MONITORING REPORT FORM (CDM-MR) *
Version 01 - in effect as of: 28/09/2010

CONTENTS

MONITORING REPORT
Version 1 and date 28/02/2011

Bangna Starch Wastewater Treatment and Biogas Utilization Project
Reference number 2556
Monitoring period number 01 and dates 10/11/2009 - 31/12/2010 (first and last days included)

SECTION A. General description of the project activity

A.1. Brief description of the project activity: >>

The proposed project activity consists of the installation of an upflow anaerobic sludge blanket technology (UASB) biogas reactor, tapioca pulp treatment 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 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 within the lagoon are the result of lagoon depth (>2m) and an average atmospheric temperature of about 28°C). The biogas reactor system is expected to handle a wastewater flow rate of 3,750m^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 EGAT electricity grid. Therefore, the project activity will reduce green house gases due to avoidance of methane emissions from the existing lagoon system and displacement of fossil fuel based electricity from the grid.

The proposed project will be implemented by P&Papop Renewable Co. Ltd. on a BOOT (Build Own Operate Transfer) basis at the Yangthalat starch production facility of Bangna Tapioca Flour Co., Ltd.

This means that P&Papop Renewable Co. Ltd. is responsible for arranging finance, constructing and operating the project. As the owner of the wastewater treatment plant, P&Papop Renewable Co. Ltd. will be the entity entitled to all the emission reductions generated from the project.

The relevant dates for the project activity are:

Event	Date
Construction of the project activity[1]	20/07/2006
Commissioning of UASB[2]	10/2007
Commissioning of gas engines[3]	21/12/2007
UNFCCC Registration[4]	10/11/2009
Gold Standard registration[5]	25/06/2010

[1] Purchase order

[2] The commissioning certificate by Papop Co.,Ltd.

[3] The commissioning test report by Guascor

[4] See: http://cdm.unfccc.int/Projects/DB/RWTUV1241593452.75/view

[5] See: https://gs1.apx.com/mymodule/ProjectDoc/EditProjectDoc.asp?id1=565

Further background information on the project activity can be found in the registered Project Design Document under following link:
http://cdm.unfccc.int/Projects/DB/RWTUV1241593452.75/view

Total emission reductions achieved in this monitoring period are 28,905 tCO2e.

A.2. Project Participants

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Thailand (host)	P & Papop Renewable Co.,Ltd.	No
Switzerland	South Pole Carbon Asset Management Ltd	No

A.3. Location of the project activity:

The project site is located at 45 Rimmaenumparn, Theenanon Road, Yangthalat, Kalasin Thailand.

The coordinates of the project, are: Latitude 16°23'7.71"N and Longitude 103°28'21.28"E

A.4. Technical description of the project

The technology to be implemented by the project activity is an Upflow Anaerobic Sludge Blanket (UASB) system. Developed in the late 1970's, it is an internationally recognized "high rate" anaerobic treatment technology known for its effectiveness in the treatment of high strength organic wastewater from such operations as food processing and distilleries. The UASB system is built, owned and operated by the Thai engineering company, Papop Co., Ltd. Since it has started its business in 1997, it has accumulated know- how and experiences in construction of biogas production and utilization system.

In the UASB process, 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 hydraulic turbulence caused by produced biogas bubbles provides mixing in the digester. The high sedimentation velocity of biological granules formed in the digester prevents washout of the sludge granules, leading to longer sludge retention time in the digester.

Through the utilization of this advanced technology, the Project will be able to achieve approximately 90% removal of COD, significantly reducing the COD load to the open lagoons, which subsequently receive effluent from the UASB digester.

The biogas will be used as fuel in a number of power generators (gensets) consisting of a biogas fired engine and an alternator, to generate maximum about 2,850 kWe electricity.

To combust the excess biogas, a closed flare system is installed. Flaring starts automatically whenever biogas is diverted to the flare equipment, which contains automatic ignition system and other safety devices to ensure that the biogas is always combusted

Sludge generated during the wastewater treatment process will be treated by land application.

For more details about the technical process, please refer to the flow diagram provided in Section C.

A.5. Title, reference and version of the baseline and monitoring methodology applied to the project activity:

Methane avoidance component:

The approved CDM small-scale baseline and monitoring methodology AMS III.H “Methane Recovery in Wastewater Treatment” (Version 09) is applied to the methane avoidance component of the project activity.

Electricity generation component:

The approved CDM small-scale baseline and monitoring methodology AMS-I.D “Grid connected renewable electricity generation” (Version 13) is applied to the electricity generation component of the project activity.

For more information on both methodologies, please refer to the link:
http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html

A.6. Registration date of the project activity:

The registration date of the project activity: 10/11/2009

A.7. Crediting period of the project activity and related information (start date and choice of crediting period):

The start date of the crediting period is the registration date of the project: 10/11/2009
Length of the first (renewable) crediting period is 7 years.

A.8. Name of responsible person(s)/entity(ies):

The contact information of the person/entity responsible for completing the monitoring report form (CDM-MR).

Patrick Bürgi
South Pole Carbon Asset Management Ltd.
Technoparkstrasse 1
CH-8005 Zurich, Switzerland

SECTION B. Implementation of the project activity

B.1. Implementation status of the project activity

The background of the implementation status is listed in the table

Event	Date
Construction of the project activity	20/07/2006
Commissioning of UASB	10/2007
Commissioning of gas engines	21/12/2007
UNFCCC Registration	10/11/2009
Gold Standard registration	25/06/2010
Pre-CDM GS VERs Issuance	11/11/2010

During the monitoring period, the starch production capacity is less than the estimated production quantity in PDD. Thus, the wastewater generated volume is also lower than the expectation. Furthermore, the starch production is dependent on the availability of the raw material, which was not available throughout the monitoring period. As a consequence, the wastewater treatment was not operated continuously for the whole monitoring period.

B.2.	**Revision of the monitoring plan**

The monitoring plan shall be revised before issuance of this monitoring period. This section shall be updated once the revision of monitoring plan is done.

B.3.	**Request for deviation applied to this monitoring period**

There is no deviation applied to this monitoring period.

B.4.	**Notification or request of approval of changes**

There is no notification or request of approval of changes for the project activity as described in the registered PDD.

SECTION C. Description of the monitoring system

1. Monitoring Management

The monitoring system is based on meter readings recorded directly at the meter location and regular records of data measured in the laboratory at the project site. .

The log sheets are prepared as follows:

- The plant manager checks the data on regular basis, recording the readings on log sheets. The readings are then inserted in an excel file, where from the values from the log sheet are rechecked. This reduces the scope of errors during data transfer.
- Since the totalizer readings are reported in log sheets; any doubtful readings can be cross-checked against the running total of the meter. This ensures a high level of accuracy.

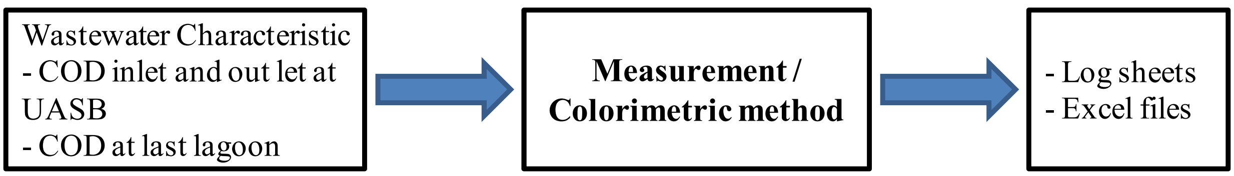
For more details about the QA/QC procedures for each monitoring parameter, please refer to the monitoring parameter tables provided in D.2.

2. Data Storage and Filing – Electric Workbook

The data collection

- Meter readings are recorded into log sheets by the plant operators on daily basis and transferred to electronic log files (excel files).

- The parameters monitored in the laboratory by the lab operator are entered into log sheets, which are later transferred to the electronic log file (excel files).



The data checking

The reporting of monitored parameters is done on daily basis by the plant operator in log sheets. The data is compiled and inserted by the responsible staff into an excel template (electronic log file). The consistency of the data in both log sheets and excel files is checked by the plant manager on a regular basis. The compiled excel report is further sent to the project consultant for detailed emission reduction analysis. The plant manager and project consultant interact on regular basis to discuss emission reduction reporting. The details of the reporting procedure are explained in more detail in the table, which summarizes the responsibility of the staff at the project site.

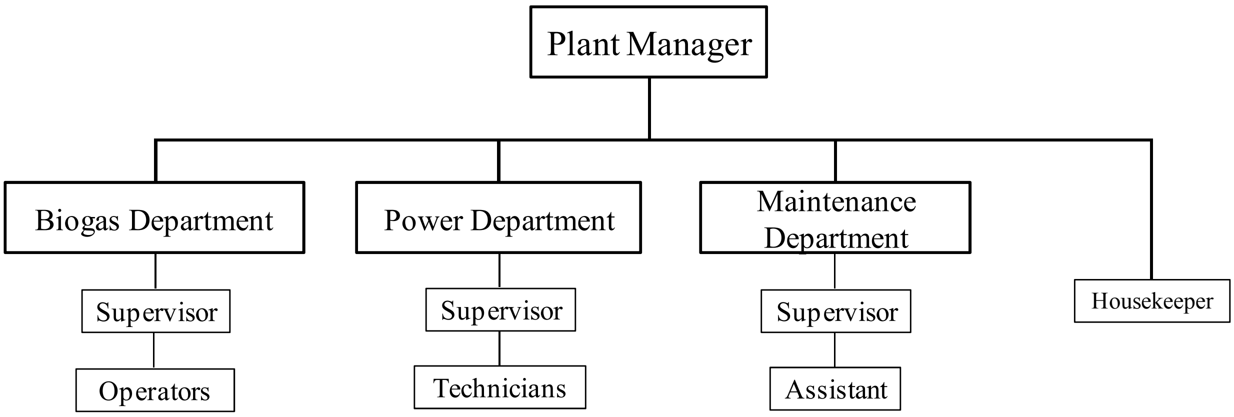


Figure 1: Organization chart

Roles and responsibilities

Roles	**Responsibilities**
Plant Manager	- Supervises the reports in form of log sheets and electronic log files - Approves the calibration plan - Assigns and approves the training plan - Approves the employment - Approves the purchase for equipment - Sends aggregated reports via email to the project consultant on a regular basis
Biogas department - Supervisor	- Checks the completeness of the parameters monitored in log sheets (i.e. Biogas Plant Log Sheet and Lab Data Sheet) and in the electronic log file (excel file) - Regularly backs up the electronic log files - Ensures the timely calibrations of the meters
Biogas department - Operator	- Logs the data monitored for biogas and power systems from the meter reading on the Biogas Plant Log Sheet on a daily basis - Takes samples and analyzes characteristics of wastewater, recording all test results in the Lab Data Sheet on daily basis
Power department - Supervisor	- Takes care for the operation of power system
Power department - Technician	- Assists the supervisor
Maintenance department - Supervisor	- Takes care for the installation of equipment - Ensures the preventive and corrective maintenance
Maintenance department - Assistant	- Assists the supervisor

Emergency procedures for the monitoring system

The staff of next shift shall be made aware of any event from the previous day or previous shift and plan to promptly handle the situation. In case of problem in any equipment or machine, the staff shall inform the project owner or the technical consultants to project for quick rectification of the problem.

Monitoring equipment of the project activity

Data / Parameter as in PDD	**Short description**	**Equipment**	**Tag no.**	**Serial no.**
$Q_{y, ww}$	Wastewater treated	Electromagnetic flowmeter	FM 1	93120819000
$COD_{y, removed, j}$	COD inlet of UASB COD outlet of UASB	Colorimeter	-	
$COD_{y, ww, treated}$	COD outlet of lagoon		-	
$S_{y, final}$	Amount of final sludge generated	Weighbridge, which belongs to the starch factory	-	
$\%CH_4$	Methane content in biogas	Biogas Check	-	BM11452
$Q_{biogas, total, y}$	Amount of biogas generated	Thermal mass flowmeter	GM 1	9502C002000
$Q_{biogas, flare, y}$	Amount of biogas flared	Thermal mass flowmeter	GM 3	9A070502000
$Q_{biogas, generator, y}$	Amount of biogas used at generators	Thermal mass flowmeter	GM 2	9502C102000
Flame detection period	Amount of minutes per hour where a flame has a higher temperature than 500C	Thermocouple	TT	-
EC_y	Electricity consumed	3 phase meter	PM4	402786
EG_y	Electricity generated	Electricity Meter	PM5	M10190010-00
		PEA’s meter	-	205055798
Period of biogas being sent to flare	Amount of minutes per hour where biogas is sent to the flare	SCADA record	-	-

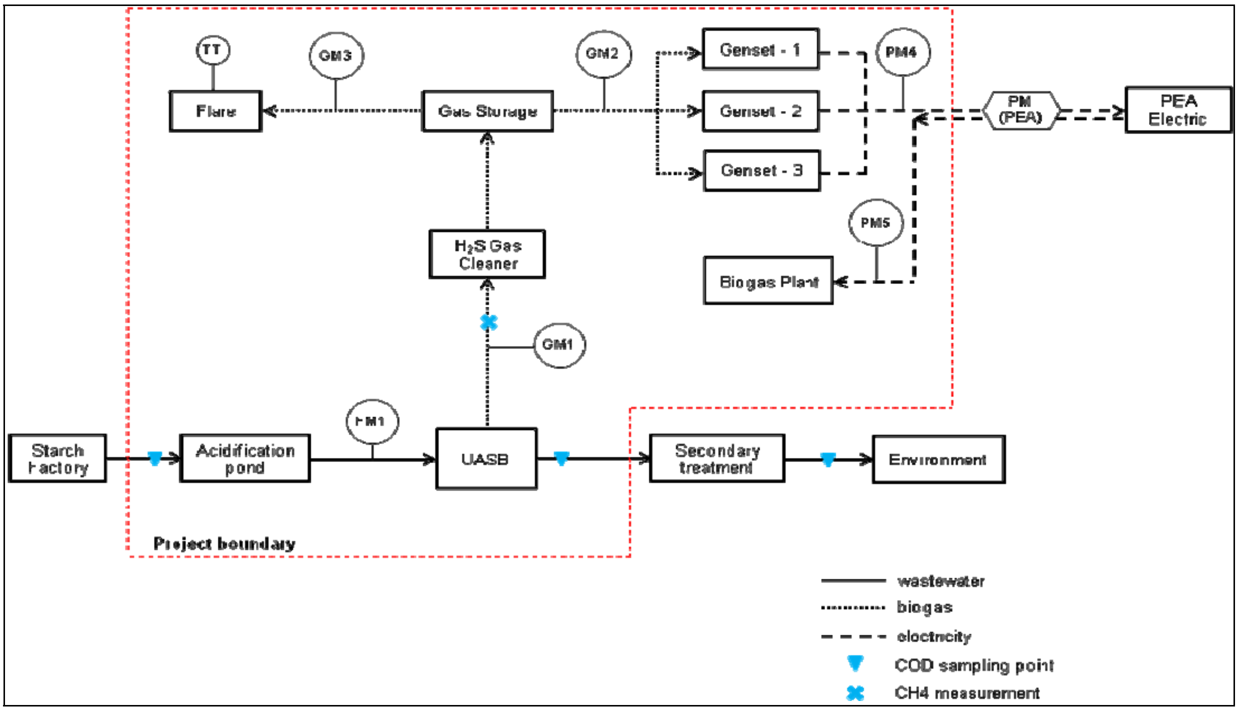


Figure 2: Flow diagram of the project activity

SECTION D. Data and parameters

D.1. Data and parameters determined at registration and not monitored during the monitoring period, including default values and factors

Data / Parameter:	**GWP_{CH4}**
Data unit:	
Description:	Global warning potential
Source of data used:	Intergovernmental Panel on Climate Change, Climate Change 1995: The Science of Climate Change (Cambridge, UK: Cambridge University Press, 1996)
Value(s) :	21
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	The data is used for baseline and project emission calculations.
Additional comment:	

Data / Parameter:	**$B_{o,ww}$**
Data unit:	kg CH_4/kg COD
Description:	IPCC default value, corrected as per methodology AMS III-H page – 4, is used for estimation
Source of data used:	IPCC default value
Value(s) :	0.21
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	The data is used for baseline and project emission calculations.
Additional comment:	As per AMS.III.H Version 09, the IPCC default value of 0.25 kg CH_4/kg COD was corrected to take into account the uncertainties.

Data / Parameter:	**MCF**

Data unit:	Fraction
Description:	Methane correction factor
Source of data used:	Table III.H.1 from AMS-III.H, Version 09 methodology and “Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site (version 02)”
Value(s) :	MCF $_{ww, treatment, i}$ = 0.8 (for baseline emissions) MCF $_{ww,l}$ = 1.0 (for project emissions from lagoon system) MCF $_{ww, final}$ = 0.2 (for wastewater released into river)
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	The values are used for baseline and project emission calculations.
Additional comment:	The original source of data can be checked for IPCC default value, Volume 5 Chapter 6, page 6.21. The lower value is used for conservative estimation of baseline emissions. All MCF values have been chosen in a conservative manner (highest values for project and lower for baseline) according to table III.H.1 from AMS-III.H, Version 09 methodology.

Data / Parameter:	**CFE $_{ww}$**
Data unit:	Fraction
Description:	Capture and flare efficiency of the methane recovery and combustion efficiency
Source of data used:	Default value specified in AMS-III.H, Version 09 methodology
Value(s) :	0.9
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	The data is used for project emission calculations.
Additional comment:	

Data / Parameter:	**EF $_{grid, y}$ = EF $_{y}$**
Data unit:	tCO_2/MWh
Description:	CO_2 emission factor of the Thailand grid
Source of data used:	Validated as part of registered PDD pdf version submitted.
Value(s) :	0.5057
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	The data is used for baseline and project emission calculations.
Additional comment:	

Data / Parameter:	**$[CH_4]_{y, ww, treated}$**
Data unit:	Tonnes/m^3
Description:	Dissolved methane content in the treated wastewater
Source of data used:	Methodology AMS-III.H
Value(s) :	0.0001
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	The data is used for baseline emission calculation.
Additional comment:	

D.2. Data and parameters monitored

Data / Parameter:	**$Q_{y, ww}$**
Data unit:	m^3
Description:	Volume of wastewater treated in the year y
Measured /Calculated /Default:	Accumulated value is measured continuously by the flow meter and calculation for daily value is done on a daily basis
Source of data:	Log sheet
Value(s) of monitored parameter:	**Monitoring period** / **Value** 2009 (10 Nov – 31 Dec): 37,334 2010 (1 Jan – 31 Dec): 527,576
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	The data is used for baseline and project emission calculations.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	**Tag no.**: FM1 **Equipment Type**: Electromagnetic flowmeter **Manufacturer**: Endress Hauser Flowtec AG **Model**: PROMAG 10W **Accuracy Level**: ±0.5%[6] **Serial No.**: 93120819000 **Calibration Frequency**: Annually **Date of previous calibration**: 28th March 2007, 30th November 2009 **Date of latest calibrations**: 21st September 2010 **Validity**: 20th September 2011
Measuring/ Reading/ Recording frequency:	The meter has continuous monitoring of the flow of wastewater. The accumulated reading shall be taken from the meter screen and recorded in the log sheet by the operator on a daily basis.
Calculation method (if applicable):	
QA/QC procedures applied:	Periodic calibration according to the equipment's specifications and applicable industrial standards.

Data / Parameter:	**$COD_{y,removed,i}$**
Data unit:	tonnes/m3
Description:	The chemical oxygen demand removed by the treatment system j i.e. project activity.
Measured /Calculated /Default:	Calculated value (Based on COD_{inlet} and COD_{outlet} readings)
Source of data:	Measured and recorded in log sheets, which is shown the test result of COD inlet and outlet The COD inlet and outlet content will be analyzed using a colorimetric method in the on-site laboratory of the treatment plant. The samples results will be logged manually in the plant operation report on a daily basis
Value(s) of monitored parameter:	**Monitoring period** / **Value**

[6] https://portal.endress.com/wa001/dla/50000000584/000/03/TI093DEN_1109.pdf

<table>
<tr><td></td><td><table><tr><td>2009 (10 Nov – 31 Dec)</td><td>12,194</td></tr><tr><td>2010 (1 Jan – 31 Dec)</td><td>16,678</td></tr></table></td></tr>
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<tr><td>Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)</td><td><table><tr><td>Equipment Type</td><td>Portable Colorimeter</td></tr><tr><td>Manufacturer</td><td>Hach</td></tr><tr><td>Model</td><td>DR/890</td></tr><tr><td>Accuracy Level</td><td>±0.24%[7]</td></tr><tr><td>Serial No.</td><td></td></tr><tr><td>Calibration Frequency</td><td>Annually</td></tr><tr><td>Date of previous calibration</td><td>-</td></tr><tr><td>Date of latest calibrations</td><td>-</td></tr><tr><td>Validity</td><td>-</td></tr></table></td></tr>
<tr><td>Measuring/ Reading/ Recording frequency:</td><td>Samples are taken every day and the analysis is performed at least once a day.</td></tr>
<tr><td>Calculation method (if applicable):</td><td>The daily $COD_{y, removed, i}$ is the difference between COD_{inlet} and COD_{outlet} readings at the digester.</td></tr>
<tr><td>QA/QC procedures applied:</td><td>The colorimetric method is well documented and well accepted either by national or international standards.</td></tr>
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<table>
<tr><td>Data / Parameter:</td><td>$COD_{y, ww, treated}$</td></tr>
<tr><td>Data unit:</td><td>Tonnes/m^3</td></tr>
<tr><td>Description:</td><td>Chemical oxygen demand of the wastewater prior to discharge</td></tr>
<tr><td>Measured /Calculated /Default:</td><td>Measured</td></tr>
<tr><td>Source of data:</td><td>Log sheet</td></tr>
<tr><td>Value(s) of monitored parameter:</td><td><table><tr><th>Monitoring period</th><th>Value</th></tr><tr><td>2009 (10 Nov – 31 Dec)</td><td>0.000076</td></tr><tr><td>2010 (1 Jan – 31 Dec)</td><td>0.000326</td></tr></table></td></tr>
<tr><td>Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)</td><td>The data is used for project emission calculation. The maximum value reported is used for conservative estimation of project emissions.</td></tr>
<tr><td>Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)</td><td><table><tr><td>Equipment Type</td><td>Portable Colorimeter</td></tr><tr><td>Manufacturer</td><td>Hach</td></tr><tr><td>Model</td><td>DR/890</td></tr><tr><td>Accuracy Level</td><td>±0.24%[8]</td></tr><tr><td>Serial No.</td><td></td></tr><tr><td>Calibration Frequency</td><td>Annually</td></tr></table></td></tr>
<tr><td>Measuring/ Reading/ Recording frequency:</td><td>Monthly analyzed by external laboratory</td></tr>
<tr><td>Calculation method (if applicable):</td><td>Third party test report. The highest value reported in the third party test over a period is used to conservatively estimate the project emissions.</td></tr>
<tr><td>QA/QC procedures applied:</td><td>The laboratory COD testing device shall be subject to periodic calibration according to the equipment’s specifications and applicable</td></tr>
</table>

[7] http://www.hach.com/fmmimghach?/CODE:SPECCOLCOMPARE-2008-16038|1

[8] http://www.hach.com/fmmimghach?/CODE:SPECCOLCOMPARE-2008-16038|1

	industrial standards.
Comments	This is not in line with the registered PDD, however the plan shall be revised prior to finalization of monitoring report for this monitoring period.

Data / Parameter:	**$S_{y, final}$**
Data unit:	Tonnes
Description:	Amount of final sludge generated by the wastewater treatment in the year "y"
Measured /Calculated /Default:	Measured
Source of data:	Measured – all the sludge quantity produced during a monitoring period is measured before final disposal / treatment
Value(s) of monitored parameter:	**Monitoring period** / **Value**: 2009 (10 Nov – 31 Dec): 0; 2010 (1 Jan – 31 Dec): 0
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	The data is used for project emission calculation.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	The sludge quantity is monitored using the weighbridge, before end use.
Measuring/ Reading/ Recording frequency:	Whenever the sludge is removed, the quantity shall be recorded and documented.
Calculation method (if applicable):	-
QA/QC procedures applied:	The measurement equipment at the starch factory located next to the project shall be calibrated on regular basis. However, during this monitoring period, no sludge has been removed from the wastewater treatment system.

Data / Parameter:	**$\%CH_4$**
Data unit:	%
Description:	Methane content in biogas
Measured /Calculated /Default:	Measured
Source of data:	Log sheet As per the Monitoring plan, there should be an online methane monitoring. However during the period the methane analyzer is not working and portable methane analyzer is used to estimate methane in biogas and recorded in the log book.
Value(s) of monitored parameter:	**Monitoring period** / **Value**: 2009 (10 Nov – 31 Dec): 61.2; 2010 (1 Jan – 31 Dec): 61.0
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	The data is used for baseline and project emissions calculation.
Monitoring equipment (type, accuracy class, serial	**Equipment Type**: Biogas Check

number, calibration frequency, date of last calibration, validity)	**Manufacturer**: Geotechnical Instruments **Model**: **Accuracy Level**: ±3%[9] **Serial No.**: BM 11452 **Calibration Frequency**: Weekly
Measuring/ Reading/ Recording frequency:	The biogas sample is analyzed at least 3 times a day and averaged for daily value.
Calculation method (if applicable):	Simple average is estimated on daily basis.
QA/QC procedures applied:	The weekly calibration using a standard gas is done and the result is recorded. The original monitoring plan shall be revised to enable the monitoring of the methane using portable methane analyzer in line with the methodology.

Data / Parameter:	$Q_{biogas, total, y}$
Data unit:	Nm^3
Description:	Amount of biogas that is generated in year y
Measured /Calculated /Default:	Accumulated value is measured continuously by the flow meter and calculation for daily value is done on a daily basis
Source of data:	Log sheet
Value(s) of monitored parameter:	**Monitoring period** / **Value** 2009 (10 Nov – 31 Dec): 216,152 2010 (1 Jan – 31 Dec): 3,086,045
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	The data is used for baseline emission calculation.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	**Tag no.**: GM1 **Equipment Type**: Thermal mass flowmeter **Manufacturer**: Endress Hauser Flowtec AG **Model**: t-mass 65I **Accuracy Level**: ±1% of reading[10] **Serial No.**: 9502C002000 **Calibration Frequency**: Annually **Date of previous calibration**: 9th May 2007; 5th August 2008; 16th November 2009 **Date of latest calibrations**: 21st September 2010 **Validity**: 20th September 2011
Measuring/ Reading/ Recording frequency:	The meter has continuous monitoring of the flow of biogas. The accumulated reading shall be taken from the meter screen and recorded in the log sheet by the operator on a daily basis.
Calculation method (if applicable):	-
QA/QC procedures applied:	The flow meter shall be subject to periodic calibration according to the equipment's specifications and applicable industrial standards.

Data / Parameter:	$Q_{biogas, flare, y}$

9 http://www.geotech.co.uk/Downloads/Portable_Biogas_Datasheet.pdf

10 https://portal.endress.com/wa001/dla/50000092467/000/02/TI069DEN_0610.pdf

<table>
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<tr><td>Description:</td><td>Amount of biogas that is sent to the flare.</td></tr>
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<tr><td>Serial No.</td><td>9A070502000</td></tr>
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<tr><td>Date of previous calibration</td><td>16th May 2007
2nd August 2008
20th November 2009</td></tr>
<tr><td>Date of latest calibrations</td><td>21st September 2010</td></tr>
<tr><td>Validity</td><td>20th September 2011</td></tr>
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<tr><td>Measuring/ Reading/ Recording frequency:</td><td>The meter has continuous monitoring of the flow of biogas. The accumulated reading shall be taken from the meter screen and recorded in the log sheet by the operator on a daily basis.</td></tr>
<tr><td>Calculation method (if applicable):</td><td></td></tr>
<tr><td>QA/QC procedures applied:</td><td>The flow meter shall be subject to periodic calibration according to the equipment’s specifications and applicable industrial standards. Volumetric balance of biogas shall ensure any loss of biogas in piping systems and shall be accounted for in project emissions if applicable.</td></tr>
</table>

<table>
<tr><td>Data / Parameter:</td><td>$Q_{biogas, generator, y}$</td></tr>
<tr><td>Data unit:</td><td>Nm^3</td></tr>
<tr><td>Description:</td><td>Amount of biogas that is sent to the electricity generator.</td></tr>
<tr><td>Measured /Calculated /Default:</td><td>Accumulated value is measured continuously by the flow meter and calculation for daily value is done on a daily basis</td></tr>
<tr><td>Source of data:</td><td>Log sheet</td></tr>
<tr><td>Value(s) of monitored parameter:</td><td>
<table>
<tr><th>Monitoring period</th><th>Value</th></tr>
<tr><td>2009 (10 Nov – 31 Dec)</td><td>220,116</td></tr>
<tr><td>2010 (1 Jan – 31 Dec)</td><td>3,005,549</td></tr>
</table>
</td></tr>
<tr><td>Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)</td><td>The data is used for project emission calculation.</td></tr>
<tr><td>Monitoring equipment (type, accuracy class, serial</td><td>
<table>
<tr><td>Tag no.</td><td>GM2</td></tr>
</table>
</td></tr>
</table>

[11] https://portal.endress.com/wa001/dla/50000092467/000/02/TI069DEN_0610.pdf

<table>
<tr><td>number, calibration frequency, date of last calibration, validity)</td><td><table>
<tr><td>Equipment Type</td><td>Thermal mass flowmeter</td></tr>
<tr><td>Manufacturer</td><td>Endress Hauser Flowtec AG</td></tr>
<tr><td>Model</td><td>t-mass 65I</td></tr>
<tr><td>Accuracy Level</td><td>±1% of reading[12]</td></tr>
<tr><td>Serial No.</td><td>9502C102000</td></tr>
<tr><td>Calibration Frequency</td><td>Annually</td></tr>
<tr><td>Date of previous calibration</td><td>9th May 2007
3rd August 2008
18th November 2009</td></tr>
<tr><td>Date of latest calibrations</td><td>21st September 2010</td></tr>
<tr><td>Validity</td><td>20th September 2011</td></tr>
</table></td></tr>
<tr><td>Measuring/ Reading/ Recording frequency:</td><td>The meter has continuous monitoring of the flow of biogas. The accumulated reading shall be taken from the meter screen and recorded in the log sheet by the operator on a daily basis.</td></tr>
<tr><td>Calculation method (if applicable):</td><td></td></tr>
<tr><td>QA/QC procedures applied:</td><td>The flow meter shall be subject to periodic calibration according to the equipment’s specifications and applicable industrial standards.
Volumetric balance of biogas shall ensure any loss of biogas in piping systems and shall be accounted for in project emissions if applicable.</td></tr>
</table>

<table>
<tr><td>Data / Parameter:</td><td>Sufficient temperature in flare detection period</td></tr>
<tr><td>Data unit:</td><td>min</td></tr>
<tr><td>Description:</td><td>Amount of minutes per hour where a flame has a higher temperature then 500°C, whenever biogas is sent to the flare.</td></tr>
<tr><td>Measured /Calculated /Default:</td><td>Measured</td></tr>
<tr><td>Source of data:</td><td>Report from SCADA</td></tr>
<tr><td>Value(s) of monitored parameter:</td><td><table>
<tr><th>Monitor ng period</th><th>Value</th></tr>
<tr><td>2009 (10 Nov – 3 Dec)</td><td>0</td></tr>
<tr><td>2010 (1 Jan – 31 Dec)</td><td>0</td></tr>
</table></td></tr>
<tr><td>Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)</td><td>The data is used for project emission calculation.</td></tr>
<tr><td>Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)</td><td>A thermocouple is used which is located in the stack.</td></tr>
<tr><td>Measuring/ Reading/ Recording frequency:</td><td>The temperature in the stack is continuously monitored and the report will be generated by SCADA on daily basis.</td></tr>
<tr><td>Calculation method (if applicable):</td><td>The parameter monitors the amount of time for which the temperature of flare is above the set point, during the flare operation period.
If flame temperature is detected for less than 20 minutes in an hour (whenever biogas is sent to flare), flare efficiency is assumed to be 0%. Otherwise flare efficiency is assumed to be 50%.</td></tr>
<tr><td>QA/QC procedures applied:</td><td>The temperature meter shall be subject to periodic calibration according to the equipment’s specifications and applicable industrial standards.</td></tr>
<tr><td>Any comment:</td><td>For this monitoring period, since no temperature readings are available, the flare efficiency is assumed to be 0.</td></tr>
</table>

[12] https://portal.endress.com/wa001/dla/50000092467/000/02/TI069DEN_0610.pdf

Data / Parameter:	**EC_y**
Data unit:	MWh/y
Description:	Electricity consumed by waste water treatment facility over the year.
Measured /Calculated /Default:	Measured
Source of data:	Log sheet
Value(s) of monitored parameter:	<table><tr><th>Monitoring period</th><th>Value</th></tr><tr><td>2009 (10 Nov – 31 Dec)</td><td>58</td></tr><tr><td>2010 (1 Jan – 31 Dec)</td><td>578</td></tr></table>
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	The data is used for project emission calculation.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	<table><tr><td>**Equipment Type**</td><td>3 phase meter</td></tr><tr><td>**Manufacturer**</td><td>Crompton Instruments</td></tr><tr><td>**Model**</td><td>DIN Integra 1630</td></tr><tr><td>**Accuracy Level**</td><td>0.2%</td></tr><tr><td>**Serial No.**</td><td>402786</td></tr><tr><td>**Calibration Frequency**</td><td>Annually</td></tr><tr><td>**Date of latest calibrations**</td><td>The meter is not calibrated. It is still within first 3 years of the installation, January 2008.</td></tr><tr><td>**Validity**</td><td>January 2011</td></tr></table>
Measuring/ Reading/ Recording frequency:	The electricity consumed is continuously monitored and the reading is recorded on daily basis by staff
Calculation method (if applicable):	
QA/QC procedures applied:	The electricity meter shall be subject to periodic calibration according to the equipment's specifications and applicable industrial standards.

Data / Parameter:	**EG_y**
Data unit:	MWh/y
Description:	Electricity generated during year y by power generation facility
Measured /Calculated /Default:	Measured by electricity meter which is maintained by PEA
Source of data:	Monthly reading report
Value(s) of monitored parameter:	<table><tr><th>Monitoring period</th><th>Value</th></tr><tr><td>2009 (10 Nov – 31 Dec)</td><td>411</td></tr><tr><td>2010 (1 Jan – 31 Dec)</td><td>4,838</td></tr></table>
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	The data is used for baseline emission calculation.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	<table><tr><td>**Equipment Type**</td><td>Electricity Meter</td></tr><tr><td>**Manufacturer**</td><td>EDMI</td></tr><tr><td>**Model**</td><td>Genius Series</td></tr><tr><td>**Accuracy Level**</td><td>Class 0.2s, ±0.2%</td></tr><tr><td>**Serial No.**</td><td>205055798</td></tr><tr><td>**Calibration Frequency**</td><td>Based on PEA procedure</td></tr></table>

	Date of latest calibrations	27th February 2009
Measuring/ Reading/ Recording frequency:	The electricity consumed is continuously monitored and the reading is recorded on monthly basis by PEA's staff	
Calculation method (if applicable):		
QA/QC procedures applied:	The electricity meter shall be subject to periodic calibration according to the equipment's specifications and applicable industrial standards.	

Data / Parameter:	**Period of biogas being sent to the flare**
Data unit:	min
Description:	Amount of minutes per hour where biogas is sent to flare.
Measured /Calculated /Default:	Measured based on SCADA
Source of data:	SCADA record
Value(s) of monitored parameter:	During the monitoring period, this parameter was captured by SCADA system; however, the temperature in the exhaust gas of the flare was lower than 500 °C. **Monitoring period** / **Value** 2009 (10 Nov – 31 Dec) / - 2010 (1 Jan – 31 Dec) / -
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	The data is used for project emission calculation.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	
Measuring/ Reading/ Recording frequency:	Biogas flow is registered by the SCADA system of the biogas plant, the time will be also recorded, which allows for a calculation of the time period of biogas being sent to the flare.
Calculation method (if applicable):	
QA/QC procedures applied:	

SECTION E. Emission reductions calculation

E.1. Baseline emissions calculation

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).

$$\mathbf{BE_{y} = BE_{y,el} + BE_{y,ww}} \qquad (1)$$

Where:

BE_{y} Baseline emissions in the year "y" (t CO_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"

$$BE_{y,el} = EF_y * EG_y \quad (2)$$

Where:

$BE_{y,el}$	The baseline emissions from grid's electricity displaced by the project activity during the year y in tCO_2e/MWh.
EG_y	Electricity generated during year y by power generation facility (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)

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:

$$BE_{y,ww} = Q_{y,ww} * \sum j\,(COD_{y,removed,j} * B_{o,ww} * MCF_{ww,treatment,j} * GWP_{CH4}) \quad (3)$$

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 "i" 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)[13]
$MCF_{ww,treatment,j}$	Methane correction factor for the existing anaerobic wastewater treatment systems "i" to which the sequential anaerobic treatment step is being introduced (MCF lower value in Table III.H.1.)
GWP_CH_4	Global Warming Potential for methane (value of 21 is used)

[13] As per AMS.III.H, the IPCC default value of 0.25 kg CH_4/kg COD was corrected to take into account the uncertainties.

Baseline emissions

Parameter	Unit	2009 10 Nov - 31 Dec	2010 1 Jan - 31 Dec
$Q_{y,\,ww}$	m^3	37,334	527,576
$COD_{y,\,removed}$	mg/l	12,194	16,678
$Q_{biogas,total,y}$	Nm^3	216,152	3,086,045
$Q_{biogas,generator,y}$	Nm^3	220,116	3,005,549
%CH4	%	61.2%	61.0%
$BE_{y,ww}$(COD)	**tCO_2**	**1606**	**31042**

EG_y	MWh	410.8	4838.46
$BE_{y,\,power}$	**tCO_2**	**208**	**2447**

$BE_{y,ww}$ (biogas)	**tCO_2**	**2027**	**27565**

E.2. Project emissions calculation

>>

The project activity emissions are calculated as follows:

$$PE_{y} = PE_{y,\,power} + PE_{y,\,ww,\,treated} + PE_{y,\,s,\,final} + PE_{y,\,fugitive} + PE_{y,\,dissolved} + PE_{y,\,upgrading} + PE_{y,\,leakage,\,pipeline} \quad (4)$$

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)[14]
$MCF_{ww, final}$	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}	Global Warming Potential for methane (value of 21 is used)

Project activity emissions from anaerobic decay of the final sludge ($PE_{y, s, final}$)

$$PE_{y, s, final} = S_{y, final} * DOC_{y, s, final} * 16/12 * MCF_{s, final} * DOC_F * F * GWP_{CH4} \quad (6)$$

Where:

$PE_{y, s, final}$	Methane emissions from the anaerobic decay of the final sludge generated in the wastewater system in the year "y" (tCO_2e))
$S_{y, final}$	Amount of final sludge generated by the wastewater treatment in the year "y" (tonnes)
$DOC_{y, s, final}$	Degradable organic content of the final sludge generated by the wastewater treatment in the year "y" (fraction). IPCC default value of 0.09 for industrial sludge (wet basis, assuming dry matter content of 35 percent) will be used
$MCF_{s, final}$	Methane correction factor of the landfill that receives the final sludge, estimated as described in category AMS III.G. A default conservative value of 1 will be used
DOC_F	Fraction of DOC dissimilated to biogas (IPCC default value of 0.5)
F	Fraction of CH_4 in landfill gas (IPCC default of 0.5)
GWP_{CH4}	Global Warming Potential for methane (value of 21 is used)

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. Thereby no emissions from sludge removal take place in project activity.

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)

The second term of the equation above is not applicable because the project activity does not comprise an anaerobic treatment system for sludge; it consists of an anaerobic treatment system for wastewater only. Hence, the term $PE_{y, fugitive, s}$ is neglected.

The first term of the equation above is calculated as follows:

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

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 21 is used)

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[14] As per AMS.III.H, the IPCC default value of 0.25 kg CH4/kg COD was corrected to take into account the uncertainties.

$MEP_{y, ww, treatment}$	Methane emission potential of the wastewater treatment plant in the year "y" (tonnes), which is calculated according to the equation below

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

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 for domestic wastewater of 0.21 kg CH4/kg COD)[15]

For this project we will only consider one treatment system j:

- The treatment system will be the UASB digester. $COD_{y, removed, j}$ will be estimated as the difference of the COD values between the inlet and outlet of the digester.

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

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

Where:

$PE_{y, dissolved}$	Emissions from dissolved methane in treated wastewater in year "y" (t CO_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 wastewater treatment default value is zero, in anaerobic treatment it can be measured, or a default value of $10e^{-4}$ tonnes/m3 can be used
GWP_{CH4}	Global Warming Potential for methane (value of 21 is used)

Here a the default value for the dissolved methane in anaerobic treatment has been applied: $[CH4]_{y, ww, treated} = 10^{-4}$ tonnes/m^3

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[16].

$$PE_{y, flare} = \sum_{h=1}^{8760} TM_{RG,h} * (1 - \eta_{flare,h}) * \frac{GWP_{CH4}}{1000} \quad \textbf{(11)}$$

$TM_{RG, h}$	Mass flow rate of methane in the residual gas in hour h (kg/h)
$\eta_{flare, h}$	Flare efficiency in hour h.

If the flare efficiency is constant / proved to be default value over the whole monitoring period. The formula can be rewritten as follows:

$$\sum_{h=1}^{8760} TM_{RG,h} = Q_{biogas, flare, y} * \%CH_4 * D_{CH4}$$

[15] As per AMS.III.H, the IPCC default value of 0.25 kg CH4/kg COD was corrected to take into account the uncertainties.

[16] http://cdm.unfccc.int/UserManagement/FileStorage/AM_CLAR_7MXW3CMZV4OVLA7J2QFUJ0MAMUKBVA

$Q_{biogas, flare, y}$	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

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 ($PE_{y, power}$)

All the equipments that are involved in operation of biogas generation and consumption are to be included in estimation of power consumption. The power consumption (MWh) will be multiplied with the national grid emission factor of electricity (t $CO2_2$/MWh).

$$PE_{y, power} = EF_y * EC_y \quad (12)$$

Where:

$PE_{y, power}$	Emissions from electricity or fossil fuel consumption in the year "y" (t CO_2e)
EC_y	Electricity consumed during year y from the national grid (MWh)
$EF_{grid, y}$	Emission factor from the national grid electricity consumed by the project activity during year "y" (t CO_2e/MWh)

No fossil fuel will be used for the operation of the project activity. Only electricity will contribute to $PE_{y, power}$. $EF_{grid, y}$ is calculated ex-ante and remains fixed during the whole crediting period.

Project emissions

Parameter	Unit	2009 10 Nov - 31 Dec	2010 1 Jan - 31 Dec
$Q_{y,\ ww}$	m^3	37,334	527,576
$COD_{y,\ ww,\ treated}$	t/m^3	0.000076	0.000326
$PE_{y,\ ww,\ treated}$	tCO_2	**3**	**152**
$PE_{y,\ s,\ final}$	tCO_2	**0**	**0**
$MEP_{y,\ ww,\ treatement}$	tonnes	99.2	1847.5
$PE_{y,\ fugutive,\ ww}$	tCO_2	**201**	**3880**
$PE_{y,\ fugutive,\ s}$	tCO_2	**Neglected**	**Neglected**
$PE_{y,\ dissolved}$	tCO_2	**78**	**1108**
$Q_{biogas,\ flare,y}$	Nm^3	7,323	63,878
Flare Efficiency	%	0%	0%
CH4% -	%	61.2%	61.0%
$PE_{y,\ flare}$	tCO_2	**67.4**	**585.9**
EC_y	MWh	57.89	578.42
$PE_{y,\ power}$	tCO_2	**29**	**293**

E.3. Leakage calculation

For AMS IIIH, there is no bottling unit thereby nil leakages on account of bottling activity.

No equipment transfer takes place as an effect of project activity, all the equipments are purchased first hand and thereby no leakage considerations.

E.4. Emission reductions calculation / table

In the absence of any leakage, emission reductions are the difference between the baseline emissions and the project emissions:

$$\mathbf{ER_y = BE_y - PE_y} \qquad \mathbf{(13)}$$

Where:

ER_y Emission reductions in the year "y" (tCO_2e)
BE_y Baseline emissions in the year "y" (tCO_2e)
PE_y Project activity emissions in the year "y" (tCO_2e)

Emission reduction

		2009 10 Nov - 31 Dec	2010 1 Jan - 31 Dec
ER (COD Approach)	tCO_2	1,436	27,470
ER (Biogas Approach)	tCO_2	2,205	29,719
ERy (final)	**tCO_2**	**1,435**	**27,470**

E.5. Comparison of actual emission reductions with estimates in the CDM-PDD

This section shall include a comparison of actual values of the emission reductions achieved during the monitoring period with the estimations in the registered CDM-PDD.

Item	Values applied in ex-ante calculation of the registered CDM-PDD	Actual values reached during the monitoring period
Emission reductions (tCO_2e)	**48,558**[17]	**28,905**

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

There are a few actual monitored parameters lower than estimated value in the PDD. Sample of the difference values in 2009 and 2010 are used to show as in the following table

Parameter	2009[18]		2010		Reason
	Actual value	PDD value	Actual value	PDD value	
Volume of wastewater (m^3)	**37,334**	70,833	**527,576**	850,000	The starch production is lower than initially expected.
% CH_4	61.2	65	**61.0**	65	The actual methane percentage of the biogas produced is lower than the default value in the PDD.
Electricity generated (MWh)	**411**	879	**4,838**	10,551	Due to lower starch production and respective lower wastewater generation, there is significantly less biogas available for electricity generation.

As compared data, the actual emission reductions for this monitoring period can be decreased significantly from the estimated emission reductions in the PDD.

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[17] The average estimation of ERs in the registered PDD is 41,701 tCO2e. The value has been revised to be same period of this monitoring report.

[18] The monitoring period in 2009 is 10 Nov – 31 Dec and the PDD value is estimated for 1 month to compare conservatively.

- - - - -

History of the document

Version	Date	Nature of revision
01	EB 54, Annex 34 28 May 2010	Initial adoption.
Decision Class: Regulatory **Document Type**: Guideline, Form **Business Function**: Issuance		

Annex – Gold Standard Monitoring Parameters

No		1
Indicator		Air quality: *Odour from the wastewater treatment plant*
Chosen parameter		Volume of biogas production and combustion (Nm^3)
Implications on monitoring requirements and justification		Approach as per GS Annex: As explained by the project owner during the public consultation, the odour will be reduced as a result of the project activity, because the new system is a closed system and the biogas produced is utilized for electricity and heat generation. Any gases that would lead to odour emissions (mainly H_2S and other sulphur compounds) are captured with the biogas and removed in the desulphurization system (gas scrubber) prior to reaching the engines, without release of odour emissions to the atmosphere.
Way of monitoring	How	Measured using gas flow meters at the reactor outlet and at the inlet of the engine/generator sets and flare system. The gas meters are capable of monitoring the biogas volume in normalized conditions and the same is reported as per the monitoring plan. The combustion of the biogas, and consequently the destruction of any gases that would lead to odour emissions, is monitored through measurement of the energy output of the engine/generator systems as well as the flame detection period of the flare system. More details about all these parameters are provided in the monitoring plan (Section B.7) of the registered PDD.
	When	Continuously using totalizer meters
	By who	Biogas plant operator
QA/QC procedures to be applied		Meters will undergo maintenance / calibration subject to appropriate industry standards. In the event of technical problems with a biogas flow meter, the value can be calculated based on a mass balance using the other installed gas meters (e.g. biogas sent to gas engine = total biogas produced – biogas sent to flare). The calculations which use biogas volumes from various gas flow meters have to make sure that the gas volumes are monitored under similar conditions. The gas meters for the project activity monitor the biogas volumes at normalized conditions.
Monitored Value & Frequency		2009 (10 Nov - 31 Dec): 227,439 Nm^3 (Biogas Combusted) 2010 (1 Jan – 31 Dec): 3,069,427 Nm^3(Biogas Combusted) Related to $Q_{biogas, generator, y}$ and $Q_{biogas, flare, y}$

No		2
Indicator		Employment (numbers)
Chosen parameter		Number of employed staffs who come from the local community and the level of income generation into the area.
Implications on monitoring requirements and justification		Approach as per GS Annex: Reference to the organisation chart is also made available to show number jobs created by the project activity; the project owner expects to increase the number. Note that it was the request of the local stakeholders for priority to be given to local people for employment at the project plant. Since the project owner confirmed that it is the company's policy to give priority to qualified villagers for employment. The purpose of this monitoring parameter is to assure that the project owner complies with this pledge.
Way of monitoring	How	Number of employees and the level of income generation will be

		recorded through salary payment records.
	When	Monthly
	By who	P & Papop Renewable Co., Ltd., management
QA/QC procedures to be applied		NA. Careful monitoring of salary payments and expenditures is a general practice of the company required for financial accounting as per Thai regulations.
Monitored Value & Frequency		Recorded Monthly and Monthly records provided as attachments. On an average 11 people are employed at a given time at the project site. Out of these 10 people are from the same or nearby province in a radius of 100 km from the project site. All positions of responsibility at project site are taken care by above people except for the plant head.

No		3
Chosen parameter		Power generation capacity of project activity
Implications on monitoring requirements and justification		This is to ensure the authenticity of the explanation given by the project proponent that there is no plan to increase the power generation capacity of the project activity. Only reason that would justify an investment of additional gas engine would be that its operation and maintenance would have taken around 3-4 weeks, meaning a loss of revenue (from power generation) to the project owner. Thus, the new addition of power generation capacity, if implemented, would only be there to allow a continuation of electricity generation during this period, and not because of an increase in biogas generation capacity due to reason such as change in starch production capacity.
Way of monitoring	How	The project proponent proposes that the DOE verify the operational condition of the available gas engines. In case it is found that the gas engine(s) is replaced with a new one during any verification, adequate reason (e.g. only as a backup engine) must be given to allow claim of emission reductions.
	When	Periodical (along with the verification of the project activity)
	By who	DOE responsible for the verification of the project activity during each monitoring period.
QA/QC procedures to be applied		-
Monitoring Value and Frequency		2.85 MW

Parameter 4, 5 and 6 are related to flare. These parameters were not monitored during this period. The flare efficiency is assumed 0 for this period to ensure that non-monitoring has no affect on the emission reduction estimate.

No	7
Chosen parameter	Occurrence of wastewater overflow and its compensation measure.
Implications on monitoring requirements and justification	As evidence during the stakeholder consultation meeting, one concern of the local stakeholders is in regards to the wastewater overflow that happened with the baseline situation. Note that the occurrence of such event will be reported by the affected stakeholders to the local authority (e.g. local governor office), who will then pass on the message to local Industrial office for further inspection, as well as guidance for the necessary mitigation and compensation measures. Despite already clear procedures on the same, this parameter is included in the sustainability monitoring plan so that the occurrence of such incidents and the implementation of necessary compensations are well documented.

Way of monitoring	How	Internal report shall be made to record the occurrence of such event and the amount of money spent to compensate the affected stakeholders for the damage cause.
	When	Periodical (depending on the occurrence of wastewater overflow)
	By who	P & Papop Renewable Co., Ltd., management
QA/QC procedures to be applied		Government archive (from the Provincial Industrial Office) can be requested for cross-checking of such event.
Monitoring Value and Frequency		No occurrence recorded during the monitoring period.

No		8
Chosen parameter		Amount of treated wastewater released to the villagers (m^3)
Implications on monitoring requirements and justification		Approach as GS Annex: This is in respond to the request from the local stakeholders during the consultation process. The local stakeholders enquired as to whether treated wastewater can be released to the villagers to be used as fertilizer; the project owner agreed to such request under the condition approval is given by local authority. The purpose of the monitoring parameter is to ensure that the wish of the stakeholders can be satisfied.
Way of monitoring	How	In the absence of volumetric wastewater flow meter to monitor the same, weighing bridge is used to measure the weight of vehicle before and after it transport wastewater out of the plant; the difference is deemed as the amount of wastewater released to the villagers. In recording this parameter, plant's operators shall manually archive the monitored data onto hard copy log sheets then transfer to the computer for electronic storage.
	When	Periodical (depending on the amount of wastewater given to farmers)
	By who	Bangna biogas plant operator
QA/QC procedures to be applied		Villagers' signatures are needed on the records. The weighbridge shall also undergo regular maintenance and calibration as per acceptable national or international standards. The calibration shall be performed at a minimum of once in three years as per general CDM requirement.
Monitoring Value and Frequency		No occurrence recorded during the monitoring period.