



Verification and Certification Report

of Bangna Starch Wastewater Treatment and Biogas Utilization Project

GLC Report No: 362, Rev. 06

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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.	"2556"	
Project Name:	Bangna Starch Wastewater Treatment and Biogas Utilization Project	
Project Country:	Thailand	
Sectoral Scope, Technical Area	CDM Sectoral Scope: 1 and 13, Technical Area: 1.1 and 13.1	
Methodology(ies) / Version(s):	AMS III.H., Version 09 AMS I.D., Version 13	
Project Size:	☐ Large Scale	☒ Small Scale
Number of verification:	2 nd	
Dates of monitoring period (incl. both days)	2011-01-01 to 2013-07-31	
Verified emission reductions	105,417 t CO ₂	
Included post registration changes	☐ yes ☒ no	
Project Assessment Team:	Technical Review Team:	Approval by:
Mr. Karunakar Avuram Dr. Ulrike E A Leroff	Ms. Anu Chaudhary Mr. Jose-Emilio Moreno Mr. Markus Weber	Mr. Markus Weber
Date of this revision:	Revision No.	Number of pages
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History of report revisions:

Rev.	Date	Person (short sign or name)	Function	Action
01	2013-10-10	Karunakar Avuram / Ulrike E A Leroff	Assessment team leader / Technical expert	Draft report
02	2013-10-15	Anu Chaudhary	Technical Reviewer	Review with corrections and comments
03	2013-10-21	Jose-Emilio Moreno	Reviewer / Technical expert	Review with corrections and comments
04	2013-11-07	Karunakar Avuram	Assessment team leader	Revising report based on TR comments
05	2013-11-08	Anu Chaudhary Jose-Emilio Moreno	Technical Reviewer Reviewer / Technical expert	Review of corrections
06	2013-11-11	Markus Weber	Final Reviewer / Approver	Final Review and approved

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Abbreviations

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

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1 INTRODUCTION

"South Pole Carbon Asset Management Ltd." has commissioned the Germanischer Lloyd Certification GmbH (GLC) to carry out the 2nd verification of the project, "Bangna Starch Wastewater Treatment and Biogas Utilization Project", registered by the UNFCCC as CDM project "2556" with regard to the relevant requirements for CDM project activities. The verifiers have reviewed the implementation of the monitoring plan (MP) as described in the approved revised PDD^{1/1/} and the Monitoring Report ^{/4/}.

The project was registered with UNFCCC on 2009-11-10. This is the 2nd verification of the project which covers the period from 2011-01-01 to 2013-07-31.

GHG data for the monitoring period was verified in detailed manner applying the set of requirements, audit practices and principles as required under the Validation and Verification Standard^{/1/} of the UNFCCC. This report summarizes the findings and conclusions of the 2nd verification of the above mentioned UNFCCC registered project activity.

1.1 Objective

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

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

1.2 Scope

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

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

- Article 12 of the Kyoto Protocol ^{/8/},

¹ It is to be noted that the Project Design Document (PDD) was revised during the 1st verification and the revised PDD was approved by the CDM-EB on 2011-09-23. Therefore, the PDD referred in the report refers to the approved revised PDD, version 4, dated 2011-08-11.

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- Guidelines for the implementation of Article 12 of the Kyoto Protocol as presented in the Marrakech Accords under decision 3/CMP.1 ^{/9/} and subsequent decisions made by the Executive Board and COP/MOP,
- Other relevant rules, including the host country legislation,
- CDM Validation and Verification Standard ^{/1/},
- Monitoring plan as given in the approved revised PDD ^{/2/},
- Approved CDM Methodologies; AMS-III.H. (Version 09) and AMS-I.D. (Version 13) ^{/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
Karunakar Avuram	ATL/ LE			X	X	X	X	X	
Ulrike E A Leroff	TE/ LE	X	X	X	X	X	X		X

1) A Auditor
ATL Assessment team leader

FE Financial expert
LE Local expert

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

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2.2 Technical Review Team and Approval

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

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

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

Table 1-2: Technical review team and approval

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

2) 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 approved revised PDD including the monitoring plan and the corresponding validation opinion^{/2/}
- Validation report^{/3/};
- Previous verification report ^{/17/};
- The applied monitoring methodologies ^{/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 2013-09-12 to 2013-09-13, Mr. Karunakar Avuram and Dr. Ulrike E A Leroff of GLC's verification team carried out an on-site visit.

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

- 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 ^{/35/36/}
- The data aggregation trails were checked
- The duly calibration of all metering equipment was checked ^{/20...31/}.

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

- General aspects of the project
- Technical equipment and operation
- Changes since validation
- Monitoring and measurement equipment
- 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. Pongpira Udomrati	General Manager, P & Papop Renewable Co., Ltd.
Mr. Suchai Rattananadhekul	Sales & Marketing Manager, P & Papop Renewable Co., Ltd.
Mr. Parinya Wongsomboon	Plant Manager, P & Papop Renewable Co., Ltd.
Mr. Watchara Boonyued	Production Supervisor, P & Papop Renewable Co., Ltd.
Ms. Ubonwan Utachkul	CDM Project Coordinator, P & Papop Renewable Co., Ltd.
Ms. Wichuda Phuwai	Laboratory staff, P & Papop Renewable Co., Ltd.
Mr. Pichai Wichapa	Production shift operator, P & Papop Renewable Co., Ltd.
Ms. Ammara Suthamma	Villager, Huakua
Ms. Lamoon Pengsutto	Villager, Huakua
Ms. Wanpen Pengsutto	Villager, Huakua

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

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the issues. In case any inconsistencies or lack of clarity were identified during the verification the team has raised a

Corrective Action Requests (CARs), if:

- the project participants have made mistakes that will influence the ability of the project activity to achieve real, measurable additional emission reductions;
- the CDM requirements have not been met;
- there is a risk that emission reductions cannot be monitored or calculated.

Clarification Request (CL), if:

- information is insufficient or not clear enough to determine whether the applicable CDM requirements have been met.

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

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

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

The verification team also reviewed validation report ^{/3/} and the previous verification report^{/17/} to find out if there are any open issues or FARs to be addressed. There are no pending issues or FARs from the validation. However, during the 1st verification, 2 FARs were raised. It is confirmed that the PP has already addressed the FARs; the assessment is provided in Annex A of the report. No further pending issues are there.

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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 approved revised PDD ^{/2/}.

The project activity involves installation of an Upflow Anaerobic Sludge Blanket (UASB) system for wastewater treatment produced out of a starch manufacturing plant. The project activity was implemented at an existing wastewater treatment plant replacing conventional open lagoon wastewater treatment system which was in the baseline scenario. The project involves installation of UASB that facilitates capturing of methane (or biogas) produced from the wastewater treatment which would have been released into the atmosphere in the baseline scenario. The captured biogas is utilised as fuel in gas engines to produce electricity. The generated electricity is supplied to national electricity grid of Thailand owned by Provincial Electricity Authority. Therefore, the project activity results in emission reduction through avoidance of methane into atmosphere and displacing fossil fuel based electricity from the grid. Three gas engines each of 0.95 MW_{el} capacity (total capacity: 3 x 0.95 = 2.85 MW_{el}) were installed to produce electricity.

UASB was commissioned in October 2007^{/14/} and gas engines were commissioned in December 2007^{/15/}. The project was in operation since 2007-12-27 after successful commissioning. The project activity was registered with UNFCCC on 2009-11-10 and the crediting period (renewable) corresponds to the period from 2009-11-10 to 2016-11-09. It is confirmed that the information has been correctly mentioned in the monitoring report (MR).

Technical Project Description:

The wastewater from the starch factory is collected in a collection pond called Acidification pond. From the Acidification pond, it is pumped into UASB reactor. In the UASB reactor, wastewater flows upward through a sludge blanket composed of microorganisms that naturally form granules or particles of 0.5 to 2 mm in diameter ("sludge granules"). When wastewater comes in contact with the granules, anaerobic decomposition of the organic material contained in the wastewater takes place, resulting in the generation of methane-rich biogas.

The biogas is collected through a dedicated pipeline network and treated in a bio scrubber to remove sulphur before it is stored in a gas storage tank (a covered lagoon) of 5000 m³. Gas storage tank acts as a buffer to ensure smooth flow of biogas to gas engines. The biogas is used as a fuel in gas engines of 2.85 MW_{el} (3x0.95 MW_{el}) capacity for electricity generation. An enclosed flaring system is also provided in order to flare out the excess biogas, if any, into the atmosphere.

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

Table 4-1: Key components of the project

Component	Design Specifications ^{/13/16/}
UASB	Handling Capacity: 3750 m ³ / day COD load: 7 – 15 kg COD / m ³ COD removal efficiency: ~ 90%
Gas engines	Capacity: 3 No's of 0.95 MW _{el} each
Gas storage tank	5000 m ³
Flare	Enclosed flare with max. capacity of 1250 Nm ³ /hr

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	P & Papop Renewable Co., Ltd.
Other involved party	Switzerland	South Pole Carbon Asset Management Ltd

Project Location:

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

Table 4-3: Project Location

Item	Location
Host Country:	Thailand
Region:	Kalasin Province
Project location address:	45 Rimmaenumpan, Theenanon Road, Yangthalat-46120
Latitude:	16°23'7.71"N (16.385475)

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Longitude:	103°28'21.28"E (103.472578)
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GLC's verification team, based on the onsite verification, can confirm that the project activity was implemented as per the PDD and is in operation as described in the approved revised PDD^{/2/}. It is further confirmed that the information provided in the final version of the MR^{/4/} is correct.

The emission reductions being claimed during this monitoring period are nearly 2 % less than the estimated emission reductions in the PDD, as given in the table below:

Table 4-4: Emission reduction comparison

2 nd monitoring period (From 2011-01-01 to 2013-07-31)	As per PDD	Monitoring report
Emission Reduction (tCO ₂ e)	107,728	105,417
% Deviation (+/-)	X	(-) 2.1%

(The estimated annual emission reduction as per the registered PDD is 41,701 tCO₂e, which corresponds to 107,728 tCO₂e for the length of the 2nd monitoring period which is 2 years and 7 months)

As presented in the table above, the reported emission reductions during the verification period are close to the estimated emission reductions. The actual emission reductions can be accepted by GLC.

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

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

As per the applied monitoring methodologies, AMS III.H (version 09) and AMS I.D (version 13)^{/10/}, the following parameters are required to be monitored:

- Flow of wastewater treated
- COD of wastewater before and after treatment
- Electricity generated by the project activity
- The amount of fossil fuel and electricity used by the project activity facility

Furthermore,

- The amount of methane recovered, fuelled and flared shall be monitored using continuous flow meters

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- Methane content of biogas shall be monitored using continuous analyser or alternatively with periodical measurements at 95% confidence level

The methodology, AMS-III.H (version 09) 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 enclosed 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 enclosed flare was not changed. The approach defined in the monitoring plan is inline with the latest tool.*

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

4.1.3 Compliance of Monitoring Activities with the Registered Monitoring Plan

The PDD was revised during the 1st verification to incorporate changes in the project design and the monitoring plan. The revised PDD was approved on 2011-09-23 (<http://cdm.unfccc.int/Projects/DB/RWTUV1241593452.75/view>).

The application of the monitoring plan of the approved revised PDD^{/2/} for the 2nd 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):	Q _{y, ww} Volume of wastewater treated in the year y (Unit: m ³)	
Type of monitoring equipment:	Type of meter	Electromagnetic flow meter with flow converter
	Make	Endress+Hauser
	Model	PROMAG 10w
	Meter tag	FM1
	Serial No.	93120819000
	Accuracy	± 0.5% ^{/19/}
Verification of data generation:	The parameter was monitored through the above mentioned flow meter. The flow meter measures the	

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	parameter on a continuous basis. The cumulative value of the parameter (or totalised value) is always displayed on the meter screen. The totalised reading is recorded from the meter by the operator everyday into the log sheet and submitted to the Biogas & Power Department Supervisor. The Supervisor checks the recorded data before it is reported to the Plant Manager everyday during the morning meeting. Since the totalised value is recorded in log sheets, any doubtful reading can easily be crosschecked by the Supervisor. The GLC's verification team 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 observed that the totalised value is appropriately indicated. Therefore, the verification team can confirm that the data generation is appropriate.
Measuring frequency:	Continuously The parameter is measured continuously with the above mentioned flow meter.
Is measuring frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes. The monitoring plan states that the parameter is measured continuously using flow meter. Though the monitoring methodology does not clearly specify the measuring frequency of wastewater; continuous measurement is preferred. 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^{/2/} and the monitoring methodology^{/10/}.
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 defined in the monitoring plan. However, GLC's Sectoral expert confirms that $\pm 0.5\%$ of accuracy represents good monitoring practice.

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Verification of data aggregation:	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. Therefore, by checking the totalised values, it is confirmed that the data aggregation is appropriate and free of mistakes.
Verification of data recording:	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 meter screen is recorded by the operator on a daily basis into the log sheets. The daily log sheets are reported to Biogas & Power Department Supervisor and further to the Plant Manager on a daily basis. Since the totalised values are recorded in the log sheets, any inconsistency can easily be detected by the Supervisor. Once the log sheet data is approved by the Supervisor, the data is transferred into electronic files (MS-Excel files) on a daily basis. The electronic files^{/36/} are printed at the end of every month by the Supervisor and submitted to the Plant Manager. Therefore, the verification team can confirm that the data recording was appropriate.
Verification of data calculation and reporting	As mentioned above, the data is recorded in log sheets and reported to Biogas & Power Department Supervisor on a daily basis. The monitored data is also reported to the Plant Manager everyday during the morning meeting. The Supervisor further reports the monthly data (print out of electronic files) that consists of all daily values to the Plant Manager on a monthly basis. The monthly reports^{/36/} are signed by the Supervisor and the Plant Manager as approved. The daily log sheets (signed by the Operator and the Supervisor) and the approved monthly reports (signed by the Supervisor and the Plant Manager) are stored in hard format. All the daily log sheets^{/35/} and the monthly reports^{/36/} were checked by the verification team during the onsite

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	verification. Besides, it was also learnt from the onsite interviews that the Plant Manager submits the monitoring data on a monthly basis to the Project Consultant (South Pole Carbon Asset Management Ltd.) for calculating emission reduction. 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. The verification team can, therefore, confirm that the data reporting and calculation is appropriate and correct.
Reporting frequency:	Daily The monitoring data is reported to the Supervisor of Biogas & Power Department and further to the Plant Manager on a daily basis.
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, as assessed above, 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^{/36/} 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^{/35/}. 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

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	procedures are in place. Further description of the monitoring management is 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):	COD_y, inflow, j The COD (chemical oxygen demand) of the wastewater entering the project system "j" (mg/l or tonnes/m ³)		
Type of monitoring equipment:	Type of meter	Colorimeter	
	Make	HACH	
	Model	DR/890	
	Serial No.	070290C62433	
	Accuracy	± 0.24% ^{/19/}	
Verification of data generation:	Data is generated from the COD (Chemical Oxygen Demand) analysis of wastewater entering the project treatment system. From the onsite verification and interview with the Quality Control (QC) laboratory staff, it is confirmed that the samples of wastewater from the acidification pond which is located before the UASB are collected for every two hours. Therefore, total 12 samples are collected. The samples collected from 12 noon to 12 midnight are mixed and the composite sample is analysed at 9 AM. Similarly, the samples collected from 12 midnight to 12 noon are mixed and the composite sample is analysed at 1 PM daily. Therefore, the COD analysis is carried out twice a day. The readings from the COD analysis is recorded in log sheets and reported to the Supervisor of QC department on a daily basis. Average of the two COD readings is considered as the daily value of the COD which is reported in the ER sheet. 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^{38/} available at the QC lab. Besides, GLC's Sectoral expert		

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	confirms that the COD analysis procedures are appropriate. Therefore, it can be confirmed that the data generation is appropriate.
Measuring frequency:	Daily The COD measurement is carried out twice a day. Average of the two is considered as daily value.
Is measuring frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes. The monitoring plan states that COD concentration is analysed using colorimetric method at onsite laboratory on a daily basis. The monitoring methodology does not specify the measuring frequency; however, the requirements of Para 35 of AMS-III.H (version 09) are considered as fulfilled. 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. Besides, the Sectoral expertise of the verification team confirms that the method of COD analysis followed at onsite laboratory is colorimetric method which is inline with the monitoring plan. The COD analysis procedure as confirmed from the onsite interview with the laboratory staff and from the written procedures is: 6 samples are mixed and the composite sample is taken into test tube. The solution is diluted with a standard dilution factor (15 for inlet COD and 1 for outlet COD). The solution is heated for 2 hours at 120 °C. It is then cooled to room temperature and the COD is measured with Colorimeter.
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:	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

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	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^{/35/}; the verification team found that the data and the data aggregation correct.
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^{/38/} available with the QC department were also checked. By interviewing the QC laboratory staff it is confirmed that the procedures were appropriately followed.
Verification of data calculation and reporting	As mentioned above, the COD analysed by the QC lab staff and the data is recorded in log sheets. The log sheets are submitted to the QC Department Supervisor on a daily basis. Once the log sheet data is approved by the Supervisor, the data is transferred into electronic files (MS-Excel files) on a daily basis. The electronic files^{/36/} are printed at the end of every month by the Supervisor and submitted to the Plant Manager. The monthly reports^{/36/} are signed by the Supervisor and the Plant Manager as approved. The daily log sheets (signed by the Laboratory staff and the Supervisor) and the approved monthly reports (signed by the Supervisor and the Plant Manager) are stored in hard format. All the daily log sheets^{/35/} and the monthly reports^{/36/} were checked by the verification team during the onsite verification. Besides, it was also learnt from the onsite interviews that the Plant Manager submits the monitoring data on a monthly basis to the Project Consultant (South Pole Carbon Asset Management Ltd.) for calculating emission reduction. 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. The verification team can, therefore, confirm that the data reporting and calculation is appropriate and correct.

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Reporting frequency:	Daily The monitoring data is reported to the Supervisor of QC Department on a daily basis.
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, as assessed above, 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 ^{36/} 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 ^{35/} . 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):	COD_{y, outflow, j} The COD (chemical oxygen demand) of wastewater exiting the project system j (mg/l or tonnes/m ³)	
Type of monitoring equipment:	Type of meter	Colorimeter
	Make	HACH
	Model	DR/890

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	Serial No.	070290C62433	
	Accuracy	$\pm 0.24\%$ ^{/19/}	
Verification of data generation:	Data is generated from the COD (Chemical Oxygen Demand) analysis of wastewater leaving the project treatment system. From the onsite verification and interview with the Quality Control (QC) laboratory staff, it is confirmed that the samples of wastewater from the outlet of UASB are collected for every two hours. The samples collected from 12 noon to 12 midnight are mixed and the composite sample is analysed at 9 AM. Similarly, the samples collected from 12 midnight to 12 noon are mixed and the composite sample is analysed at 1 PM daily. Therefore, the COD analysis is carried out twice a day. The readings from the COD analysis is recorded in log sheets and reported to the Supervisor of QC Department on a daily basis. Average of the two COD readings is considered as the daily value of the COD which is reported in the ER sheet. 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^{/38/} available at the QC lab. Besides, GLC's sectoral expert confirms that the COD analysis procedures are appropriate. Therefore, it can be confirmed that the data generation is appropriate.		
Measuring frequency:	Daily The COD measurement is carried out twice a day. Average of the two is considered as daily value.		
Is measuring frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes. The monitoring plan states that COD concentration is analysed using colorimetric method at onsite laboratory on a daily basis. The monitoring methodology does not specify the measuring frequency; however, the requirements of Para 35 of AMS-III.H (version 09) are fulfilled. Therefore, since the actual measuring frequency is		

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	better than the requirement, the verification team can confirm that the measuring frequency is inline with the monitoring plan and the monitoring methodology. Besides, the Sectoral expertise of the verification team confirms that the method of COD analysis followed at onsite laboratory is colorimetric method which 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?	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:	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/m ³ . The reported data in the ER sheet was checked with the log sheets ^{/35/} ; the verification team found that the data and the data aggregation correct.
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 ^{/38/} available with the QC department were also checked. By interviewing the QC laboratory staff it is confirmed that the procedures were appropriately followed.
Verification of data calculation and reporting	As mentioned above, the COD analysed by the QC lab staff and the data is recorded in log sheets. The log sheets are submitted to the QC Department Supervisor on a daily basis. Once the log sheet data is approved by the Supervisor, the data is transferred into electronic files (MS-Excel files) on a daily basis. The electronic files^{/36/} are printed at the end of every month by the Supervisor and submitted to the Plant Manager. The monthly reports^{/36/} are signed by the Supervisor and the Plant Manager as approved. The daily log sheets (signed by the Laboratory staff and the Supervisor) and the approved monthly reports (signed by the Supervisor and the Plant Manager) are stored in hard format. All the daily log sheets^{/35/} and the monthly reports^{/36/} were

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	checked by the verification team during the onsite verification. Besides, it was also learnt from the onsite interviews that the Plant Manager submits the monitoring data on a monthly basis to the Project Consultant (South Pole Carbon Asset Management Ltd.) for calculating emission reduction. 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. The verification team can, therefore, confirm that the data reporting and calculation is appropriate and correct.
Reporting frequency:	Daily The monitoring data is reported to the Supervisor of QC Department on a daily basis.
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, as assessed above, 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^{/36/} 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^{/35/}. 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

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	procedures are in place. Further description of the monitoring management is 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):	COD_{y, removed, j} The chemical oxygen demand removed by the project treatment system "j" (tonnes / m ³)
Type of monitoring equipment:	The parameter is calculated as the difference of COD at inlet and outlet of the project treatment system. $COD_{y, removed, j} = COD_{y, inflow, j} - COD_{y, outflow, j}$ Monitoring of COD _{y, inflow, j} and COD _{y, outflow, j} is assessed above.
Verification of data generation:	Please refer to the assessment of COD _{y, inflow, j} and COD _{y, outflow, j}
Measuring frequency:	Please refer to the assessment of COD _{y, inflow, j} and COD _{y, outflow, j}
Is measuring frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Please refer to the assessment of COD _{y, inflow, j} and COD _{y, outflow, j}
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?	Please refer to the assessment of COD _{y, inflow, j} and COD _{y, outflow, j}
Verification of data aggregation:	Please refer to the assessment of COD _{y, inflow, j} and COD _{y, outflow, j}
Verification of data recording:	Please refer to the assessment of COD _{y, inflow, j} and COD _{y, outflow, j}
Verification of data calculation and reporting	Please refer to the assessment of COD _{y, inflow, j} and COD _{y, outflow, j}

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Reporting frequency:	Please refer to the assessment of COD _{y, inflow, j} and COD _{y, outflow, j}
Is reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Please refer to the assessment of COD _{y, inflow, j} and COD _{y, outflow, j}
If applicable, has the reported data been cross-checked with other available data?	Please refer to the assessment of COD _{y, inflow, j} and COD _{y, outflow, j}
How were the values in the monitoring report verified?	Please refer to the assessment of COD _{y, inflow, j} and COD _{y, outflow, j}
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 COD _{y, inflow, j} and COD _{y, outflow, j}

	Assessment activities
Data / Parameter (as per monitoring plan in the PDD):	COD_{y, ww, treated} Chemical oxygen demand of the wastewater prior to discharge (mg/l or tonnes/m ³)
Type of monitoring equipment:	Not applicable (NA) The parameter is measured by an external laboratory in line with the requirement of the monitoring plan.
Verification of data generation:	From the onsite interviews it is confirmed that wastewater samples are collected at the discharge from last open lagoon. The COD content was analyzed using a standard method in an external laboratory (Environmental Engineering Laboratory Faculty of Engineering, KKU) ^{/33/} on a monthly basis. The COD reports issued by the external laboratory have been submitted to the verification team. The verification team can confirm that the data generation is appropriate.
Measuring frequency:	Monthly

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Is measuring frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes. The monitoring plan of the approved revised PDD^{/2/} states, <i>"Wastewater samples will be collected at the last open anaerobic lagoon prior to discharge. The COD content will be analyzed using a standard method in an external laboratory on a monthly basis"</i>. Therefore, it can be confirmed that the measuring frequency is in accordance with the monitoring plan. It is to be noted that the applied methodology does not specify the measuring frequency.
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:	The parameter is measured by an external laboratory on a monthly basis. The values are reported in the ER sheet. Reported data in the MR and ER sheet has been checked from the laboratory reports ^{/33/} . The data is found to be correct.
Verification of data recording:	Data recording is verified from the external laboratory reports ^{/33/} .
Verification of data calculation and reporting	Data calculation and reporting is verified from the ER sheet. The ER sheet contains the COD values analysed and reported by the external laboratory. The data was appropriately considered for the emission reduction calculation. The monitoring plan states, <i>"90/10 confidence / precision level approach shall be used for the collected data and conservative value shall be used for calculation of project emissions"</i>. The calculation for 90/10 confidence / precision has been provided in the ER sheet. Nevertheless, it is worth to note that the samples were not sent to the external laboratory in March 2011 and May 2011 due to miscommunication between the operator and production department as clarified in response to a CL (please refer to CL 3 in Annex A). The PP implemented appropriate corrective measures to avoid such mistakes in future. The verification team can confirm that the parameter was measured every month

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	since June 2011. To take the non availability of data for the two months into account, the PP has adopted conservative approach in the emission reduction calculation. Since the parameter is used for project emission calculation, highest value recorded in the year has been considered. The approach is more conservative than applying 90/10 confidence/precision.
Reporting frequency:	Monthly
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, as assessed above, that the reporting frequency represents good monitoring practice.
If applicable, has the reported data been cross-checked with other available data?	The parameter was also measured by the plant's team with the help of onsite colorimeter for crosscheck purpose as mentioned in the monitoring plan. The internal records ^{40/} were provided to the verification team. Upon review of the internal lab reports and comparing them with the external lab reports, the verification team confirms that both the values are in the same range. Moreover, PP followed conservative approach by taking the highest recorded value in the year for emission reduction calculation.
How were the values in the monitoring report verified?	The reported values in the MR and ER sheet were verified with the laboratory reports ^{33/} .
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.

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	Assessment activities		
Data / Parameter (as per monitoring plan in the PDD):	S_{y, final} Amount of sludge generated by the wastewater treatment system in the year y (Tonnes)		
Type of monitoring equipment:	Type of measuring device	Weighing machine	
	Make	Cardinal	
	Model	205	
	Serial No.	E07512-0201	
	Accuracy	± 20 kg ^{/19/}	
Verification of data generation:	The weighing machine (details mentioned above) available at the starch plant is used to weigh the sludge generated. The measurement is carried out whenever the organic material (or sludge) is removed from the UASB reactor. However, from the onsite interviews, it is confirmed that there was no removal of sludge during the monitoring period.		
Measuring frequency:	The measurement is carried out whenever the sludge is removed from the reactor. However, there was no removal of sludge during the monitoring period.		
Is measuring frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Neither the monitoring plan nor the monitoring methodology defines the measuring frequency.		
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?	Neither the monitoring plan nor the monitoring 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.		

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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):	%CH ₄ Methane content in biogas (%)		
Type of monitoring equipment:	Type of meter	Gas Analyser	
	Make	Geotechnical Instruments	
	Model	Biogas Check	
	Serial No.	BM 11452	
	Accuracy	± 3% ^{/19/}	
Verification of data generation:	The parameter was measured using the above mentioned portable analyser on a daily basis during the monitoring period. It was understood from onsite interviews that an online		

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	gas analyser was installed in the beginning to monitor the parameter continuously. However, due to technical problem in the online analyser, it was never used for monitoring of the parameter. Therefore, portable gas analyser was only used for periodic measurement during the monitoring period. From the onsite interviews and the operator log sheets it is confirmed that the methane content (%CH₄) was measured every 4 hours but at least twice a day depending on the availability. The values were recorded in log sheets and the average of the measured values was taken as daily %CH₄. As per the methodological requirements 95% confidence level was applied to determine %CH₄. Therefore, the verification team confirms that the data generation is appropriate.
Measuring frequency:	Periodically The parameter was measured at least twice a day. 95% confidence level was applied to the measured value in order to be conservative.
Is measuring frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes. Though continuous measurement of the parameter is preferred, periodic measurement is approved as per the applied methodology and the monitoring plan. The monitoring plan states, <i>"In case of malfunction, the portable methane analyzer will be used to measure the percent of methane in biogas at least twice a day. Data will be logged manually in the log records and transferred to electronic file i.e. excel sheet template."</i> <i>In case if the continuous measurements are not available, the methane percentage value shall be established using a 95% confidence level and be applied in a conservative manner for estimation of baseline and project emissions".</i> Para 36 of the applied methodology, AMS III.H (version 09) states, <i>"The fraction of methane in the gas should be measured with a continuous analyser or, alternatively, with periodical measurements at a 95% confidence level. Temperature and pressure of the gas are required to determine the density of methane combusted."</i>

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	Therefore, the verification team can confirm that the measuring frequency is in accordance with the monitoring plan and the applied 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 PDD does not specify the accuracy of the monitoring equipment. However, according to GLC's Sectoral expertise, the accuracy of the instrument ($\pm 3\%$) is appropriate. Besides, from calibration of the gas analyser conducted on 2011-06-15 and 2012-08-30, the error before calibration was found to be 1.3% and 1.1% respectively^{/25/}. The error after calibration was reported as less than 0.2%. Therefore, the verification team is of the opinion that the accuracy of the gas analyser represents a good monitoring practice.
Verification of data aggregation:	From the onsite verification and interview with the operating team it is confirmed that the parameter is measured daily and recorded in the log sheets. Average of the measured values is 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.
Verification of data recording:	Data recording was verified by checking the gas analyser and the daily log sheets during the onsite verification. It is confirmed that the data was measured using portable gas analyser 2 to 6 times a day and the values were recorded in the log sheets. The daily log sheet data is reported to Biogas & Power Department Supervisor. Once the log sheet data is approved by the Supervisor, the data is transferred into electronic files (MS-Excel files) on a daily basis. The electronic files^{/36/} are printed at the end of every month by the Supervisor and submitted to the Plant Manager. Therefore, the verification team can confirm that the data recording was appropriate.
Verification of data calculation and reporting	The parameter is recorded by the operator in the log sheets. The daily log sheet data is reported to Biogas & Power Department Supervisor. Once the log sheet data is approved by the Supervisor, the data is transferred into electronic files (MS-Excel files) on a daily basis. The

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	electronic files^{36/} are printed at the end of every month by the Supervisor and reported to the Plant Manager. The monthly reports^{36/} are signed by the Supervisor and the Plant Manager as approved. The daily log sheets (signed by the Operator and the Supervisor) and the approved monthly reports (signed by the Supervisor and the Plant Manager) are stored in hard format. All the daily log sheets^{35/} and the monthly reports^{36/} were checked by the verification team during the onsite verification. Besides, it was also learnt from the onsite interviews that the Plant Manager submits the monitoring data on a monthly basis to the Project Consultant (South Pole Carbon Asset Management Ltd.) for calculating emission reduction. The average of the values recorded over a day is calculated and reported in the ER sheet. A 95% confidence level was also applied conservatively to arrive at the annual average value in line with the requirements of the monitoring plan and the applied monitoring methodology. 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. The verification team can, therefore, confirm that the data reporting and calculation is appropriate and correct.
Reporting frequency:	Daily The monitoring data is reported to the Supervisor of Biogas & Power Department on a daily basis.
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, as assessed above, 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^{36/} approved by the Plant Manager. The reported data in the ER sheet is consistent with the

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	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 ^{35/} . It is confirmed that the values reported in the final MR and the corresponding 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):	Q _{biogas, total, y} Amount of biogas that is generated using the project activity in year y (Nm ³)													
Type of monitoring equipment:	<table><tr><td>Type of meter</td><td>Thermal mass gas flow meter indicating cumulative reading</td></tr><tr><td>Make</td><td>Endress+Hauser</td></tr><tr><td>Model</td><td>t-mass 65l</td></tr><tr><td>Tag No.</td><td>GM 1</td></tr><tr><td>Serial No.</td><td>9502C002000</td></tr><tr><td>Accuracy</td><td>± 1% ^{/19/}</td></tr></table>		Type of meter	Thermal mass gas flow meter indicating cumulative reading	Make	Endress+Hauser	Model	t-mass 65l	Tag No.	GM 1	Serial No.	9502C002000	Accuracy	± 1% ^{/19/}
Type of meter	Thermal mass gas flow meter indicating cumulative reading													
Make	Endress+Hauser													
Model	t-mass 65l													
Tag No.	GM 1													
Serial No.	9502C002000													
Accuracy	± 1% ^{/19/}													
Verification of data generation:	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 totalised reading is recorded from the meter by the operator everyday into the log sheet and submitted to the Biogas & Power Department Supervisor. The Supervisor checks the recorded data													

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	before it is reported to the Plant Manager everyday during the morning meeting. Since the totalised value is recorded in log sheets, any doubtful reading can easily be crosschecked by the Supervisor. The GLC's verification team during the onsite verification observed that the meter was installed on the biogas pipeline at the outlet of UASB reactor. The verification team also checked the meter display and observed that the totalised value is appropriately indicated. Therefore, the verification team can confirm that the data generation is appropriate.
Measuring frequency:	Continuously The parameter is measured continuously with the above mentioned flow meter.
Is measuring frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes. As per the monitoring plan of the approved revised PDD^{/2/} and the applied monitoring methodology (AMS III.H., version 09) ^{/10/}, the parameter shall be measured using continuous flow meter. Since the parameter was measured and recorded continuously by the flow meter, the measuring frequency is considered to be in accordance with the monitoring plan^{/2/} and the monitoring methodology^{/10/}.
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 defined in the monitoring plan. However, GLC's Sectoral expert confirms that $\pm 1\%$ of accuracy represents good monitoring practice.
Verification of data aggregation:	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. Therefore, by checking the totalised values, it is

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	confirmed that the data aggregation is appropriate and free of mistakes.
Verification of data recording:	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 meter screen is recorded by the operator on a daily basis into the log sheets. The daily log sheets are reported to Biogas & Power Department Supervisor and further to the Plant Manager on a daily basis. Since the totalised values are recorded in the log sheets, any inconsistency can easily be detected by the Supervisor. Once the log sheet data is approved by the Supervisor, the data is transferred into electronic files (MS-Excel files) on a daily basis. The electronic files^{/36/} are printed at the end of every month by the Supervisor and submitted to the Plant Manager. Therefore, the verification team can confirm that the data recording was appropriate.
Verification of data calculation and reporting	As mentioned above, the data is recorded in log sheets and reported to Biogas & Power Department Supervisor on a daily basis. The monitored data is also reported to the Plant Manager everyday during the morning meeting. The Supervisor further reports the monthly data (print out of electronic files) that consists of all daily values to the Plant Manager on a monthly basis. The monthly reports^{/36/} are signed by the Supervisor and the Plant Manager as approved. The daily log sheets (signed by the Operator and the Supervisor) and the approved monthly reports (signed by the Supervisor and the Plant Manager) are stored in hard format. All the daily log sheets^{/35/} and the monthly reports^{/36/} were checked by the verification team during the onsite verification. Besides, it was also learnt from the onsite interviews that the Plant Manager submits the monitoring data on a monthly basis to the Project Consultant (South Pole Carbon Asset Management Ltd.) for calculating emission reduction. 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

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	reproduced by the verification team and all the formulae have been verified with the PDD and the applied methodology. The verification team can, therefore, confirm that the data reporting and calculation is appropriate and correct.
Reporting frequency:	Daily The monitoring data is reported to the Supervisor of Biogas & Power Department and further to the Plant Manager on a daily basis.
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, as assessed above, 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^{36/} 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^{35/}. 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):	Q biogas, flare, y

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	Amount of biogas that is flared (Nm ³)	
Type of monitoring equipment:	Type of meter	Thermal mass gas flow meter indicating cumulative reading
	Make	Endress+Hauser
	Model	t-mass 65l
	Tag No.	GM 3
	Serial No.	9A070502000
	Accuracy	± 1% ^{/19/}
Verification of data generation:	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 totalised reading is recorded from the meter by the operator everyday into the log sheet and submitted to the Biogas & Power Department Supervisor. The Supervisor checks the recorded data before it is reported to the Plant Manager everyday during the morning meeting. Since the totalised value is recorded in log sheets, any doubtful reading can easily be crosschecked by the Supervisor. The GLC's verification team during the onsite verification observed that the meter was installed on the biogas pipeline that goes to flare. The verification team also checked the meter display and observed that the totalised value is appropriately indicated. Therefore, the verification team can confirm that the data generation is appropriate.	
Measuring frequency:	Continuously The parameter is measured continuously with the above mentioned flow meter.	
Is measuring frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes. As per the monitoring plan of the approved revised PDD^{/2/} and the applied monitoring methodology (AMS III.H., version 09) ^{/10/}, the parameter shall be measured	

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	using continuous flow meter. Since the parameter was measured and recorded continuously by the flow meter, the measuring frequency is considered to be in accordance with the monitoring plan^{/2/} and the monitoring methodology^{/10/}.
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 defined in the monitoring plan. However, GLC's Sectoral expert confirms that $\pm 1\%$ of accuracy represents good monitoring practice.
Verification of data aggregation:	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. Therefore, by checking the totalised values, it is confirmed that the data aggregation is appropriate and free of mistakes.
Verification of data recording:	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 meter screen is recorded by the operator on a daily basis into the log sheets. The daily log sheets are reported to Biogas & Power Department Supervisor and further to the Plant Manager on a daily basis. Since the totalised values are recorded in the log sheets, any inconsistency can easily be detected by the Supervisor. Once the log sheet data is approved by the Supervisor, the data is transferred into electronic files (MS-Excel files) on a daily basis. The electronic files^{/36/} are printed at the end of every month by the Supervisor and submitted to the Plant Manager. Therefore, the verification team can confirm that the data recording was appropriate.

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Verification of data calculation and reporting	As mentioned above, the data is recorded in log sheets and reported to Biogas & Power Department Supervisor on a daily basis. The monitored data is also reported to the Plant Manager everyday during the morning meeting. The Supervisor further reports the monthly data (print out of electronic files) that consists of all daily values to the Plant Manager on a monthly basis. The monthly reports^{/36/} are signed by the Supervisor and the Plant Manager as approved. The daily log sheets (signed by the Operator and the Supervisor) and the approved monthly reports (signed by the Supervisor and the Plant Manager) are stored in hard format. All the daily log sheets^{/35/} and the monthly reports^{/36/} were checked by the verification team during the onsite verification. Besides, it was also learnt from the onsite interviews that the Plant Manager submits the monitoring data on a monthly basis to the Project Consultant (South Pole Carbon Asset Management Ltd.) for calculating emission reduction. 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. The verification team can, therefore, confirm that the data reporting and calculation is appropriate and correct.
Reporting frequency:	Daily The monitoring data is reported to the Supervisor of Biogas & Power Department and further to the Plant Manager on a daily basis.
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, as assessed above, 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^{/36/} approved by the Plant Manager. The reported data in the ER sheet is consistent with the

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	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 ^{35/} . 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):	Q biogas, generator, y Amount of biogas that is used in electricity generators (Nm³)	
Type of monitoring equipment:	Type of meter	Thermal mass gas flow meter indicating cumulative reading
	Make	Endress+Hauser
	Model	t-mass 65l
	Tag No.	GM 2
	Serial No.	9502C102000
	Accuracy	± 1% /19/
Verification of data generation:	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 totalised reading is recorded from the meter by the operator everyday into the log sheet and submitted to the Biogas & Power Department Supervisor. The Supervisor checks the recorded data	

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	before it is reported to the Plant Manager everyday during the morning meeting. Since the totalised value is recorded in log sheets, any doubtful reading can easily be crosschecked by the Supervisor. The GLC's verification team during the onsite verification observed that the meter was installed on the biogas pipeline that goes from biogas storage system to gas engines. The verification team also checked the meter display and observed that the totalised value is appropriately indicated. Therefore, the verification team can confirm that the data generation is appropriate.
Measuring frequency:	Continuously The parameter is measured continuously with the above mentioned flow meter.
Is measuring frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes. As per the monitoring plan of the approved revised PDD^{/2/} and the applied monitoring methodology (AMS III.H., version 09) ^{/10/}, the parameter shall be measured using continuous flow meter. Since the parameter was measured and recorded continuously by the flow meter, the measuring frequency is considered to be in accordance with the monitoring plan^{/2/} and the monitoring methodology^{/10/}.
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 defined in the monitoring plan. However, GLC's Sectoral expert confirms that $\pm 1\%$ of accuracy represents good monitoring practice.
Verification of data aggregation:	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.

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	Therefore, by checking the totalised values, it is confirmed that the data aggregation is appropriate and free of mistakes.
Verification of data recording:	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 meter screen is recorded by the operator on a daily basis into the log sheets. The daily log sheets are reported to Biogas & Power Department Supervisor and further to the Plant Manager on a daily basis. Since the totalised values are recorded in the log sheets, any inconsistency can easily be detected by the Supervisor. Once the log sheet data is approved by the Supervisor, the data is transferred into electronic files (MS-Excel files) on a daily basis. The electronic files^{/36/} are printed at the end of every month by the Supervisor and submitted to the Plant Manager. Therefore, the verification team can confirm that the data recording was appropriate.
Verification of data calculation and reporting	As mentioned above, the data is recorded in log sheets and reported to Biogas & Power Department Supervisor on a daily basis. The monitored data is also reported to the Plant Manager everyday during the morning meeting. The Supervisor further reports the monthly data (print out of electronic files) that consists of all daily values to the Plant Manager on a monthly basis. The monthly reports^{/36/} are signed by the Supervisor and the Plant Manager as approved. The daily log sheets (signed by the Operator and the Supervisor) and the approved monthly reports (signed by the Supervisor and the Plant Manager) are stored in hard format. All the daily log sheets^{/35/} and the monthly reports^{/36/} were checked by the verification team during the onsite verification. Besides, it was also learnt from the onsite interviews that the Plant Manager submits the monitoring data on a monthly basis to the Project Consultant (South Pole Carbon Asset Management Ltd.) for calculating emission reduction. The calculation was transparently provided by the project participant (PP) in the ER sheet and submitted to

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	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. The verification team can, therefore, confirm that the data reporting and calculation is appropriate and correct.
Reporting frequency:	Daily The monitoring data is reported to the Supervisor of Biogas & Power Department and further to the Plant Manager on a daily basis.
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, as assessed above, 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^{/36/} 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^{/35/}. 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	T_{flare}

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(as per monitoring plan in the PDD):	Temperature of the exhaust gases of the flare in stack (°C)		
Type of monitoring equipment:	Type of equipment	N type Thermocouple	
	Make	TAIE / WR&W /30/	
	Model	FY800	
	Serial No.	SP08071880025	
Verification of data generation:	From the onsite verification it can be confirmed that an enclosed flare system was installed to flare out any excess biogas. An N type thermocouple is mounted on top of the flare stack to measure the temperature of exhaust gases. The operation of biogas plant including the flare is controlled by SCADA (Supervisory Control And Data Acquisition) system. Temperature indication could be observed on the SCADA screen during the site visit. Nevertheless, the data was not logged sufficiently during the operation of the flare. Therefore, PP assumed the flare efficiency as zero which is a conservative approach.		
Measuring frequency:	Not applicable (NA)		
Is measuring frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	NA Though the temperature measuring device i.e. thermocouple was installed on stack of the flare, the temperature readings were not recorded properly when the flare was operated. Therefore, the measuring frequency could not be determined. Nevertheless, PP followed conservative approach in calculating the emission reduction. From the onsite interviews and by checking the log sheets of the biogas flow meter readings of the flare, it is confirmed that the flare was not operated at all in 2011 and 2013; it was operated only in 2012 on few days. PP calculated the emission reduction by assuming the flare efficiency as zero for the monitoring period in order to be conservative. The approach is in accordance with the monitoring plan.		
Is accuracy of the monitoring equipment as stated in the PDD?	NA		

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If the PDD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practise?	
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?	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):	Time of biogas sent to flare (Amount of minutes per hour where biogas is sent to the flare)
Type of monitoring equipment:	From the onsite verification it can be confirmed that an enclosed flare system was installed to flare out any excess biogas. The operation of biogas plant including the flare is controlled by SCADA (Supervisory Control And Data Acquisition) system. Biogas flow indication to the flare (which was showing 0 Nm ³) could be observed

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	on the SCADA screen during the site visit. From the onsite interviews with the operating team, it was understood that the SCADA system captures the biogas flow every minute and stores it from where the time can be calculated. However, it was learnt that the flare was not operated at all in 2011 and 2013. Though the flare was operated for few days in 2012, the data was not logged sufficiently during the operation of the flare. Therefore, PP assumed the flare efficiency as zero which is a conservative approach. The approach is in accordance with the monitoring plan.
Verification of data generation:	NA
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:	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	Yes. The verification team, based on the document review and onsite verification, confirms that the data management (from monitoring equipment to emission

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of emission reductions and are necessary QA/QC processes in place?	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.
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	Assessment activities																		
Data / Parameter (as per monitoring plan in the PDD):	EC_y Electricity consumed by the wastewater treatment facility over the year (MWh)																		
Type of monitoring equipment:	Electricity meter with continuous measuring and recording of electrical energy was used to measure the parameter. It is to be noted the meter was changed two times during the monitoring period. From 2008-01-18 (the date is before beginning of the crediting period) to 2011-06-27, the electricity meter with the following specifications was used: <table border="1"> <tr> <td>Type of meter</td><td>Electricity meter</td></tr> <tr> <td>Make</td><td>EDMI</td></tr> <tr> <td>Model</td><td>Genius Series Mk6</td></tr> <tr> <td>Serial No.</td><td>205055772 (PEA No. 20963014)</td></tr> <tr> <td>Accuracy</td><td>± 0.5% ^{/19/}</td></tr> </table> From 2011-06-27 to 2012-11-02: <table border="1"> <tr> <td>Type of meter</td><td>Electricity meter</td></tr> <tr> <td>Make</td><td>EDMI</td></tr> <tr> <td>Model</td><td>Genius Series Mk6</td></tr> <tr> <td>Serial No.</td><td>203327329 (PEA No.18323271)</td></tr> </table>	Type of meter	Electricity meter	Make	EDMI	Model	Genius Series Mk6	Serial No.	205055772 (PEA No. 20963014)	Accuracy	± 0.5% ^{/19/}	Type of meter	Electricity meter	Make	EDMI	Model	Genius Series Mk6	Serial No.	203327329 (PEA No.18323271)
Type of meter	Electricity meter																		
Make	EDMI																		
Model	Genius Series Mk6																		
Serial No.	205055772 (PEA No. 20963014)																		
Accuracy	± 0.5% ^{/19/}																		
Type of meter	Electricity meter																		
Make	EDMI																		
Model	Genius Series Mk6																		
Serial No.	203327329 (PEA No.18323271)																		

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	Accuracy	$\pm 0.5\%$ ^{/19/}
	From 2012-11-02 to 2013-07-31 (i.e. till the end of the monitoring period:	
	Type of meter	Electricity meter
	Make	EDMI
	Model	Genius Series Mk10E
	Serial No.	212054801 (PEA No.27664781)
	Accuracy	$\pm 0.5\%$ ^{/19/}
Verification of data generation:	Electricity is imported from the grid to meet the requirement of the wastewater treatment facility or biogas plant. During the onsite verification it was observed that an electricity meter was installed at the incoming point of the biogas plant to measure the electricity consumption. The parameter under assessment was monitored through the above mentioned electricity meters. The electricity meter measures the parameter on a continuous basis. The electricity meter is owned and controlled by the grid company, Provincial Electricity Authority (PEA). The PEA officials archive the data from the meter in presence of the Biogas plant's operator on monthly basis. The recording is done on 1st of every month and the recorded data corresponds to the previous month (i.e. from the first day of the month to the last day). Based on the monthly readings, a report is prepared by PEA and sent to P & Papop Co., Ltd. for invoicing. The verification team can confirm that the data generation is appropriate.	
Measuring frequency:	Continuously The parameter is measured continuously with the above mentioned electricity meter.	
Is measuring frequency in accordance with the monitoring plan and monitoring	Yes. As per the monitoring plan of the approved revised	

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methodology? (Yes / No)	PDD^{/2/} and the applied monitoring methodology (AMS I.D., version 13) ^{/10/}, the parameter shall be measured continuously using electricity meter. Since the parameter was measured and recorded continuously by the electricity meter, the measuring frequency is considered to be in accordance with the monitoring plan^{/2/} and the monitoring methodology^{/10/}.
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 defined in the monitoring plan. However, the electrical meter is owned and controlled by PEA. Therefore, the accuracy of electricity meter is assumed to be at required level. Besides, GLC's Sectoral expert confirms that $\pm 0.5\%$ of accuracy represents good monitoring practice.
Verification of data aggregation:	All the monthly reports^{/32/} issued by PEA were submitted to the verification team. The monthly values of the parameter are presented in the ER sheet and correctly aggregated. Based on the PEA reports and ER sheet, it can be confirmed that the data aggregation is correct.
Verification of data recording:	From the onsite interviews with the plant's operating team, it was understood that the PEA officials visit the site on 1st of every month and record the data from the electricity meter in presence of the plant's operator. The recorded data represents for the previous month. Based on such monthly recording, a report is prepared by PEA and issued for invoicing. All the monthly PEA reports^{/32/} were checked by the verification team. Therefore, the verification team can confirm that the data recording was appropriate.
Verification of data calculation and reporting	As mentioned above, the data is recorded and reported by PEA on monthly basis. Besides, it was learnt from the onsite interviews that the Plant Manager submits the monitoring data on a monthly basis to the Project Consultant (South Pole Carbon Asset Management Ltd.) for calculating emission reduction. 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

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	have been verified with the PDD and the applied methodology. The verification team can, therefore, confirm that the data reporting and calculation is appropriate and correct.
Reporting frequency:	Monthly
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. However, the monitoring plan states, "<i>The measurement of this parameter shall be done continuously using electricity meter, owned by PEA. Monthly monitoring of the power meter is done. This can be verified from the reports issued by PEA (Provincial Electricity Authority)</i>". Therefore, the verification team is of the opinion that the overall monitoring approach is in accordance with the monitoring plan and the reporting frequency represents good monitoring practice.
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 reported in the monitoring report ^{4/} and the corresponding ER sheet ^{5/} were verified with the monthly reports issued by PEA ^{32/} . 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
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Data / Parameter (as per monitoring plan in the PDD):	EG_y Electricity exported to the grid during the year y by power generation facility (MWh)											
Type of monitoring equipment:	<table border="1"> <tr> <td>Type of meter</td> <td>Electricity meter</td> </tr> <tr> <td>Make</td> <td>EDMI</td> </tr> <tr> <td>Model</td> <td>Genius Series Mk6</td> </tr> <tr> <td>Serial No.</td> <td>205055798 (PEA No. 20963040)</td> </tr> <tr> <td>Accuracy</td> <td>± 0.5% ^{/19/}</td> </tr> </table>	Type of meter	Electricity meter	Make	EDMI	Model	Genius Series Mk6	Serial No.	205055798 (PEA No. 20963040)	Accuracy	± 0.5% ^{/19/}	
Type of meter	Electricity meter											
Make	EDMI											
Model	Genius Series Mk6											
Serial No.	205055798 (PEA No. 20963040)											
Accuracy	± 0.5% ^{/19/}											
Verification of data generation:	Electricity generated by the project activity is exported to the grid. During the onsite verification it was observed that an electricity meter was installed at the grid connection point to measure the electricity exported. The parameter under assessment was monitored through the above mentioned electricity meter. The electricity meter measures the parameter on a continuous basis. The electricity meter is owned and controlled by the grid company, Provincial Electricity Authority (PEA). The PEA officials archive the data from the meter in presence of the Biogas plant's operator on monthly basis. The recording is done on 1st of every month and the recorded data corresponds to the previous month (i.e. from the first day of the month to the last day). Based on the monthly readings, a report is prepared by PEA and sent to P & Papop Co., Ltd. for invoicing. The verification team can confirm that the data generation is appropriate.											
Measuring frequency:	Continuously The parameter is measured continuously with the above mentioned electricity meter.											
Is measuring frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes. As per the monitoring plan of the approved revised PDD ^{2/} and the applied monitoring methodology (AMS I.D., version 13) ^{/10/} , the parameter shall be measured											

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	continuously using electricity meter. Since the parameter was measured and recorded continuously by the electricity meter, the measuring frequency is considered to be in accordance with the monitoring plan^{/2/} and the monitoring methodology^{/10/}.
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 defined in the monitoring plan. However, the electrical meter is owned and controlled by PEA. Therefore, the accuracy of electricity meter is assumed to be at required level. Besides, GLC's Sectoral expert confirms that $\pm 0.5\%$ of accuracy represents good monitoring practice.
Verification of data aggregation:	All the monthly reports ^{/32/} issued by PEA were submitted to the verification team. The monthly values of the parameter are presented in the ER sheet and correctly aggregated. Based on the PEA reports and ER sheet, it can be confirmed that the data aggregation is correct.
Verification of data recording:	From the onsite interviews with the plant's operating team, it was understood that the PEA officials visit the site on 1st of every month and record the data from the electricity meter in presence of the plant's operator. The recorded data represents for the previous month. Based on such monthly recording, a report is prepared by PEA and issued for invoicing. All the monthly PEA reports^{/32/} were checked by the verification team. Therefore, the verification team can confirm that the data recording was appropriate.
Verification of data calculation and reporting	As mentioned above, the data is recorded and reported by PEA on monthly basis. Besides, it was learnt from the onsite interviews that the Plant Manager submits the monitoring data on a monthly basis to the Project Consultant (South Pole Carbon Asset Management Ltd.) for calculating emission reduction. 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

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	methodology. The verification team can, therefore, confirm that the data reporting and calculation is appropriate and correct.
Reporting frequency:	Monthly
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. However, the monitoring plan states, "<i>The measurement of this parameter shall be done continuously using electricity meter, owned by PEA. Monthly monitoring of the power meter is done. This can be verified from the reports issued by PEA (Provincial Electricity Authority)</i>". Therefore, the verification team is of the opinion that the overall monitoring approach is in accordance with the monitoring plan and the reporting frequency represents good monitoring practice.
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 reported in the monitoring report ^{4/} and the corresponding ER sheet ^{5/} were verified with the monthly reports issued by PEA ^{32/} . 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):	FE or $\eta_{\text{flare-h}}$ Flare efficiency (%)
Type of monitoring equipment:	The parameter is calculated based on T_{flare} (Temperature of the exhaust gases of the flare in stack)

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	and Time of biogas sent to flare (i.e. Amount of minutes per hour where biogas is sent to the flare) assessed above.
Verification of data generation:	From the onsite verification, it can be confirmed that an enclosed flare was installed for the project system to flare out any excess biogas. The flare efficiency is calculated according to the 'Tool to determine project emissions from flaring gases containing methane', EB28, Annex 13 ^{/11/} (It is worth to note that the tool was replaced with Methodological tool "Project emissions from flaring", version 02.0.0. Nevertheless, the requirement for flare efficiency calculation is unchanged in the revised tool). As T_{flare} (Temperature of the exhaust gases of the flare in stack) and Time of biogas sent to flare (i.e. Amount of minutes per hour where biogas is sent to the flare) were not sufficiently recorded as assessed above, the flare efficiency is assumed to be zero for the current monitoring period. The approach results in conservative estimation of emission reduction and therefore it is considered appropriate.
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:	NA
Verification of data recording:	NA
Verification of data calculation and reporting	The emission reduction calculation presented in the ER sheet ^{5/} was checked by the verification team. It is confirmed that the flare efficiency was taken as zero in the calculation. It results in higher project emissions and therefore lower emission reduction.

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	It is worth to note that there was no biogas flared in 2011 and 2013. Therefore, the flare efficiency does not have any impact on emission reduction calculation for 2011 and 2013.
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?	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.

Thus GLC confirms that

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

Monitoring management and QA/QC procedures:

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

The PP developed a procedure for monitoring and reporting of various parameters. The monitoring procedures^{39/} were verified during the site visit. It was understood from the monitoring procedures and

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the interview with the operating team that the data is collected by the trained operators and recorded in the operator log sheets under the supervision of respective heads of department. The recorded data is checked by the Supervisor and reported to the Plant Manager on a daily basis. The approved log sheets^{/35/} are filed and stored. Once the log sheet data is checked and approved by the Supervisor, the data is also transferred into electronic format (excel sheets). The electronic files are printed on a monthly basis and reported to the Plant Manager. The Plant Manager checks the data and approves the monthly reports. The approved monthly reports^{/36/} are stored in separate files. The monitored data is further sent to the project consultant (South Pole Carbon Asset Management Ltd) on monthly basis for emission reduction calculation.

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

It is worth to note that the parameters related to electricity (EC_y and EG_y) are recorded by the PEA officials on a monthly basis from the meters installed at plant's premises in presence of the plant's operator. Based on such monthly readings, a report is prepared and issued by PEA in the beginning of every month for invoicing. The electricity meters are owned and controlled by PEA. The calibration of those meters is under the purview of PEA. The monthly electricity reports issued by PEA and the calibration reports of electricity meters were provided to the verification team.

It was learnt that regular training programmes on safety, operation and maintenance of the wastewater treatment plant are conducted on-site ^{/37/}. The verification team interviewed the plant's operating team (i.e. staff of wastewater treatment plant) during the on-site assessment. The team was found to be technically competent with respect to project operation, maintenance, safety and monitoring of parameters.

Though the monitoring parameters are recorded manually in log sheets, the parameters such as wastewater flow, biogas generation, biogas sent to gas engines and biogas sent to flare are measured using continuous flow meters. The meters always display the totalised value which is recorded by the operators in the log sheets. Therefore, any doubtful reading could easily be crosschecked with the totalised value. The COD values are analysed under the supervision of experienced QC Supervisor. Furthermore, all the measuring equipments possess good level of accuracy.

It is worth to note that for all the flow meters, calibration frequency was defined as 3 years in the monitoring plan. However, PP chose to calibrate the monitoring equipment annually and developed the calibration plan accordingly. Based on Sectoral and local expertise of GLC's assessment team it is confirmed that there are no standards for calibration frequency of the monitoring equipment in the host country and therefore the calibration frequency of one year chosen by the PP represents better monitoring practice. Therefore, for any calibration delay over one year, PP has applied the error and calculated the measured values so as to result in conservative estimation of emission reduction. The information and the calculation have been transparently provided in the final version of the ER sheet. It is confirmed that the PP has applied maximum permissible error or the error identified during the

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calibration whichever was higher. The approach is confirmed to be correct according to Para 238 – 242 of CDM VVS (version 05.0)^{1/}.

Hence, the verification team is of the opinion that the monitoring management system and QA/QC procedures reflect good practice.

From the review of validation report^{3/}, it is confirmed that there are no open or pending issues. However, from the review of the 1st verification report^{17/} it was found that 2 FARs were raised during the 1st verification. The verification team through onsite verification and onsite interviews confirms that the FARs were sufficiently addressed by the PP and therefore the FARs can be closed. Further assessment on the FARs is provided in Annex A of the report. It is confirmed that there are no pending issues.

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

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

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):	Q_{y, ww} Volume of wastewater treated in the year y (Unit: m ³)
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?	The monitoring plan of the PDD states, <i>"The flow meter is calibrated at least once every three years in line with the manufacturer's recommendation and the latest EB guidelines for small-scale project"</i> . Nevertheless, PP developed calibration plan to

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	calibrate the monitoring equipment annually. In case the calibration was conducted after one year, conservative approach was followed for the delayed period as assessed below. This represents better monitoring practice.	
Company performing the calibration:	Calibration date	Company name
	2010-09-21	Endress & Hauser (Thailand) Ltd. (Endress + Hauser) ^{/20/}
	2011-09-22	Endress + Hauser
	2012-09-11	Endress + Hauser
	2013-06-19	Endress + Hauser
	Based on Sectoral and local expertise of verification team, it is confirmed that Endress + Hauser (http://www.th.endress.com/) is a well established company which supplies and calibrates 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 monitoring equipment.	
Is(are) calibration(s) valid for the whole reporting period?	From the above mentioned calibration dates, it can be seen that there was a calibration delay by one day. Therefore, PP has applied the error and calculated the measured value on 2011-09-21 so as to result in conservative estimation of emission reduction. The information and the calculation have been transparently provided in the final version of the ER sheet ^{/5/}. It is confirmed that the PP has applied maximum permissible error or the error identified during the calibration whichever was higher. The approach is confirmed to be correct according to Para 238 – 242 of CDM VVS (version 05.0)^{/1/}. Further assessment is provided in Table 4-5 below.	

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	Assessment activities									
Data / Parameter (as per monitoring plan in the PDD):	COD_{y, inflow, j} The COD (chemical oxygen demand) of the wastewater entering the project system "j" (mg/l or tonnes/m ³)									
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?	Yes, the calibration frequency is inline with the monitoring plan of the PDD.									
Company performing the calibration:	<table border="1"> <tr> <td>Calibration date</td><td>Company name</td></tr> <tr> <td>2011-05-31</td><td>EnviScience Company Limited^{21/}</td></tr> <tr> <td>2012-05-29</td><td>EnviScience Company Limited</td></tr> <tr> <td>2013-05-08</td><td>EnviScience Company Limited</td></tr> </table> 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.		Calibration date	Company name	2011-05-31	EnviScience Company Limited ^{21/}	2012-05-29	EnviScience Company Limited	2013-05-08	EnviScience Company Limited
Calibration date	Company name									
2011-05-31	EnviScience Company Limited ^{21/}									
2012-05-29	EnviScience Company Limited									
2013-05-08	EnviScience Company Limited									
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?	The colorimeter was first calibrated on 2011-05-31 after the purchase of the equipment. Therefore, the period from 2011-01-01 to 2011-05-30 is considered as delayed period. PP has applied the error and calculated the measured values for the delayed period so as to result in conservative estimation of emission reduction. The information and the calculation have been transparently provided in the final version of the ER sheet. It is confirmed that the PP has applied maximum permissible error or the									

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	error identified during the calibration whichever was higher. The approach is confirmed to be correct according to Para 238 – 242 of CDM VVS (version 05.0) ^{/1/}. Further assessment is provided in Table 4-5 below.
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	Assessment activities	
Data / Parameter (as per monitoring plan in the PDD):	COD_{y, outflow, j} The COD (chemical oxygen demand) of wastewater exiting the project system j (mg/l or tonnes/m ³)	
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?	Yes, the calibration frequency is inline with the monitoring plan of the PDD.	
Company performing the calibration:	Calibration date	Company name
	2011-05-31	EnviScience Company Limited ^{/21/}
	2012-05-29	EnviScience Company Limited
	2013-05-08	EnviScience Company Limited
	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?	The colorimeter was first calibrated on 2011-05-31 after the purchase of the equipment. Therefore, the	

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	period from 2011-01-01 to 2011-05-30 is considered as delayed period. PP has applied the error and calculated the measured values for the delayed period so as to result in conservative estimation of emission reduction. The information and the calculation have been transparently provided in the final version of the ER sheet. It is confirmed that the PP has applied maximum permissible error or the error identified during the calibration whichever was higher. The approach is confirmed to be correct according to Para 238 – 242 of CDM VVS (version 05.0) ^{/1/}. Further assessment is provided in Table 4-5 below.
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	Assessment activities
Data / Parameter (as per monitoring plan in the PDD):	S_{y, final} Amount of sludge generated by the wastewater treatment system in the year y (Tonnes)
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?	According to the monitoring plan, " <i>The measurement equipment shall be tested / calibrated once in every 3 years.</i> " However, PP chose to calibrate the monitoring equipment once in 2 years, which represents good monitoring practice.
Company performing the calibration:	The monitoring equipment was calibrated on 2012-06-12 by the manufacturer, Cardinal Scale Manufacturing Co. (Cardinal). The validity date of the calibration was mentioned as 2014-06-11 ^{/31/} .
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes. The calibration report was verified by the verification team which confirm the proper functioning of the monitoring equipment.
Is(are) calibration(s) valid for the whole reporting period?	It is worth to note that calibration of the weighing machine was not conducted before 2012-06-12. Nevertheless, it does not have any impact since the sludge was never removed from the treatment

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	system during the monitoring period.
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	Assessment activities	
Data / Parameter (as per monitoring plan in the PDD):	%CH ₄ Methane content in biogas (%)	
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?	The monitoring plan of the PDD states, "<i>Periodic calibration according to the manufacturer's specification or recommendation.</i>" From the calibration report, it is understood that the recommended calibration frequency for gas analyser is 1 year. Therefore, PP chose to follow the annual calibration for the monitoring equipment.	
Company performing the calibration:	Calibration date	Company name
	2011-06-15	Entech Associate Co., Ltd. /25/
	2012-08-30	Entech Associate Co., Ltd.
	Based on local expertise of GLC's assessment team it is confirmed that Entech Associate Co., Ltd. is a well established company (http://www.entech.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?	The gas analyser was first calibrated on 2011-06-15 after the purchase of the equipment. Therefore, the period from 2011-01-01 to 2011-06-14 is considered as delayed period. Besides, the calibration was delayed by few days from 2012-06-15 to 2012-08-29 as can be seen from the above mentioned calibration dates. Therefore, PP has applied the error and	

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	calculated the measured values for the delayed period so as to result in conservative estimation of emission reduction. The information and the calculation have been transparently provided in the final version of the ER sheet. It is confirmed that the PP has applied maximum permissible error or the error identified during the calibration whichever was higher. The approach is confirmed to be correct according to Para 238 – 242 of CDM VVS (version 05.0) ^{/1/}. Further assessment is provided in Table 4-5 below.
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	Assessment activities	
Data / Parameter (as per monitoring plan in the PDD):	Q biogas, total, y Amount of biogas that is generated using the project activity in year y (Nm ³)	
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?	The monitoring plan of the PDD states, " <i>The flow meter is calibrated at least once every three years in line with the manufacturer's recommendation and the latest EB guidelines for small-scale project</i> ". Nevertheless, PP developed calibration plan to calibrate the monitoring equipment annually. In case the calibration was conducted after one year, conservative approach was followed for the delayed period as assessed below. This represents better monitoring practice.	
Company performing the calibration:	Calibration date	Company name
	2010-09-21	Endress + Hauser ^{/22/}
	2011-09-30	Endress + Hauser
	2012-09-10	Endress + Hauser
	2013-06-19	Endress + Hauser

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	Based on Sectoral and local expertise of verification team, it is confirmed that Endress + Hauser (http://www.th.endress.com/) is a well established company which supplies and calibrates 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 monitoring equipment.
Is(are) calibration(s) valid for the whole reporting period?	From the above mentioned calibration dates, it can be seen that there was a calibration delay by few days from 2011-09-21 to 2011-09-29. Therefore, PP has applied the error and calculated the measured values for delayed period so as to result in conservative estimation of emission reduction. The information and the calculation have been transparently provided in the final version of the ER sheet ^{/5/}. It is confirmed that the PP has applied maximum permissible error or the error identified during the calibration whichever was higher. The approach is confirmed to be correct according to Para 238 – 242 of CDM VVS (version 05.0)^{/1/}. Further assessment is provided in Table 4-5 below.

	Assessment activities
Data / Parameter (as per monitoring plan in the PDD):	Q biogas, flare, y Amount of biogas that is flared (Nm³)
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?	The monitoring plan of the PDD states, “<i>The flow meter is calibrated at least once every three years in line with the manufacturer’s recommendation and the latest EB guidelines for small-scale project</i>”. Nevertheless, PP developed calibration plan to calibrate the monitoring equipment annually. In case the calibration was conducted after one year, conservative approach was followed for the delayed period as assessed below. This represents better monitoring practice.

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Company performing the calibration:	Calibration date	Company name
	2010-09-21	Endress + Hauser ^{/24/}
	2011-09-30	Endress + Hauser
	2012-09-10	Endress + Hauser
	2013-06-20	Endress + Hauser
Based on Sectoral and local expertise of verification team, it is confirmed that Endress + Hauser (http://www.th.endress.com/) is a well established company which supplies and calibrates 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 monitoring equipment.	
Is(are) calibration(s) valid for the whole reporting period?	From the above mentioned calibration dates, it can be seen that there was a calibration delay by few days from 2011-09-21 to 2011-09-29. Nevertheless, flare was never operated during 2011. The parameter recorded during the delayed calibration period was zero. Therefore, the delay in calibration does not have any impact on emission reduction calculation. The information is transparently provided in the MR also. Further assessment is provided in Table 4-5 below.	

	Assessment activities
Data / Parameter (as per monitoring plan in the PDD):	Q biogas, generator, y Amount of biogas that is used in electricity generators (Nm ³)
Calibration frequency /interval:	Yearly
Is the calibration interval in line with the monitoring plan of the PDD?	The monitoring plan of the PDD states, "The flow meter is calibrated at least once every three years in

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If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practise?	<i>line with the manufacturer's recommendation and the latest EB guidelines for small-scale project".</i> Nevertheless, PP developed calibration plan to calibrate the monitoring equipment annually. In case the calibration was conducted after one year, conservative approach was followed for the delayed period as assessed below. This represents better monitoring practice.											
Company performing the calibration:	<table border="1"> <thead> <tr> <th>Calibration date</th> <th>Company name</th> </tr> </thead> <tbody> <tr> <td>2010-09-21</td> <td>Endress + Hauser ^{/23/}</td> </tr> <tr> <td>2011-09-30</td> <td>Endress + Hauser</td> </tr> <tr> <td>2012-09-10</td> <td>Endress + Hauser</td> </tr> <tr> <td>2013-06-19</td> <td>Endress + Hauser</td> </tr> </tbody> </table>	Calibration date	Company name	2010-09-21	Endress + Hauser ^{/23/}	2011-09-30	Endress + Hauser	2012-09-10	Endress + Hauser	2013-06-19	Endress + Hauser	Based on Sectoral and local expertise of verification team, it is confirmed that Endress + Hauser (http://www.th.endress.com/) is a well established company which supplies and calibrates various measuring equipment.
Calibration date	Company name											
2010-09-21	Endress + Hauser ^{/23/}											
2011-09-30	Endress + Hauser											
2012-09-10	Endress + Hauser											
2013-06-19	Endress + Hauser											
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 monitoring equipment.											
Is(are) calibration(s) valid for the whole reporting period?	From the above mentioned calibration dates, it can be seen that there was a calibration delay by few days from 2011-09-21 to 2011-09-29. Therefore, PP has applied the error and calculated the measured values for delayed period so as to result in conservative estimation of emission reduction. The information and the calculation have been transparently provided in the final version of the ER sheet ^{/5/}. It is confirmed that the PP has applied maximum permissible error or the error identified during the calibration whichever was higher. The approach is confirmed to be correct according to Para 238 – 242 of CDM VVS (version 05.0)^{/1/}. Further assessment is provided in Table 4-5 below.											

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	Assessment activities						
Data / Parameter (as per monitoring plan in the PDD):	T_{flare} Temperature of the exhaust gases of the flare in stack (°C)						
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?	Yes, the calibration frequency is inline with the monitoring plan of the PDD.						
Company performing the calibration:	<table border="1"> <tr> <td>Calibration date</td><td>Company name</td></tr> <tr> <td>2011-09-30</td><td>WR&W Calibration Laboratory Co., Ltd.^{/30/}</td></tr> <tr> <td>2013-08-26</td><td>SCM Calibration Laboratory^{/30/}</td></tr> </table>	Calibration date	Company name	2011-09-30	WR&W Calibration Laboratory Co., Ltd. ^{/30/}	2013-08-26	SCM Calibration Laboratory ^{/30/}
Calibration date	Company name						
2011-09-30	WR&W Calibration Laboratory Co., Ltd. ^{/30/}						
2013-08-26	SCM Calibration Laboratory ^{/30/}						
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 monitoring equipment.						
Is(are) calibration(s) valid for the whole reporting period?	It is clear from the above mentioned dates that the calibration frequency was not respected. However, the delay in calibration does not have any impact on emission reduction since the PP assumed the flare efficiency as zero.						

	Assessment activities
Data / Parameter (as per monitoring plan in the PDD):	EC_y Electricity consumed by the wastewater treatment facility over the year (MWh)
Calibration frequency /interval:	Yearly

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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?	Yes. The monitoring plan of the PDD states, <i>"The PEA shall conduct the calibration on an annual basis as per internal PEA regulation and the project owner shall approach PEA for execution of the same."</i> The verification team confirms that the calibration was conducted annually by PEA and the calibration reports were submitted to the verification team. If there was any delay in calibration, PP applied the error conservatively inline with the VVS guidelines as assessed below.	
Company performing the calibration:	Calibration of electricity meter with serial no. 205055772	
	Calibration date	Company name
	2009-02-27	Provincial Electricity Authority (PEA)^{/27/}
	2011-06-27	PEA ^{/27/}
	Meter with serial no. 205055772 was replaced with new meter of serial no. 203327329 on 2011-06-27 as mentioned in above section. It is also worth mentioning that the meter with serial no. 205055772 was removed and calibrated by PEA on 2011-06-27. Though it was not used after that date, PP obtained the calibration report from PEA in order to consider the error for the delayed calibration period. The same was provided to the verification team. Therefore, the calibration date of both the meters is mentioned for the sake of transparency.	
	Calibration of electricity meter with serial no. 203327329:	
	Calibration date	Company name
	2011-06-27	PEA ^{/28/}
	2012-06-05	PEA ^{/28/}
	Meter with serial no. 203327329 was replaced with new meter of serial no. 212054801 on 2012-11-02^{/34/}	

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	<table border="1"> <tr> <td colspan="2">Calibration of electricity meter with serial no. 212054801:</td> </tr> <tr> <td>Calibration date</td><td>Company name</td> </tr> <tr> <td>2013-06-21</td><td>PEA ^{/29/}</td> </tr> </table> It is to be noted that the electricity meter is owned and controlled by PEA who is the grid operator. Calibration of the electricity meter was conducted by PEA.	Calibration of electricity meter with serial no. 212054801:		Calibration date	Company name	2013-06-21	PEA ^{/29/}
Calibration of electricity meter with serial no. 212054801:							
Calibration date	Company name						
2013-06-21	PEA ^{/29/}						
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 monitoring equipment.						
Is(are) calibration(s) valid for the whole reporting period?	From the above mentioned calibration dates, it can be seen that there was a calibration delay from 2011-01-01 to 2011-06-26. Therefore, PP has applied the error and calculated the measured values for delayed period so as to result in conservative estimation of emission reduction. The information and the calculation have been transparently provided in the final version of the ER sheet ^{/5/}. It is confirmed that the PP has applied maximum permissible error or the error identified during the calibration whichever was higher. The approach is confirmed to be correct according to Para 238 – 242 of CDM VVS (version 05.0)^{/1/}. It is worth to mention that PP also applied the calibration error from November 2012 to June 2013. The reason understood from the interview with the PP is – calibration report of the meter installed on 2012-11-02 was provided by PEA only for the calibration conducted on 2013-06-21. Since no previous calibration report was available, though it was a new meter, PP applied the error in order to be conservative. The verification team accepts the approach since it would result in conservative estimation of emission reduction. Further assessment is provided in Table 4-5 below.						

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	Assessment activities										
Data / Parameter (as per monitoring plan in the PDD):	EG_y Electricity exported to the grid during the year y by power generation facility (MWh)										
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?	Yes. The monitoring plan of the PDD states, " <i>The PEA shall conduct the calibration on an annual basis as per internal PEA regulation and the project owner shall approach PEA for execution of the same.</i> " The verification team confirms that the calibration was conducted annually by PEA and the calibration reports were submitted to the verification team. If there was any delay in calibration, PP applied the error conservatively inline with the VVS guidelines as assessed below.										
Company performing the calibration:	<table border="1"> <thead> <tr> <th>Calibration date</th><th>Company name</th></tr> </thead> <tbody> <tr> <td>2009-02-27</td><td>PEA /26/</td></tr> <tr> <td>2011-06-27</td><td>PEA /26/</td></tr> <tr> <td>2012-06-05</td><td>PEA /26/</td></tr> <tr> <td>2013-06-21</td><td>PEA /26/</td></tr> </tbody> </table> It is to be noted that the electricity meter is owned and controlled by PEA who is the grid operator. Calibration of the electricity meter was conducted by PEA.	Calibration date	Company name	2009-02-27	PEA /26/	2011-06-27	PEA /26/	2012-06-05	PEA /26/	2013-06-21	PEA /26/
Calibration date	Company name										
2009-02-27	PEA /26/										
2011-06-27	PEA /26/										
2012-06-05	PEA /26/										
2013-06-21	PEA /26/										
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 monitoring equipment.										
Is(are) calibration(s) valid for the whole reporting period?	From the above mentioned calibration dates, it can be seen that there was a calibration delay from 2011-01-01 to 2011-06-26 and from 2013-06-05 to 2013-06-20. Therefore, PP has applied the error and										

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	calculated the measured values for delayed period so as to result in conservative estimation of emission reduction. The information and the calculation have been transparently provided in the final version of the ER sheet ^{/5/}. It is confirmed that the PP has applied maximum permissible error or the error identified during the calibration whichever was higher. The approach is confirmed to be correct according to Para 238 – 242 of CDM VVS (version 05.0)^{/1/}. Further assessment is provided in Table 4-5 below.
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Addressing the calibration delay of monitoring equipment and accounting the error in conservative manner is assessed in the below table.

Table 2-5: Delayed calibrations

Parameter	Parameter Description	Measured value	Maximum permissible error	Error identified during delayed calibration	Comment
Q_{y, ww}	Volume of wastewater treated in the year y	<u>2011:</u> 846,845 m ³ <u>2012:</u> 1,138,373 m ³ <u>2013:</u> 586,738 m ³	$\pm 0.5\%$ ^{/19/}	0.08% ^{/20/}	Since the error identified during the calibration is lower than the maximum permissible error, 0.5% was applied for all the daily measured values during the delayed calibration on 2011-09-21. As the parameter was used for calculation of both baseline emissions and project emissions, 0.5% was deducted from the measured value for baseline emissions and 0.5% was added for project emissions. It was transparently presented in separate columns in the ER sheet ^{/5/}. The total measured value of the parameter for the year 2011 was 846,845 m³, whereas the value considered for baseline emissions is 846,824 m³ and the value for project emissions is 846,866 m³.
COD_{y, inflow, j}	The COD (chemical oxygen demand) of wastewater entering the project	<u>2011 (Avg.):</u> 14,360 mg/l <u>2012 (Avg.):</u> 14,206 mg/l	$\pm 0.24\%$ ^{/19/}	5.1% ^{/21/}	The verification team reviewed the calibration report and observed that the measuring equipment was tested at different wave lengths. The identified error was varying from 0.3% to 5.1%. Therefore, PP applied 5.1% to the measured values during the delayed period from 2011-01-01 to 2011-05-30 (both the days included) in

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Parameter	Parameter Description	Measured value	Maximum permissible error	Error identified during delayed calibration	Comment
	system j	<u>2013 (Avg.):</u> 14,260 mg/l			order to be conservative. Since the parameter COD_{y, inflow, j} was used for calculation of both baseline emissions and project emissions, 5.1% was deducted from the measured value for baseline emissions and 5.1% was added for project emissions. It was transparently presented in separate columns in the ER sheet ^{/5/}. The average measured value of the parameter for the year 2011 was 14,360 mg/l, whereas the value considered for baseline emissions is 14,069 mg/l and the value for project emissions is 14,652 mg/l.
COD_{y, outflow, j}	The COD (chemical oxygen demand) of wastewater exiting the project system j	<u>2011 (Avg.):</u> 1,220 mg/l <u>2012 (Avg.):</u> 1,234 mg/l <u>2013 (Avg.):</u> 1,295 mg/l	$\pm 0.24\%$ ^{/19/}	5.1% ^{/21/}	The verification team reviewed the calibration report and observed that the measuring equipment was tested at different wave lengths. The identified error was varying from 0.3% to 5.1%. Therefore, PP applied 5.1% to the measured values during the delayed period from 2011-01-01 to 2011-05-30 (both the days included) in order to be conservative. Since the parameter COD_{y, outflow, j} was used for calculation of both baseline emissions and project emissions, 5.1% was added from the measured value for baseline emissions and 5.1% was deducted for project emissions. It was transparently presented in separate columns in the ER sheet ^{/5/}. The average measured value of the parameter for the year 2011 was 1,220 mg/l, whereas the value considered for baseline emissions is 1,244 mg/l and the value for project emissions is 1,195 mg/l.
%CH₄	Methane content in biogas	<u>2011 (Avg.):</u> 59.66% <u>2012 (Avg.):</u>	$\pm 3.00\%$ ^{/19/}	1.83% ^{/25/}	Since the maximum permissible error is higher than the error identified during the calibration, maximum permissible error of 3% was applied for all the daily measured values during the delayed calibration period from 2011-01-01 to 2011-06-14 and

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Parameter	Parameter Description	Measured value	Maximum permissible error	Error identified during delayed calibration	Comment
		60.21% <u>2013 (Avg.):</u> 60.45%			from 2012-06-15 to 2012-08-29 (both the days included). As the parameter was used for calculation of both baseline emissions and project emissions, 3% was deducted from the measured value for baseline emissions and 3% was added for project emissions. It was transparently presented in separate columns in the ER sheet ^{/5/}. For example, the average measured value of the parameter for the year 2011 was 59.66%, whereas the value considered for baseline emissions is 58.88% and the value for project emissions is 60.44%. Similarly, for 2012, the value considered for baseline emissions is 59.84% and the value for project emissions is 60.22%.
Q _{biogas, total, y}	Amount of biogas that is generated using the project activity in year y	<u>2011:</u> 4,655,353 Nm ³ <u>2012:</u> 6,618,247 Nm ³ <u>2013:</u> 3,584,618 Nm ³	± 1.00% ^{/19/}	0.38% ^{/22/}	Since the maximum permissible error is higher than the errors identified during the calibration, maximum permissible error of 1% was applied for all the daily measured values during the delayed calibration period from 2011-09-21 to 2011-09-29 (both the days included). It was transparently presented in separate columns in the ER sheet ^{/5/}. However, the amount of biogas used in electricity generators (Q_{biogas, generator, y}) and the amount of biogas flared (Q_{biogas, flare, y}) was used in the emission reduction calculation and not the total amount of biogas generated. The calculation approach is more appropriate and is in accordance with the applied methodology and the PDD. Therefore, delay in calibration of the monitoring equipment for this parameter does not have any impact on the emission reduction.
Q _{biogas, flare, y}	Amount of biogas that is flared	<u>2011:</u> 0 Nm ³ <u>2012:</u>	± 1.00% ^{/19/}	0.84% ^{/24/}	The identified error during the calibration on 2011-09-30 was lower than the maximum permissible error. Nevertheless, the delay in calibration from 2011-09-21 to 2011-09-29 does not have any impact on emission reduction since no biogas was

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Parameter	Parameter Description	Measured value	Maximum permissible error	Error identified during delayed calibration	Comment
		660,620 Nm ³ <u>2013:</u> 0 Nm ³			flared out during 2011 and 2013.
Q_{biogas, generator, y}	Amount of biogas that is used in electricity generators	<u>2011:</u> 4,513,441 Nm ³ <u>2012:</u> 5,900,350 Nm ³ <u>2013:</u> 3,466,368 Nm ³	$\pm 1.00\%$ ^{/19/}	0.51% ^{/23/}	Since the maximum permissible error is higher than the error identified during the calibration, maximum permissible error of 1% was applied for all the daily measured values during the delayed calibration period from 2011-09-21 to 2011-09-29 (both the days included). As the parameter was used for calculation of baseline emissions, 1% was deducted from the measured values. It is transparently presented in separate columns in the ER sheet ^{/5/}. The total measured value of the parameter for the year 2011 is 4,513,441 Nm³, whereas the value considered for baseline emission calculation is 4,511,260 Nm³.
EC_y	Electricity consumed by waste water treatment facility over the year	<u>2011:</u> 241,800 kWh <u>2012:</u> 142,260 kWh <u>2013:</u> 81,600 kWh	$\pm 0.5\%$ ^{/19/}	0.7768% ^{/27/} 0.0555% ^{/29/}	The error identified during the calibration on 2011-06-27 was ~0.78% which is higher than the maximum permissible error of 0.5%. Therefore, an error of 0.78% was applied for the delayed period from 2011-01-01 to 2011-06-26. Nevertheless, since the parameter was recorded and reported monthly, the error was applied for the monthly recorded values from January to June 2011. Similarly the error identified during the calibration on 2013-06-21 was ~0.05% which is lower than the maximum permissible error of 0.5%. Therefore, the error of 0.5% was applied for the measured values from November 2012 to June 2013 (delayed calibration period is from 2012-11-02 to 2013-06-20). As the parameter is used for calculation of project emissions, the error was added to the measured quantity. It is transparently

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Parameter	Parameter Description	Measured value	Maximum permissible error	Error identified during delayed calibration	Comment
					presented in separate columns in the ER sheet ^{/5/} . The parameter considered in the emission reduction calculation was 242,883 kWh, 142,361 kWh and 82,008 kWh respectively for 2011, 2012 and 2013.
EG _y	Electricity exported to the grid during year y by power generation facility	<u>2011:</u> 6,502,260 kWh <u>2012:</u> 9,064,620 kWh <u>2013:</u> 5,623,800 kWh	$\pm 0.5\%$ ^{/19/}	0.3569% ^{/26/} 0.2151% ^{/26/}	The error identified during the calibration on 2011-06-27 was ~0.36% which is lower than the maximum permissible error of 0.5%. Similarly the error identified during the calibration on 2013-06-21 was ~0.21% which is also lower than the maximum permissible error of 0.5%. Therefore, an error of 0.5% was applied for the delayed period. Nevertheless, since the parameter was recorded and reported monthly, the error was applied for the monthly recorded values from January to June 2011 (delayed calibration period is from 2011-01-01 to 2011-06-26). Similarly, the error of 0.5% was applied to the measured values for June 2013 (delayed calibration period is from 2013-06-05 to 2013-06-20). As the parameter is used for calculation of baseline emissions, 0.5% was deducted from the measured quantity. It is transparently presented in separate columns in the ER sheet ^{/5/}. The parameter considered in the emission reduction calculation for 2011 and 2013 was 6,491,376 kWh and 5,618,012 kWh respectively. The approach results in conservative estimation of emission reduction.

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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^{/4/} has been verified by crosschecking with other sources such as log books^{/35/}, calibration reports^{/20...31/}, electricity reports issued by PEA^{/32/}, COD analysis reports by external laboratory^{/33/}, equipment specifications^{/13/15//19/}, etc. Besides, monthly plant reports approved by the Plant Manager were also checked for consistency of the data^{/36/}. 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.

It is to be noted that revised Global Warming Potential (GWP) of methane has been considered for emission reduction calculation achieved from 2013-01-01 onwards. The validated ex-ante value of GWP from section B.6.2 of the PDD is 21. 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 for 2013. The revised GWP of methane that was applied for the emission reduction achieved from 2013-01-01 onwards 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 verification team observed some inconsistencies and some errors in the webhosted MR and draft ER sheet initially submitted to the verification team. Therefore, the GLC's verification team raised CARs and CLs as relevant and provided to PP for resolving. As assessed in Annex A of this report, it is confirmed that all the CARs and CLs were appropriately addressed by the PP. Therefore, the CARs and CLs were successfully closed. It is confirmed that the information reported in the final version of the MR and the corresponding ER sheet is correct.

By checking publicly available sources it was verified that the applied emission factors, IPCC default values^{/7/} and other reference values were applied correctly. It is confirmed that the fixed values reported in section B.6.2 of the PDD were correctly applied in the calculation of emission reduction. The fixed ex-ante parameters were correctly reported in section D.1 of the final MR^{/4/}. All the fixed values used in the calculation were also separately mentioned in the ER sheet document^{/5/} for the sake of transparency.

The emission reduction due to methane capturing and utilisation in onsite electricity generators was correctly calculated by measuring the required parameters using appropriate monitoring equipment. The formulae described in the applied methodologies (AMS III.H., version 09 and AMS I.D., version 13)^{/10/} and the approved revised PDD^{/2/} were correctly used to calculate the baseline and project emissions. The emission reductions were calculated as the difference of baseline emissions and project emissions as there were no leakage emissions associated with the project activity.

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

Where:

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

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

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

$$BE_y = BE_{y,el} + BE_{y,ww}$$

Where,

$BE_{y,el}$: Baseline emissions from grid's electricity displaced by the project activity during the year y in tCO₂e.

$BE_{y,ww}$: Baseline Emissions from degradable organic carbon in treated wastewater in year “y”.

$BE_{y,ww}$ was calculated by both approaches; through COD approach and through Biogas approach. PP considered the conservative value for emission reduction calculation. For this monitoring period, the $BE_{y,ww}$ calculated through COD approach is conservative. The calculation was transparently presented in the ER sheet.

$$BE_{y,el} = EG_y \times EF_y$$

Where,

EG_y : Electricity generated during year y by power generation facility (MWh)

EF_y : Emission factor of the electricity grid (0.5057 tCO₂/MWh; calculated as fixed ex-ante)

$$PE_y = PE_{y,power} + PE_{y,ww,treated} + PE_{y,s,final} + PE_{y,fugitive} + PE_{y,dissolved} + PE_{y,upgrading} + PE_{y,leakage,pipeline}$$

Where,

PE_y Project activity emissions in the year “y” (tCO₂e)

$PE_{y,power}$ Emissions from electricity or fossil fuel consumption in the year “y”

$PE_{y,ww,treated}$ Emissions from degradable organic carbon in treated wastewater in year “y”

$PE_{y,s,final}$ Emissions from anaerobic decay of the final sludge produced in the year “y”

$PE_{y,fugitive}$ Emissions from methane release in capture and utilization/combustion/flare systems in year “y”

$PE_{y,dissolved}$ Emissions from dissolved methane in treated wastewater in year “y”

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$PE_{y, \text{upgrading}}$ Emissions related to the upgrading and compression of biogas in year “y”

$PE_{y, \text{leakage, pipeline}}$ Emissions due to physical leakage from the dedicated piped network in year “y”

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

4.2 Post Registration Changes

This assessment:

- ☒ Does not include any post registration changes and therefore this section is not applicable to this project activity.
- ☐ Includes changes as part of the request for issuance. The assessment of the changes is done in a separated document.
- ☐ 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 2nd verification of the project: **“Bangna Starch Wastewater Treatment and Biogas Utilization Project”**, with regard to the relevant requirements for CDM project activity. The project reduces GHG emissions due to capturing of methane from wastewater treatment through UASB technology and utilising it as a fuel in onsite electricity generators.

This verification covers the period from 2011-01-01 to 2013-07-31 (including both days).

P & Papop Renewable Co. Ltd. is responsible for the collection of data in accordance with the approved revised monitoring plan and the reporting of GHG emissions reductions from the project.

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

GLC conducted the verification on the basis of the monitoring methodologies (AMS III.H., version 09 and AMS I.D., version 13) ^{/10/}, the approved revised PDD ^{/2/} of the project and the monitoring report dated 2013-10-24 (version 2.1). The verification included:

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

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

In GLC's opinion, the GHG emission reductions for the “Bangna Starch Wastewater Treatment and Biogas Utilization Project” project as reported in the final version of the Monitoring Report issued on 2013-10-24 are calculated in a conservative and appropriate manner.

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

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

Total emission reductions: 105,417 t CO₂e

Emission reductions from
2011-01-01 to 2012-12-31: 76,183 t CO₂e

Emission reductions from
2013-01-01 to 2013-07-31: 29,234 t CO₂e

2013-11-11

Germanischer Lloyd
Certification

Markus Weber

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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/	Revised Project Design Document of “Bangna Starch Wastewater Treatment and Biogas Utilization Project” (version 4, dated 2011-08-11) approved on 2011-09-23 GLC: Validation opinion on ‘Changes from the Project Activity and Monitoring Plan as Described in the Registered PDD’
/3/	TUV NORD CERT GmbH: Validation report of “Bangna Starch Wastewater Treatment and Biogas Utilization Project” (report no. 8000353483– 07/168), dated 2009-11-10
/4/	Draft Monitoring Report (webhosted) of “Bangna Starch Wastewater Treatment and Biogas Utilization Project”, Version 1 dated 2013-08-26 Final MR of “Bangna Starch Wastewater Treatment and Biogas Utilization Project”, Version 2.1 dated 2013-10-24
/5/	Draft Emission reduction calculation spreadsheet, version 1, dated 2013-08-26 Final Emission reduction calculation spreadsheet, version 2, dated 2013-10-08
/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)
/9/	UNFCCC: Decision 3/CMP. 1 (Marrakesh – Accords)

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/10/	CDM-EB: Approved CDM small-scale baseline and monitoring methodology AMS III.H, Version 09: "Methane Recovery in Wastewater Treatment" CDM-EB: Approved CDM small-scale baseline and monitoring methodology AMS I.D, Version 13: "Grid connected renewable electricity generation"
/11/	CDM-EB: Methodological "Tool to determine project emissions from flaring gases containing methane" (Version 1) - EB 28, Annex 13 CDM-EB: Methodological tool "Project emissions from flaring" (Version 02.0.0) – EB 68, Annex 15
/12/	CDM-EB: General Guidelines for SSC CDM methodologies (Version 20.0) EB 76, Annex 11
/13/	<u>Technical specifications of UASB and Gas engines</u> GUASCOR S.A.: Engine and Alternator characteristics, February 2006 P & Papop Renewable Co., Ltd. (PAPOP): Portfolio of CDM project
/14/	PAPOP: Commissioning Certificate of UASB, October 2007
/15/	GUASCOR S.A.: Commissioning Test Report of Gas engine, dated 2007-12-21
/16/	BKE: Specifications of Biogas flaring system, dated 2007-10-09 BKE: Operation & Maintenance manual for biogas flare
/17/	GLC: Verification and Certification Report of "Bangna Starch Wastewater Treatment and Biogas Utilization Project" of the 1 st verification (Report no. 127; Rev. 07) dated 2012-02-14
/18/	Geotechnical Instruments: Biogas Operating Manual
/19/	<u>Specifications of monitoring equipment</u> Endress+Hauser Ltd: Technical Information of Electromagnetic Flow Measuring System – Flow measurement of liquids in wastewater applications HACH: Key Specifications of Spectrometers and Colorimeters Endress+Hauser Ltd: Technical Information of "Proline t-mass 65F, 65I" – Mass flow

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	measurement of Gases Geotech: Product Specifications of Portable Gas Analyser Tyco Electronics: Integra 1630 – Installation guide and Specifications (Power meter) Cardinal Scale manufacturing Co. (Cardinal): Specifications of 200 Series Digital Weight Indicators
/20/	<u>Calibration reports of Wastewater flow meter (FM1) – Serial No. 93120819000</u> Endress & Hauser (Thailand) Ltd: Flowmeter Verification Certificate with certificate no. EH10/204-1/7, dated 2010-09-23 (Verification date: 2010-09-21) Endress & Hauser (Thailand) Ltd: Flowmeter Verification Certificate with certificate no. 459019258-4/8, dated 2011-09-30 (Verification date: 2011-09-22) Endress & Hauser (Thailand) Ltd: Flowmeter Verification Certificate with certificate no. 4409088014-4/9, dated 2012-09-28 (Verification date: 2012-09-11) Endress & Hauser (Thailand) Ltd: Flowmeter Verification Certificate with certificate no. 4409088664-5/11, dated 2013-07-29 (Verification date: 2013-06-19)
/21/	<u>Calibration reports of Portable Colorimeter – Serial No. 070290C62433</u> EnviScience Company Limited: Test Report of Preventive Maintenance (Report No. LEVS1101877), Date of test: 2011-05-31 EnviScience Company Limited: Test Report (Report No. LEVS 1202080), Date of test: 2012-05-29 EnviScience Company Limited: Test Report (Report No. LEVS 1301811), Date of test: 2013-05-08
/22/	<u>Calibration reports of Gas flow meter – Biogas generation (GM1), Serial No. 9502C002000</u> Endress & Hauser (Thailand) Ltd: Certificate of Calibration with certificate no. EH10/204-4/7, date of calibration: 2010-09-21 Endress & Hauser (Thailand) Ltd: Certificate of Calibration with certificate no. 459019258-1/8, date of calibration: 2011-09-30 Endress & Hauser (Thailand) Ltd: Certificate of Calibration with certificate no. 4409088014-1/9, date of calibration: 2012-09-10 Endress & Hauser (Thailand) Ltd: Certificate of Calibration with certificate no. 4409088664-7/11, date of calibration: 2013-06-19

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/23/	<u>Calibration reports of Gas flow meter – Biogas sent for Electricity generators (GM2), Serial No. 9502C102000</u> Endress & Hauser (Thailand) Ltd: Certificate of Calibration with certificate no. EH10/204-4/7, date of calibration: 2010-09-21 Endress & Hauser (Thailand) Ltd: Certificate of Calibration with certificate no. 459019258-2/8, date of calibration: 2011-09-30 Endress & Hauser (Thailand) Ltd: Certificate of Calibration with certificate no. 4409088014-2/9, date of calibration: 2012-09-10 Endress & Hauser (Thailand) Ltd: Certificate of Calibration with certificate no. 4409088664-8/11, date of calibration: 2013-06-19
/24/	<u>Calibration reports of Gas flow meter – Biogas to flare (GM3), Serial No. 9A070502000</u> Endress & Hauser (Thailand) Ltd: Certificate of Calibration with certificate no. EH10/204-5/7, date of calibration: 2010-09-21 Endress & Hauser (Thailand) Ltd: Certificate of Calibration with certificate no. 459019258-3/8, date of calibration: 2011-09-30 Endress & Hauser (Thailand) Ltd: Certificate of Calibration with certificate no. 4409088014-3/9, date of calibration: 2012-09-10 Endress & Hauser (Thailand) Ltd: Certificate of Calibration with certificate no. 4409088664-9/11, date of calibration: 2013-06-20
/25/	<u>Calibration reports of Portable gas analyser, Serial No. BM 11452</u> Entech Associate Co., Ltd.: Calibration Certificate with Certificate No. G/O 540225, dated 2011-06-27; date of calibration: 2011-06-15 Entech Associate Co., Ltd.: Calibration Certificate with Certificate No. G/O 550618, dated 2012-09-04; date of calibration: 2012-08-30
/26/	<u>Calibration reports of Export power meter to monitor EG_y with Serial No. 205055798 and PEA No. 20963040</u> PEA: Test report , Calibration date: 2009-02-27 PEA: Tested Report Energy Meter, Calibrated date: 2011-06-27 PEA: Tested Report Energy Meter, Calibrated date: 2012-06-05 PEA: Tested Report Energy Meter, Calibrated date: 2013-06-21

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/27/	<u>Calibration reports of Import power meter to monitor EC_y with Serial No. 205055772 and PEA No. 20963014</u> PEA: Test report , Calibration date: 2009-02-27 PEA: Tested Report Energy Meter, Calibrated date: 2011-06-27
/28/	<u>Calibration reports of Import power meter to monitor EC_y with Serial No. 203327329 and PEA No. 18323271</u> PEA: Tested Report Energy Meter, Calibrated date: 2011-06-27 PEA: Tested Report Energy Meter, Calibrated date: 2012-06-05
/29/	<u>Calibration reports of Import power meter to monitor EC_y with Serial No. 212054801 and PEA No. 27664781</u> PEA: Tested Report Energy Meter, Calibrated date: 2013-06-21
/30/	<u>Calibration report of Thermocouple with Serial No. SP08071880025 to monitor flare temperature</u> WR&W Calibration Laboratory Co., Ltd.: Certificate of Calibration (Certificate No. CT11 – TM – 0066); Date of calibration: 2011-09-30 SCM Calibration Laboratory: Certificate of Calibration (Certificate No. SCM03846-13) dated 2013-09-04; Date of calibration: 2013-08-26
/31/	<u>Calibration report of Digital Weighing machine with Serial No. E07512-0201</u> Cardinal Scale Manufacturing Co.: Verification report of Cardinal weigh scale (model: 205), Verification date: 2012-06-12 (Valid until: 2014-06-11)
/32/	PEA: Monthly energy reports of export and import from January 2011 to July 2013
/33/	COD Analysis Reports of wastewater from last lagoon (i.e. at the discharge) by Environmental Engineering Laboratory Faculty of Engineering, KKU for the months January 2011, February 2011, April 2011 and from June 2011 to July 2013
/34/	Report from PEA on replacement of old meter (PEA No. 1832327) with new meter (PEA No. 27664781) on 2012-11-02

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/35/	PAPOP: Daily log sheet records of the following parameters from 2011-01-01 to 2013-07-31 • COD analysis of wastewater at inlet and outlet of UASB • Wastewater flow • Biogas generation • Biogas consumption in electricity generators • Biogas consumption for flare • Methane concentration in biogas
/36/	PAPOP: Monthly reports of monitored parameters approved by the Plant Manager from January 2011 to July 2013
/37/	PAPOP: Training records on operation, maintenance and safety
/38/	PAPOP: Procedure document for COD analysis at on-site laboratory
/39/	Other documents verified during site visit • List of employees • Monitoring procedure
/40/	PAPOP: Final open lagoon Lab data from January 2011 to July 2013

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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 (2013-09-20) The Emission reduction calculation spreadsheet (ER sheet) indicates that the monitoring parameters were recorded as zero for few days. However, the MR does not contain any information or the reason for that.	2013-09-27 (1 st round): The dates where the value is shown as zero are the days when the starch plant/project activity was not operating. The same reason is also provided in section B.1 in the MR and the ER sheet.	2013-10-04 (1 st round): OK. It is understood that the biogas plant (the project activity plant) was not operated during the new year holidays and when the starch factory was stopped. GLC considers this as usual scenario and recording of zero for such days is appropriate. The information has been provided in section B.1 of the revised MR and the ER sheet for the sake of transparency. Therefore, the CAR is closed.	OK
CAR 2 (2013-09-20) Serial numbers of weighbridge and thermocouple have not been provided in the monitoring equipment table in section C of the MR.	2013-09-27 (1 st round): The serial numbers of weighbridge and thermocouple are provided in the monitoring equipment table in section C and D.2 of the MR.	2013-10-04 (1 st round): OK. The serial numbers of weighbridge (E07512-0201) and thermocouple (SP08071880025) have been provided in section C and D.2 of the MR consistently. The serial numbers of the monitoring equipment confirmed to be	OK

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		correct from the provided evidence documents. Therefore, the CAR is closed.	
CAR 3 (2013-09-20) Details of monitoring equipment available to measure the amount of sludge generated were not provided in the MR.	2013-09-27 (1 st round): The detail of weighbridge is provided in the monitoring equipment table in section C and D.2 of the MR.	2013-10-04 (1 st round): OK. Details of the weighbridge available to measure the amount of sludge generated are provided in section D.2 of the revised MR. Nevertheless, it is confirmed from the document review and onsite interviews that sludge was never removed from the UASB during the monitoring period. Therefore, the CAR is closed.	OK
CAR 4 (2013-09-20) It was understood from the onsite interviews that portable gas analyser was used for monitoring of methane content during the monitoring period instead of online gas analyser due to its malfunctioning. However, the MR has inconsistent statements with reference to number of times the gas is sampled and analysed in a day.	2013-09-27 (1 st round): The methane content is measured by portable gas analyzer at least twice a day and the monitored data is manually recorded onto log sheets. The MR in section D.2 has been revised to reflect this.	2013-10-04 (1 st round): OK. The inconsistent statements in the MR have been corrected. From the onsite interviews and verification of the log sheets, it can be confirmed that the methane content of the biogas (%CH ₄) was measured at least twice (in general 2 to 6 times depending on the availability of operator) a day. The monitoring practice is in accordance with the monitoring plan of the approved revised PDD.	OK

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		Therefore, the CAR is closed.	
CAR 5 (2013-09-20) The accuracy of electricity meters is mentioned as $\pm 0.2\%$. However, from the calibration reports and physical inspection of the meters during the site visit it was found that the accuracy of the meters is $\pm 0.5\%$. Besides, the electricity meter used to monitor the electricity consumption (EC_y) available at site is different from the one mentioned in the MR.	2013-09-27 (1st round): The accuracy of electricity meters is revised to $\pm 0.5\%$ as per the calibration certificates of the meters in the monitoring equipment table in section D.2 of the MR. As per the actual situation, the electricity meter used for monitoring electricity consumption has been changed twice. In the MR version 1, the details of the first two electricity meters were provided. The meter currently at the project site is the 3rd meter whose details are now included in section C and D.2 of the MR version 2 including revision of the period of use of the meters used during the monitoring period in line with the actual situation.	2013-10-04 (1st round): OK. The accuracy of electricity meters used to monitor EC_y and EG_y has been corrected to $\pm 0.5\%$ in the revised MR. It was understood that the meters are not under the purview of PP; they are owned and controlled by PEA (Provincial Electricity Authority). OK. It is understood that the electricity meter used to monitor EC_y was changed twice during the monitoring period. Details of all the 3 meters and the period of use have been transparently mentioned in the revised MR. From the provided evidence documents, it can be confirmed that the meter with serial number with serial number 205055772 was is use from the beginning of the monitoring period till 2011-06-27. The meter with serial number 203327329 was in use from 2011-06-27 till 2012-11-02 and the meter with serial number 212054801 was in use from 2012-11-02 till date. The serial numbers and the date of	OK

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		replacement can be confirmed to be correct based on the monthly electricity bills issued by PEA. Therefore, the CAR is closed.	
CAR 6 (2013-09-20) For the electricity meter used to measure the exported electricity (EG_y), the latest calibration date and the validity date are respectively mentioned as 2012-06-05 and 2013-06-04. Nevertheless, a calibration report was already provided to the verification team which indicates a calibration date of 2013-06-21. This shows a calibration delay by few days, however, it was not addressed by the PP.	2013-09-27 (1st round): The calibration delay for the measured values is applied and addressed in the ER sheet and section D.2 of the MR. The measured values of the amount of electricity consumed for the period from 01/01/2011 – 30/06/2011 and 01/06/2013 – 30/06/2013 has been adjusted by applying the maximum permissible error ($\pm 0.5\%$) in a conservative manner. More details can be found in the calculation sheet. It is noted that the actual period for applying the error is 01/01/2011 – 26/06/2011 and 06/06/2013 – 20/06/2013, however, since the parameter is recorded on a monthly basis by PEA, the error is applied for the full month of June 2011 and June 2013.	2013-10-04 (1st round): OK. The calibration of the electricity meter used to monitor Electricity exported to the grid (EG_y) was conducted on 2009-02-27, 2011-06-27, 2012-06-05 and 2013-06-21. From the revised ER sheet, it can be confirmed that PP has applied the maximum permissible error ($\pm 0.5\%$) conservatively to the measured electricity for the months from January 2011 to June 2011 and for June 2013 for which calibration was delayed. From the calibration reports it can be confirmed that the error identified during the calibration on 2011-06-27 was 0.35% and similarly it was 0.21% during the calibration test on 2013-06-21. Therefore, the approach followed by PP is in accordance with the guidance in the CDM VVS. The approach results in conservative estimation of emission	OK

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		reduction. Therefore, the CAR is closed.	
CAR 7 (2013-09-20) Section D.2 of the MR has several editorial mistakes in monitoring description and calibration dates. PP shall correct all the editorials in the MR.	2013-09-27 (1 st round): All the editorials of the monitoring description and calibration dates are corrected in section D.2 of the MR.	2013-10-04 (1 st round): OK. It is observed that the editorial mistakes have been corrected in section D.2 of the MR. Therefore, the CAR is closed.	OK
CAR 8 (2013-09-20) During the onsite verification, all the monitored parameters were verified with the pant records and crosschecked with the operator log sheets. It was observed that for all the flow related parameters (wastewater flow and biogas flow), the operators have recorded the totaliser value from the meters every day into log sheets and the daily value is calculated as the difference of the two consecutive readings. It was learnt that on 2013-01-01, the wastewater and biogas flow meters were reset to zero. However, the totaliser value before resetting could not be	2013-09-27 (1 st round): The operator by mistake forgot to note down the totaliser value before resetting the meter therefore, the daily value on 2012-12-31 is revised to be zero in the ER sheet for the amount of wastewater treated ($Q_{y,ww}$), biogas generated by the UASB system ($Q_{biogas, total, y}$) and biogas sent to electricity generator system ($Q_{biogas, generator, y}$).	2013-10-04 (1 st round): OK. From the revised ER sheet, it is observed that the parameters – amount of wastewater treated ($Q_{y,ww}$), biogas generated by the UASB system ($Q_{biogas, total, y}$) and biogas sent to electricity generators ($Q_{biogas, generator, y}$) – are considered as zero for 2012-12-31 since they were not recorded before resetting on 2013-01-01. The approach is considered appropriate as it results in conservative estimation of emission reduction. Therefore, the CAR is closed.	OK

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found in the log sheets. Therefore, it is not clear how the parameter values presented in the ER sheet for 2012-12-31 were determined.			
CAR 9 (2013-09-20) The COD data presented in the ER sheet was verified with the log sheets during the onsite verification. The data provided in the ER sheet for few days (2012-05-05, 2012-06-27, 2012-07-10 and from 2012-10-07 to 2012-10-11) was found to be not inline with the log sheet values. The inconsistency in the data shall be corrected by the PP. Besides, the exported electricity for Jan 2011 is not inline with the	2013-09-27 (1st round): The following COD data is corrected in line with the log sheets. COD_{y,ww,out} is corrected from 1,189 mg/l to 1,639 mg/l on 2012-05-05. COD_{y,ww,in} is corrected on the following dates. - 2012-06-27 from 13,819 to 13,788 mg/l - 2012-07-10 from 13,829 to 13,739 mg/l - 2012-10-07 from 13,853 to 13,763 mg/l - 2012-10-08 from 15,018 to 13,455 mg/l - 2012-10-09 from 13,455 to 14,314 mg/l - 2012-10-10 from 14,314 to 13,309 mg/l - 2012-10-11 from 13,309 to 14,071 mg/l The exported electricity for Jan 2011 is revised in line with the PEA monthly report.	2013-10-04 (1st round): OK. It is confirmed that the mentioned corrections have been made in the revised ER sheet. The revised values are consistent with the log sheet values. OK. The exported electricity for Jan 2011 has been corrected from 308,106	OK

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PEA monthly report for Jan 2011.		kWh to 308,160 kWh. The revised value is in line with the PEA report. Therefore, the CAR is closed.	
CAR 10 (2013-09-20) As per Para 66 of the CDM EB 69 th meeting report of and Annex 3 of EB 69, all emission reductions and removals 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.	2013-09-27 (1 st round): The global warming potentials (GWPs) value for methane is corrected from 21 to 25 in all emission reductions of the project activity from 01/01/2013 onwards. In reference to Requirements Para 2 and 3 of Annex 3 version 01.0 of EB 69 report, 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 – 31/07/2013 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.	2013-10-04 (1 st round): OK. It is observed that in the revised ER sheet, the PP has taken GWP of 25 for methane (CH ₄) for calculating the emission reduction achieved only from 2013-01-01 to 2013-07-31 in the monitoring period. 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 4 th Assessment Report to which the Decision 4 of CMP.7 refers to. The revised value of GWP is also mentioned in section D.1 of the revised	OK

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		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. It is to be noted that the revision in GWP value has caused an increase in baseline emissions by 5,102 tCO₂e. The revised calculation in the ER sheet is confirmed to be correct. The CAR is deemed sufficiently addressed and therefore closed.	
CAR 11 (2013-09-20) <u>FAR 1 from the 1st verification</u> <i>It was observed during the site visit that labelling was wrongly mentioned on wastewater and gas pipelines. For example, 'recycled water' was mentioned on wastewater inlet pipe and 'wastewater' was mentioned on a gas pipeline.</i> <i>It was also observed that the identification tags were not provided at some of the meters.</i>	2013-09-27 (1st round): For this monitoring period, the labelling mentioned on wastewater and gas pipelines has been corrected properly and all the meters identification tags have been provided.	2013-10-04 (1st round): OK. Based on onsite observations, the verification team can confirm that labelling on wastewater and gas pipelines has been corrected. The identification tags have also been provided to all the monitoring equipment. It is confirmed that the FAR raised during the 1st verification was sufficiently addressed and therefore it is closed.	OK

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<i>In order to enhance the transparency and to avoid any misunderstandings during upcoming verifications the labelling shall be corrected and for all meters identification tags shall be provided.</i>			
CAR 12 (2013-09-20) <u>FAR 2 from the 1st verification</u> <i>Based on verbal information the BOT (Built Operate and Transfer) contract between Papop and Bangna is currently under revision. In case a new contract will be established at the time of the next verification, the DOE shall review if the revised modalities affect the additionality.</i>	2013-09-27 (1 st round): The BOT contract between P & Papop Renewable and Bangna Starch has not been revised since the initial signing.	2013-10-04 (1 st round): OK. From the onsite interviews with the representatives of P & Papop Co., Ltd. it was learnt that the BOT contract was not revised. The initial contract will continue till the end of the crediting period. Therefore, the FAR from the 1 st verification can be closed.	OK
CL 1 (2013-09-20) <i>Section C of the MR states, "The plant manager checks the data on regular basis, recording the readings on log sheets." However, from the onsite interviews it is understood that the operator records the data into log sheets</i>	2013-09-27 (1 st round): The statement in regard to the monitoring management is clarified correctly in section C of the MR as per the actual procedure.	2013-10-04 (1 st round): OK. The statement in the MR has been revised. It can be confirmed that the operator records the parameters daily into log sheets and reports to the Biogas and Power Department Supervisor. The data is further reported to the Plant Manager during the morning meeting	OK

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and reports to the supervisor and further to the plant manager on a daily basis. PP shall clarify the statement in the MR.		daily. The revised information in the MR is inline with the onsite monitoring procedures. Therefore, the CL is closed.	
CL 2 (2013-09-20) The calibration tags at the monitoring equipments (wastewater and gas flow meters) indicate a calibration date in June 2013. However, the MR indicates a different date for latest calibration. PP to clarify this. If there was a latest calibration conducted as indicated on the tag, the calibration reports are to be submitted. The calibration tag at the wastewater flow meter and gas flow meters indicates the validity period for 1 year. However, validity of calibration is mentioned for 3 years in section D.2 of the MR which is not clear.	2013-09-27 (1st round): The correct dates for the latest calibration have been updated in the monitoring equipment table in section D.2 of the MR. The calibration reports are submitted to the verification team. The validity period for 1 year as mentioned on the tags is in line with the internal procedure or calibration plan of the project. However, 3-year period as mentioned in section D.2 of the MR version 1 was referred from manufacturers' recommendations. For the sake of clarity, the validity period of calibration of wastewater and gas flow meters is revised to 1 year in monitoring equipment tables in section D.2 of the MR.	2013-10-04 (1st round): OK. The latest calibration dates have been provided in section D.2 of the revised MR. It can be confirmed that the calibration dates are inline with the dates on calibration tags observed during the site visit. Besides, the calibration reports have also been provided to the verification team. OK. It is understood that the calibration validity date was mentioned in the published MR (version 1) based on the calibration frequency of 3 years mentioned in the monitoring plan and the manufacturer recommendations. Nevertheless, the PP decided to follow a better calibration frequency of 1 year and therefore the validity date on	OK

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	This is a better practice than conducting calibration every three years as per the registered PDD	calibration tags was mentioned for 1 year. The calibration validity date has been revised in the MR (version 2) inline with the calibration tags for the sake of clarity. Therefore, the CL is closed.	
CL 3 (2013-09-20) COD of treated wastewater before discharge is to be determined once in a month as per the monitoring plan by external laboratory. However, the COD was not analysed in March 2011 and May 2011. Though the value was considered conservatively for emission reduction calculation, the reason for not conducting during the two months was not provided in the MR.	2013-09-27 (1 st round): There were no test reports for two months in 2011 as the plant's operator misunderstood that the samples were already sent to the external laboratory by the operator of the starch factory. The above reason is provided in monitored parameter table in section D.2 of the MR. It is to be noted that this miscommunication never happened after May 2011.	2013-10-04 (1 st round): OK. It is understood that due to miscommunication between biogas plant operator and starch factory, the wastewater samples were not sent to the laboratory for COD analysis. It is also observed that PP ensured regular analysis on monthly basis from June 2011. It is worth to mention that the missing information for the two months does not have any negative impact on the emission reduction since the PP took the highest value recorded during the year instead of average value. This would result in higher project emission and lower emission reduction. Therefore, the CL is closed.	OK
CL 4 (2013-09-20) The flare efficiency has been considered as zero in the	2013-09-27 (1 st round): As the statement <i>'During the monitoring period, this parameter was captured by</i>	2013-10-04 (1 st round): OK. The project activity has an automated enclosed flare to flare out	OK

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emission reduction calculation which is conservative. However, the reason for taking zero has not been transparently provided in the MR.	<i>SCADA system; however, the temperature in the exhaust gas of the flare was lower than 500C'</i> was wrongly mentioned in the monitoring parameter table in section D.2 of the MR, it is removed from the monitored parameter table and the actual reason below is provided instead. As per the monitored data during the monitoring period, there was no biogas flared in 2011 and 2013. For 2012, the parameters, which are the temperature of the exhaust gases of the flare and the time of biogas sent to flare, used for estimation the flare efficiency are not recorded completely for the entire period, thereby resulting the efficiency is zero.	any excess biogas which usually happens when the gas engines were stopped. Therefore, the flare is rarely operated. From the ER sheet and onsite verification it is understood that the flare was not operated at all in 2011 and 2013. However, in 2012 when the flare was operated on some occasions the required monitoring parameters (temperature of the exhaust gases of the flare and the time of biogas sent to flare) were not recorded properly. Therefore, flare efficiency was assumed as zero. This is the most conservative approach. The information is transparently provided in the revised MR and the calculation is correctly made in the ER sheet. Therefore, the CL is closed.	
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