Verification and certification report form for CDM project activities (Version 02.1)

Complete this form in accordance with the instructions attached at the end of this form.

BASIC INFORMATION	
Title and UNFCCC reference number of the project activity	Bangna Starch Wastewater Treatment and Biogas Utilization Project. Ref No: 2556
Version number of the verification and certification report	1.2Aa
Completion date of the verification and certification report	05/03/2018
Monitoring period number and duration of this monitoring period	Monitoring period number-03, 01/08/2013 to 09/11/2016 (Both days are included)
Version number of the monitoring report to which this report applies	2.0
Crediting period of the project activity corresponding to this monitoring period	10/11/2009 to 09/11/2016
Project participants	P & Papop Renewable Co., Ltd. (Thailand) South Pole Carbon Asset Management Ltd. (Switzerland)
Host Party	Thailand
Applied methodologies and standardized baselines	Methodology: AMS-III.H: Methane recovery in wastewater treatment, version 09 of 14/03/2008 Methodology: AMS-I.D – Grid connected renewable electricity generation, version 13 of 14/12/2007
Mandatory sectoral scopes linked to the applied methodologies	Sectoral scope 13: Waste handling and disposal.
Conditional sectoral scope(s) linked to the applied methodologies	Sectoral scope 01: Energy industries (renewable-/non-renewable sources).
Estimated amount of GHG emission reductions or GHG removals for this monitoring duration in the registered PDD	136,871 tCO_2e
Certified amount of GHG emission reductions or GHG removals for this monitoring period	162,964 tCO_2e
Name and UNFCCC reference number of the DOE	RINA Services SpA(RINA – 0037)
Name, position and signature of the approver of the verification and certification report	Laura SEVERINO – Sustainability & Food Certification Compliance Head 

SECTION A. Executive summary

>> **Purpose and general description:**

As detailed in the registered PDD /01/ and as verified during the onsite visit, the project activity consists of the installation of an Upflow Anaerobic Sludge Blanket technology (UASB) biogas reactor and power generation (2.85 MW_{el} gas engine (3 x 0.95 MW) at an existing starch manufacturing plant for:

a) extraction of methane (biogas) from the wastewater stream through the biogas reactor, and
b) reuse of biogas as fuel for power generation (installed capacity of 2.85 MW_{el} gas engines).

The project activity replaces the existing wastewater treatment practice (open lagoon system) and thus avoids the release of methane into the atmosphere that results from the anaerobic digestion of the organic content in the wastewater treated in the lagoon system (anaerobic conditions, leading to methane generation). The biogas reactor system is expected to handle a wastewater flow rate of 3,750 m^3/day and an expected average COD concentration of 18,000 mg/l. The biogas reactor produces sufficient quantities of biogas to fuel a number of gas engines for the production and sale to the electricity grid, thus displacing the production of power from fossil sources in the national grid. Therefore, the project activity will reduce greenhouse gases due to avoidance of methane emissions from the existing lagoon system and displacement of fossil fuel based electricity from the grid.

Verification Scope:

This report summarizes the findings of the verification of the project, performed on the basis of UNFCCC criteria for CDM, as well as criteria given to provide for consistent project operations, monitoring and reporting.

The objective of the verification is to have an independent review ex post determination by a Designated Operational Entity (DOE) of the monitored reductions in GHG emissions that have occurred as a result of the registered CDM project activity during a defined monitoring period. Certification is the written assurance by the DOE that, during a specific time period, a proposed CDM project activity achieved the reductions in anthropogenic emissions by sources of GHGs as verified.

The scope of the verification is to verify that:

- the actual monitoring systems and procedures are in compliance with the monitoring systems and procedures described in the monitoring plan;
- the GHG emission reduction data and express a conclusion with a reasonable level of assurance about whether the reported GHG emission reduction data is free from material misstatement;
- the reported GHG emission data is sufficiently supported by evidence.

Verification shall ensure that reported emission reductions are complete and accurate in accordance with applicable UNFCCC criteria for CDM in order to be certified.

UNFCCC criteria for CDM refer to Article 12 of the Kyoto Protocol, the CDM modalities and procedures, for SSC project add the simplified modalities and procedures for small-scale CDM project activities and the subsequent decisions by the CDM Executive Board.

Verification process:

Verification is conducted using RINA procedures in line with the requirements specified in the latest version of the CDM Validation and Verification Standard, relevant decisions of the CDM EB and applying standard auditing techniques. RINA assesses and determines that the implementation and operation of the project activity, and steps taken to report emission reductions comply with the CDM criteria and relevant guidance provided by the Board. The verification assessment involved a document review of relevant documentation and the on-site visit. Verification is not meant to provide any consultancy towards the project participants. However, stated requests for clarifications and/or corrective actions may have provided input for improvement of the monitoring.

Conclusion:

In conclusion, it is RINA's opinion that the project activity "Bangna Starch Wastewater Treatment and Biogas Utilization Project" in Thailand", as described in the Monitoring Report version 02 of 29/12/2017, meets all relevant requirements for CDM activities and all relevant host Party criteria and correctly applies the approved baseline and monitoring methodology AMS-III.H: Methane recovery in wastewater treatment, version 09 of 14/03/2008 and AMS-I.D – Grid connected renewable electricity generation, version 13 of 14/12/2007

SECTION B. Verification team, technical reviewer and approver

B.1. Verification team member

No.	Role	L	Last name	First name	Affiliation	Involvement in

					(e.g. name of central or other office of DOE or outsourced entity)	Desk/document review	On-site inspection	Interviews	Verification findings
1.	Team Leader	IR	Menon	Rekha	RINA India	☑	☑	☑	☑
2.	Technical Expert	IR	Augustus	Cyril	RINA India	☑	☑	☑	☑

B.2. Technical reviewer and approver of the verification and certification report

No.	Role	Type of resource	Last name	First name	Affiliation (e.g. name of central or other office of DOE or outsourced entity)
1.	Technical reviewer	IR	Carvalho	Thaís	Rina Brazil
2.	Approver	IR	Severino	Laura	Rina Central Office

SECTION C. Application of materiality

C.1. Consideration of materiality in planning the verification

No.	Risk that could lead to material errors, omissions or misstatements	Assessment of the risk		Response to the risk in the verification plan and/or sampling plan
		Risk level	Justification	
1.	Human errors	medium	Human error is likely to occur if the monitoring personnel are not trained well or inexperienced in data recording procedures and monitoring processes.	Wherever there is a greater likelihood of errors and chances of incorrect transfer of data, effective data verification should be done on those days/months data. Noted that the data recording is performed by trained personnel and all the personnel involved in data storage and archiving are undergone training yearly.
2	Design of data management	medium	Use of spreadsheets without adequate data control, changes/updates, version tracking, traceability and security	Depending on how data is generated, processed, and reported, place greater emphasis on verifying data captured and processed manually and/or in spreadsheets versus those that are generated from an automated system
3	Manual data	Low	Typographic errors in the spreadsheets and log books while recording.	Require the PPs to assess all the data again and confirm that no further errors are made

C.2. Consideration of materiality in conducting the verification

>> In order to detect errors, omissions or misstatements in emission reductions or removals being claimed by project participants in the monitoring report, the materiality have been applied by RINA a per clause 9.1.2.3 of VVS, Version 01.0 /05/. The project is a small scale CDM project activity and a 5 percent materiality threshold is applied.

(a) In planning the verification, RINA is able to understand the environment in which the project activity operates, the sources of project emissions within the project boundary and the leakage, the monitoring activities, the equipment used to monitor or measure activity data, the origin and application of data used to calculate or measure the emissions, data flow, the internal quality control system, and the overall organization with respect to monitoring and reporting.

(b) A verification plan and intensive sampling plan has been designed to minimize risks that a material discrepancy would not be detected. The project activity happens at a single site and 100% data is available for verification. The data which directly affect emission reduction calculations being " COD, the amount of biogas captured and sent to boilers, generators and flare, the net electricity supplied to the grid and imported from the grid are monitored and measured by calibrated energy meters, hence 100% verifiable. The data log sheets of all the parameters used in ER calculations were verified 100%. The use of spreadsheets shows the adequate controls related to data updates, version tracking, traceability and security.

(c) During the course of the verification, no errors related to the materiality threshold of 5 per cent have been identified in the data set. Further, any individual or aggregate errors, omission or misstatement identified, which resulted in discrepancies have been considered material and requested to be corrected.

RINA confirms that the claimed emission reductions are free from material errors, omissions or misstatements, with a reasonable level of assurance, and proceeds with the verification as defined in the verification plan.

SECTION D. Means of verification

D.1. Desk/document review

>>The monitoring report, version 1 of 01/08/2017 and version 2 of 29/12/2017 /02/, the emission reduction calculations provided in the form of a spreadsheet (084_Bangna_3rd ER_01082017.xlsx) version 01 of 01/08/2017 and (084_Bangna_3rd ER_v2_29122017) version 02 of 29/12/2017 /03/ were assessed as part of the verification. In addition the Project Design Document (PDD) /01/ in particular the baseline estimations and the monitoring plan for the project were reviewed. The list of all documents reviewed are referenced during the verification is available in Appendix 3 below.

The monitoring report version 1 of 01/08/2017 was made publicly available on the CDM UNFCCC website on 07/09/2017.

D.2. On-site inspection

Duration of on-site inspection: 20/10/2017				
No.	**Activity performed on-site**	**Site location**	**Date**	**Team member**
1.	During the on-site assessment of the project RINA assessed the implementation and operation of the proposed project activity, the composting facility, reviewed the information flows for generating, aggregating and reporting the monitoring parameters, interviewed key personnel of the plant to confirm the operational and data collection procedures, cross-checked between information provided in the monitoring report and data plant. The values used in the ER calculations were confirmed by means of checking the records provided by the client. Checked the quality control and quality assurance procedures in place to prevent or identify and correct any errors or omissions in the reported monitoring parameters. There were no hindrances or barriers that were faced by the verification team while carrying out the site visits all equipment and processes of the project activity were accessible.	Yangthalat, Kalasin Province, Thailand.	20/10/2017	Cyril Augustus Arokiasamy, Rekha Menon.

D.3. Interviews

No.	**Interviewee**			**Date**	**Subject**	**Team member**
	Last name	**First name**	**Affiliation**			
1.	Singh	Santosh	South pole Carbon (Regional Director)	20/10/2017	1. Project implementation, status , construction and actual operation. 2. Moniotring plan and moniotring parameters for this monitroing period. 3. Emission Redcution calculation. 4. QA/QC procedures 5.Environmental Impacts 6. ER calculations and calibration details	Rekha Menon and Cyril Augustus.
2	Rukwongtrakool	Suwipa	South pole Carbon(Project Manager)	20/10/2017		
3	Inmuang	Donrudee	PAPRCL, Investment Development Manager	20/10/2017		
4	Rattananadheku	Suchai	PAPRCL, Manager Design	20/10/2017		
5	Boonyued	Watchara	PAPRCL, Plant Manager	20/10/2017		

D.4. Sampling approach

>> N/A

D.5. Clarification requests (CLs), corrective action requests (CARs) and forward action requests (FARs) raised

Areas of verification findings	No. of CL	No. of CAR	No. of FAR
Compliance of the monitoring report with the monitoring report form			
Compliance of the project implementation and operation with the registered PDD			
Post-registration changes			
Compliance of the registered monitoring plan with the methodologies including applicable tools and standardized baselines			
Compliance of monitoring activities with the registered monitoring plan	1		
Compliance with the calibration frequency requirements for measuring instruments			
Assessment of data and calculation of emission reductions or net removals	4		
Assessment of reported sustainable development co-benefits			
Global stakeholder consultation			
Others (please specify)			
Total	5		

SECTION E. Verification findings

E.1. Compliance of the monitoring report with the monitoring report form

Means of verification	To check the compliance of the monitoring report with the latest monitoring report form available at UNFCCC.
Findings	N/A
Conclusion	The latest version of MR form available at UNFCCC is 06.0 and the same has been used by the project proponent in the monitoring report. RINA confirms that the above MR is based on the currently valid MR template /19/ and is completed in accordance with the applicable instruction /20/.

E.2. Remaining forward action requests from validation and/or previous verifications

>> This is 3rd verification of the project activity. There are no FAR(s) from validation or previous verification reports /05/ that needs to be closed during this verification.

E.3. Compliance of the project implementation and operation with the registered project design document

Means of verification	As checked during the site visit the project replaces the existing wastewater treatment practice (open lagoon system) and thus avoids the release of methane into the atmosphere that results from the anaerobic digestion of the organic content in the wastewater treated in the lagoon system. The project activity consists of the installation of an Upflow Anaerobic Sludge Blanket technology (UASB) biogas reactor, and power generation (2.85 MWel gas engine (3 x 0.95 MW) at an existing starch manufacturing plant for: a) extraction of methane (biogas) from the wastewater stream through the biogas reactor, and b) reuse of biogas as fuel for power generation (installed capacity of 2.85 MWel gas engines). The project activity uses a part of biogas (a renewable fuel) which is captured from

	the methane avoidance component of the project activity to generate electricity in 2.85 MW_{el} gas engine /05/. The electricity generated is exported to the Thai national grid /05/, thus displacing the production of power from fossil sources in the EGAT electricity grid. The UASB was commissioned in 10/2007 and the gas engines were commissioned in 21/12/2007. The commissioning reports of the same were checked during the first and 2nd verification period /05/. During the site visit it was checked that the project UASB is designed with a total volumetric capacity of 6,581 m^3 , 3 Guascor gas engines (SFGLD 560) with total installed capacity of 2.85 MWel and BKE closed flare system with a maximum capacity of 1,250 Nm^3/hr. It is checked that there is no change in the technical design of the project and the equipment's used in the project activity. This is in line with the registered PDD /01/.
Findings	N/A
Conclusion	The project is fully implemented according to the description presented in the PDD, which is discussed above. RINA confirms, through physical inspection at site that all features of the CDM project activity including the equipment's, data collecting systems and storage have been implemented in accordance with the registered PDD. The project activity is completely operational and the same has been confirmed during on-site.

E.4. Post-registration changes

E.4.1. Temporary deviations from the registered monitoring plan, applied methodologies or applied standardized baselines

>> N/A

E.4.2. Corrections

>> N/A

E.4.3. Change to the start date of the crediting period of the project activity

>> N/A

E.4.4. Inclusion of a monitoring plan

>> N/A

E.4.5. Permanent changes from registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines or other applied standards or tools

>> N/A

E.4.6. Changes to the project design

>> N/A

E.4.7. Changes specific to afforestation and reforestation project activities

>> N/A

E.5. Compliance of the registered monitoring plan with the methodology including applicable tools and standardized baselines

Means of verification	During the monitoring period it was noted that the parameters monitored (also discussed in detail in section E.6.2) and the monitoring plan was found as per the applied methodology. There is no deviation observed between monitoring plan of the project activity with the monitoring plan of the applied methodology of the project activity and applicable methodological tools.
Findings	N/A
Conclusion	There is no deviation observed between monitoring plan of the project activity with the monitoring plan of the applied methodology of the project activity. All monitoring parameters, monitoring and calibration procedures follow the methodology requirements.

E.6. Compliance of monitoring activities with the registered monitoring plan

E.6.1. Data and parameters fixed ex ante or at renewal of crediting period

Means of verification

Data and parameters fixed ex-ante as listed in the monitoring report have been crosschecked and reviewed as applicable against the registered PDD, monitoring plan as well as against the applied methodology and other relevant CDM documentation.

DATA/PARAMETER Unit	Source of data	Reported value for the project period	Assessment/Observation
GWP_{CH4} : Global Warming Potential for methane in tCO_{2e}/tCH_4	According EB 69 - Annex 3	25	As per Annex 3, EB 69, following decision 4/CMP.7 the GWP of CH_4 for the second commitment period (from 01/01/2013) is applied /25/.
$Bo_{,ww}$: Methane producing capacity of the wastewater in kg CH_4/kg COD	IPCC default value	0.21	The value is fixed ex-ante as per the registered PDD /01/, which has been justified and validated by validation DOE /04/.
MCF Methane correction factor	As per the methodology AMS-III.H	$MCF_{ww,\ treatment,i}$: 0.8 $MCF_{ww,\ i}$:1.0 $MCF_{ww,\ final}$:0.2	The value is fixed ex-ante as per the registered PDD /01/, which has been justified and validated by validation DOE /04/.
CFE_{ww}: Capture efficiency of the biogas recovery equipment in the wastewater Treatment systems	Default value specified in AMS-III.H, Version 09 methodology	0.9	The value is fixed ex-ante as per the registered PDD /01/, which has been justified and validated by validation DOE /04/.
$EF_{grid,y}$: CO_2 emission factor for grid connected power generation in year y in tCO_2/MWh	Data from publically available source, published by DEDE (Ministry of energy)	0.5057	The value is fixed ex-ante as per the registered PDD /01/, which has been justified and validated by validation DOE /04/.
$[CH4]_{y,ww,\ treated:}$ Dissolved methane content in the treated wastewater	As per the methodology AMS-III.H	0.0001	The value is fixed ex-ante as per the registered PDD /01/, which has been justified and validated by validation DOE /04/.

Findings	N/A
Conclusion	RINA is able to confirm that the Data and parameters fixed ex ante have been implemented in full compliance with the monitoring plan and that they are the same used at the validation stage and in the previous verifications.

E.6.2. Data and parameters monitored

Means of verification

Data/Parameter	$Q_{y,ww}$
Data Unit	m^3
Description	Volume fo waste water treated in the year y
Source of data to be used	Plant log sheets /23

Value of monitored parameter for the monitoring period

Monitoring period	Total value (m^3)
01/08/2013 – 31/12/2013	328,271
01/01/2014 – 31/12/2014	721,328
01/01/2015 – 31/12/2015	674,753
01/01/2016 – 09/11/2016	664,975

Monitoring equipment

Electromagnetic flow meters

Se.no	Make	Accuracy	Calibration date	Does it cover MP(Y/N)
93120819000	Endress Hauser flowtec AG	±0.5%	19/06/2013 21/05/2014 /12/	Y
J9095D120000	Endress Hauser flowtec AG	±0.5%	26/05/2015 18/05/2016 /13/	Y

During the site visit , it was checked that the meter 93120819000 is replaced with meter J9095D120000 on 27/11/2014, which was confirmed from the internal records /26/ and accepted by RINA team.

Accuracy of the monitoring equipment	As discussed above.
Measuring/Reading/Recording frequency	The parameter is continuously measured by the flow meter, which is then recorded in the log sheets daily. The daily log sheets are reported to Biogas & Power Department Supervisor and further to the Plant Manager on a daily basis.
Calcualtion method (if applicable)	N/A.

Data/Parameter	$COD_{y,inflow,i}$:
Data Unit	mg/l or tonnes/m^3
Description	The chemical oxygen demand of the wastewater entering the project system j
Source of data to be used	Measured by onsite laboratory and sourced through plant log sheets /22/

Value of monitored parameter for the monitoring period	

Monitoring Period	Average Value	
	mg/l	tonnes/m^3
01/08/2013-31/12/2013	17,599	0.017599
01/01/2014–31/12/2014	17,151	0.017151
01/01/2015-31/12/2015	18,727	0.018727
01/01/2016-09/11/2016	19,800	0.019800

Monitoring equipment

Portable colorimeter

Se.no	Make	Accuracy	Calibration date	Does it cover MP(Y/N)
070290C62433	Hach	±0.24 %	08/05/2013 29/04/2014 22/04/2015 19/02/2016 /11/	Y

Accuracy of the monitoring equipment	As discussed above.
Measuring/Reading/Recording frequency	Wastewater samples are collected at the inlet of the anaerobic treatment system (project system). The COD content is analyzed using a colorimetric method in the on-site laboratory. The COD test results are logged manually in the plant operation report on a daily basis. Samples collection and analysis for COD are done at least once per day. The results from the plant operation report are transferred to an electronic file i.e. excel sheet template. The sheets were checked and found to be satisfactory.
Calcualtion method (if applicable)	N/A.

Data/Parameter	**$COD_{y,outflow,j}$**:
Data Unit	mg/l or tonnes/m^3
Description	The chemical oxygen demand of the wastewater exiting the project system j

Source of data to be used	Measured by onsite laboratory and sourced through plant log sheets /22/

Value of monitored parameter for the monitoring period

Monitoring Period	Average Value	
	mg/l	tonnes/m^3
01/08/2013-31/12/2013	1,238	0.001238
01/01/2014–31/12/2014	1,043	0.001043
01/01/2015-31/12/2015	1,046	0.001046
01/01/2016-09/11/2016	1,043	0.001043

Monitoring equipment

Portable colorimeter

Se.no	Make	Accuracy	Calibration date	Does it cover MP(Y/N)
070290C62433	Hach	±0.24 %	08/05/2013 29/04/2014 22/04/2015 19/02/2016 /11/	Y

Accuracy of the monitoring equipment	As discussed above.
Measuring/Reading/Recording frequency	Wastewater samples are collected at the outlet of the anaerobic treatment system (project system). The COD content is analyzed using a colorimetric method in the on-site laboratory. The COD test results are logged manually in the plant operation report on a daily basis. Samples collection and analysis for COD are done at least once per day. The results from the plant operation reports are transferred to an electronic file i.e. excel sheet template . The same was checked and found to be satisfactory
Calcualtion method (if applicable)	N/A.

Data/Parameter	**$COD_{y,removed,i}$**:
Data Unit	mg/l or tonnes/m^3

Description	The chemical oxygen demand removed by the treatment system j
Source of data to be used	Calculated from the $COD_{y,inflow,j}$ and $COD_{y,outflow,j}$
Value of monitored parameter for the monitoring period	

Monitoring Period	Average Value	
	mg/l	tonnes/m^3
01/08/2013-31/12/2013	16,789	0.016789
01/01/2014–31/12/2014	17,520	0.017520
01/01/2015-31/12/2015	18,510	0.018510
01/01/2016-09/11/2016	20,235	0.020235

Monitoring equipment	N/A
Accuracy of the monitoring equipment	N/A
Measuring/Reading/Recording frequency	N/A
Calcualtion method (if applicable)	Calculated based on the difference of $COD_{y,inflow,j}$ and $COD_{y,outflow,j}$

Data/Parameter	**$COD_{y,ww,treated}$**:
Data Unit	mg/l or tonnes/m^3
Description	The chemical oxygen demand prior to discharge
Source of data to be used	External laboratory test reports /27/
Value of monitored parameter for the monitoring period	

Monitoring Period	Maximum value	
	mg/l	tonnes/m^3
01/08/2013-31/12/2013	116.02	0.000116
01/01/2014–31/12/2014	99.40	0.000099
01/01/2015-31/12/2015	134.08	0.000134
01/01/2016-09/11/2016	83.36	0.000083

Checked with the lab reports issued by third party “central laboratory (Thailand) co ltd” /27/. Same is accepted by RINA.

Monitoring equipment	N/A The parameter is measured by an external laboratory in line with the requirement of the monitoring plan.
Accuracy of the monitoring equipment	N/A

Measuring/Reading/Recording frequency	Wastewater samples are collected at the last open anaerobic lagoon prior to discharge. The COD content is analyzed using a standard method in an external laboratory on a monthly basis.
Calcualtion method (if applicable)	N/A

Data/Parameter	$S_{y, final}$:
Data Unit	tonnes
Description	Amount of final sludge generated by the waste water treatment system in the year "y"
Source of data to be used	Plant records
Value of monitored parameter for the monitoring period	Monitoring Period / Tonnes 01/08/2013-31/12/2013: 0 01/01/2014–31/12/2014: 0 01/01/2015-31/12/2015: 0 01/01/2016-09/11/2016: 0
Monitoring equipment	Weighing machine Se.no: E07512-0201; Make: Cardinal; Accuracy: 20 kg; Calibration date: 12/06/2012, 16/10/2014, 14/09/2016 /28/; Does it cover MP(Y/N): Y Calibration frequency is once in 3 years, which is as per the registered PDD.
Accuracy of the monitoring equipment	As discussed above.
Measuring/Reading/Recording frequency	As confirmed during the site visit and interviews with the PP, the sludge was never removed from the UASB reactor. It was also confirmed that the on removal of sludge, the same will be recorded in plant log sheets.
Calcualtion method (if applicable)	N/A

<table>
<tr><td>Data/Parameter</td><td>% CH_4:</td></tr>
<tr><td>Data Unit</td><td>%</td></tr>
<tr><td>Description</td><td>Methane content in Biogas</td></tr>
<tr><td>Source of data to be used</td><td>Plant records /21/</td></tr>
<tr><td>Value of monitored parameter for the monitoring period</td><td>
<table>
<tr><td>Monitoring Period</td><td></td></tr>
<tr><td></td><td>Average value in %</td></tr>
<tr><td>01/08/2013-31/12/2013</td><td>58.59</td></tr>
<tr><td>01/01/2014–31/12/2014</td><td>58.38</td></tr>
<tr><td>01/01/2015-31/12/2015</td><td>56.91</td></tr>
<tr><td>01/01/2016-09/11/2016</td><td>58.07</td></tr>
</table>
</td></tr>
<tr><td>Monitoring equipment</td><td>Since there was a malfunction in the online system, the parameter is measured by means of portabale gas analyaser. The same is as per the registered PDD.
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.
The details of the equipment are given below:
Portable gas analyser
<table>
<tr><td>Se.no</td><td>Make</td><td>Accuracy</td><td>Calibration date</td><td>Does it cover MP(Y/N)</td></tr>
<tr><td>G501076</td><td>Geotechnical Instruments</td><td>±1.5%</td><td>26/03/2013
03/10/2014
24/08/2015 /29/</td><td>N</td></tr>
</table>
Noted that the calibration of the equipment was delayed during the monitoring period, the measured values of the methane content in biogas for the period from 03/03/2014 – 02/10/2014 has been adjusted by applying the error identified in the calibration report (±3.0%) in conservative manner.</td></tr>
<tr><td>Accuracy of the monitoring equipment</td><td>As discussed above.</td></tr>
</table>

Measuring/Reading/Recording frequency	The portable gas analyzer is used to monitor the CH4 content at least twice a day. The monitored data is manually recorded onto log sheets, checked by the plant manager on regular basis, and transferred to excel file.
Calcualtion method (if applicable)	As per the methodological requirements 95% confidence level was applied to determine %CH4. From the onsite visit 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. ER sheets checked and the same was found to be appropriate.

Data/Parameter	$Q_{biogas, total, y}$:
Data Unit	Nm^3
Description	Amount of biogas that is generated using the project activity in the year "y"
Source of data to be used	Log sheets /23/
Value of monitored parameter for the monitoring period	Monitoring Period: 01/08/2013-31/12/2013 — Total value (Nm^3): 2,417,389 01/01/2014–31/12/2014 — 5,484,678 01/01/2015-31/12/2015 — 5,400,911 01/01/2016-09/11/2016 — 5,932,912
Monitoring equipment	Thermal mass flow meter (GM1)

Se.no	Make	Accuracy	Calibration date	Does it cover MP(Y/N)
9502C002000	Endress & Hauser	±1%	19/06/2013 21/05/2014 26/05/2015 18/05/2016 /14/	N
A9059702000	Endress & Hauser	±1%	26/05/2015 18/05/2016 /15/	Y

Noted that there is a calibration delay from 21/05/2015 to 26/05/2015. ER sheets checked and noted that the error for the same is not considered. The same was

	accepted since the values are not used in ER calculations and thus doesn't impact the Emission Reductions.
Accuracy of the monitoring equipment	As discussed above.
Measuring/Reading/Recording frequency	The amount of biogas generated is continuously measured by means of a cumulative flow meter installed after UASB. Data is logged manually in the log sheet and transferred to the excel sheet template on daily basis, which is checked by the plant manager on regular basis.
Calcualtion method (if applicable)	N/A

Data/Parameter	$Q_{biogas, flare, y}$:
Data Unit	Nm^3
Description	Amount of biogas that is flared
Source of data to be used	Log sheets /23/
Value of monitored parameter for the monitoring period	Monitoring Period: 01/08/2013-31/12/2013 — Total value (Nm^3): 54 01/01/2014–31/12/2014 — 820,637 01/01/2015-31/12/2015 — 409,455 01/01/2016-09/11/2016 — 101,142
Monitoring equipment	Thermal mass flow meter (GM3) Se.no: 9A070502000 — Make: Endress & Hauser — Accuracy: ±1% — Calibration date: 20/06/2013, 21/05/2014, 26/05/2015, 18/05/2016 /16/ — Does cover MP(Y/N): N Noted that there is a calibration delay from 21/05/2015 to 25/05/2015, however, noted that there was no biogas flared during this period. Thus no error was calculated.
Accuracy of the monitoring equipment	As discussed above.
Measuring/Reading/Recording frequency	The amount of biogas sent to the flare is continuously measured by means of a cumulative flow meter installed after the blower and before the flare. Data is logged manually in the log sheet and transferred to the excel sheet template on daily basis, which is checked by the plant manager on regular basis.

Calcualtion method (if applicable)	N/A

Data/Parameter	$Q_{biogas, generator, y}$:
Data Unit	Nm^3
Description	Amount of biogas that is used in electricity generators
Source of data to be used	Log sheets /23/
Value of monitored parameter for the monitoring period	Monitoring Period: 01/08/2013-31/12/2013 — Total value (Nm^3): 2,668,487 01/01/2014–31/12/2014 — 5,235,481 01/01/2015-31/12/2015 — 5,551,988 01/01/2016-09/11/2016 — 6,464,220
Monitoring equipment	Thermal mass flow meter (GM2)

Se.no	Make	Accuracy	Calibration date	Does cover MP(Y/N)
9502C102000	Endress & Hauser	±1%	19/06/2013 21/05/2014 26/05/2015 18/05/2016 /17/	N

Noted that there is a calibration delay from 21/05/2015 to 25/05/2015. The PP has applied the error factor for the period 21/05/2015 – 25/05/2015 as per the calibration report (±2.756%) in conservative manner in the ER sheets and the same was addressed in the MR and accepted by RINA.

Accuracy of the monitoring equipment	As discussed above.
Measuring/Reading/Recording frequency	The amount of biogas sent to the gensets is continuously measured by means of a cumulative flow meter installed after the blower and before the flare. Data is logged manually in the log sheet and transferred to the excel sheet template on daily basis, which is checked by the plant manager on regular basis.
Calcualtion method (if applicable)	N/A

<table>
<tr><td>Data/Parameter</td><td>T _{flare}:</td></tr>
<tr><td>Data Unit</td><td>°C</td></tr>
<tr><td>Description</td><td>Temperature of the exhaust gases of the flare in stack (N type thermocouple). Data shall be recorded automatically on SCADA system.</td></tr>
<tr><td>Source of data to be used</td><td>Reports from SCADA /30/</td></tr>
<tr><td>Value of monitored parameter for the monitoring period</td><td>
<table>
<tr><td>Monitoring Period</td><td></td></tr>
<tr><td></td><td>Total value (Nm^3)</td></tr>
<tr><td>01/08/2013-31/12/2013</td><td>0</td></tr>
<tr><td>01/01/2014–31/12/2014</td><td>0</td></tr>
<tr><td>01/01/2015-31/12/2015</td><td>0</td></tr>
<tr><td>01/01/2016-09/11/2016</td><td>0</td></tr>
</table>
It was noted that the data was not logged during the flare operations and thus PP has assumed flare efficiency as 0, which is a conservative approach and the same was accepted by RINA.</td></tr>
<tr><td>Monitoring equipment</td><td>
<table>
<tr><td>Se.no</td><td>Make</td><td>Calibration date</td><td>Does it cover MP(Y/N)</td></tr>
<tr><td>Thermocouple type N SP08071880025</td><td>Taie/WR&W</td><td>26/08/2013 /32/</td><td>N</td></tr>
<tr><td>Thermocouple type K 33508001</td><td>SK</td><td>17/03/2016 /33/</td><td>N</td></tr>
</table>
Thermocouple type K, 33508001 was installed on 27/08/2015 /31/.
Noted that the calibration were not carried out on regular basis as per manufacturer’s recommendation or at least once a year. However, the flare efficiency is assumed to be zero since no temperature readings were available for this monitoring period. Thus, the same was accepted.</td></tr>
<tr><td>Accuracy of the monitoring equipment</td><td>As discussed above.</td></tr>
<tr><td>Measuring/Reading/Recording frequency</td><td>As discussed above.</td></tr>
<tr><td>Calcualtion method (if applicable)</td><td>N/A</td></tr>
</table>

Data/Parameter	**Time of biogas sent to flare**:

Data Unit	Minutes
Description	Amount of minutes per hour where biogas is sent to the flare
Source of data to be used	Reports from SCADA /30/
Value of monitored parameter for the monitoring period	Monitoring Period / Value (minutes) 01/08/2013-31/12/2013: 0 01/01/2014–31/12/2014: 0 01/01/2015-31/12/2015: 0 01/01/2016-09/11/2016: 0 It was noted that the data was not logged during the flare operations and thus PP has assumed flare efficiency as 0, which is a conservative approach and the same was accepted by RINA.
Monitoring equipment	Whenever biogas flow is registered by the SCADA system of the biogas plant, the time is also recorded, which allows for a calculation of the time period of biogas being sent to the flare. Since the parameter was not recorded completely for the entire monitoring period based on SCADA record, the value is assumed to be zero . The same is accepted since it is conservative.
Accuracy of the monitoring equipment	As discussed above.
Measuring/Reading/Recording frequency	As discussed above.
Calcualtion method (if applicable)	N/A

Data/Parameter	**EC_y**:
Data Unit	MWh/y
Description	Electricity consumed by waste water treatment facility over the year.
Source of data to be used	Reports by PEA /24/
Value of monitored parameter for the monitoring period	Monitoring Period / Value (kWh) 01/08/2013-31/12/2013: 31,500 01/01/2014–31/12/2014: 201,120 01/01/2015-31/12/2015: 96,060 01/01/2016-09/11/2016: 100,380 Monthly reports from PEA checked /24/ and noted that for the month of November , though the last date of MP

	is 09/11/2016, the value for the entire month of November has been considered in ER calculations. Same was accepted by RINA since, it is conservative.
Monitoring equipment	Electricty meter

Se.no	Make	Accuracy	Calibration date	Does it cover MP(Y/N)
212054801 (PEAno.27664781)	EDMI	0.5 S	21/06/2013 08/07/2014 24/06/2015 11/07/2016 /18/	The calibration is under the control of PEA.

Accuracy of the monitoring equipment	As discussed above.
Measuring/Reading/Recording frequency	The measurement of this parameter is done continuously using electricity meter, owned by PEA. The reports are issued by Provincial Electricity Authority (PEA) which the monitored data is monthly recorded by the PEA officer together with plant's operator.
Calcualtion method (if applicable)	N/A

Data/Parameter	**EG_y**:
Data Unit	MWh/y
Description	Electricity exported to the grid during the year y by power generation facility
Source of data to be used	Reports by PEA /24/
Value of monitored parameter for the monitoring period	Monitoring Period / Value (kWh) 01/08/2013-31/12/2013: 4,421,940 01/01/2014–31/12/2014: 8,827,260 01/01/2015-31/12/2015: 9,637,620 01/01/2016-09/11/2016: 10,305,960 Monthly reports from PEA checked /24/ and noted that for the month of November , though the last date of MP is 09/11/2016, the value for the entire month of November has not been considered in ER calculations. Same was accepted by RINA since, it is conservative.
Monitoring equipment	Electricty meter

Se.no	Make	Accuracy	Calibration date	Does it cover MP(Y/N)

20505579 8(PEAno. 20963040)	EDMI	0.5S	21/06/201 3 08/07/201 4 24/06/201 5 11/07/201 6 /18/	The calibrati on is under the control of PEA.

Accuracy of the monitoring equipment	As discussed above.
Measuring/Reading/Recordi ng frequency	The measurement of this parameter is done continuously using electricity meter, owned by PEA. The reports are issued by Provincial Electricity Authority (PEA) which the monitored data is monthly recorded by the PEA officer together with plant's operator.
Calcualtion method (if applicable)	N/A

Data/Parameter	**FE or ηflare-h :**
Data Unit	%
Description	Flare efficiency
Source of data to be used	Calculated based on the tool to determine project emissions from flaring gases containing methane, EB 28, Annex 13
Value of monitored parameter for the monitoring period	Monitoring Period / Value (%) 01/08/2013-31/12/2013: 0 01/01/2014–31/12/2014: 0 01/01/2015-31/12/2015: 0 01/01/2016-09/11/2016: 0
Monitoring equipment	N/A
Accuracy of the monitoring equipment	N/A
Measuring/Reading/Recordi ng frequency	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 monitoring period, thereby resulting the efficiency is zero, which is conservative and accepted by RINA.
Calcualtion method (if applicable)	N/A

Findings

CL 1

$Q_{y,ww}$

1. As per the log sheets for 2014 it is 7,18,353 and for 2016 it is 6,61,747, which is not consistent with ER spread sheets. PP to check and confirm.
2. During the site visit , it was checked that the meter 93120819000 is replaced with meter J9095D120000. However, the same is not transparent in the MR. PP is to clarify the dates of meter replacement along with evidences.

$COD_{y,removed,j}$:

	3. The values provided in the MR is not consistent with the values given in the ER sheets. **$COD_{y,ww,treated}$**: 4. PP is requested to provide the monthly reports of COD provided by external lab. **$S_{y,final}$**: 5. Noted that there is a calibration frequency mentioned in the table is once in two years and in the QA/QC procedures it is once in three years. PP is requested to clarify the inconsistency and also provide the calibration certificates. **% CH_4**: 6. PP is requested to provide the calibration certificates of portable gas analyser for the current monitoring period. **$Q_{biogas,total,y}$**: 7. Noted that there is a calibration delay from 21/05/2015 to 26/05/2015, which is not transparent in the MR and ER spread sheets. PP is requested to clarify on how the delay is justified. **$Q_{biogas,flare,y}$**: 8. PP is requested to correct the calibration dates in the MR for the year 2015.The values for the year 2014 is not consistent with the figures provided in ER spread sheets. **T_{flare}**: 9. Pls provide the calibration test report for the year 2013. **EC_y, EG_y**: 10. Pls provide the PEA reports for the months from July to October 2016. For more details, please refer to Appendix-4. CL 1 is closed.
Conclusion	The monitoring has been carried out in accordance with the monitoring plan contained in the registered PD. All the parameters were monitored and determined as per the registered monitoring plan. DOE confirms through site visit verification, from the document review, the actual monitoring system complies with the registered monitoring plan. During the verification, all the relevant monitoring parameters of the registered monitoring plan have been verified with regard to the appropriateness of the verification method; the correctness of the values applied for ER calculation, the accuracy and applied QA/QC measures. It is confirmed that all the monitoring parameters have been measured/determined without material misstatements and are in line with all applicable standards and relevant requirements. All parameters required to be monitored are recorded at the intervals required by the registered monitoring plan and applied methodology. On the basis of review of source of nature of available evidences and records, the verification team confirms the quality of evidence for emission reduction provided is sufficient as per CDM VVS, version 01.0.

E.6.3. Implementation of sampling plan

Means of verification	N/A
Findings	N/A
Conclusion	N/A

E.7. Compliance with the calibration frequency requirements for measuring instruments

Means of verification	The calibration details and the frequency of the calibration are discussed above in section E.6.2. The meters, which are not calibrated as per the frequency, the maximum error has been applied to the respective values and the same has been deducted from emission reductions.
Findings	As discussed above in section E.6.2 Please refer to Appendix 4 for more details. CL 1 is closed.
Conclusion	As discussed, above it is noted that for few meters the calibration doesn't cover the monitoring period. However, PP has calculated error for the delayed calibration as per Guidelines for assessing compliance with the calibration frequency requirements, (CDM VVS, Version 01.0 para 369(a)) states that: "Applying the maximum permissible error of the instrument to the measured values, if the results of the delayed calibration do not show any errors in the measuring equipment, or if

	the error is smaller than the maximum permissible error;". The same was accepted by RINA. Further the measuring equipment's have been calibrated by accredited agencies. This is consistent with registered PDD /01/and CDM VVS, Version 01.0 /08/.

E.8. Assessment of data and calculation of emission reductions or net removals

E.8.1. Calculation of baseline GHG emissions or baseline net GHG removals by sinks

Means of verification	Baseline emissions are the sum of emissions from the degradable organic matter in the treated wastewater (calculated according to AMS.III.H version 9) and the emission due to the displacement of electricity from the grid (calculated according to AMS.I.D version 13). $\mathbf{BE_y = BE_{y,el} + BE_{y,ww}}$ **(1)** Where: BE_y Baseline emissions in the year "y" (tCO_2e) $BE_{y,el}$ Baseline emissions from grid's electricity displaced by the project activity during the year y in tCO_2e

	$BE_{y, ww}$ Baseline Emissions from degradable organic carbon in treated wastewater in year "y" **$BE_{y, el} = EF_{y} * EG_{y}$** Where: $BE_{y,el}$ The baseline emissions from grid's electricity displaced by the project activity during the year y in tCO_2e/MWh. EF_{y} Emission factor from the electricity displaced by the project activity during year "y". As electricity is exported to the grid, the emission factor of the national grid will be chosen: $EF_{y} = EF_{grid, y}$. (Calculated – Fixed ex-ante) EG_{y} Electricity generated during year y by power generation facility (MWh) For the case of introduction of a sequential anaerobic wastewater treatment system with methane recovery (option (vi) according to AMS.III.H), Paragraph 24 of AMS III.H. Version 09, applies to baseline emissions as follows: **$BE_{y, ww} = Q_{y, ww} * \sum_{j} (COD_{y, removed, j} * B_{o, ww} * MCF_{ww, treatment, j} *$ (3)** Where, **$BE_{y, ww}$:** Baseline Emissions from degradable organic carbon in treated wastewater in year "y" (tCO_2/yr) **$Q_{y, ww}$:** Volume of wastewater treated in the year "y" (m^3/yr) **$COD_{y, removed, j}$:** Chemical oxygen demand removed by the anaerobic wastewater treatment systems "j" in the baseline situation in the year "y" to which the sequential anaerobic treatment step is being introduced in tonnes/m^3 (COD content of in the inlet and outlet of the lagoon system has been monitored for determination of the COD removed) As electricity is exported to the grid, the emission factor of the national grid will be chosen: $EF_{y} = EF_{grid, y}$. (Calculated – Fixed ex-ante) **$B_{o, ww}$:** Methane producing capacity of the wastewater (The IPCC default value for domestic wastewater of 0.21 kg CH_4/kg COD) **$MCF_{ww, treatment, j}$:** Methane correction factor for the existing anaerobic wastewater treatment systems "j" to which the sequential anaerobic treatment step is being introduced (MCF lower value in Table III.H.1.) **GWP_{CH4}:** Global Warming Potential for methane (value of 25 is used)
Findings	CL2 COD y, removed, j in ERs sheet is not consistent in cell no E8 and M13. For more details, please refer to Appendix-4 of this report CL2 is closed.
Conclusion	RINA confirms that the baseline emissions have been appropriately calculated and are consistent with site visit observations, the applied methodology, registered PDD and the previous verification reports **/09/, /01/, /05/.**

E.8.2. Calculation of project GHG emissions or actual net anthropogenic GHG removals by sinks

Means of verification

The project activity emissions are calculated as follows:

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

Where:

PE_y	Project activity emissions in the year "y" (tCO_2e)
$PE_{y, power}$	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"
$PE_{y, upgrading}$	Emissions related to the upgrading and compression of biogas in year "y"
$PE_{y, leakage, pipeline}$	Emissions due to physical leakage from the dedicated piped network in year "y"

Project activity emissions from degradable organic carbon in the treated wastewater ($PE_{y, ww, treated}$)

$$PE_{y, ww, treated} = Q_{y, ww} * COD_{y, ww, treated} * B_{o, ww} * MCF_{ww, final} * GWP_{CH4} \quad (5)$$

Where:

$PE_{y, ww, treated}$	Emissions from degradable organic carbon in treated wastewater in year "y" (tCO_2e)
$Q_{y, ww}$	Volume of wastewater treated in the year "y" (m^3/yr)
$COD_{y, ww, treated}$	Chemical oxygen demand of the treated wastewater in the year "y" ($tonnes/m^3$)
$B_{o, ww}$	Methane producing capacity of the wastewater (IPCC default value of 0.21 kg CH_4/kg COD)
$MCF_{ww, final}$	Methane correction factor based on type of treatment and discharge pathway of the wastewater (as per AMS.III.H a value of 0.2 shall be used for wastewater discharge to sea, river or lake)
GWP_{CH4} = 268 tCO_2e	Global Warming Potential for methane (value of 25 is used)

$PE_{y, s, final}$: The sludge removed from project activity is used for starting new anaerobic digesters or restarting other digesters by the same technology provider and is not dumped on a landfill site. The same was confirmed by the technology provider during the site visit. Further it was confirmed that no sludge was generated. Thus, no emissions from sludge removal is accounted.

Fugitive emissions from methane release in capture and flare systems ($PE_{y, fugitive}$)

$$PE_{y, fugitive} = PE_{y, fugitive, ww} + PE_{y, fugitive, s} \quad (7)$$

Where:

$PE_{y, fugitive, ww}$	Fugitive emissions through capture and utilization/combustion/flare inefficiencies in the anaerobic wastewater treatment in year "y" (tCO_2e)
$PE_{y, fugitive, s}$	Fugitive emissions through capture and utilization/combustion/flare inefficiencies in the anaerobic sludge treatment in the year "y" (tCO_2e)

$PE_{y, fugitive, s}$ is accounted 0, since there is no sludge generation.

$$PE_{y, fugitive, ww} = (1-CFE_{ww}) * MEP_{y, ww, treatment} * GWP_{CH4} \quad (8)$$

Where:

CFE_{ww}	Capture and flare efficiency of the methane recovery and combustion equipment in the wastewater treatment (a default value of 0.9 is used)
GWP_{CH4}	Global Warming Potential for methane (value of 25 is used)
$MEP_{y, ww, treatment}$	Methane emission potential of the wastewater treatment plant in the year "y" (tonnes), which is calculated according to the equation below

= 18,520 tCO_2e

$$MEP_{y, ww, treatment} = Q_{y, ww} * B_{o, ww} * \sum_j COD_{y, removed, j} * MCF_{ww, j} \quad (9)$$

Where:

$Q_{y, ww}$	Volume of wastewater treated in the year "y" (m^3/yr)
$COD_{y, removed, j}$	The chemical oxygen demand removed by the treatment system "j" of the project activity equipped with methane recovery in the year "y" (tonnes/m^3)
$MCF_{ww, j}$	Methane correction factor for the wastewater treatment system "j" equipped with methane recovery and combustion/flare/utilization equipment (MCF higher values in table III.H.1)
$B_{o, ww}$	Methane producing capacity of the wastewater (IPCC default value of 0.21 kg CH_4/kg COD)

= 7,408 tCO_2e

Emissions from dissolved methane in treated wastewater ($PE_{y, dissolved}$)

$$PE_{y, dissolved} = Q_{y, ww} * [CH4]_{y, ww, treated} * GWP_{CH4} \quad (10)$$

Where:

$PE_{y, dissolved}$	Emissions from dissolved methane in treated wastewater in year "y" (tCO_2e)

	$Q_{y, ww}$ Volume of wastewater treated in the year "y" (m^3/yr) $[CH4]_{y, ww, treated}$ Dissolved methane content in the treated wastewater (tonnes/m^3). In aerobic Since it is anaerobic treatment default value of $10e^{-4}$ tonnes/m^3 can be used. GWP_{CH4} Global Warming Potential for methane (value of 25 is used) = 5,973 tCO_2e **Emissions from flaring of biogas ($PE_{y, flare}$)** The project emissions from flaring are incorporated into the emission reduction calculations as per the clarifications to the version 09 of the methodology. $PE_{y,flare} = \sum_{h=1}^{8760} TM_{RG,h} * (1-\eta_{flare,h}) * \frac{GWP_{CH4}}{1000}$ **(11)** Where: $TM_{RG, h}$ Mass flow rate of methane in the residual gas in hour h (kg/h) $\eta_{flare, h}$ Flare efficiency in hour h The flare efficiency is considered to be 0%, which is conservative. $\sum_{h=1}^{8760} TM_{RG,h}$ = $Q_{biogas, flare, y}$ * $\%CH_4$ * D_{CH4} Where: $Q_{biogas, flare, y}$ The biogas quantity flared by the project activity (Nm^3) $\%CH_4$ Methane % in biogas, based on 95% confidence limit, for conservative estimation D_{CH4} Density of methane at normal conditions = 14,039 tCO_2e **Emission from upgrading and use of bottled biogas $PE_{y, upgrading}$ and from pipeline leakage $PE_{y, leakage, pipeline}$** No production, upgrading, pipeline transportation and use of bottled biogas is planned in this project, thus: $PE_{y, leakage, pipeline}$ = 0 $PE_{y, upgradining}$ = 0 **Project activity emissions from electricity or fossil fuel consumption ($PE_{y, power}$)** **$PE_{y, power} = EF_y * EC_y$** **(12)** Where: $PE_{y, power}$ Emissions from electricity or fossil fuel consumption in the year "y" (tCO_2e) EC_y Electricity consumed during year y from the national grid (MWh)

	EF_y Emission factor from the national grid electricity consumed by the project activity during year "y" (tCO_2e/MWh) = 217 tCO_2e Noted that there is no fossil fuel consumption in the project activity.
Findings	CL 03 1. The equation used for the calculation of PE y, s, final is not as per the equation provided in the MR. 2. In the ER spread sheets for the calculation of MEP y, ww, treatement , the formula does not use MCFww,j 3. %CH4 – upper . for the year 2016 lower value is used. For more details, please refer to Appendix-4 of this report CL3 is closed.
Conclusion	RINA confirms that the project emissions have been appropriately calculated and are consistent with site visit observations, the applied methodology, registered PDD and the previous verification reports **/09/, /01/, /05/.**

E.8.3. Calculation of leakage GHG emissions

Means of verification	Leakage emissions has to be considered only when energy generating equipment is transferred from another activity. Since the project activity employs a new set of equipment/, leakage emissions is neglected, which is as per the registered PDD/01/.
Findings	N/A
Conclusion	N/A

E.8.4. Summary calculation of GHG emission reductions or net anthropogenic GHG removals by sinks

Means of verification	For the conservative estimation of emission reduction calculation, the following approaches are applied and the lowest value is taken into account. - COD approach $ER (COD) = BE_{y,el} + BE_{y,ww} - PE_y$ - Biogas approach $ER (Biogas) = BE_{y,ww\ (biogas)} - PE_y$ **$BE_{y,ww}$ (biogas) = Q_{biogas} * $\%CH_4$ * D_{CH4} * Flare efficiency * GWP_{CH4}** Noted that values from the COD approach is considered , which is conservative. Emission Reductions =162, 964 tCO_2e
Findings	CL 4 The equations used for COD approach and biogas approach and the minimum of the two considered in the ER calculations is not transparent in the MR. For more details, please refer to Appendix-4 of this report CL4 is closed.
Conclusion	The data presented in the monitoring report /**01**/ and emission reduction worksheet /03/ were assessed by reviewing in detail project documentation, collection of monitored data, observation of established monitoring and reporting practices and assessment of the reliability of monitoring equipment. Sufficient evidences were presented and verified by RINA for the reported emission reductions as listed above. RINA confirms: - All the data and parameters were monitored in accordance with the registered PDD; - The data reported in the emission reductions calculation spreadsheet were cross-checked with the raw data and the values reported in the monitoring report were verified against the data presented in the spreadsheet; - The calculation of emission reductions have been carried out in accordance with the formulae and methods described in the registered PDD, the applied methodology and methodological tool; Emission factor and default values have been applied in the calculation in

	accordance with the registered PDD.

E.8.5. Comparison of actual GHG emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD

Means of verification	The emission reductions from the project for the monitoring period as reported in the monitoring report revision 2 of 29/12/2017 /**02**/ is equivalent to 162,964 tCO_{2e} while the emission reductions estimated ex-ante accounts to 136,871 $tCO_{2e.}$ Noted that the difference is because of the following: - GWPCH4 : The value has been revised from 21 to 25. According to EB 69 Annex 3, the second commitment period GWP shall be effective from 01/01/2013.
Findings	Please refer to section E.8.1 and E.8.2 For more information, please refer to Appendix-4 of the report. CL2 and CL3 are closed.
Conclusion	The actual emission reductions are 19% more than the expectations stated in the registered PDD.

E.8.6. Remarks on difference from estimated value in registered PDD

Means of verification	The reported emission reductions higher than the estimated emission reduction due to operational reasons
Findings	CL 5 The reported emission reductions are 162,964 which is more than 136,871. However, section E.5 of the MR is inconsistent with the ER spread sheets. PP is further requested to justify increase in emission reduction compared to estimated emission reductions with evidences. For more details, please refer to Appendix-4 of this report CL5 is closed.
Conclusion	The emission reductions from the project for the monitoring period as reported in the monitoring report revision 2 of 29/12/2017 /**02**/ is equivalent to 162,964 tCO_{2e} while the emission reductions estimated ex-ante accounts to 136,871 $tCO_{2e.}$ Noted that the difference is because of the following: - GWPCH4 : The value has been revised from 21 to 25. According to EB 69 Annex 3, the second commitment period GWP shall be effective from 01/01/2013. The same was checked and accepted by RINA.

E.8.7. Actual GHG emission reductions or net anthropogenic GHG removals by sinks during the first commitment period and the period from 1 January 2013 onwards

Means of verification	GHG emission reductions or net GHG removals by sinks reported up to 31 December 2012	GHG emission reductions or net GHG removals by sinks reported from 1 January 2013 onwards
	NA	162,964 tCO_2e
Findings	Please refer to section E.8.1 and E.8.2 For more information, please refer to Appendix-4 of the report. CL2 and CL3 are closed.	
Conclusion	The actual monitoring period does not fall into the first commitment period.	

E.9. Assessment of reported sustainable development co-benefits

Means of verification	N/A
Findings	N/A
Conclusion	N/A

E.10. Global stakeholder consultation

Means of verification	N/A
Findings	N/A
Conclusion	N/A

SECTION F. Internal quality control

>> The draft final verification report before being submitted to request for issuance was subjected to an independent internal technical review to confirm that all verification activities had been completed according to the pertinent RINA instructions. The technical review was performed by a technical reviewer(s) qualified in accordance with RINA's qualification scheme for CDM validation and verification.

SECTION G. Verification opinion

>> RINA Service Spa (RINA) has performed verification of the emission reductions reported for the project activity "Bangna Starch Wastewater Treatment and Biogas Utilization Project" project in Thailand, CDM Registration Reference N° 2556, for the period 01/08/2013 to 09/11/2016 (Both days are included), with regard to the relevant requirements for CDM activities.
The project participants of the "Bangna Starch Wastewater Treatment and Biogas Utilization Project" are responsible for:

- the preparation of greenhouses gas emissions data and the reported greenhouse gas emission reductions from the project on the basis set out in the monitoring plan contained in the registered project design document version Version 4.0 of 11/08/2011.
- the development and maintenance of records and reporting procedures in accordance with that plan, including the calculation and determination of greenhouse gas emission reductions of the project .

It is the responsibility of RINA to express an independent verification opinion about the project's conformity with the requirements of paragraph 62 of the CDM modalities and procedures and on the reported greenhouse gas emission reductions from the project.

Based on documented evidence and corroborated by an on-site assessment RINA can confirm that:

- the project has been implemented and operated as per the registered PDD;
- the monitoring report and other supporting documents provided are complete and verifiable and in accordance with the applicable CDM requirements;
- the monitoring is in place as per the applied baseline and monitoring methodology;
- the monitoring complies with the monitoring plan in the registered PDD;
- the monitoring plan in the registered PDD is as per the applied baseline and monitoring methodology.

SECTION H. Certification statement

>> >> It is RINA's opinion that the GHG emission reduction stated in the monitoring report version 2 of 29/12/2017 for the "Bangna Starch Wastewater Treatment and Biogas Utilization Project" project in Thailand for the period 01/08/2013 to 09/11/2016 (Both days are included) are fairly stated. The GHG emission reductions were calculated correctly on the basis of the approved monitoring methodology "AMS-III.H: Methane recovery in wastewater treatment, version 09 of 14/03/2008 and AMS-I.D – Grid connected renewable electricity generation, version 13 of 14/12/2007 and the monitoring plan contained in the registered PDD.

Hence RINA is able to certify that the emission reductions from the project during the monitoring period 01/08/2013 to 09/11/2016 is 162,964, tCO_2e.

Appendix 1. Abbreviations

Abbreviations	Full texts
BE	Baseline Emissions
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CDM M&P	Modalities and Procedures CDM
CER(s)	Certified Emission Reduction(s)
CH4	Methane
CL	Clarification Request
CO2	Carbon dioxide
CO2e	Carbon dioxide equivalent
CRT	Coordination and Technical Control Staff
DCI	Certification Division of RINA Services Spa
DNA	Designated National Authority
DOE	Designated Operational Entity
EB	Executive Board
ER	Emission Reductions
FAR	Forward Action Request
GHG(s)	Greenhouse gas(es)
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
JMR	Joint Meter Report
LoA	Letter of Approval
MoV	Means of Verification
MR	Monitoring Report
NGO	Non-governmental Organization
ODA	Official Development Assistance
PPRCL	P and Papop Renewable Co., Ltd.
PDD	Project Design Document
PE	Project Emission
PEA	Provincial Electricity Authority
PP(s)	Project Participant(s)
PPA	Power Purchase Agreement
Ref.	Document Reference
RINA	RINA Services Spa
SS(s)	Sectoral Scope(s)
SPCAML	South Pole Carbon Asset Management Ltd.
TA(s)	Technical Area(s)
UNFCCC	United Nations Framework Convention on Climate Change
VVS	Validation and Verification Standard

Appendix 2. Competence of team members and technical reviewers

RINA

CERTIFICATO DI QUALIFICA
QUALIFICATION CERTIFICATE

Si attesta che il sig./sig.ra: *We declare that Mr/Mrs/Ms:*	**Rekha Menon**
è qualificato come[1]: *is qualified as:*	**CDM–TEC, –VAL, -VER, -TL ITRP**
per le seguenti aree tecniche: for the following technical areas:	**1.2, 2.1, 13.1, 13.2, 14.1**

AREE TECNICHE TECHNICAL AREAS	DESCRIZIONE DELL'AREA TECNICA *TECHNICAL AREA DESCRIPTION*	SCOPO SETTORIALE *SECTORAL SCOPE*
1.2	Renewables	1
2.1	Energy Demand	2
13.1	Solid Waste and wastewater	13
13.2	Manure	13
14.1	Afforestation and reforestation	14

in accordo alle istruzioni dell'unita Sostenibilità & Cambiamenti Climatici.
in accordance with the instructions of the Sustainability & Climate Change Unit.

REVISIONE *REVISION*	DATA *DATE*	MOTIVAZIONI PER LA REVISIONE *REASON FOR THE REVISION*
0	06-03-2008	-
11	31/03/2017	Update qualification as ITRP

Il Resp. QPT
Head of QPT

[1] Legend:

VAL:	Validator	CDM: Clean Development Mechanism
VER:	Verifier	VCS : Verified Carbon Standard:
TEC:	Technical Expert	GS: Gold Standard
TL:	Team Leader	SCS: SocialCarbon Standard
FIN-EXP:	Financial Expert	JI: Joint Implementation
DET:	Determiner	

RINA Services S.p.A. è accreditato da UNFCCC, quale Entità Operativa Designata (DOE), per condurre la Validazione e la Verifica di Progetti CDM, da VCSA per condurre la Validazione e la Verifica di Progetti VCS, da GS Foundation, per condurre la Validazione e la Verifica di Progetti GS, da Ecologica Institute per condurre la Validazione e la Verifica di rapporti SCS

RINA Services S.p.A. is accredited by the UNFCCC, as Designated Operational Entity (DOE), to carry out Validation and Verification of CDM Projects, by the VCSA, to carry out Validation and Verification of VCS Projects, by the GS Foundation, to carry out Validation and Verification of GS Projects and by the Ecologica Institute, to carry out Validation and Verification of SCS Reports

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RINA

CERTIFICATO DI QUALIFICA
QUALIFICATION CERTIFICATE

Si attesta che il sig./sig.ra: **Amalorpavanathan Cyril Augustus Arokiasamy**

We declare that Mr/Mrs/Ms:

è qualificato come[1]: **CDM-TEC, CDM-VAL, CDM-VER, CDM-TL, ITRP**
is qualified as:

per le seguenti aree tecniche: **1.1, 1.2, 3.1, 5.1, 13.1**
for the following technical areas:

AREE TECNICHE TECHNICAL AREAS	DESCRIZIONE DELL'AREA TECNICA *TECHNICAL AREA DESCRIPTION*	SCOPO SETTORIALE *SECTORAL SCOPE*
1.1	Thermal energy generation	1
1.2	Renewables	1
3.1	Energy Demand	3
5.1	Chemical industry	5
13.1	Solid Waste and wastewater	13

in accordo alle istruzioni della Divisione Certificazione.
in accordance with the instructions of the Certification Division.

REVISIONE *REVISION*	DATA *DATE*	MOTIVAZIONI PER LA REVISIONE *REASON FOR THE REVISION*
0	30/06/2010	-
13	31/03/2017	Updated qualification as ITRP

Il Resp. QPT
Head of QPT

[1] Legend:

VAL:	Validator	CDM: Clean Development Mechanism
VER:	Verifier	VCS : Verified Carbon Standard:
TEC:	Technical Expert	GS: Gold Standard
TL:	Team Leader	SCS: SocialCarbon Standard
FIN-EXP:	Financial Expert	JI: Joint Implementation
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RINA Services S.p.A. è accreditato da UNFCCC, quale Entità Operativa Designata (DOE), per condurre la Validazione e la Verifica di Progetti CDM, da VCSA per condurre la Validazione e la Verifica di Progetti VCS, da GS Foundation, per condurre la Validazione e la Verifica di Progetti GS, da Ecologica Institute per condurre la Validazione e la Verifica di rapporti SCS

RINA Services S.p.A. is accredited by the UNFCCC, as Designated Operational Entity (DOE), to carry out Validation and Verification of CDM Projects, by the VCSA, to carry out Validation and Verification of VCS Projects, by the GS Foundation, to carry out Validation and Verification of GS Projects and by the Ecologica Institute, to carry out Validation and Verification of SCS Reports

GHG_QUAL_CERT_EN_04_12 Page 1 of 1

RINA

CERTIFICATO DI QUALIFICA
QUALIFICATION CERTIFICATE

Si attesta che il sig./sig.ra: / *We declare that Mr/Mrs/Ms:* **Thais De Lima Carvalho**

è qualificato come[1]: / *is qualified as:* **CDM -TEC, -VAL, -VER, -TL ITRP**

per le seguenti aree tecniche: / *for the following technical areas:* **1.1, 1.2, 2.1, 13.1**

AREE TECNICHE *TECHNICAL AREAS*	DESCRIZIONE DELL'AREA TECNICA *TECHNICAL AREA DESCRIPTION*	SCOPO SETTORIALE *SECTORAL SCOPE*
1.1	Thermal energy generation	1
1.2	Renewables	1
2.1	Electricity distribution	2
13.1	Solid waste and wastewater	13

in accordo alle istruzioni della Divisione Certificazione.
in accordance with the instructions of the Certification Division.

REVISIONE *REVISION*	DATA *DATE*	MOTIVAZIONI PER LA REVISIONE *REASON FOR THE REVISION*
0	19-08-2009	-
13	31-03-2017	Added qualification as ITRP

Il Resp. QPT
Head of QPT

[1] Legend:
VAL: Validator
VER: Verifier
TEC: Technical Expert
TL: Team Leader
FIN-EXP: Financial Expert
DET: Determiner
CDM: Clean Development Mechanism
VCS : Verified Carbon Standard:
GS: Gold Standard
SCS: SocialCarbon Standard
JI: Joint Implementation

RINA Services S.p.A. è accreditato da UNFCCC, quale Entità Operativa Designata (DOE), per condurre la Validazione e la Verifica di Progetti CDM, da VCSA per condurre la Validazione e la Verifica di Progetti VCS, da GS Foundation, per condurre la Validazione e la Verifica di Progetti GS, da Ecologica Institute per condurre la Validazione e la Verifica di rapporti SCS

RINA Services S.p.A. is accredited by the UNFCCC, as Designated Operational Entity (DOE), to carry out Validation and Verification of CDM Projects, by the VCSA, to carry out Validation and Verification of VCS Projects, by the GS Foundation, to carry out Validation and Verification of GS Projects and by the Ecologica Institute, to carry out Validation and Verification of SCS Reports

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Appendix 3. Documents reviewed or referenced

No.	Author	Title	References to the document	Provider
1	SPCAML	CDM-SSC-PDD for the project activity titled "Bangna Starch Wastewater Treatment and Biogas Utilization Project"	Version 3.1 of 25/09/2009 Version 4.0 of 11/08/2011	PP
2	SPCAML	Monitoring report for project activity "Bangna Starch Wastewater Treatment and Biogas Utilization Project" in Thailand.	Version 1 of 01/08/2017 Version 2 of 29/12/2017	PP
3	SPCAML	Emission reduction calculations provided in the form of a spreadsheet, (084_Bangna_3rd ER_01082017.xlsx) Emission reduction calculations provided in the form of a spreadsheet (084_Bangna_3rd ER_v2_29122017_edited. xlsx)	version 01 of 01/08/2017 Version 2 of 29/12/2017	PP
4	TÜV NORD CERT GmbH	validation report , Report nº 8000353483-07/168	Version 2 of 10/11/2009	Others
5	Germanischer Lloyd Certification	2nd Verification report	Version 06 of 11/11/2013	Others
6	CDM Executive Board	CDM project standard for project activities	Version 01.0 of 03/03/2017	Others
7	CDM Executive Board	CDM validation and verification standard for project activities	Version 01.0 of 03/03/2017	Others
8	CDM Executive Board	CDM Executive Board: "AMS-III.H", " methane recovery in waste water treatment"	version 09 of 14/03/2008	Others
9	CDM Executive Board	Baseline and monitoring methodology "AMS-I.D", "Grid connected renewable electricity generation"	Version 13 of 14/12/2007	Others
10	RINA Services SpA:	Stakeholders/Endusers Interview sheet	dated 10/11/2016	RINA
11	Envi Science company Ltd	Colorimeter (se.no: 070290C62433) calibration test certificates	08/05/2013 29/04/2014 22/04/2015 19/02/2016	PP

12	Endress+ Hauser	Calibration test certiifcates if se.no 93120819000 (FM1)	19/06/2013 21/05/2014	PP
13	Endress+ Hauser	Calibration test certiifcates if se.no J9095D120000 (FM1)	26/05/2015 18/05/2016	PP
14	Endress+ Hauser	Calibration test certiifcates if se.no 9502C002000 (GM1)	19/06/2013 21/05/2014 26/05/2015 18/05/2016	PP
15	Endress+ Hauser	Calibration test certiifcates if se.no A9059702000 (GM1)	26/05/2015 18/05/2016	PP
16	Endress+ Hauser	Calibration test certiifcates if se.no, 9A070502000 (GM3)	20/06/2013 21/05/2014 26/05/2015 18/05/2016	PP
17	Endress+ Hauser	Calibration test certiifcates if se.no, 9502C102000 (GM2)	19/06/2013 21/05/2014 26/05/2015 18/05/2016	PP
18	Provincial Electricty Authority	Calibration test certificates of export (205055798) and import meter (212054801)	21/06/2013 08/07/2014 24/06/2015 11/07/2016	
19	CDM Executive Board	CDM Executive Board: CDM-MR-FORM	version 06.0 of 07/06/2017	-
20	CDM Executive Board	Attachment “Instructions for filling out the monitoring report form”.	version 06.0 of 07/06/2017	-
21	P & Papop Renewable Co.,Ltd.	Plant log sheets for methane content for the period 01/08/2013 – 09/11/2016	-	PP
22	P & Papop Renewable Co.,Ltd.	Plant log sheets on COD analysed for the period 01/08/2013 – 09/11/2016	-	PP
23	P & Papop Renewable Co.,Ltd.	Plant log sheets for FM and GM for the period 01/08/2013 – 09/11/2016	-	PP
24	Provincial Electricty Authority	Export and import meter readings from August 2013 to June 2016	-	pp
25	IPCC	Fourth Assessment Report	http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-	Others

			10-2.html in English language retrieved on 04/11/2016.	
26	P & Papop Renewable Co.,Ltd.	Internal record of reset of meter FM1	Dated 27/11/2017	
27	central laboratory (Thailand) co ltd	External lab reports for the period 01/08/2013 – 09/11/2016		
28	Central bureau of weights and measureas	Calibration certificates for S/N E07512-0201	Dated 12/06/2012 16/10/2014 14/09/2016	
29	Geotech Laboratory	Portable gas analyser : calibration certificates G501076	26/03/2013 03/10/2014 24/08/2015	
30	P & Papop Renewable Co.,Ltd.	Reports from SCADA for the period 01/08/2013 -09/11/2016		
31	P & Papop Renewable Co.,Ltd	Installation of new temperture sensor	27/08/2015	
32	Sang Chai meter (calibration laboratory),	Thermocouple type N : SP08071880025	26/08/2013	
33	GIIC calibration laboratory	Thermocouple type K : 33508001	17/03/2016	

Appendix 4. Clarification requests, corrective action requests and forward action requests

Table 1. Remaining FAR from validation and/or previous verification

FAR ID	N/A	**Section no.**	E.2	**Date:** DD/MM/YYYY
Description of FAR				
Project participant response				**Date:** DD/MM/YYYY
Documentation provided by project participant				
DOE assessment				**Date:** DD/MM/YYYY

Table 2. CL from this verification

CL ID	01	Section no.	E.6.2	Date: 24/10/2017
Description of CL				

CL 1

$Q_{y,ww}$

1. As per the log sheets for 2014 it is 718,353 and for 2016 it is 6,61,747, which is not consistent with ER spread sheets. PP to check and confirm.
2. During the site visit, it was checked that the meter 93120819000 is replaced with meter J9095D120000. However, the same is not transparent in the MR. PP is to clarify the dates of meter replacement along with evidences.

$COD_{y,removed,j}$:

3. The values provided in the MR is not consistent with the values given in the ER sheets.

$COD_{y,ww,treated}$:

4. PP is requested to provide the monthly reports of COD provided by external lab.

$S_{y,final}$:

5. Noted that there is a calibration frequency mentioned in the table is once in two years and in the QA/QC procedures it is once in three years. PP is requested to clarify the inconsistency and also provide the calibration certificates.

% CH_4:

6. PP is requested to provide the calibration certificates of portable gas analyser for the current monitoring period.

$Q_{biogas,total,y}$:

7. Noted that there is a calibration delay from 21/05/2015 to 26/05/2015, which is not transparent in the MR and ER spread sheets. PP is requested to clarify on how the delay is justified.

$Q_{biogas,flare,y}$:

8. PP is requested to correct the calibration dates in the MR for the year 2015.The values for the year 2014 is not consistent with the figures provided in ER spread sheets.

T_{flare}:

9. Pls provide the calibration test report for the year 2013.

EC_y, EG_y:

10. Pls provide the PEA reports for the months from July to October 2016.

Project participant response	Date: 29/12/2017

$Q_{y,ww}$

1. The following details has been provided as per the log sheets for 2014 and 2016.
   2014:
   First totalized value on 01/01/2014: 915,009
   Last totalized value on 27/01/2014 (before resetting): 1,569,100
   Last totalized value on 01/01/2015: 67,237
   The total value for 2014 = [(1,569,100 – 915,009) + 67,237] = *721,328*
   2016:
   First totalized value on 01/01/2016:
   Last totalized value on 10/11/2016:
   The total value for 2016 = (1,406,965 – 741,990) = *664,975*
   Therefore, the total values for 2014 and 2016 as per the log sheet is consistent with the value in the ER spread sheet.
2. The date for period of use for each meter has been mentioned in the MR. Further, the evidence supported the meter replacement is provided to DOE.

$COD_{y,removed,j}$:

3. The value of $COD_{y,removed,j}$ in 2013 has been corrected in the ER sheet which is consistent with the value in the MR.

$COD_{y,ww,treated}$:

4. The monthly reports of COD in the last lagoon have been provided to DOE.

$S_{y, final}$:

5. The calibration frequency has been revised to once in three years as per the QA/QC procedures in the registered PDD. Further, the calibration records and certificates have been provided to DOE.

% CH_4:

6. The calibration certificates of the portable gas analyzer for the current monitoring period (2013, 2014 and 2015) have been provided to DOE.

$Q_{biogas,total,y}$:

7. As per the calibration records, there was the calibration delay for GM1 (S/N9502C002000) for the period from 21/05/2015 - 25/05/2015. However, since the data of $Q_{biogas,total,y}$ was not used for the calculation of emission reductions, the identified maximum error was not applied during the period.

$Q_{biogas, flare, y}$:

8. The calibration date for the year 2015 has been corrected to be 26/05/2015 in line with the calibration certificate and the value for the year 2014 in the MR has been revised as per the ER spread sheet.

T_{flare}:

9. The calibration certificates of the

EC_y, EG_y:

10. The PEA reports for the months from July to October 2016 have been provided to DOE.

Documentation provided by project participant

- Log sheet November 2016
- Internal note for change of FM1
- Monthly test reports of COD in the last lagoon by external lab for the monitoring period
- The calibration record and certificate of weighing machine
- Calibration certificates of the portable gas analyser for 2013, 2014 and 2015
- Calibration certificates of the thermocouple for 2013 and 2016, Internal note for change of thermocouple in 2015
- PEA reports for the months from July to October 2016

DOE assessment	**Date:** 11/02/2018

1. ER spread sheets were made consistent with log sheets checked and accepted.
2. Meter 93120819000 is replaced with meter J9095D120000 on 27/11/2014. Checked internal record and accepted.
3. The values provided in the MR is made consistent with the values provided in ER sheets.
4. Checked with the lab reports issued by third party “central laboratory (Thailand) co ltd”. Same is accepted.
5. Calibration frequency is made consistent with the registered PDD, which is once in 3 years.
6. Calibration certificates of the portable gas analyser dated 26/03/2013, 03/10/2014, 24/08/2015 checked.
7. Justification provided by the PP is accepted.
8. MR checked and note that the dates of calibration and the values mentioned for the year 2014 has been corrected.
9. Calibration test reports done by Sang Chai meter (calibration laboratory), dated 26/08/2013 checked and accepted.
10. It is noted that the data was recorded jointly by PEA and project representative as a monthly basis and the end of monitoring period is on 9th Nov. Therefore, the monitored value for Nov is included in the EC value and excluded from the EG value for conservativeness. Same is accepted and closed.

CL 1 is closed.

CL ID	02	**Section no.**	E.8.1	**Date:** 24/10/2017

Description of CL

CL 2

COD y, removed, j in ERs sheet is not consistent in cell no E8 and M13.

Project participant response	**Date:** 29/12/2017

The value of $COD_{y,removed,j}$ in cell E8 has been revised in line with the value in cell M13.
Documentation provided by project participant
Revised ER spread sheet
DOE assessment **Date:** 11/02/2018
Revised ER spread sheets checked and the same is accepted.

CL ID	03	**Section no.**	E.8.2	**Date:** 24/10/2017
Description of CL				
CL 2 1. The equation used for the calculation of PE y, s, final is not as per the equation provided in the MR. 2. In the ER spread sheets for the calculation of MEP y, ww, treatement , the formula does not use MCFww,j 3. %CH4 – upper. for the year 2016 lower value is used.				
Project participant response				**Date:** 29/12/2017
1. The equation used for the calculation of $PE_{y,s,final}$ has been revised in line with the equation provided in the MR. 2. The calculation of $MEP_{y,ww,treatment}$ has been revised to apply $MCF_{ww,j}$ to the formula. 3. The upper value of $\%CH_4$ has been applied for the calculation of $PE_{y,flare}$ for the year 2016.				
Documentation provided by project participant				
Revised ER spread sheet				
DOE assessment				**Date:** 11/02/2018
Revised ER spread sheets checked and accepted. CL 03 is closed.				

CL ID	04	**Section no.**	E.8.4	**Date:** 24/10/2017
Description of CL				
CL 4 The equations used for COD approach and biogas approach and the minimum of the two considered in the ER calculations is not transparent in the MR.				
Project participant response				**Date:** 29/12/2017
The description of the COD and biogas approach and the minimum of the two considered in the ER calculations has been provided in section E.3 of the MR.a				
Documentation provided by project participant				
Revised MR				
DOE assessment				**Date:** 11/02/2018
The equations used for COD approach and biogas approach and the minimum of the two considered in the ER calculations has been updated in the MR. CL 4 is closed.				

CL ID	05	**Section no.**	E.8.6	**Date:** 24/10/2017
Description of CL				

CL 5 The reported emission reductions are 159,614, which is more than 136,871. However, section E.5 of the MR is inconsistent with the ER spread sheets. PP is further requested to justify increase in emission reduction compared to estimated emission reductions with evidences.
Project participant response **Date:** 29/12/2017
Since the ER calculation has been revised, the reported emission reductions have been 162,964 and the same value has been updated in section E.5 of the MR, which is greater than the estimated given in the registered PDD. The reasoning on the difference is the revised value of two fixed parameters as follows. - GWP_{CH4} : The value has been revised from 21 to 25. According to EB 69 Annex 3, the second commitment period GWP shall be effective from 01/01/2013. The same explanation of the increased in the achieved ERs has been provided in section E.6 of the MR.
Documentation provided by project participant
N/A
DOE assessment **Date:** 11/02/2018
RINA confirms that the justification provided by PP is acceptable. The difference in the amount was due the change in value for GWP and $Bo_{,ww}$. CL 5 is closed.

Table 3. CAR from this verification

CAR ID	N/A	**Section no.**		**Date:** DD/MM/YYYY
Description of CAR				
Project participant response				**Date:** DD/MM/YYYY
Documentation provided by project participant				
DOE assessment				**Date:** DD/MM/YYYY

Table 4. FAR from this verification

FAR ID	N/A	**Section No.**		**Date:** DD/MM/YYYY
Description of FAR				
Project participant response				**Date:** DD/MM/YYYY
Documentation provided by project participant				
DOE assessment				**Date:** DD/MM/YYYY

- - - - -

Document information

Version	*Date*	*Description*
02.1	11 January 2018	Editorial revision to correct the numbering of appendices in the instructions.
02.0	31 October 2017	Revision to align with the requirements of the “CDM validation and verification standard for project activities” (version 01.0).
01.0	23 March 2015	Initial publication.

Decision Class: Regulatory
Document Type: Form
Business Function: Issuance
Keywords: project activities, verifying and certifying