tCO₂e)

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All the formulae and values have been transparently provided in the final version of the monitoring report ^{/4/}. The calculation provided in the corresponding emission reduction calculation spread sheet^{/5/} is deemed 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.
- Includes changes that required prior approval of the Board. The assessment of the changes was done in a separated document.

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5 VERIFICATION STATEMENT

Germanischer Lloyd Certification GmbH (GLC) has performed the 4th verification of the project: **CYY Biopower Wastewater treatment plant including biogas reuse for thermal oil replacement and electricity generation Project, Thailand**, with regard to the relevant requirements for CDM project activities. The project reduces GHG emissions by capturing methane from wastewater treatment through UASB technology and utilising it as a fuel in onsite thermal oil boiler and electricity generators. This verification covers the period from 2013-01-01 to 2013-08-20 (including both days).

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 validated and registered PDD. GLC conducted the verification on the basis of the monitoring methodology "AM0022" (version 04), the monitoring plan of the project and the monitoring report of dated 2013-10-09 (version 2). The verification included:

- i) checking whether the design of the project was implemented and installed as planned and described in the project design document ^{/2/};
- ii) checking whether the provisions of the monitoring methodology^{/10/} and the monitoring plan^{/3/} were consistently and appropriately applied
- iii) the collection of evidence supporting the reported data;
- iv) checking whether the installed equipment essential for measuring parameters required for calculating emission reductions 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 emissions reduction for the **CYY Biopower Wastewater treatment plant including biogas reuse for thermal oil replacement and electricity generation Project, Thailand**, as reported in the final Monitoring Report are calculated without considerable misstatements 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 approved revised monitoring plan for the project.

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

Emission reductions: 46,136 t CO_{2e}

2013-11-11

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A handwritten signature in blue ink, appearing to read 'M. Weber'.

Markus Weber

Germanischer Lloyd
Certification

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6 REFERENCES

Reference	Author: Title, version, date of issue
/1/	CDM-EB: Clean development mechanism validation and verification standard (version 05.0)
/2/	Project Design Document for CDM project: "CYY Biopower Wastewater treatment plant including biogas reuse for thermal oil replacement and electricity generation Project, Thailand" (version 4.1, dated 2012-01-31) approved on 2012-03-16
/3/	Revised monitoring plan of "CYY Biopower Wastewater treatment plant including biogas reuse for thermal oil replacement and electricity generation Project, Thailand" project approved on 2010-08-12 RINA: Validation opinion of RINA on the request for revision in the monitoring plan in case of "CYY Biopower Wastewater treatment plant including biogas reuse for thermal oil replacement and electricity generation Project, Thailand", CDM project registration no: 2141 (Report No: 09IQ150ME)
/4/	Draft Monitoring Report (webhosted) of "CYY Biopower Wastewater treatment plant including biogas reuse for thermal oil replacement and electricity generation Project, Thailand" project, (version 1) dated 2013-08-30 Final MR of "CYY Biopower Wastewater treatment plant including biogas reuse for thermal oil replacement and electricity generation Project, Thailand" project, (version 2) dated 2013-10-09
/5/	Draft Emission reduction calculation spreadsheet (version 1) dated 2013-08-30 Final Emission reduction calculation spreadsheet (version 2) dated 2013-10-09
/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)

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/9/	UNFCCC: Decision 3/CMP. 1 (Marrakesh – Accords)
/10/	CDM-EB: Approved CDM baseline and monitoring methodology AM0022, Version 04: "Avoided Wastewater and Onsite Energy Use Emissions in the Industrial Sector"
/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/	TUV NORD CERT GmbH: Validation report of "CYY Biopower Wastewater treatment plant including biogas reuse for thermal oil replacement and electricity generation Project, Thailand" (report no. 8000352987– 07/150) dated 2009-03-09
/13/	RINA Services S.p.A.: First verification report of "CYY Biopower Wastewater treatment plant including biogas reuse for thermal oil replacement and electricity generation Project, Thailand" (Report no. 2009-IQ-150-ME)
/14/	GLC: Second verification report of "CYY Biopower Wastewater treatment plant including biogas reuse for thermal oil replacement and electricity generation Project, Thailand" (Report no. 126) dated 2012-04-20 GLC: Third verification report of "CYY Biopower Wastewater treatment plant including biogas reuse for thermal oil replacement and electricity generation Project, Thailand" (Report no. 350) dated 2013-07-29
/15/	<u>Technical specifications of UASB and Gas engines</u> Global Water Engineering Ltd: "Proposal for a Biogas Plant for CYY", dated 2006-02-01 Pro2 Analgentchnik GmbH: Technical data of gas engines, January 2006
/16/	<u>Commissioning Certificates</u> Global Water Engineering Ltd.: Certificate of Civil / Mechanical / Electrical Completion, dated 2007-11-03 PRO2: Minutes of Commissioning of gas engine, dated 2008-12-09 (Commissioning period: from 2008-12-02 to 2008-12-08)
/17/	<u>Specifications of monitoring equipment</u>

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	<p>KROHNE: 'Technical data sheet' of electromagnetic flow converter – wastewater flow meter</p> <p>HACH: Key specifications of Spectrometers and Colorimeters</p> <p>YOKOGAWA: 'General Specifications' of Differential Pressure Transmitter – Gas flow meters</p> <p>Drager: 'Technical Data' of methane gas analyser</p> <p>DEIF: 'Designer's Reference Handbook' – Technical specifications of multi-line 2 PPU power meter</p> <p>Industrial Scientific: Specifications of MX4 multi-gas monitor – Portable gas detector</p> <p>Weighing machine specifications (Load: 100,000 kg; Accuracy: \pm 20 kg)</p>
/18/	<p><u>Calibration report of Wastewater flow meter – Serial No. A06 42633</u></p> <p>(MITCL): Calibration Certificate of Certificate No. L1210-636 issued on 2012-10-25 (Calibration date: 2012-10-19)</p>
/19/	<p><u>Calibration report of Portable Colorimeter – Serial No. 07089C64902</u></p> <p>EnviScience Company Limited: Test report (report no. LEVS 1204104), date of test: 2012-10-30</p>
/20/	<p><u>Calibration report of Biogas flow meter to boiler – Serial No. 91FA19282 639</u></p> <p>MITCL: Calibration Certificate of Certificate No. C1210-639 issued on 2012-10-25 (Calibration date: 2012-10-19)</p>
/21/	<p><u>Calibration report of Biogas flow meter to flare – Serial No. 265DS6600065941</u></p> <p>MITCL: Calibration Certificate of Certificate No. C1210-638 issued on 2012-10-25 (Calibration date: 2012-10-19)</p>
/22/	<p><u>Calibration report of Biogas flow meter to Gen-A – Serial No. 265DS6600032493</u></p> <p>MITCL: Calibration Certificate of Certificate No. C1210-640 issued on 2012-10-25 (Calibration date: 2012-10-19)</p>
/23/	<p><u>Calibration report of Biogas flow meter to Gen-B – Serial No. 265DS6600028459</u></p> <p>MITCL: Calibration Certificate of Certificate No. C1210-641 issued on 2012-10-25 (Calibration date: 2012-10-19)</p>

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/24/	<p><u>Calibration report of Energy meter of Gen-A – Serial No. A010393</u></p> <p>TIP Industry Services Co., Ltd.: Certificate of Calibration (Certificate No. 413/2012) issued on 2012-10-29 (Calibration date: 2012-10-27)</p>
/25/	<p><u>Calibration report of Energy meter of Gen-B – Serial No. A004997</u></p> <p>TIP Industry Services Co., Ltd.: Certificate of Calibration (Certificate No. 414/2012) issued on 2012-10-29 (Calibration date: 2012-10-27)</p>
/26/	<p>CYY Bio Power: Operation Check Sheet dated 2013-05-26</p>
/27/	<p><u>Calibration report of CH4 Analyser – Serial No. ARCC-0038</u></p> <p>MITCL: Calibration Certificate of Certificate No. C1212-916 issued on 2013-01-02 (Calibration date: 2012-12-22)</p>
/28/	<p><u>Calibration reports of Portable gas detector – Serial No. 10110R4-006</u></p> <p>Industrial Services: Calibration Certificate of Gas Detector, Certificate No. G 550346, Issued on 2012-11-29 (Date of Calibration: 2012-11-29)</p>
/29/	<p><u>Verification certificates of Weighing machine – Serial No. 0000237</u></p> <p>Central Bureau of Weights & Measurement: Verification Certificate, dated 2011-03-01 (Expiry date: 2013-02-28)</p> <p>Central Bureau of Weights & Measurement: Verification Certificate, dated 2013-01-18 (Expiry date: 2015-01-15)</p>
/30/	<p>CYY Bio Power Co., Ltd.: Calibration plan for 2012 & 2013</p>
/31/	<p>CYY Bio Power: Daily log sheet records from 2013-01-01 to 2013-08-20 for the following parameters</p> <ul style="list-style-type: none"> • COD analysis of wastewater at inlet and outlet of UASB • Wastewater flow • Biogas sent to facility heaters • Biogas consumption in electricity generators • Biogas consumption for flare • Methane concentration in biogas • Electricity generation

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	<ul style="list-style-type: none"> • Chemical oxidising agents (Sulphates) entering system boundary • Leakage test reports
/32/	CYY Bio Power: Work Instruction manual dated 2009-09-20 – Laboratory procedures of COD analysis and SO ₄ analysis
/33/	<p><u>External laboratory reports of COD analysis</u></p> <p>Suranaree University of Technology: Report no. 1271, dated 2012-12-19</p> <p>Suranaree University of Technology: Report no. 1797, dated 2013-06-28</p>
/34/	<p>CYY Bio Power: Electronic files of monitored data (Excel files of monthly monitoring reports submitted to the Plant Manager) from 2013-01-01 to 2013-08-20</p> <p>CYY Bio Power: Monthly reports checked and signed by the Plant Manager from January 2013 to August 2013</p>
/35/	<p><u>Combustion efficiency test reports of Boiler by United Analyst and Engineering Consultant Co., Ltd</u></p> <p>Report dated: 2013-03-16 & Analysis date: 2012-02-24</p> <p>Report dated: 2013-03-15 & Analysis date: 2013-03-10</p> <p><u>Combustion efficiency test reports of Gas engine Generator A by United Analyst and Engineering Consultant Co., Ltd</u></p> <p>Report dated: 2013-03-16 & Analysis date: 2012-02-23</p> <p>Report dated: 2013-03-15 & Analysis date: 2013-03-09</p> <p><u>Combustion efficiency test reports of Gas engine Generator B by United Analyst and Engineering Consultant Co., Ltd</u></p> <p>Report dated: 2013-03-16 & Analysis date: 2012-02-23</p> <p>Report dated: 2013-03-15 & Analysis date: 2013-03-09</p>
/36/	CYY Bio Power: Internal leakage test procedure and test reports
/37/	<p>Global Water Engineering Ltd.: Installation, operation & maintenance manual for an elevated flare</p> <p>Global Water Engineering Ltd.: Flare operating sequence at CYY Biopower, document dated 2009-05-20</p>
/38/	CYY Bio Power: Monitoring & reporting procedures approved by the Plant Manager on 2009-08-03

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/39/	CYY Bio Power: Training records on safety, operation and maintenance of biogas plant
/40/	Global Water Engineering Ltd.: Process Operation Manual for the wastewater treatment plant, November 2007
/41/	CYY Bio Power: Work Instruction Manual for Emergency Preparedness and Response, dated 2009-01-09
/42/	CYY Bio Power: SCADA system screen shots indicating the monitoring system
/43/	CYY Bio Power: CSV files of monitoring data captured by SCADA every minute for June 2013
/44/	CYY Bio Power: List of equipment for Biogas plant and their rated capacity
/45/	CDM-EB: Guideline "Completing the monitoring report form", version 03.2 (EB 70, Annex 11)

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

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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)
CAR 1 (2013-09-23) Length of the monitoring period mentioned in section A.5 of the monitoring report (MR) is not inline with the monitoring period dates.	2013-09-27: Length of the monitoring period in section A.5 of the MR is revised in line with the monitoring period date.	2013-10-04: OK. The monitoring period is from 2013-01-01 to 2013-08-20. The length of the monitoring period is now correctly mentioned as 7 months and 20 days in section A.5 of the revised MR. Therefore, the CAR is closed.	OK
CAR 2 (2013-09-23) Monitoring data presented in the Emission reduction spreadsheet (ER sheet) was checked with the log sheet information during the onsite verification. The following data in the ER sheet was found to be not consistent with the log sheet. 1) Biogas consumption for Gas engine B (Gen B) on 2013-08-20 2) COD of wastewater leaving the	2013-09-27: The following data in the ER sheet is corrected to be consistent with the log sheets. 1) Biogas consumption for Gas engine B (Gen B) on 2013-08-20 is corrected from 18 to 11,842 Nm ³ 2) COD of wastewater leaving the treatment system on the following dates is corrected - 2013-06-27 from 1,833 to 1,933 mg/l	2013-10-04: OK. All the mentioned corrections were made in the revised ER sheet. It is confirmed that the revised values in the ER sheet are in accordance with the log sheet values. Therefore, the CAR is closed.	OK

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<p>treatment system on 2013-06-27 and 2013-08-12</p> <p>3) Volume of biogas sent to boiler on 2013-02-27</p> <p>4) Methane concentration on 2013-03-17, 2013-06-18 and 2013-08-05</p>	<p>- 2013-08-12 from 1,025 to 1,028 mg/l</p> <p>3) Volume of biogas sent to boiler on 2013-02-27 is corrected from 19,730 to 17,930 Nm³</p> <p>4) Methane concentration on the following dates is corrected</p> <ul style="list-style-type: none"> - 2013-03-17 from 67.02 to 67.62 % - 2013-06-18 from 55.90 to 58.90 % - 2013-08-05 from 63.58 to 64.08 % 		
<p>CAR 3 (2013-09-23)</p> <p>There are two gas engines for electricity generation and each gas engine has a separate electricity meter to measure the parameter AM0022 ID 7 (Electricity generated from collected biogas). However, the monitored data for the parameter has been presented as a single value in the ER sheet. PP shall provide the data separately as measured by the two meters for the sake of transparency.</p> <p>Besides, the serial number of one of the electricity meters was found to</p>	<p>2013-09-27:</p> <p>The monitored data of electricity generated from generator A (GEN A) and generator B (GEN B) has been provided separately in the ER sheet.</p>	<p>2013-10-04:</p> <p>OK. The net electricity generation as recorded by the two electricity meters and the sum of the two has been transparently provided in the revised ER sheet for the parameter AM0022 ID 7 (Electricity generated from collected biogas).</p> <p>All the values are confirmed to be corrected based on the log sheet information collected during the verification site visit.</p>	<p>OK</p>

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<p>be different from that provided in the MR during the onsite verification. It was understood from the operating team that the meter was replaced with new one in August 2013. PP shall provide further evidence to confirm on which date the meter was replaced.</p>	<p>The evidence for installation of new electricity meter on 23/08/2013 is submitted to the verification team</p>	<p>OK. From the provided evidence document it can be confirmed that one of the electricity meters was replaced with new one on 2013-08-23 which is after the end of the monitoring period.</p> <p>Therefore, the CAR is closed.</p>	
<p>CAR 4 (2013-09-23)</p> <p>Number of days mentioned in Formula 10 in the ER sheet is not inline with the duration of the monitoring period.</p>	<p>2013-09-27:</p> <p>The number of days used in Formula 10 is corrected in line with the duration of the monitoring period.</p>	<p>2013-10-04:</p> <p>OK. The number of days in the formula 10 has been corrected from 200 to 232 days. 232 days corresponds to the total number of days in the monitoring period. This results the conservative estimation of emission reduction since the plant was not operated for all the days. In the formula, using higher number of days will result in lower baseline emissions. Therefore, it resulted in the reduction of emission reduction by 71 tCO₂e.</p> <p>Therefore, the CAR is closed.</p>	<p>OK</p>
<p>CAR 5 (2013-09-23)</p> <p>As per Para 66 of the CDM EB 69th meeting report of and Annex 3 of EB 69, all emission reductions and removals achieved by the project</p>	<p>2013-09-27:</p> <p>The global warming potentials (GWPs) value is corrected from 21 to 25 in all emission reductions of the project activity.</p> <p>In reference to Requirements Para 2 and 3</p>	<p>2013-10-04:</p> <p>OK. It is observed that in the revised ER sheet, the PP has taken GWP of 25 for methane (CH₄) for calculating the emission reduction achieved only from</p>	<p>OK</p>

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<p>activity in the second commitment period of the Kyoto Protocol shall be calculated using the global warming potentials (GWPs) adopted by the Conference of the Parties serving as the meeting of the Parties at its seventh session, in accordance with decision 4/CMP.7.</p>	<p>of Annex 3 version 01.0 of EB 69, all emission reductions achieved by the project activity in the second commitment period of the Kyoto Protocol shall be calculated using the global warming potentials (GWPs) adopted by the Conference of the Parties serving as the meeting of the Parties at its seventh session, in accordance with decision 4/CMP.7. Therefore since the project has also claimed the emission reductions from 01/01/2013 – 20/08/2013 which is in the second commitment period of the Kyoto Protocol, the value of GWPs applied in the mentioned period is revised in compliance with the Requirements.</p>	<p>2013-01-01 to 2013-07-31 in the monitoring period.</p> <p>The revised calculation is considered appropriate as it meets the requirements of Annex 3 of EB 69 (STANDARD FOR APPLICATION OF THE GLOBAL WARMING POTENTIALS TO CLEAN DEVELOPMENT MECHANISM PROJECT ACTIVITIES AND PROGRAMMES OF ACTIVITIES FOR THE SECOND COMMITMENT PERIOD OF THE KYOTO PROTOCOL). It is further confirmed that the GWP of 25 is correct as per the IPCC 4th Assessment Report to which the Decision 4 of CMP.7 refers to.</p> <p>The revised value of GWP is also mentioned in section D.1 of the revised MR. As per the guideline provided in Para 5 of EB 69 Annex 3, the verification team is of the opinion that it is not required to amend the PDD and hence no PRC is required.</p> <p>It is to be noted that use of revised GWP has increased emission reduction due to increase in baseline emissions by 6678 tCO₂e.</p>	
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		The CAR is deemed sufficiently addressed and therefore closed.	
<p>CL 1 (2013-09-23)</p> <p>For the volume of biogas sent to facility heaters (boiler), zero has been mentioned from 2013-05-27 in the ER sheet. However, the log sheets contain the values till 2013-05-30. PP to clarify about taking zero from 2013-05-27 to 2013-05-30.</p> <p>PP is also required to clarify why the biogas was not utilised in the boiler from 2013-05-31 onwards.</p>	<p>2013-09-27:</p> <p>As per the actual situation, the biogas was used in boiler until 2013-05-30. In the ER sheet version 1, the data from 2013-05-27 to 2013-05-30 was by mistake inserted as zero. The monitored data for the period from 2013-05-27 to 2013-05-30 is now included in the ER sheet version 2 in line with the log sheet.</p> <p>Regarding the data from 2013-05-31 onwards, since the starch factory has produced only wet starch, the biogas was not consumed at the boiler to generate heat for drying process.</p>	<p>2013-10-04:</p> <p>OK. The ER sheet has been revised to include the data for 'biogas sent to facility heaters (boiler)' from 2013-05-27 to 2013-05-30. The revised values are as per the log sheets. From the revised ER sheet, it can be confirmed that this inclusion of data has caused an increase in baseline emissions from 3258 tCO₂e to 3313 tCO₂e due to fossil fuel displacement in the boiler. The revised calculation is confirmed to be correct.</p> <p>OK. It is understood that since the starch factory produced only wet starch from 2013-05-31, there was no requirement to generate heat for drying process. Therefore, biogas was not sent for the boiler from 2013-05-31 onwards till the end of the monitoring period.</p> <p>Therefore, the CL is closed.</p>	OK
<p>CL 2 (2013-09-23)</p> <p>The achieved emission reduction is</p>	<p>2013-09-27:</p> <p>It is noted that as per the revise ER sheet</p>	<p>2013-10-04:</p> <p>OK. As per the revised ER sheet the</p>	OK

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<p>nearly 38% lower than the estimated value for the corresponding monitoring period. PP is requested to provide the reason.</p>	<p>the achieved emission reductions is about 28% lower than the estimated value for this monitoring period as per the PDD. The current monitoring period does not represent full year of operation during which operational variations may occur but we can confirm that based on previous verification and the current, the project's performance is lower than initially estimated. This is mainly due to lower wastewater volume, lower COD and biogas generation. The comparison data is submitted to the DOE. Given that the amount of emission reduction claimed is lower, it is conservative.</p>	<p>achieved emission reduction is nearly 28% lower than the estimated value in the PDD for the corresponding monitoring period. The provided reason for lower emission reduction is deemed appropriate. A comparison data is also provided in the ER sheet.</p> <p>Therefore, the CL is closed.</p>	
<p>CL 3 (2013-09-23)</p> <p>It was learnt from the onsite interviews that biogas leak detecting exercise was carried out on weekly basis. However, the information in the ER sheet is not transparent with reference to the date of leak detecting test and any leakage.</p>	<p>2013-09:</p> <p>The monitored data as zero is provided transparently with reference to the date of leak detecting test and there was no any leakage found during the monitoring period.</p>	<p>2013-10-04:</p> <p>OK. The biogas leak detecting exercise was carried out on weekly basis. From the document review and interviews with the operating team during the site visit, it can be confirmed that no leakage was detected during the monitoring period. The information is transparently presented in the ER sheet.</p> <p>Therefore, the CL is closed.</p>	<p>OK</p>