

“P.S.C Starch Wastewater Treatment and Biogas Utilization Project”



By

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Summary:

KBS Certification Services Pvt. Ltd. has been contracted by, “Swiss Carbon Value Ltd.” to undertake independent 2nd periodic verification and certification for the greenhouse gas (GHG) emission reductions reported from ‘P.S.C Starch Wastewater Treatment and Biogas Utilization Project’ for the monitoring period 01/09/2013 to 11/05/2016 in the initial monitoring report version 01 date 19/02/2018, with regard to the relevant requirements of VCS Standard Version 3.7.

The project was validated and registered with reference no. 417 under VCS (Verified Carbon Standard) program on 18/11/2009. The project was validated by TÜV NORD CERT GmbH (validation report N° 53219108-08/509 issued on 18-November-2009). This is the 2nd periodic verification of this project which covers the period from 01/09/2013 to 11/05/2016 (including both the days). The project is verified against the VCS Version 3. The verification is based on the monitoring plan of registered VCS Project Description document (VCS PD)/23/, requirements of VCS (VCS Standard and VCS Program Guide of VCS Version 3) and CDM Validation and Verification Standard for project activity /24/.

The methodologies applied for the project to estimate the GHG emission reduction are AMS-III.H., version 13 – “Methane Recovery in Wastewater Treatment” and AMS.I.D., version 14 - “Grid connected renewable electricity generation” /27/.

The verification is based on the VCS PD, proof of title, proof of right, additional documents related to baseline and monitoring methodology; the subsequent background investigation, follow-up interviews and supporting documents made available to the verification team by project proponent.

Monitoring report (MR)/02/, Emission reduction calculation spread sheet (ER sheet)/04/, Project Description document (VCS PD)/23/ and other supporting documents have also been made available to the verification team.

A risk based approach has been followed to perform the verification of the project activity. In the course of verification, 01 Corrective Action Requests (CAR) and 02 Clarification Request (CL) have been raised. All the CARs and CLs have been closed out successfully.

It is our responsibility to express an independent GHG verification opinion on the GHG emissions and on the calculation of GHG emission reductions from the project for the period 01/09/2013 to 11/05/2016 based on the reported emission reductions in the final monitoring report Version 04 dated 19/06/2018 for the same period.

Based on an understanding of the risks associated with reporting GHG emissions data and the controls in place to mitigate these, KBS planned and performed our work to obtain the information and explanations that we considered necessary to provide sufficient evidence for us to give reasonable assurance that this reported amount of GHG emission reductions for the period is fairly stated.

As a result of the verification, the verifiers confirm that the GHG emission reduction in the verification period from 01/09/2013 to 11/05/2016, including both the days, is **159,287 tCO₂e**.

Year	Net GHG emission reductions or removals (tCO ₂ e)
2013 (01/09/2013 to 31/12/2013)	19,048
2014	37,232

(01/01/2014 to 31/12/2014)	
2015 (01/01/2015 to 31/12/2015)	77,971
2016 (01/01/2016 to 11/05/2016)	25,036
Total	159,287

However during the VCS review of the project for the previous monitoring period, assessment finding was raised on 18/07/2016 and closed on 12/10/2016. The conclusion of the assessment finding required that the project deduct 6,861 tCO₂e from the subsequent monitoring period. In line with the same, 6,861 tCO₂e are deducted from this monitoring period and the revised table with the final emission reductions is presented below:

KBS confirms the following;

Reporting period: 01/09/2013 to 11/05/2016

Year	Net GHG emission reductions or removals (tCO ₂ e)
2013 (01/09/2013 to 31/12/2013)	12,187
2014 (01/01/2014 to 31/12/2014)	37,232
2015 (01/01/2015 to 31/12/2015)	77,971
2016 (01/01/2016 to 11/05/2016)	25,036
Total	152,426

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1 INTRODUCTION

1.1 Objective

KBS has been commissioned by 'Swiss Carbon Value Ltd.' to perform verification of its registered VCS project 'P.S.C Starch Wastewater Treatment and Biogas Utilization Project', for the reported GHG emission reductions for the given monitoring period 01/09/2013 to 11/05/2016 (both dates included). The VCS projects must undergo an independent third party verification and certification of emission reductions as the basis for issuance of Voluntary Emission Reductions (VERs).

The objectives of this verification exercise are, by review of objective evidence, to establish that:

- The project activity has been implemented and operated as per the project description (PD) and that all physical features (technology, project equipment, and monitoring and metering equipment) of the project are in place;
- Monitoring report and other supporting documents are complete;
- The data is recorded and stored as per the monitoring methodology and approved monitoring plan.
- To confirm that the monitoring system is implemented and fully functional to generate Voluntary Emission Reductions (VERs/VCUs) without any double counting, and
- To establish that the data reported are accurate, complete, consistent, transparent and free of material error or omission by checking the monitoring records and the emissions reduction calculation.

1.2 Scope and Criteria

The verification scope is defined as an independent and objective review of monitoring report, VCS project description (VCS PD), including the monitored data and other relevant documents made available to verifier and information collected through performing interviews during on-site assessment of the project activity.

The project is assessed against the requirements of VCS standard version 3.6 and related rules and guidance. KBS has, based on the recommendations in the latest version of Verified Carbon standard, and employed a rule-based approach (as criteria) in the verification, focusing on the identification of significant reporting rules and the reliability of project monitoring.

The aspects to be covered under the purview of verification are:

- Ensure that the project activity has been implemented and operated as per the registered VCS PD and that all physical features (technology, project equipment, and monitoring and metering equipment) of the project are in place as per the documents provided by the client and on-site visit;
- Ensure that the monitoring report and other supporting documents provided are complete
- Ensure that the practiced monitoring system and procedures comply with the monitoring systems and procedures described in the monitoring plan and the approved CDM methodology;
- Evaluate the data recorded and stored are as per the monitoring methodology.

1.3 Level of Assurance

☒ Reasonable level of assurance

1.4 Summary Description of the Project

The project activity involves biogas recovery and its utilization as a fuel in hot oil boiler and steam boilers. The project involves wastewater generation from two different manufacturing units turning out three products (i.e. starch, sweetener and ethanol). The project was implemented at P.S.C Starch Products Public Company Limited on 28-April-2005 (project start date). In the baseline, wastewater generated was treated in cascading open anaerobic lagoons. The project activity involves an intertwined network of anaerobic treatment systems, which consists of UASB system and covered lagoons. The newly constructed covered lagoon 1 (CL1) pre-treats the wastewater before feeding to UASB. Later, in June 2006, a covered sheet at the existing first open anaerobic lagoon was installed to collect the biogas generated. This covered lagoon (CL2) was designed to receive wastewater from sweetener factory together with the effluent from the UASB reactor. In October 2009, a new ethanol plant started operation in line with these existing facilities. Thus the biogas generated by the overall system (UASB + CL1 + CL2 + CL3) will be used at sweetener plant (steam boilers), starch plant (hot oil boiler) and sweetener plant (electricity generation). The components of electricity production and fuel replacement will not be claimed for emission reduction. Verification team has checked the project activity equipments installed as the project site and found in compliance with the registered VCS PD /23/.

As per the registered VCD PD /23/, waste water from the starch factory goes to the covered lagoon 1 and then to the UASB and then to the covered lagoon 2. Waste water from the Sweetener plant is directly routed to covered lagoon 2. Waste water exiting from covered lagoon 2 is taken through 7 cascading ponds for internal use (plantation). Waste water from Ethanol plant is taken in to covered lagoon 3 (CL3) and to open ponds for disposal/ reuse. The biogas recovered is taken through a Bio scrubber and at steam boilers and generators.

As per the monitoring report /02/, waste water from the starch factory goes to the covered lagoon 1 and then to the UASB and then to the covered lagoon 2. Waste water from the Sweetener plant is directly routed to covered lagoon 2. Waste water exiting from covered lagoon 2 is taken through 7 cascading ponds for internal use (plantation and reuse). Waste water from Ethanol plant is taken in to covered lagoon 3 and then the same is diverted to covered lagoon 1 and is treated in tandem with waste water from starch factory. The biogas recovered is taken through a Bio scrubber and at steam boilers and generators. This was confirmed during on-site visit.

The expected emission reduction from the project activity as estimated in the VCS PD is 36,973 tCO₂e per year. The project activity contributes to sustainable development of the local community with environmental and economic benefits. The project activity is at Nongyai District, Chonburi Province, Thailand. The physical location has been confirmed during the site visit.

The project site is located in the compound of the P.S.C. Starch factory located at 999 Nongya Bothong Road, Nongyai, Chonburi about 150 km southeast of Bangkok with geographical coordinates: Latitude 13° 18' 6.50" N Longitude 101° 21' 49.47" E as verified during site visit.

Project initial crediting period is from 01-12-2009 to 30-11-2019, Hence the monitoring period selected for 2nd periodic verification i.e. 01/09/2013 to 11/05/2016 is within the crediting period.

The total emission reduction for 2nd verification period from 01/09/2013 to 11/05/2016 is 152,426 tCO₂e. The emission reduction is calculated conservatively as per the applied methodologies.

Project entity information is presented below:

Item	Data
Project Entities	P.S.C Starch Products Public Company Limited, 999 Moo.5 Nongyai , Chonburi Thailand
	Swiss Carbon Value Ltd., Technoparkstrasse 1 Zurich -8005 Switzerland

2 VERIFICATION PROCESS

2.1 Method and Criteria

The verification process was carried out inline with the requirements VCS Version 3. In addition, the verification team followed the guidelines of the CDM Validation and Verification Standard. Standard auditing techniques and KBS's CDM Procedures were also applied during the verification. A risk-based approach was followed to carry out verification and access all the factors and concerns that relate to the issuance of emission reductions from a project activity.

They include:

- Identification of all the sources contributing to the baseline emissions, project emissions and emission reductions.
- Authenticity of the provided data is checked.
- A risk based analysis is carried out to ensure a clear and transparent assessment. The risks involved in this process are mainly with the informational flows and data recording.

KBS follows a risk based verification approach, wherein a desk review of the project documentation is undertaken, which is followed by an onsite visit by the members of verification team. The verification protocol is filled by the verification team that is based on standard auditing practices and VCS requirements. The verification protocol provides transparent means to record the observations by the verification team members and the non-conformities, if any. The verification protocol is an internal document, and available on request.

Duration of Verification:

Verification Contract	26/02/2018
On site verification	13/03/2018
Findings raised	19/03/2018
Draft Verification Report	10/05/2018
Final Verification Report	19/06/2018

2.2 Document Review

A desk review is undertaken, involving but not limited to,

- A review of the data and information presented to verify their completeness;
- A review of the monitoring plan and monitoring methodology, paying particular attention to the frequency of measurements, the quality of metering equipment including calibration requirements, and the quality assurance and quality control procedures;
- An evaluation of data management and the quality assurance and quality control system in the context of their influence on the generation and reporting of emission reductions.

The list of document reviewed is included in the Appendix 2: 'References'

2.3 Interviews

The site visit for this verification assessment was undertaken by Chetan Swaroop Sharma (Team Leader and Technical Expert (TA 1.1, 13.1)). Summary of on-site activities are mentioned below;

Location	P.S.C Starch Products Public Company Limited, 999 Nongya Bothong Road, Nongyai, Chonburi about 150 km southeast of Bangkok
Dates	13/03/2018
Key points discussed	Name of persons interviewed, Designation, Organization
• General aspects of the project • Project equipment operation and technical details • Changes since validation • Monitoring and measurement equipment • Remaining issues from previous verification • Calibration procedures • Quality management system • Involved personnel and responsibilities • Training and practice of the operational personnel • Implementation of the monitoring plan • Monitoring data management • Data uncertainty and residual risks • GHG calculation • Maintenance	Sarum Sereethoranakul, Assistance MD, P.S.C Starch Products Public Company Limited
	Piyanuch lalun, Environment, P.S.C Starch Products Public Company Limited
	Ketmanec Poomehaweng, Safety, P.S.C Starch Products Public Company Limited
	Teerawut Sangsawatdikol, Safety, P.S.C Starch Products Public Company Limited
	Wassana Wannatong, Environment, P.S.C Starch Products Public Company Limited
	Anan taveetbumnusin, CSR, P.S.C Starch Products Public Company Limited
	Nattaya Lonawan, Project Manager, Swiss Carbon Value Ltd.
	Sukprasert Terasawert, Villager, Headman of Moo.5
	Pantong sako, Member of Nongyai Municipality
	Naleorn Puaisri, Contrator, Local Stakeholder
	Sucjata Batea, Contrator, Local Stakeholder
	Panusphum Pornngam, Farmer, Cassava root supplier

2.4 Site Inspections

A site visit is undertaken by members of verification team, involving but not limited to,

- An assessment of the implementation and operation of the project activity as per the registered VCS PD;
- A review of information flows for generating, aggregating and reporting the monitoring parameters;
- Interviews with relevant personnel to confirm that the operational and data collection procedures are implemented in accordance with the approved monitoring plan;
- A cross-check between information provided in the monitoring report and data from other sources such as plant log books, inventories, purchase records or similar data sources;
- A check of the monitoring equipments including calibration performance and observations of monitoring practices against the requirements of the registered VCS PD and the selected methodologies/27/;
- A review of calculations and assumptions made in determining the GHG data and emission reductions;
- An identification of quality control and quality assurance procedures in place to prevent or identify and correct any errors or omissions in the reported monitoring parameters.

2.5 Resolution of Findings

KBS applies the risk based approach aimed at focusing on high risk issues to the validation results whilst not omitting any part of the mandatory processes. A few discrepancies were found during the validation and the validation report was submitted to the project proponent, indicated under the titles corrective action requests (CARs) and clarification requests (CLs). CARs and CLs require the PP to take relevant actions. Criteria for judging items as CAR or CL are as follows:

Corrective action request (CAR):

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

Clarification request (CL):

- Information is insufficient or not sufficiently clear to determine whether the applicable VCS requirements have been met.

FARs is to be raised to highlight issues related to project implementation that require review during the first verification of the project activity. FARs does not relate to VCS requirements for registration.

CARs and CLs are to be resolved or closed out if the PP modifies the project description, rectifies the PD or provides adequate additional explanations or evidence that satisfies the concerns. If this is not completed, the project activity cannot be recommended for registration under VCS registry.

The project description document was revised addressing the CARs & CLs issued by KBS. After reviewing the revised and resubmitted project description/23/; resolving the CARs & CLs raised and outstanding concerns, KBS issues this final validation report and opinion.

01 CAR and 02 CL were found during verification and closed satisfactorily. The list of CARs/CLs raised and the response provided, the means of verification, reasons for their closure and references to correction in the MR are provided in appendix 4 of this report. The revised MR with changes incorporated as per the issues raised were rechecked with the documentary evidences and found to be inline.

2.5.1 Forward Action Requests

No FAR was raised during this monitoring period.

2.6 Eligibility for Validation Activities

KBS conducts the verification activity; the validation was performed by the other VVB and the separate validation report issued and approved by the VCS association. KBS has a valid UNFCCC accreditation in the sectoral scope from UNFCCC.

3 VALIDATION FINDINGS

Refer above section.

3.1 Participation under Other GHG Programs

PP does not apply for other GHG program as declared in the registered VCS PD.

3.2 Methodology Deviations

The verification team confirms that the registered VCS PD complies with the requirements in the applied monitoring methodologies AMS-III.H.: "Methane Recovery in Wastewater Treatment", version 13 and AMS-I.D.: "Grid connected renewable electricity generation", version 14. Therefore, no methodology deviations are applied during the monitoring period.

The verification team confirms that no deviations were observed during the current monitoring period.

3.3 Project Description Deviations

Two deviations from the monitoring plan have been applied by the PP during this monitoring period. Description of the deviations and the assessment on conservativeness of the deviation is provided below.

Description of the deviation	Assessment by the verification team
Deviation-1: <u>Description of deviation</u> The COD ww,discharge.PJ.y is the COD of water coming out of from CL2 instead of the wastewater coming out from CL3. <u>Period of deviation</u> This deviated approach is applied for this whole monitoring period. <u>Deviated approach</u> The COD ww,discharge.PJ.y is the COD of the treated wastewater discharged into the sea , river or lake in the project scenario. In this case, the wastewater treated by anaerobic project activity which ended by CL2, is discharged into the pond. Although the additional amount of biogas generated from the treating of effluent from CL3 at CL1 increases the amount of biogas combusted. The amount of biogas combusted is used for MDy calculation and the result of MDy is raised up in the same way. As per equation 13, in line with conservative principle, the final result of ERexpost is from the COD approach which is lower than MDy approach. Hence, this changing has no effect to the achieved emission reductions in this monitoring period. <u>Justification for deviated approach</u> The PEww,discharge,y, methane emissions from degradable organic carbon in treated wastewater, is the methane emission from the digestion of residue COD, COD remained after anaerobic digestion with biogas recovery system, in the open system which methane can freely release into the environment. In the monitoring diagram shown in the registered PD, the treated wastewater from CL3 is sent to pond system. The COD ww,discharge.PJ.y is the COD at the outlet of CL3.	The deviation has been transparently described in section 2.2.2 of the MR. The verification team is of the opinion that the approach followed by the PP is appropriately described and justified and the project remains in compliance with the VCS rules. The deviation does not overestimate the emission reduction and hence accepted to the verification team. Hence the deviation is accepted.

Deviation-2: <u>Description of deviation</u> The COD_{y,ww.untreated,starch}, COD_{y,ww.untreated,sweetener}, COD_{y,ww.untreated,ethanol}, COD_{y,ww.reated,CL2}, COD_{y,ww.reated,CL3} and COD_{y,ww.treated.lagoon} are not measured on daily basis which determined in the monitoring plan for COD parameters in the registered VCS PD. <u>Period of deviation</u> This deviated approach is applied for the monitoring period. <u>Deviated approach</u> The wastewater analysis of the samples were carried out by internal laboratory, but not on every operational days. Refer to AMS III.H version 18 , for COD parameters : Average value may be used through sampling with the confidence/precision level 90/10. The example of calculating step from Annex 13 of EB 48 which is followed the standard statistical calculation is applied. Calculate sample mean (μ). $\mu_{\text{COD},y} = \sum_{m=1}^{n_m} \text{COD}_{y,ww} / n_m$ Where : $\mu_{\text{COD},y}$ = Mean of the COD_{ww,untreated,y} and COD_{y,out,PJ,lagoon} in year y () COD_{y,ww} = Monitored COD_{y,ww} in measurement m in year y n_m = Number of measurements m in year y (minimum is 4) Calculate the sample standard deviation (σ). $\sigma_{\text{COD},y} = \sqrt{\sum_{m=1}^{n_m} (\text{COD}_{y,ww} - \mu_{\text{COD},y})^2 / (n_m - 1)}$ Where :	The deviation has been transparently described in section 2.2.2 of the MR. The verification team is of the opinion that the approach followed by the PP is appropriately described and justified and the project remains in compliance with the VCS rules. The deviation does not overestimate the emission reduction and hence accepted to the verification team. The deviation leads to conservative emission reduction. Hence the deviation is accepted.
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$\sigma_{\text{COD},y}$ = Standard deviation of COD y the in year y () Calculate the 95% confidence interval. $\mu_{\text{COD},y} - t * \frac{\sigma_{\text{COD},y}}{\sqrt{n_m}} \leq \text{COD}_{y,\text{ww}} \leq \mu_{\text{COD},y} + t * \frac{\sigma_{\text{COD},y}}{\sqrt{n_m}}$ Where : t = Value from standard t distribution for a confidence level of 95% with degrees of freedom nm-11 Use the lower bound of the 95% confidence interval obtained above for COD_{y,ww,untreated} and the upper bound one for COD_{y,ww,treated} to ensure conservativeness. The above calculating is performed in the ER calculation spreadsheet. Justification for deviated approach This approach is in line with conservative principle, the upper bound value is used for project emission calculation while the lower bound value is used for baseline emission calculation, to achieve the lower emission reductions.	
Deviation-3: <u>Description of deviation</u> Refer to the latest version of VCS Program rules, which allows project to transition immediately to using the global warming potentials set out in the IPCC Fourth Assessment Report. Period of deviation This deviated approach is applied for the monitoring period. Deviated approach The global warming potential (GWP) to be applied in the emission	The deviation has been transparently described in section 2.2.2 of the MR. The verification team is of the opinion that the approach followed by the PP is appropriately described and justified and the project remains in compliance with the VCS rules. The deviation does not overestimate the emission reduction and

¹ <http://www.stat.tamu.edu/~lzhou/stat302/T-Table.pdf>

reductions in this monitoring period is changed from 21 (in the registered VCS PD) to 25. Justification for deviated approach This approach is in line with the latest version of VCS Program rules and does not impact the applicability of the methodology, additionality or appropriateness of the baseline scenario.	also do not impact the applicability of the methodology, additionality or appropriateness of the baseline scenario and hence accepted to the verification team. Hence the deviation is accepted.
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3.4 Grouped Project

The project is not a grouped project. Therefore this section is not applicable.

4 VERIFICATION FINDINGS

4.1 Project Implementation Status

The project activity is in operation stage as evidenced by the physical verification of the site. The project started its operations from 01-December-2009 as per the registered Validation Report.

All the physical components and project boundary are in conformity with the description in registered VCS PD. The capacity of project equipments have been cross-checked during the on-site visit and found in-compliance with the registered VCS-PD/23/. On the basis of the on-site visit and the reviewed project documentation, the verification team confirms that the project was implemented and operated as described in the registered VCS PD/23/.

There are two deviations which have been addressed in the section 3.3 of this report and have been assessed by the verification team.

Ownership and other programs:

The PP declared that the project is not registered any other mechanism apart VCS. Thus emission reductions generated by project will be solely claimed by PP and PP has right of use and hence accepted. Net GHG emission reductions or removals generated by this project will not be used for compliance with an emissions trading program or to meet binding limits on GHG emissions as the host country i.e. Thailand is not a participant in any emission trading programs or nor does it have any binding limits.

PP will not claim the carbon credits under any other GHG emission reduction scheme for the crediting period under VCS and PP has provided declaration on the same during the validation. Hence there is no possibility of double counting. Apart from VCS, it has neither applied nor been rejected under any other GHG program.

Management and operational system:

Verification team was able to verify that authorities and responsibilities for monitoring and reporting of all data related to the emission reductions were clearly defined for the monitoring period from 01/09/2013 to 11/05/2016.

The allocation of the responsibilities is documented in a written form and is followed as described in the registered VCS PD. Routines for the archiving of data are defined and documented. During the site visit all the required plant records were verified and found that the data is consistent with the provided in the final MR/02/ and ER sheets/04/.

The monitoring plan described in section 3.3 of the MR is confirmed to be correct. All the parameters of the monitoring plan are monitored using appropriate metering system.

The verification team has interviewed the plant personnel who are involved in the monitoring of the parameters that are used to determine the emission reductions of the VER project. It is confirmed based on the interviews that the plant's team is competent enough to monitor the parameters as described in the monitoring plan.

As discussed above, the verification team concludes that management and operational system of the project is implemented and operated well. Thus it ensures the quality of data which is required in calculating the emission reductions.

Implementation status of the monitoring plan:

Verification team confirms through on-site verification and from the document review, the actual monitoring system complies with the monitoring plan mentioned in the registered VCS-PD/23/.

During the verification, all 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. All monitoring parameters have been measured / determined without material misstatements and are in line with all applicable standards and relevant requirements. It is confirmed that the monitoring mechanism is effective and reliable. Wherever a parameter was not sufficiently monitored as per the monitoring plan of the VCS PD, a deviation was applied by the PPs and the emission reduction was calculated by a conservative approach.

Therefore, from the document review and onsite verification, it is confirmed that all the parameters were monitored in accordance with the registered monitoring plan during the monitoring period. Following are the details of monitoring in accordance with the monitoring plan of the registered VCS PD:

Monitored Parameter	Assessment/Observation								
Data / Parameter: (as in monitoring plan of the VCS PD):	$Q_{y,ww,starch}$ Volume of wastewater treated in the year y from the starch plant (m^3)								
Measuring frequency:	Continuously The parameter is measured on a continuous basis and recorded by the flow meter (FM1).								
Reporting frequency:	Daily basis. As per the monitoring report /02/, the operators shall archive the monitored data manually into the log sheets /29/ and then, upload and transfer the same to the electronic storage. The same was also verified during the on-site visit and found OK.								
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes. From the document review and onsite verification, it is confirmed that the measuring and reporting frequencies are inline with the monitoring plan of the registered VCS PD.								
Type of monitoring equipment:	The monitoring equipment details have been checked during the site visit and found consistent. <table border="1"> <tr> <td>Meter name</td><td>FM1</td></tr> <tr> <td>Serial Number</td><td>3K220000021352</td></tr> <tr> <td>Brand</td><td>ABB</td></tr> <tr> <td>Model</td><td>FEV11</td></tr> </table>	Meter name	FM1	Serial Number	3K220000021352	Brand	ABB	Model	FEV11
Meter name	FM1								
Serial Number	3K220000021352								
Brand	ABB								
Model	FEV11								

	Accuracy	0.4%
	Calibration Frequency	Once in 3 years
	Calibration Date	10/03/12 06/05/15
Is accuracy of the monitoring equipment as stated in the VCS PD? If the VCS PD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	Volumetric Flow meters (FM1) to monitor the flow of waste water is of 0.4% accuracy class, against 1% mentioned in the registered VCS PD. Hence accepted to the verification team.	
Calibration frequency /interval:	The defined calibration frequency by the PP is at least once every 3 years.	
Is the calibration interval in line with the monitoring plan of the VCS PD? If the VCS PD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	No, there was a delay during this monitoring period for which correction factor has been applied accordingly for the conservative emission reduction calculation. CL-02 has been raised in this regard and successfully closed.	
Company performing the calibration:	The calibration was carried out by “Miracle International Technology Co Ltd” /08/.	
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	No, Corrections in the values have been applied for the conservative calculation of the emission reduction.	
If applicable, has the reported data been crosschecked with other available data?	NA	
How were the values in the monitoring report verified?	The values mentioned in the monitoring report and ER sheet were verified with the operator log sheets/29/. The reported values in the MR and ER sheet were found to be consistent with the operator log sheet information.	
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	The data management procedure is transparent; which ensure correct transfer of data and reporting of emission reductions.	

Monitored Parameter	Assessment/Observation
Data / Parameter: (as in monitoring plan of	$Q_{y,ww,sweetener}$ Volume of wastewater treated in the year y from the sweetener plant (m ³)

the VCS PD):															
Measuring frequency:	Continuously The parameter is measured on a continuous basis and recorded by the flow meter (FM2).														
Reporting frequency:	Daily basis. As per the monitoring report /02/, the operators shall archive the monitored data manually into the log sheets /29/ and then, upload and transfer the same to the electronic storage. The same was also verified during the on-site visit and found OK.														
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes. From the document review and onsite verification, it is confirmed that the measuring and reporting frequencies are inline with the monitoring plan of the registered VCS PD.														
Type of monitoring equipment:	The monitoring equipment details have been checked during the site visit and found consistent. <table border="1"> <tr> <td>Meter name</td><td>FM2</td></tr> <tr> <td>Serial Number</td><td>3K220000021353</td></tr> <tr> <td>Brand</td><td>ABB</td></tr> <tr> <td>Model</td><td>FEV11</td></tr> <tr> <td>Accuracy</td><td>0.4%</td></tr> <tr> <td>Calibration Frequency</td><td>Once in 3 years</td></tr> <tr> <td>Calibration Date</td><td>10/03/12 06/05/15</td></tr> </table>	Meter name	FM2	Serial Number	3K220000021353	Brand	ABB	Model	FEV11	Accuracy	0.4%	Calibration Frequency	Once in 3 years	Calibration Date	10/03/12 06/05/15
Meter name	FM2														
Serial Number	3K220000021353														
Brand	ABB														
Model	FEV11														
Accuracy	0.4%														
Calibration Frequency	Once in 3 years														
Calibration Date	10/03/12 06/05/15														
Is accuracy of the monitoring equipment as stated in the VCS PD? If the VCS PD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	Volumetric Flow meters (FM2) to monitor the flow of waste water is of 0.4%/0.35% accuracy class, against 1% mentioned in the registered VCS PD. Hence accepted to the verification team.														
Calibration frequency /interval:	The defined calibration frequency by the PP is at least once every 3 years.														
Is the calibration interval in line with the monitoring plan of the VCS PD? If the VCS PD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	No, there was a delay during this monitoring period for which correction factor has been applied accordingly for the conservative emission reduction calculation. CL-02 has been raised in this regard and successfully closed.														
Company performing the calibration:	The calibration was carried out by "Miracle International Technology Co Ltd" /08/.														
Did calibration confirm	No, Corrections in the values have been applied for the conservative														

proper functioning of monitoring equipment? (Yes / No):	calculation of the emission reduction.
If applicable, has the reported data been crosschecked with other available data?	NA
How were the values in the monitoring report verified?	The values mentioned in the monitoring report and ER sheet were verified with the operator log sheets/29/. The reported values in the MR and ER sheet were found to be consistent with the operator log sheet information.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	The data management procedure is transparent; which ensure correct transfer of data and reporting of emission reductions.

Monitored Parameter	Assessment/Observation														
Data / Parameter: (as in monitoring plan of the VCS PD):	$Q_{y,ww,Ethanol}$ Volume of wastewater treated in the year y from the ethanol plant (m ³)														
Measuring frequency:	Continuously The parameter is measured on a continuous basis and recorded by the flow meter (FM3).														
Reporting frequency:	Daily basis. As per the monitoring report /02/, the operators shall archive the monitored data manually into the log sheets /29/ and then, upload and transfer the same to the electronic storage. The same was also verified during the on-site visit and found OK.														
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes. From the document review and onsite verification, it is confirmed that the measuring and reporting frequencies are inline with the monitoring plan of the registered VCS PD.														
Type of monitoring equipment:	The monitoring equipment details have been checked during the site visit and found consistent. <table border="1"> <tr> <td>Meter name</td><td>FM3</td></tr> <tr> <td>Serial Number</td><td>S5G802553 736</td></tr> <tr> <td>Brand</td><td>Yokogawa</td></tr> <tr> <td>Model</td><td>APX1500</td></tr> <tr> <td>Accuracy</td><td>0.35%</td></tr> <tr> <td>Calibration Frequency</td><td>Once in 3 years</td></tr> <tr> <td>Calibration Date</td><td>29/03/12 06/05/15</td></tr> </table>	Meter name	FM3	Serial Number	S5G802553 736	Brand	Yokogawa	Model	APX1500	Accuracy	0.35%	Calibration Frequency	Once in 3 years	Calibration Date	29/03/12 06/05/15
Meter name	FM3														
Serial Number	S5G802553 736														
Brand	Yokogawa														
Model	APX1500														
Accuracy	0.35%														
Calibration Frequency	Once in 3 years														
Calibration Date	29/03/12 06/05/15														

Is accuracy of the monitoring equipment as stated in the VCS PD? If the VCS PD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	Volumetric Flow meters (FM3) to monitor the flow of waste water is of 0.35% accuracy class, against 1% mentioned in the registered VCS PD. Hence accepted to the verification team.
Calibration frequency /interval:	The defined calibration frequency by the PP is at least once every 3 years.
Is the calibration interval in line with the monitoring plan of the VCS PD? If the VCS PD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	No, there was a delay during this monitoring period for which correction factor has been applied accordingly for the conservative emission reduction calculation. CL-02 has been raised in this regard and successfully closed.
Company performing the calibration:	The calibration was carried out by "Miracle International Technology Co Ltd" /08/.
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	No, Corrections in the values have been applied for the conservative calculation of the emission reduction.
If applicable, has the reported data been crosschecked with other available data?	NA
How were the values in the monitoring report verified?	The values mentioned in the monitoring report and ER sheet were verified with the operator log sheets/29/. The reported values in the MR and ER sheet were found to be consistent with the operator log sheet information.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	The data management procedure is transparent; which ensure correct transfer of data and reporting of emission reductions.

Monitored Parameter	Assessment/ Observation
Data / Parameter: (as in monitoring plan of the VCS PD):	COD _{y,ww,untreated,starch} COD of wastewater from starch plant (mg/l)
Measuring frequency:	Daily. The COD measurement technique as per the VCS PD is colorimetric method, however as seen during the site visit and as per the monitoring report /02/ the same is estimated by titrimetric method. The closed reflux

	titrimetric method is well documented and well accepted by international standards /39/. The same is in-line with the applied methodology /27/. Hence, accepted.
Reporting frequency:	Daily basis. The COD content is analyzed using a titration method in the on-site laboratory of the treatment plant. The COD samples are taken from the outlet of wastewater from starch plant before entering CL1, as verified during the site visit and found to be consistent with the registered PD /23/.
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	No, It should be done on daily but the data is missing for some operational days, especially on weekend and holidays. In cases where COD value is not available for a particular day, the same estimated in a conservative manner (as per deviation 2 of section 2.2 of MR /02/) or ignored out of emission reduction estimation. The same is accepted to the verification team.
Type of monitoring equipment:	NA
Is accuracy of the monitoring equipment as stated in the VCS PD? If the VCS PD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	NA
Calibration frequency /interval:	NA
Is the calibration interval in line with the monitoring plan of the VCS PD? If the VCS PD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	NA
Company performing the calibration:	NA
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	NA
Is (are) calibration(s) valid for the whole reporting period?	NA
If applicable, has the reported data been crosschecked with other available data?	NA
How were the values in the monitoring report verified?	The values mentioned in the monitoring report and ER sheet were verified with the operator log sheets/29/. The reported values in the MR and ER sheet were found to be consistent with the daily reports and the operator log sheet information.
Does the data	Yes, it is confirmed from document review and onsite verification that the

management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	data management ensures correct transfer of data and reporting of emission reductions and the necessary QA/QC procedures are in place.
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Monitored Parameter	Assessment/ Observation
Data / Parameter: (as in monitoring plan of the VCS PD):	COD _{y,ww,untreated,sweetener} COD of wastewater from sweetener plant (mg/l)
Measuring frequency:	Daily. The COD measurement technique as per the VCS PD is colorimetric method, however as seen during the site visit and as per the monitoring report /02/ the same is estimated by titrimetric method. The closed reflux titrimetric method is well documented and well accepted by international standards /39/. The same is in-line with the applied methodology /27/. Hence, accepted.
Reporting frequency:	Daily basis. The COD content is analyzed using a titration method in the on-site laboratory of the treatment plant. The COD samples are taken from the outlet of wastewater from sweetener plant before entering CL2, as verified during the site visit and found to be consistent with the registered PD /23/.
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	No, It should be done on daily but the data is missing for some operational days, especially on weekend and holidays. In cases where COD value is not available for a particular day, the same estimated in a conservative manner (as per deviation 2 of section 2.2 of MR /02/) or ignored out of emission reduction estimation. The same is accepted to the verification team.
Type of monitoring equipment:	NA
Is accuracy of the monitoring equipment as stated in the VCS PD? If the VCS PD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	NA
Calibration frequency /interval:	NA
Is the calibration interval in line with the monitoring plan of the VCS PD? If the VCS PD does not specify the frequency of calibration, does the selected frequency represent good	NA

monitoring practice?	
Company performing the calibration:	NA
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	NA
Is (are) calibration(s) valid for the whole reporting period?	NA
If applicable, has the reported data been crosschecked with other available data?	NA
How were the values in the monitoring report verified?	The values mentioned in the monitoring report and ER sheet were verified with the operator log sheets/29/. The reported values in the MR and ER sheet were found to be consistent with the daily reports and the operator log sheet information.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Yes, it is confirmed from document review and onsite verification that the data management ensures correct transfer of data and reporting of emission reductions and the necessary QA/QC procedures are in place.

Monitored Parameter	Assessment/ Observation
Data / Parameter: (as in monitoring plan of the VCS PD):	COD _{y,ww,untreated,Ethanol} COD of wastewater from ethanol plant (mg/l)
Measuring frequency:	Daily. The COD measurement technique as per the VCS PD is colorimetric method, however as seen during the site visit and as per the monitoring report /02/ the same is estimated by titrimetric method. The closed reflux titrimetric method is well documented and well accepted by international standards /39/. The same is in-line with the applied methodology /27/. Hence, accepted.
Reporting frequency:	Daily basis. The COD content is analyzed using a titration method in the on-site laboratory of the treatment plant. The COD samples are taken from the outlet of wastewater from ethanol plant before entering CL3, as verified during the site visit and found to be consistent with the registered PD /23/.
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	No, It should be done on daily but the data is missing for some operational days, especially on weekend and holidays. In cases where COD value is not available for a particular day, the same estimated in a conservative manner (as per deviation 2 of section 2.2 of MR /02/) or ignored out of emission reduction estimation. The same is accepted to the verification team.
Type of monitoring equipment:	NA

Is accuracy of the monitoring equipment as stated in the VCS PD? If the VCS PD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	NA
Calibration frequency /interval:	NA
Is the calibration interval in line with the monitoring plan of the VCS PD? If the VCS PD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	NA
Company performing the calibration:	NA
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	NA
Is (are) calibration(s) valid for the whole reporting period?	NA
If applicable, has the reported data been crosschecked with other available data?	NA
How were the values in the monitoring report verified?	The values mentioned in the monitoring report and ER sheet were verified with the operator log sheets/29/. The reported values in the MR and ER sheet were found to be consistent with the daily reports and the operator log sheet information.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Yes, it is confirmed from document review and onsite verification that the data management ensures correct transfer of data and reporting of emission reductions and the necessary QA/QC procedures are in place.

Monitored Parameter	Assessment/ Observation
Data / Parameter: (as in monitoring plan of the VCS PD):	COD _{y,ww,treated,CL2} COD of wastewater exiting the covered lagoon 2 treatment process (mg/l)
Measuring frequency:	Daily. The COD measurement technique as per the VCS PD is colorimetric

	method, however as seen during the site visit and as per the monitoring report /02/ the same is estimated by titrimetric method. The closed reflux titrimetric method is well documented and well accepted by international standards /39/. The same is in-line with the applied methodology /27/. Hence, accepted.
Reporting frequency:	Daily basis. The COD content is analyzed using a titration method in the on-site laboratory of the treatment plant. The COD samples are taken from the outlet of CL2 before entering the open lagoons, as verified during the site visit and found to be consistent with the registered PD /23/.
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	No, It should be done on daily but the data is missing for some operational days, especially on weekend and holidays. In cases where COD value is not available for a particular day, the same estimated in a conservative manner (as per deviation 2 of section 2.2 of MR /02/) or ignored out of emission reduction estimation. The same is accepted to the verification team.
Type of monitoring equipment:	NA
Is accuracy of the monitoring equipment as stated in the VCS PD? If the VCS PD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	NA
Calibration frequency /interval:	NA
Is the calibration interval in line with the monitoring plan of the VCS PD? If the VCS PD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	NA
Company performing the calibration:	NA
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	NA
Is (are) calibration(s) valid for the whole reporting period?	NA
If applicable, has the reported data been crosschecked with other available data?	NA
How were the values in the monitoring report verified?	The values mentioned in the monitoring report and ER sheet were verified with the operator log sheets/29/. The reported values in the MR and ER sheet were found to be consistent with the daily reports and the operator log

	sheet information.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Yes, it is confirmed from document review and onsite verification that the data management ensures correct transfer of data and reporting of emission reductions and the necessary QA/QC procedures are in place.

Monitored Parameter	Assessment/ Observation
Data / Parameter: (as in monitoring plan of the VCS PD):	COD _{y,ww,treated,CL3} COD of wastewater exiting the covered lagoon 3 treatment process (mg/l)
Measuring frequency:	Daily. The COD measurement technique as per the VCS PD is colorimetric method, however as seen during the site visit and as per the monitoring report /02/ the same is estimated by titrimetric method. The closed reflux titrimetric method is well documented and well accepted by international standards /39/. The same is in-line with the applied methodology /27/. Hence, accepted.
Reporting frequency:	Daily basis. The COD content is analyzed using a titration method in the on-site laboratory of the treatment plant. The COD samples are taken from the outlet of CL3, as verified during the site visit and found to be consistent with the registered PD /23/.
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	No, It should be done on daily but the data is missing for some operational days, especially on weekend and holidays. In cases where COD value is not available for a particular day, the same estimated in a conservative manner (as per deviation 2 of section 2.2 of MR /02/) or ignored out of emission reduction estimation. The same is accepted to the verification team.
Type of monitoring equipment:	NA
Is accuracy of the monitoring equipment as stated in the VCS PD? If the VCS PD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	NA
Calibration frequency /interval:	NA
Is the calibration interval in line with the monitoring plan of the VCS PD? If the VCS PD does not specify the frequency of calibration, does the	NA

selected frequency represent good monitoring practice?	
Company performing the calibration:	NA
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	NA
Is (are) calibration(s) valid for the whole reporting period?	NA
If applicable, has the reported data been crosschecked with other available data?	NA
How were the values in the monitoring report verified?	The values mentioned in the monitoring report and ER sheet were verified with the operator log sheets/29/. The reported values in the MR and ER sheet were found to be consistent with the daily reports and the operator log sheet information.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Yes, it is confirmed from document review and onsite verification that the data management ensures correct transfer of data and reporting of emission reductions and the necessary QA/QC procedures are in place.

Monitored Parameter	Assessment/ Observation
Data / Parameter: (as in monitoring plan of the VCS PD):	W _{CH₄} Methane content in biogas (%)
Measuring frequency:	Continuously The parameter is monitored using a online analyser.
Reporting frequency:	Daily basis. As per the monitoring report /02/, the operators shall archive the monitored data manually into the log sheets /29/ and then, upload and transfer the same to the electronic storage. The same was verified during the on-site visit and found OK.
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes. The measuring and reporting frequency of the parameter is inline with the monitoring plan and also with the monitoring methodology.
Type of monitoring equipment:	The monitoring equipment details have been checked during the site visit and found consistent.

	Meter name	MS01
	Serial Number	1090 3240 2610 0000 0019
	Brand	Wuhan
	Model	Gasboard-3200
	Accuracy	2%
	Calibration Frequency	Once in 3 years
	Calibration Date	10/01/12 10/01/14
Is accuracy of the monitoring equipment as stated in the VCS PD? If the VCS PD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	The accuracy of the online gas analyser as mentioned in the monitoring report /02/ is 2%/1% and the same is verified with the technical specification /11/ provided by the manufacturer and found to be consistent with the registered PD /23/.	
Calibration frequency /interval:	Once in three years	
Is the calibration interval in line with the monitoring plan of the VCS PD? If the VCS PD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	From the above mentioned calibration dates and the Monitoring report /02/, it can be confirmed that the calibration interval is inline with the monitoring plan of the VCS PD and it represents good monitoring practice.	
Company performing the calibration:	The calibration was carried out by “Techtronic Corporation Limited” /08/.	
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes. The calibration certificates were checked and the meter was found functioning properly.	
If applicable, has the reported data been crosschecked with other available data?	NA	
How were the values in the monitoring report verified?	The values mentioned in the monitoring report and ER sheet were verified with the operator log sheets/29/. The reported values in the MR and ER sheet were found to be consistent with the operator log sheet information.	
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary OA/OC	The data management procedure is transparent; which will ensure correct transfer of data and reporting of emission reductions.	

processes in place?	
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Monitored Parameter	Assessment/ Observation																								
Data / Parameter: (as in monitoring plan of the VCS PD):	BG _{combusted, y} Amount of biogas combusted for gainful use in the year y (Nm ³)																								
Measuring frequency:	Continuously The parameter is measured on a continuous basis and recorded by the biogas flow meters (GM1 and GM2), the value is available in Nm ³ . Measurements of volume of biogas sent to boilers are done continuously carusing gas flow meters. The gas flow meters are installed and values recorded regularly by skilled employees. In recording this parameter, plant's operators shall first manually archive the monitored data onto log sheets then transfer to the computer for electronic storage.																								
Reporting frequency:	Daily basis. As per the monitoring report /02/, the operators shall archive the monitored data manually into the log sheets /17/ and then, upload and transfer the same to the electronic storage. The same was verified during the on-site visit and found OK.																								
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes																								
Type of monitoring equipment:	The monitoring equipment details have been checked during the site visit and found consistent. <table border="1"> <tr><td>Meter name</td><td>GM1</td></tr> <tr><td>Serial Number</td><td>301123</td></tr> <tr><td>Brand</td><td>FCI</td></tr> <tr><td>Model</td><td>ST51</td></tr> <tr><td>Accuracy</td><td>2%</td></tr> <tr><td>Calibration Frequency</td><td>Once in 3 years</td></tr> <tr><td>Calibration Date</td><td>13/03/12 29/02/16</td></tr> </table> <table border="1"> <tr><td>Meter name</td><td>GM2</td></tr> <tr><td>Serial Number</td><td>301122</td></tr> <tr><td>Brand</td><td>FCI</td></tr> <tr><td>Model</td><td>ST51</td></tr> <tr><td>Accuracy</td><td>2%</td></tr> </table>	Meter name	GM1	Serial Number	301123	Brand	FCI	Model	ST51	Accuracy	2%	Calibration Frequency	Once in 3 years	Calibration Date	13/03/12 29/02/16	Meter name	GM2	Serial Number	301122	Brand	FCI	Model	ST51	Accuracy	2%
Meter name	GM1																								
Serial Number	301123																								
Brand	FCI																								
Model	ST51																								
Accuracy	2%																								
Calibration Frequency	Once in 3 years																								
Calibration Date	13/03/12 29/02/16																								
Meter name	GM2																								
Serial Number	301122																								
Brand	FCI																								
Model	ST51																								
Accuracy	2%																								

	Calibration Frequency	Once in 3 years	
	Calibration Date	13/03/12 08/05/15	
Is accuracy of the monitoring equipment as stated in the VCS PD? If the VCS PD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	VCS PD does not specify the accuracy of monitoring equipment. The accuracy class of the flow meters represents good monitoring practice.		
Calibration frequency /interval:	The defined calibration frequency by the PP is at least once every 3 years.		
Is the calibration interval in line with the monitoring plan of the VCS PD? If the VCS PD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	No, there was a delay during this monitoring period for which correction factor has been applied accordingly for the conservative emission reduction calculation. CL-02 has been raised in this regard and successfully closed.		
Company performing the calibration:	The calibration was carried out by "Miracle International Technology Co Ltd" /08/.		
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	No, Corrections in the values have been applied for the conservative calculation of the emission reduction.		
If applicable, has the reported data been crosschecked with other available data?	NA		
How were the values in the monitoring report verified?	The values mentioned in the monitoring report and ER sheet were verified with the operator log sheets/29/. The reported values in the MR and ER sheet were found to be consistent with the operator log sheet information.		
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	The data management procedure is transparent; which ensure correct transfer of data and reporting of emission reductions.		

Monitored Parameter	Assessment/ Observation
Data / Parameter: (as in monitoring plan of the VCS PD):	EC _y Electricity consumption by wastewater treatment system and biogas plant in year y – MWh
Measuring frequency:	NA

Reporting frequency:	Calculated based on the rated capacity.
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	No, however conservative approach has been taken which is accepted to the verification team.
Type of monitoring equipment:	NA
Is accuracy of the monitoring equipment as stated in the VCS PD? If the VCS PD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	NA
Calibration frequency /interval:	NA
Is the calibration interval in line with the monitoring plan of the VCS PD? If the VCS PD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	NA
Company performing the calibration:	NA
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	NA
Is (are) calibration(s) valid for the whole reporting period?	NA
If applicable, has the reported data been crosschecked with other available data?	NA
How were the values in the monitoring report verified?	Maximum rated consumption is calculated by multiplying total electrical capacity with 8,760 hours and 10% additional factor (for transmission losses) to be conservative. This value is defined in the registered VCS PD /23/, however the installed capacity has been updated as per actuals. Since the value available during the validation is the installed capacity of UASB only. The new actual value is more conservative since it results in higher project emission. This list was verified during site visit against name plate details.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data	The data management procedure is transparent; which ensure correct transfer of data and reporting of emission reductions.

and reporting of emission reductions and are necessary QA/QC processes in place?	
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Remaining Issues from Validation or Previous Verification:

From the review of validation report and the previous (1st) verification report, Verification team has found that there is no remaining FAR to be addressed during this verification.

4.2 Accuracy of GHG Emission Reduction and Removal Calculations

The verification team has reviewed the emission reduction (ER) spread sheet and checked all the formulae and found they are correct and inline with the monitoring plan of the registered VCS PD and the applied monitoring methodologies.

All the monitored parameters are described above in section 4.1. All the ex-ante parameters which are used in the calculation of emission reduction are presented in section 3.1 of the MR transparently. It is confirmed that all the ex-ante parameters have been correctly used in the emission reduction calculation.

Baseline emissions:

It is noted that the formula and calculation used for baseline emission calculation in the monitoring report and ER sheet is in compliance with the registered VCS PD. The default values and data used in the monitoring report /02/ is in-line with the registered PD/23/. Hence, accepted.

Project Emissions:

It is noted that the formula and calculation used for project emission calculation in the monitoring report and ER sheet is in compliance with the registered VCS PD. The default values and data used in the monitoring report /02/ is in-line with the registered PD/23/. Hence, accepted.

Leakage:

As per the methodology AMS-III.H and as defined in the registered VCS PD no leakage is considered in the project activity and the same is followed in this monitoring period also. Thus, it is in compliance with the registered VCS PD.

The following are the ex-ante parameters used in the ER calculation which are in compliance with registered VCS PD/23/:

Parameter	Description	Value	Unit
GWP_{CH_4}	Global Warming Potential for methane gas	25	-
$B_{o, ww}$	Methane generation capacity of COD in wastewater	0.21	kg CH ₄ / kg COD
UF_{BL}	Model correction factor to account for model uncertainties	0.94	-
UF_{PJ}	Model correction factor to account for model uncertainties	1.06	-
$MCF_{ww, treatment, BL, lagoon}$	Methane correction factor for the baseline anaerobic wastewater treatment system	0.8	-
$MCF_{ww, treatment, PJ, k}$	Methane correction factor for the project wastewater treatment system k equipped with the biogas recovery	$MCF_{ww, treatment, PJ, UASB} = 0.8$ $MCF_{ww, treatment, PJ, CL1} = 0.8$ $MCF_{ww, treatment, PJ, CL2} = 0.8$ $MCF_{ww, treatment, PJ, CL3} = 0.8$	-
$MCF_{ww, treatment, PJ, lagoon}$	Methane correction factor for the project wastewater treatment system not equipped with biogas recovery	0.8	-
$MCF_{ww, PJ, discharge}$	Methane correction factor based on discharge pathway in the project situation	0.8	-
CFE_{ww}	Capture and utilization/combustion/flare efficiency of the methane recovery and combustion/utilization equipment in the wastewater treatment.	0.9	-
$\eta_{BL, starch}$	COD removal efficiency of baseline wastewater treatment system for the starch and sweetener plants	98.61%	%
$\eta_{BL, ethanol}$	COD removal efficiency of baseline wastewater treatment system for the ethanol plants	87.76%	%
FE	Flare efficiency	50%	%
P_{el}	Total electrical capacity of the equipment installed in the project activity	245.1	kW
EF_y	"The calculation of emission factor for an electricity system in Thailand 2007", DEDE.	0.5057	tCO ₂ /MWh

According to the applied methodologies, the conservativeness of the achieved emission reduction was checked and the calculation has been transparently provided in the ER sheet. The emission reduction is calculated using both COD approach and MD approach as specified by the applied methodology, AMS III.H., version 13. The total emission reduction for the monitoring period calculated by MD approach and by COD approach is stated below.

Year	2013 (01/09/2013 to 31/12/2013)	2014 (01/01/2014 to 31/12/2014)	2015 (01/01/2015 to 31/12/2015)	2016 (01/01/2016 to 11/05/2016)
ER by COD approach (tCO ₂ e)	19,048	37,232	77,971	25,036
ER by MDy approach (tCO ₂ e)	32,839	80,267	81,335	28,359
Total ER considered in the MR (tCO ₂ e)	19,048	37,232	77,971	25,036

The detailed emission reduction calculation is presented in the ER spread sheet/04/. All the formulae and the calculation procedure were checked by the verification team. It was observed that the emission reduction was determined in a conservative manner.

4.3 Quality of Evidence to Determine GHG Emission Reductions and Removals

During the verification site visit, all relevant documents were checked to assess the correctness and quality of data submitted by the project participants, which are used to determine emission reductions. All records needed for monitoring are archived in line with the requirements of the registered monitoring plan. No significant, lack of evidence and missing data were detected during onsite verification. Hence, the verification team confirms that the monitoring system ensures required quality of the monitoring system to ensure the quality of the monitored data. All internal data are subjected to QA/QC measures.

It was verified through onsite interviews that the plant's team involved in the monitoring of project activity is well experienced. Hence, the verification team concludes that competent staff is employed by the project proponent to carry out the relevant tasks with sufficient accuracy. Furthermore, it was learnt from the onsite interviews with the operating team that internal training program /06/ are conducted on regular basis as per ISO requirements.

4.4 Non-Permanence Risk Analysis

Not Applicable to the project activity

5 SAFEGUARDS

5.1 No Net Harm

The project activity has no potential negative environment and social-economic impacts. Assessment team confirms it based on its on-site visit, document review and local & sectoral expertise.

5.2 Local Stakeholder Consultation

The local stakeholder consultation meeting for the project activity has been conducted on project site on 09/12/2008 and the process was validated during the registration of project activity under VCS. VCS validation report verified to confirm the same. The PP had invited identified stakeholders well in advance. The stakeholder meeting process is described in the section 6 of the registered VCS PD in detail. Further the verification team has interviewed the local stakeholders during the on-site visit for this verification and could not find any negative impact out of the project activity.

6 VERIFICATION CONCLUSION

KBS Certification Services Pvt. Ltd. has been contracted by 'Swiss Carbon Value Ltd.' to undertake independent 2nd periodic verification and certification for the greenhouse gas (GHG) emission reductions reported from "P.S.C Starch Wastewater Treatment and Biogas Utilization Project", for the monitoring period 01/09/2013 to 11/05/2016 (including both the days).

The verification is based on the registered VCS PD and the monitoring report for this project activity. Our verification approach was based on the requirements as defined under the Kyoto Protocol, Marrakech accord, as well as those defined by the CDM Executive Board and the VCS Standard Version 3.7.

The management of the 'P.S.C Starch Products Public Company Limited' and "Swiss Carbon Value Ltd." is responsible for the preparation of the GHG emissions data and the reported GHG emissions reductions on the basis set out within the project Final Monitoring Report Version 04 and dated 19/06/2018. The calculation and determination of GHG emission reductions from the project is the responsibility of the management of 'P.S.C Starch Products Public Company Limited' and "Swiss Carbon Value Ltd.". The development and maintenance of records and reporting procedures are in accordance with the Monitoring Report Version 04 and dated 19/06/2018.

It is our responsibility to express an independent GHG verification opinion on the GHG emissions and on the calculation of GHG emission reductions from the project for the period 01/09/2013 to 11/05/2016 based on the reported emission reductions in the Final Monitoring Report Version 04 and dated 19/06/2018 for the same period.

As a result of the verification, the verification team confirms that:

- All operations of the project are implemented and installed as planned and described in the project description.
- The monitoring system is in place and functional.
- The installed equipment essential for generating emission reductions runs reliably.
- The GHG emission reductions are calculated without material misstatements in a conservative and appropriate manner.

Based on an understanding of the risks associated with reporting GHG emissions data and the controls in place to mitigate these, KBS planned and performed our work to obtain the information and explanations that we considered necessary to provide sufficient evidence for us to give reasonable assurance that this reported amount of GHG emission reductions for the period is fairly stated.

Verification period: From [01-09-2013] to [11-05-2016]

Verified GHG emission reductions and removals in the above verification period:

Year	Net GHG emission reductions or removals (tCO ₂ e)
2013 (01/09/2013 to 31/12/2013)	12,187
2014 (01/01/2014 to 31/12/2014)	37,232
2015 (01/01/2015 to 31/12/2015)	77,971
2016 (01/01/2016 to 11/05/2016)	25,036
Total	152,426

Location: Faridabad

Date: 19/06/2018



Authorized Signatory: Kaushal Goyal

Designation: Managing Director

KBS Certification Services Pvt. Ltd.

APPENDIX 1: ABBREVIATIONS

Abbreviations	Full texts
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CDM EB	CDM Executive Board
CL	Clarification request
CO ₂	Carbon dioxide
CO ₂ e	Carbon dioxide equivalent
COD	Chemical Oxygen Demand
DOE	Designated Operational Entity
EB	Executive Board
ER	Emission Reduction
FAR	Forward Action Request
GHG	Greenhouse Gas(es)
MP	Monitoring Plan
MR	Monitoring Report
PD	Power Density
PP	Project Participant
QA/QC	Quality Assurance / Quality Control
UASB	Up-flow Anaerobic Sludge Blanket
UNFCCC	United Nations Framework Convention on Climate Change
VCS	Verified Carbon Standard
VCSA	VCS Association

VCS PD	VCS Project Design document
VCU	Verified Carbon Unit
VVS	Validation And Verification Standard

APPENDIX 2: REFERENCES

S. No.	Name of document	date
/1/	Draft Monitoring Report	Version 01, dated 19/02/2018
/2/	Final Monitoring Report	Version 04, dated 19/06/2018
/3/	Draft ER sheet	Version 01, dated 19/02/2018
/4/	Final ER sheet	Version 03, dated 15/05/2018
/5/	COD Measurement from External Laboratory during this monitoring period	-
/6/	Attendance sheets for the training conducted in the plant-biogas & lab	-
/7/	Operating License for the starch factory	-
/8/	Calibration certificates for the instruments used in the project activity covering this monitoring Period	-
/9/	Calibration plan	
/10/	Competency proof of the calibrating agency.	-
/11/	Extract of manual of all the major equipments (UASB, HCLU, boiler) and all meters/measuring instruments/devices clearly indicating their specifications/technical details corresponding to the project activity. Specification of fuel oil meters Specification of portable gas analyzer specifications on flow meters	-
/12/	List of auxiliary drives along with their rated capacity	-
/13/	Operation Manual of Biogas Plant	-
/14/	COD sampling method.	-
/15/	Operation start date of the project activity, as per the first record of biogas sent to boiler	-

/16/	Single line diagram corresponding to the project activity describing the monitoring points	-
/17/	Snap shots of the following 1. Equipments: Covering the equipment and corresponding nameplates under project boundary (all major equipments). 2. All the meters and measuring & testing equipment (including their specifications/nameplates).	-
/18/	1. Extract of operation and maintenance record 2. Records of outage	-
/19/	Competency certificates of operators.	-
/20/	Flare specification	-
/21/	All the Government approvals e.g. from local section and ministry of industry, Thailand. Operational permit.	-
/22/	P.S.C Starch Products Public Company Limited: EIA report of P.S.C Starch Products prepared by ENCAD Consultants Limited dated May, 2007.	-
/23/	VCS registered PD for project: "P.S.C Starch Wastewater Treatment and Biogas Utilization Project"	Version 3.1 dated 18/11/2009
/24/	CDM-EB: Clean Development Mechanism Validation and Verification Standard for project activity	Version 01.0
/25/	TÜV NORD CERT GmbH: Validation report for the project "P.S.C Starch Wastewater Treatment and Biogas Utilization Project", report number 53219108-08/509	Dated 18/11/2009
/26/	RINA Services S.p.A. (RINA): Verification report of the project "P.S.C Starch Wastewater Treatment and Biogas Utilization Project" for the 1st verification. Report ID 2013-IQ-23-MD	Dated 06/11/2014
/27/	Small-Scale CDM methodologies AMS III.H., version 13 – "Methane Recovery in Wastewater Treatment" AMS.I.D., version 14 - "Grid connected renewable electricity generation"	-
/28/	IPCC: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, available at	-

	weblink http://www.ipcc-nggip.iges.or.jp/public/2006gl/	
/29/	Daily reports for all the monitoring parameters for the monitoring period.	-
/30/	P.S.C. Starch Products Public Company Limited: Production details for the monitoring period.	-
/31/	P.S.C Starch Products Public Company Limited: Work Instructions for the Operation of wastewater treatment plant, emergency plan for biogas leakage, COD test and waste water sampling	-
/32/	CDM-EB: Tool to determine project emissions from flaring gases containing methane, Version 01	EB 28, Annex 13
/33/	CDM-EB: Tool to calculate the emission factor for an electricity system"	version 1.1
/34/	VCS Verified Carbon Standard: VCS Program Guide, VCS Version 03, v3.7	21 June 2017
/35/	VCS Verified Carbon Standard: VCS Standard, VCS Version 03, v3.7	21 June 2017
/36/	VCS Verified Carbon Standard: VCS Verification Report Template Version 3.4	19 October 2016
/37/	VCS Verified Carbon Standard: VCS Guidance, Validation and Verification Manual, Version 3.2	19 October 2016
/38/	VCS Verified Carbon Standard: VCS Monitoring Report Template Version 3.4	19 October 2016
/39/	"The Examination of water and wastewater", 1st Ed 2005 and Wastewater analysis manual from Environmental Engineering Association , Thailand , 3rd Ed. 1997	-

APPENDIX 3: COMPETENCE OF TEAM MEMBERS AND TECHNICAL REVIEWERS

Personnel Name:		Chetan Swaroop Sharma	
Qualified to work as:			
Team Leader	☒	Technical Expert	☒
Validator/Verifier	☒	Financial Expert	☒
Technical Reviewer	☒	Local Expert (India)	☒

Area(s) of Technical Expertise	
Sectoral Scope	Technical Area
Energy industries (renewable/non-renewable sources)	TA 1.2: Energy generation from renewable energy sources
	TA 1.1: Thermal energy generation from fossil fuels and biomass including thermal electricity from solar
Approved by (Manager C & T)	Gagandeep Kakkar
Approval date:	09/10/2015

Personnel Name:		M P Kanal	
Qualified to work as:			
Team Leader	☒	Technical Expert	☒
Validator/Verifier	☒	Financial Expert	☒
Technical Reviewer	☒	Local Expert (India)	☒
Area(s) of Technical Expertise			
Sectoral Scope		Technical Area	
Energy industries (renewable/non-renewable sources)		TA 1.2: Energy generation from renewable energy sources	
Energy Demand		TA 3.1: Energy Demand	
Waste handling and disposal		TA 13.1. Solid waste and wastewater	
Agriculture		TA 15.1. Agriculture	
Approved by (Manager C & T)		Gagandeep Kakkar	
Approval date:		03/11/2015	

APPENDIX 4: CLARIFICATION REQUESTS, CORRECTIVE ACTION REQUESTS AND FORWARD ACTION REQUESTS

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

No remaining FAR from validation and/or previous verification

FAR-ID	xx	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

Table 2. CL from this verification

CL ID	01	Section no.	-	Date: 19/03/2018
Description of CL				
During the review of the Calibration reports /08/, the results of the calibration for the below meters were found more than accuracy class.				
Monitoring parameter		Meter	Calibration date	
BG _{combusted,y}		GM1-301123	13/03/2012	
		GM2-301122	08/05/2015	
Project participant response				Date: 10/04/2018
1) GM1 - calibration report of 13/03/2012 The maximum UCC error from Table 1 is 3.46% of reading plus the uncertainty of 14 Nm³/h. The UCC reading is 1252.3 Nm³/h while the STD reading is 1210.42 Nm³/h. The difference between two readings is 41.88 Nm³/h, deducted by the uncertainty, the error of the installed flow meter will be 27.88 Nm³/h or 2.3% UCC error, which is 0.3% over spec. Therefore 0.3% will be applied to deduct with the readings from GM1 for period 2012 till the first period of 2016. The lower value is used, to be in line with conservative approach. 2) GM2 - calibration report of 08/05/2015 The maximum UCC error from Table 3 is -5.2% of reading plus the uncertainty of 14 Nm³/h, means the amount of biogas from installed biogas flow meter is lower than standard. The minus error is acceptable even it is higher than maximum limit since the ERs result will be decreased which is conservative. No adjusting is required for this case.				
Documentation provided by project participant				
ER calculation spread sheet , in 'blue' letter				
DOE assessment				Date: 01/05/2018

PP has corrected the values in such a manner that results lower baseline emission and hence conservative. The same is accepted to the verification team. Hence this CL is closed.

CL ID	02	Section no.	-	Date: 19/03/2018
Description of CL				
During the review of the Calibration reports /08/, Verification team has found that calibration of most of the meters have been delayed during this monitoring period. PP need to clarify how the emission reduction calculation has been calculated conservatively.				
Project participant response				Date: 10/04/2018
The data adjusting from calibration delay, deduction by the maximum error for conservativeness, is done as follows,				
• FM1 , FM2 and FM3 : 2015 • GM1 : 2015 and first period of 2016 • GM2 : 2015				
Documentation provided by project participant				
ER calculation spreadsheet, with 'green' highlight				
DOE assessment				Date: 01/05/2018
PP has applied the maximum error of the instruments for the delayed period for conservative emission reduction calculation. Verification team has verified the same from the ER sheet /04/ and found OK. PP has applied the error in such a manner that result lower baseline emission and higher project emission and hence conservative. The same is accepted to the verification team. Hence this CL is closed.				

Table 3. CAR from this verification

CAR ID	01	Section no.	-	Date: 19/03/2018
Description of CAR				
During the review of the COD data ($COD_{y,ww,untreated,starch}$, $COD_{y,ww,untreated,sweetener}$, $COD_{y,ww,untreated,Ethanol}$, $COD_{y,ww,treated,CL2}$, $COD_{y,ww,treated,CL3}$), Verification team has found that the COD data is the ER calculation sheet /04/ is not consistent (few places) with the log sheets /29/.				
Project participant response				Date: 10/04/2018
The COD data is rechecked and corrected in 'blue', to ensure the consistency.				

Documentation provided by project participant	
ER calculation spreadsheet	
Log sheet for COD test result	
DOE assessment	Date: 01/05/2018
Correction has been done in the revised ER sheet /04/ and found OK. Verification team has cross-checked the same from the log sheet /29/ and found consistent. Hence this CAR is closed.	

Table 4. FAR from this verification

No FAR raised during this monitoring period.

FAR ID	xx	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