



Voluntary Carbon Standard 2007.1

Validation Report

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Report Title:	Approved by:
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Client:	Project Title:
South Pole Carbon Asset Management Ltd	P.S.C Starch wastewater treatment and biogas utilization project

Summary:

The M/s South Pole Carbon Asset Management Ltd on behalf of M/s P.S.C. Starch Products Public Company Limited, has commissioned the TÜV NORD JI/CDM Certification Program to validate the project: “P.S.C Starch wastewater treatment and biogas utilization project”, with regard to the relevant requirements of the VCS 2007.1 Guidelines/ VCSA Rules for project activities, as well as criteria for consistent project operations, monitoring and reporting.

- The purpose of this project activity is to recover methane using an Upflow Anaerobic Sludge Blanket (UASB) system and covered lagoons. The biogas will be utilized as fuel for a boiler to produce steam in order to produce electricity and heat, thereby replacing the previous fuel mix based on biomass and coal used earlier by the project proponent. However, GHG emission reduction is not claimed for the heat and electricity generated.
- The review of the VCS PD and additional documents related to baseline and monitoring methodology; the subsequent background investigation, follow-up interviews and review of comments by parties, stakeholders have provided TÜV NORD JI/CDM CP with sufficient evidence to validate the fulfilment of the stated criteria.
- A risk-based approach has been followed to perform this validation. In the course of the validation, Fourteen (14) Corrective Action Requests (CARs) and one (1) clarification request (CL) were raised and successfully closed. Two (02) Forward Action Requests (FARs) are raised, which will be verified during the next verification.

The validation is based on the VCS PD version 2.0, proof of title, additional documents related to baseline and monitoring methodology; the subsequent background investigation, follow-up interviews and supporting documents made available to the validation team by the project proponent.

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

- The project fulfils criteria of VCS 2007.1 provided.
- The project additionality is sufficiently justified in the PD.
- The monitoring plan is transparent, adequate and in line with the applied baseline and monitoring methodology AMS III.H/Version 13: “Methane Recovery in Wastewater Treatment”. The approved small scale

methodology of UNFCCC CDM program is correctly applied.

- The calculation of the project emission reductions is carried out in a transparent and conservative manner, so that the estimated emission reductions of 369,730 tCO₂e is most likely to be achieved from 1 December, 2009 onwards till end of 1st ten(10) years (renewable) crediting period.

- There are no restrictions or uncertainties faced related to the validation of the project.

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1 Introduction

1.1 Objective

The purpose of this validation is to have an independent third party assessment of the project design, in particular, the project's baseline, the additionality, the monitoring plan (MP) and the project's compliance with

- The requirements of VCS 2007.1 program guidelines;
- Requirements of the applied approved SSC CDM methodology AMS III.H/Version 13: “Methane Recovery in Wastewater Treatment” which is adopted by VCSA;
- To assess the project's compliance with other relevant rules, including the Project country (Thailand) legislation; and
- Other relevant rules, of VCS sustainability criteria are validated in order to confirm that the project design as documented is sound and reasonable and meet the stated requirements and identified criteria. Validation is seen as necessary to provide assurance to stakeholders on the quality of the project and its intended generation of Verified emission reductions (VERs/VCUs¹) without any double counting.

1.2 Scope and Criteria

The validation scope is given as an independent and objective review of the project design, the project's baseline study and monitoring plan (based on AMS III.H/Version 13: “Methane Recovery in Wastewater Treatment”) which are included in the VCS-PD and other relevant supporting documents.

The items covered in the validation are described below:

- VCS 2007.1 and Project Country Criteria
 - To meet the requirements of VCS 2007.1 guidelines requirements, in particular,
 - Project country requirements / criteria
- VCS Project Description
 - Project design
 - Project boundaries and Predicted VCS project GHG emissions

¹ As per VCS, Verified Emission Reductions (VERs) are considered to be VCUs only after successful registration in an approved VCU Registry

- Project Baseline
 - Baseline methodology
 - Baseline GHG emissions
- Monitoring Plan
 - Monitoring methodology
 - Indicators/data to be monitored and reported
 - Responsibilities
- Project Additionality
- Background investigation and follow up interviews
- Draft validation reporting with CARs, CLs & FARs, if any
- Final validation reporting.

The information included in the VCS-PD and the supporting documents were reviewed against the requirements and criteria mentioned above. The TÜV NORD CERT GmbH JI/CDM CP has employed a risk-based approach in the validation, focusing on the identification of significant risks for project implementation and the generation of VERs. The validation is based on the information made available to TÜV NORD JI/CDM CP and on the contract conditions.

The validation is not meant to provide any consulting to the project participant. However, stated requests for clarifications and/or corrective actions may provide input for improvement of the project design.

1.3 VCS project Description

Baseline Emissions:

P.S.C. Starch Products Public Company Limited factory is located at Nongyai in Chonburi province of Thailand (Latitude 13°18'6.50"N, Longitude 101°21'49.47"E). Wastewater from 200 TPD starch plant and 240 TPD sweetener plant was being treated by 8 cascading open anaerobic deep lagoons (minimum depth of 4.5 m) before methane capture and destruction/ utilization project was implemented^{/BLS/}.

Baseline fuel for hot air generator and steam boiler was coal and biomass residues and the baseline electricity for starch factory is grid.

The operating days of the starch processing plants is approximately 300 days^{/TD/}.

As per the interview during site visit the lagoon treated wastewater was being used for plantation purposes within the factory premises^{/IM01/} within local pollution control norms^{/SC/}.

Bio-Methane Recovery Project Description:

The 2,800 m³ wastewater from the starch plant and 320 m³ wastewater from the sweetener plant on a daily basis^{/EIA/} is being treated by one Up-flow Anaerobic Sludge Blanket (UASB) reactor and one covered lagoon in order to capture and store biogas generated from waste water treatment process.

There is no additional sludge treatment involved in the above methane recovery treatment scheme. No final disposal of sludge has happened from the wastewater treatment system.

One out of 8 open lagoons in baseline scenario has been redesigned and converted to covered lagoon in order to recover and store biogas generated from waste water coming from UASB.

Apart from this one new covered lagoon is planned to be installed for the treatment of waste water (1600 m³/day as designed) from ethanol plant.

There are 5 steam boilers to utilise the biogas as a fuel along with coal powder. One out of 5 steam boilers is being used to generate steam to run the turbine for electricity generation. Biogas will also be utilised in the one hot air generator installed in starch plant.

Bio-Methane destruction/utilisation:

The starting date of the project, i.e., 1st emission reduction happened on 28 April 2005. This is the date on which first destruction of biogas occurred in the boiler after completion of piping network for biogas transmission^{/SD/}. The destruction/utilisation of the biogas was being carried out through a set of 5 steam boilers and one hot air generator.

Though currently there is no onsite flaring, in future flaring equipment will be installed to destroy any surplus biogas.

However, additional claim for grid electricity displacement and biomass replacement is not made in order

to hold the conservativeness principle and to avoid baseline complications.

There is no additional sludge treatment in the project activity. The final sludge disposal continued to be soil application in the project scenario. Sludge removal and its application will be monitored by the project owner and record will be maintained on at the project site.

1.4 Level of assurance

The validation report is based on VCS PD^{/PD1//PD2/}, supporting documents made available to the validation team and information collected through performing interviews and during the on-site assessment. The validation opinion is assured provided the credibility of all above.

2 Methodology

The validation of the project was carried out from August 2009 to November 2009

Preparations	:	01/08/2009-09/08/2009
On-site validation	:	10/08/2009
(Draft) Reporting	:	31/08/2009
(Final) Reporting	:	18/11/2009

The validation consisted of the following three phases:

- a desk review of the project design and the baseline and monitoring methodology
- follow-up interviews
- the resolution of outstanding issues and the issuance of the final validation report and opinion

2.1 Review of Document

The draft PD^{/PD1/} submitted by the M/s South Pole Carbon Asset Management Ltd in August 2009 and supporting background documents related to the project design and baseline were reviewed on 09/08/2009. Furthermore, the validation team used additional documentation by third parties like project country legislation, technical reports referring to the project design or to the basic conditions and technical data.

The documents that were considered during the validation process are given in Annexure-2 of this report. They are listed as follows:

- Documents provided by the project proponent (Table 5-1)
- Background investigation and assessment documents (Table 5-2)
- Websites used (Table 5-3).

2.2 Follow-up Interviews

On 10/08/2009, the TÜV NORD JI/CDM CP performed validation visit with the project proponent at M/s P.S.C. Starch Products Public Company Limited, Thailand.

During this visit, as well as earlier and after, interviews with the project proponent, the consultant, project stakeholders and with local authorities were carried out to confirm selected information and to resolve issues identified in the document review.

The key interviewee and main topics of the interviews are summarised in Table 2-1.

Table 2-1 Interviewed persons and interview topics

Interviewed Persons / Entities	Interview topics
Mr. Sarun Sereethoranakul Mr. Siam Phoolcharoen	- Chronological description of Project with documents of key steps - Technical details of the project realisation- project feasibility, designing, engineering, operational life time - Compliance with local laws and regulations - Monitoring and measurement equipments - Financial aspects - Crediting period - Project activity starting date - VER allocation /ownership - Sustainable development issues - Analysis of local stake holder consultation - Roles & responsibilities of the staff members w.r.t project management, monitoring and reporting - QA/QC and calibration procedures

Interviewed Persons / Entities	Interview topics
	- Editorial aspects of PD - Methodology selection aspects - Base line study, project emissions, leakage and additionality - Details of emission reduction calculation.

A detailed list including the functions or designations of the interviewed persons is given in Annexure-2 (see. Table 5-4). This table also includes reference codes to be used in the validation protocol.

2.3 Resolution of any material discrepancy

A few discrepancies were found during the validation and the validation report containing a set of CARs and CLs were submitted to the project proponent. The project design document was revised addressing the CARs and CLs issued by TÜV NORD JI/CDM CP.

3 Validation Findings

The findings of validation are summarised in table 3-1:

Table 3-1: Summary of CAR, FAR and CL issued

Validation topic	No. of CAR	No. of FAR	No. of CL
D- Project Design	06	01	01
B- Baseline and additionality	03	-	-
M- Monitoring plan	03	01	-
C-Calculation of GHG emissions	01	-	-
E- Environmental Impact	-	-	-
L- Local Stakeholder Comments	-	-	-
SUM	13	02	01

For an in depth analysis/evaluation of all CARs and CLs can be referred to the below sections from 3.1 to 3.6.

3.1 Project Design

The conclusions are as follows:

- The technology used: This project has involved two different wastewater treatment technologies (as anaerobic digester systems), namely, UASB and covered lagoon. There is one UASB in the project with 70% COD removal efficiency and design volumetric capacity of wastewater of 8,000 m³ /TD/. There are three covered lagoons also in the project with volumetric capacity of 32,400 m³ of wastewater and design COD removal efficiency of 60%-70%^{/TD/}.

The project design implementation and its components are as per the project description given in the PD section 1.4, 1.9 and 2.3 and were evidenced during the site visit and interviews conducted by validation team.^{/IM01/}

- Project duration: 15 years (= residual operational life time)
- Crediting time :10 years
- Project start date :28/04/2005
- Ownership
 - Proof of title: The proof of title is considered by following evidences: Evidences of proof of title /ownership (Cp section 8.1 of the VCS-PD template) for actual project^{/PT/} owner “M/s P.S.C. Starch Products Public Company Limited, Thailand” are as follows.
- Company affidavit dated 10.03.2005
- Contract between PSC starch and BAU Contract No. PSC/01/2546
- The project is not participated and intends to participate in another emission trading program. Hence no double counting applies for this project.^{/UND/}
- This project is not rejected under other GHG programme.
- The project is eligible under the VCS 2007.1 standard.

VCS 2007.1 Validation Report of the GHG emission reduction project entitled “P.S.C Starch wastewater treatment and biogas utilization project”

Nevertheless following FAR D1 is raised and would be closed in next verification.

	D1
Classification	☐ CAR ☒ FAR ☐ CL ☐ None
Findings	Marking of flow direction and name of the fluid on all HDPE pipelines (wastewater, biogas gas) within the project boundary are requested in section 2.3 of the PD ^{/PD1/} to facilitate easy traceability during next verifications.
Corrective Action # 1	The marking of flow direction and name of fluid on all HDPE pipeline within the project boundary will be made before next verifications.
DOE Assessment # 1	The compliance will be checked during next verification site visit.
Conclusion	☒ To be checked during the first periodic verification ☐ Appropriate action was taken ☐ Project documentation was corrected correspondingly ☐ Appropriate was action not taken ☐ The project complies with the requirements

	D2
Classification	☒ CAR ☐ FAR ☐ CL ☐ None
Findings	Following consolidated CAR is raised on version 1 of the VD^{/PD1/}: 1. Production capacity of the individual plants i.e. starch plant and sweetener plant is not matching with the total capacity of the starch factory as mentioned in the section 1.4 of the PD. 2. In section 1.4, provide some published or book reference as M.E. thesis is not an appropriate document. 3. The version number of methodology is wrongly entered at several places in the PD (i.e. page 11, 42). It needs correction. 4. Description of the biogas utilisation and destruction units should be discussed in the section 1.4 of the VCS PD. 5. Figure captions needs to be provided wherever required in the VCS PD. 6. Exact position of Methane utilisation units (Boilers) and COD sampling points and other measurement location should be

	D2
	specified in the provided figures in section 2.3 of VCS PD. 7. In section 2.3, the schematic diagrams are indicating 6 cascading open lagoons in project scenario. However during site visit 7 open lagoons are found to be in place. It needs to be corrected. Moreover all the boilers within project boundary need to be indicated. 8. The table provided in section 7 needs to be completed properly. 9. The documents required as proof of title need to be listed in the section 8.1 of VCS PD.
Corrective Action # 1	1. The starch plant has a production capacity of 200 tonne per day, but majority of intermediate product i.e. starch mixture is used as a raw material in sweetener plant. The sweetener plant has a design capacity of 240 tonnes but operates at lower capacity, and most of waste water is contributed by starch production process. 2. Reference from the thesis is just made to weather conditions and anaerobic conditions. The data or analysis in PD has no relation to this source. 3. The version number of methodology had been changed throughout PD and follows version 13. 4. Description of biogas utilisation and destruction units has been elaborated in section 1.4 5. The figure captions have been provided in the PD 6. Figures have been corrected in order to specify the exact location of utilization units and COD sampling point along with other measurement locations. 7. The correction in the diagram has been made. The correct amounts of lagoon are 8 in the baseline and 7 in the project. 8. The table in section 7 is completed. 9. The proof of title had been listed in section 8.1 of VCS PD.
DOE Assessment # 1	Necessary corrections as per the request have been satisfactorily done in the revised PD ^{/PD2/} . Thus the CAR is closed.
Conclusion	☐ To be checked during the first periodic verification

	D2
	☒ Appropriate action was taken ☒ Project documentation was corrected correspondingly ☐ Appropriate was action not taken ☐ The project complies with the requirements

	D3
Classification	☒ CAR ☐ FAR ☐ CL ☐ None
Findings	During site visit it was found that only steam from one boiler is utilised for electricity and the steam from other boilers are being directly used in process, whereas the description in section 1.4 of PD page 3^{/PD1/} it appears that all the steam generated from the boilers are being used for electricity generation. Pl. make necessary corrections.
Corrective Action # 1	The correction had been made in section 1.4 of PD. There is one boiler that produces steam for electricity. Other two lines of biogas, supply gas to five steam boilers and one hot oil boiler.
DOE Assessment # 1	Necessary Corrections have been satisfactorily made in the revised PD. The same is also reflected in figure-5 of the PD. CAR is thus closed.
Conclusion	☐ To be checked during the first periodic verification ☒ Appropriate action was taken ☒ Project documentation was corrected correspondingly ☐ Appropriate was action not taken ☐ The project complies with the requirements

	D4
Classification	☒ CAR ☐ FAR ☐ CL ☐ None
Findings	Following consolidated CAR is raised on version 1 of the VCS PD^{/PD1/}: 1. Operation start date of UASB system cannot be start date of the project. Instead the date on which first destruction/utilisation of biogas occurs need to be considered as start date. Cp definition of start date on page 7 of VCS 2007.1 std. Also provide

	D4
	the proof for the same. 2. During the validation site visit it was found that old boilers were operated in the wastewater treatment plant for methane utilisation/destruction, thus please give brief discussion on the residual lifetime of the boilers in section 1.4 of the PD.
Corrective Action # 1	1. The combustion of biogas in P.S.C. Starch starts on 28 April 2005 at the steam boiler in sweetener factory, which is now considered as project start date. The proof document is the commissioning report from the contractor. 2. Residual lifetime of destruction units shall not be a concern for project activity as they are not implemented as part of project activity. These units were already being operated on site and are requirement of the manufacturing process, with or without biogas, shall be operated on biomass or fossil fuel.
DOE Assessment # 1	1. VCS project start date has been corrected in the revised PD^{/PD2/} and found to be as per the definition described in VCS 2007.1 std. Moreover the proof of start date has been submitted, which found to be correct and authentic. ^{/SD/} 2. Methane combustion units are integral part of the project and their residual lifetime will ensure the destruction/utilisation throughout the crediting period. Thus the residual life of these old boilers, where biogas is being combusted need to be determined and reported.
Corrective Action # 2	The monitoring of boiler performance is not required as per AMS III. H. and no emission reductions are claimed for energy generation component. The change in methodology thus has no impact on the project design. In addition to this the change in boiler status or biogas usage practices shall be transparently reported as part of monitoring report to ensure destruction of captured biogas.

	D4
DOE Assessment # 2	Boiler life will be assessed during verifications. A FAR is raised for this purpose
Conclusion	☐ To be checked during the first periodic verification ☒ Appropriate action was taken ☐ Project documentation was corrected correspondingly ☐ Appropriate was action not taken ☒ The project complies with the requirements

	D5
Classification	☒ CAR ☐ FAR ☐ CL ☐ None
Findings	Following consolidated CAR is raised: 1.The description of emission reduction under section 1.8 of the PD^{/PD1/} is incorrect. Only CH₄ recovery does not ensure the avoidance of methane emission to the atmosphere rather it has to be gainfully utilised/destroyed/combusted in order to achieve emission reduction. 2.The expected level of activity for employed project technologies needs to be described in the section 1.9 of VCS PD. Cp VCS PD template.
Corrective Action # 1	1.The description under section 1.8 of PD has been corrected. The project activity ensures that all the captured methane is combusted or utilised. 2.The PD is revised to include description of employed technologies.
DOE Assessment # 1	1.The Revised PD version 2 has been checked for correction. It has been explained in section 1.8 of revised PD that the biogas from treatment system is combusted in boilers. Since the correction is satisfactorily applied in section 1.8, CAR is closed out. 2.Description of the technologies employed including UASB, covered lagoon and secondary treatment system is found to be included in section 1.9 of revised PD^{/PD2/}. The CAR is thus closed out.
Conclusion	☐ To be checked during the first

	D5
	periodic verification ☒ Appropriate action was taken ☒ Project documentation was corrected correspondingly ☐ Appropriate was action not taken ☐ The project complies with the requirements

	D6
Classification	☒ CAR ☐ FAR ☐ CL ☐ None
Findings	Please justify the compliance with all applicability criteria mentioned in para 1 to 12. In case any applicability condition is not applicable that also has to be justified.
Corrective Action # 1	The PD is revised to incorporate the changes suggested.
DOE Assessment#1	Necessary corrections have not been observed in the revised PD version 2. CAR is open.
Corrective Action # 2	The necessary corrections have been made in the revised PD to address all the applicability conditions as per AMS III., H. version 13.
DOE Assessment#2	Compliances with all applicability conditions of AMSIII.H version 13 are satisfactorily explained in PD section 2.2 ^{/PD2/} .
Conclusion	☐ To be checked during the first periodic verification ☒ Appropriate action was taken ☒ Project documentation was corrected correspondingly ☐ Appropriate was action not taken ☒ The project complies with the requirements

	D7
Classification	☒ CAR ☐ FAR ☐ CL ☐ None
Findings	Any deviation/adjustment from/with the meth has to be elaborated in the PD^{/PD1/} with justification on following issue: 1.As the statistical analysis methane is not carried out, the CH₄% values to be reported or lower value is to be applied for conservative emission reduction calculation. Though, in

	D7
	section 3.3 of the PD, it is stated that the deviation in methodology is taken but it is not discussed anywhere in the PD.
Corrective Action # 1	The deviation related to methane percentage in biogas is explained in PD and calculation approach i.e. excel sheet.
DOE Assessment # 1	Since historical continuous measurement data of CH ₄ % is not available, the project proponent has sought a deviation from the applied monitoring methodology for ex-ante estimation. The lowest value in the range of 55-80% has been considered with help of third party literature of repute. The approach is acceptable as it is not overestimating the VCUs and satisfies the requirement of para 5.3, page 13 of VCS 2007.1 standard. Moreover deviation does not affect the conservativeness of the baseline and the additionality of the project. For the ex-ante estimations for the years 2009 and onwards, a value of 55% has been considered. Further, the proof of the installed online analyser to be used for continuous measurement for the subsequent verification periods has been submitted ^{/INV/} .
Corrective Action # 2	Ex-ante estimation is based on the methane capture and all the biogas generated is assured for destruction. Moreover, since no IRR calculation is done for this project activity, there is no need to calculate the amount of biogas generated and the value of methane content is not needed for ex-ante calculation.
DOE Assessment#2	Methane content of biogas has no impact on ex ante calculations of emission reductions. Methane content is required for calculation of ex post emission reductions from equation 15 & 16 of AMS III.H version 13. Thus this requirement will be checked as a part of verification. A FAR is raised for this purpose.
Conclusion	☒ To be checked during the first periodic verification ☐ Appropriate action was taken ☐ Project documentation was corrected correspondingly ☐ Appropriate was action not taken ☒ The project complies with the requirements

D8				
Classification	☐ CAR	☐ FAR	☒ CL	☐ None
Findings	1. Pl. clarify how the methane capture and utilisation/destruction from wastewater generated from the proposed ethanol plant will satisfy the applicability criteria 1 (vi) of AMS IIH, Ver. 13, 2. As per the figures described in section 2.3 the treated waste water being used for plantation in baseline and project scenario as well. In section 1.4, Pl. clarify, how the water conservation is being taken place as a result of the implementation of the project.			
Corrective Action # 1	1. The waste water generated from ethanol plant shall be processed in CL3, UASB and CL2 in the same sequence before it goes into the open lagoons. However, the project proponent had option of going for open lagoon system directly, which is available and no extra investment required on gas capture. 2. With the proposed treatment system, the quality of wastewater is improved significantly so the wastewater from sixth or seventh ponds can use without waiting for more days. It avoids substantial losses attributed to evaporation.			
DOE Assessment # 1	1. Wastewater treatment of ethanol plant is a new project and needs to be justified through general guidance for SSC methodologies in line with para 9. Accordingly information in section given in section 2.2 of the PD version 1 need to be changed. 2. It is clarified that water may be conserved from reduction in evaporation losses. Clarifications have been accepted.			

	D8
Corrective Action # 2	The baseline for the ethanol plant has been determined in line with the “Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories”, version 12.1 Paragraph 12. For the purpose of the demonstration, steps 1 to 3 of the “Combined tool to identify the baseline scenario and demonstrate additionality” have been applied. Section 2.4 of the VCS PD has been revised accordingly. It is thereby demonstrated that the methane capture and utilisation/destruction from wastewater generated from the proposed ethanol plant satisfies the applicability criteria 1 (vi) of AMS IIIH, Ver. 13.
DOE Assessment#2	The PD ^{PD2/} is found satisfactorily updated in section 2.2 for applicability of wastewater treatment from ethanol plant. The CL is closed out.
Conclusion	☐ To be checked during the first periodic verification ☒ Appropriate action was taken ☐ Project documentation was corrected correspondingly ☐ Appropriate was action not taken ☒ The project complies with the requirements

3.2 Baseline

The conclusions are as follows:

- The applied baseline methodology is AMS III.H/Version 13 i.e. “Methane Recovery in Wastewater Treatment” which is approved CDM methodology.
- The AMS III.H is correctly -applied. The justifications on applicability conditions presented in the section 2.2 of VCS-PD are found appropriate.
- There is one deviation from applied methodology which has been described and assessed in Appendix I of this report.

- The project activity involves the capture of methane from wastewater and avoids methane emission through the modification of existing lagoon system by one UASB and three covered lagoons. The project also utilizes the captured methane to generate hot oil with the help of dual fuel burners in the hot oil boilers and to generate electricity in the captive gas engines and steam in boilers. Due to high demand of gas for boiler and gas engine there was no flaring happened in the first monitoring period. The baseline for biogas capture is open anaerobic lagoon.
- The project correctly applies the approved CDM small-scale methodology AMS-III.H, version 13 for methane recovery in wastewater treatment. The project is within the eligibility requirements of the baseline methodology since the estimated annual emission reductions due to methane recovery from the project activity is 369,730 tCO₂e (2009– 2018), which is less than the stipulated 60 ktCO₂e/yr limit of the methodology (para 12). The baseline for the project activity is selected as per option (vi) of para 1 of AMS III H/Version 13 which is, “Introduction of a sequential stage of wastewater treatment with biogas recovery and combustion, with or without sludge treatment, to an existing anaerobic wastewater treatment system without biogas recovery”.

Baseline determination for wastewater treatment system (in accordance with AMS.III.H.):

Open lagoon systems represent the prevalent mode of wastewater treatment in Thailand and would have been the continued option for P.S.C. Starch Products Public Company Limited in the absence of the project activity. Moreover, the project activity is not mandated by any law, and it has been confirmed that the open lagoon system was in compliance with the existing environmental regulations prior to implementation of the activity. Thus, in the baseline scenario, the spent wash treatment would have been lagoon based wastewater treatment, which would have resulted in methane escaping to the atmosphere. By extracting and capturing methane enriched biogas in the anaerobic digester the project reduces CH₄ emission that would have otherwise emitted from the open lagoon system. Hence, for the proposed VCS project activity, baseline emissions are CH₄ emissions from wastewater treatment systems.

The baseline emissions are calculated correctly as per the equation 1 of the applied baseline methodology i.e. AMS III.H Ver. 13, which is clearly and transparently described in section 4.1 & Section 4.2 of the final PD^{PD2/}.

The baseline emissions include;

$BE_{ww, treatment, y}$ i.e. Baseline emissions of the wastewater treatment systems affected by the project activity in year y (tCO₂e).

Other components of baseline emissions have been neglected either due to non applicability or in order to estimate baseline emission conservatively. These are follows;

$BE_{power, y}$ i.e. Baseline emissions from electricity or fuel consumption in year y (tCO₂e) is neglected for conservativeness.

$BE_{s, treatment, y}$ i.e. Baseline emissions of the sludge treatment systems affected by the project activity in year y (tCO₂e) is assumed as zero as there are no sludge treatment in baseline scenario as confirmed during site visit assessments.

$BE_{ww, discharge, y}$ i.e. Baseline methane emissions from degradable organic carbon in treated wastewater discharged into sea/river/lake in year y (tCO₂e) is also assumed to be zero as there are no discharge of treated waste water into surface water bodies mentioned in the methodology. During site visit interviews it was concluded that the treated waste water has been reused inside the factory premises for plantation purpose.

$BE_{s, final, y}$ i.e. Baseline methane emissions from anaerobic decay of the final sludge produced in year y (tCO₂e) is also neglected as the sludge will be used for soil applications. This confirmed during the site visit interviews with local stakeholders.

The average methane baseline emissions (79,986 tCO₂e per year) are calculated in accordance with equation 2 of AMS III.H ver. 13.

Altogether the project activity reduces emissions of 369,730 tCO₂e over the ten year crediting period (renewable).

Nevertheless, CAR B1 was raised and successfully closed.

	B1
Classification	☒ CAR ☐ FAR ☐ CL ☐ None
Findings	Following consolidated CAR is raised on version 1 of the VCS PD^{/PD1/}: 1. The description in section 1.8 does not correspond to the additionality demonstration. Pl. revise. That was merely just comparison of pre-project and post project scenario. 2. It appears that project test as per the clause 5.8 of VCS 2007.1 std. has been chosen for the demonstration of additionality. The same need to be clearly referenced in section 2.5 of the PD.
Corrective Action # 1	1. The correction has been made incorporated in section 1.8 of PD 2. The reference of project test as per clause 5.8 of VCS 2007.1 standard has been put in the section 2.5 of the PD.
DOE Assessment # 1	1. Necessary correction has been done by removing wrong mention of section 1.8 in the section 2.5 of revised PD^{/PD2/}. 2. Revised PD version 2 is referenced with project test in the section 2.5. Revised PD version 2 has been checked and found corrected. CAR is thus closed out.
Conclusion	☐ To be checked during the first periodic verification ☒ Appropriate action was taken ☒ Project documentation was corrected correspondingly ☐ Appropriate was action not taken ☒ The project complies with the requirements

	B2
Classification	☒ CAR ☐ FAR ☐ CL ☐ None
Findings	In section 2.5, step 2 of VCS PD^{/PD1/}, PP mentions about the conflict between technology provider and project participants. However the explanation provided not lead to any conclusion. The description needs to be further elaborated. The provided table to support the issue should be filled in a proper manner including avoidance of local language and date

	B2
	format. Moreover, the technological barrier described in the section 2.5 of VCS PD needs to be more precise and evidenced by authentic sources.
Corrective Action # 1	The section 2.5 is revised to include proper references. The table is revised as per the CAR.
DOE Assessment # 1	Conflict with earlier contracted technology supplier is found elaborated and referenced with chronology of events in the revised section 2.5. Also, description on technical/technological barriers in section 2.5 has been satisfactorily revised. Since necessary corrections have been made in the revised PD ^{/PD2/} , CAR is closed out.
Conclusion	☐ To be checked during the first periodic verification ☒ Appropriate action was taken ☒ Project documentation was corrected correspondingly ☐ Appropriate was action not taken ☒ The project complies with the requirements

Demonstration and Assessment of additionality:

The additionality was demonstrated in PD acc. to § 5.8, Test 1 (the Project Test) of the VCS 2007.1 specification^{/VCS/} and the attachment A to Appendix B of the Simplified Modalities and procedures for small-scale CDM project activities, as referred by the applied small-scale CDM methodologies.

Regulatory Surplus: Under step 1 of the project test it has been assured that the project does not undertaken to meet any national or local regulatory requirements.

It was verified that there are presently no regulatory requirements that enforce implementation of a specific wastewater treatment technology, such as anaerobic digester or aerobic treatment system to tapioca starch processing plants for effluent treatment^{/SC/}. Current Thai law allows utilization of open lagoon systems for wastewater treatment in the tapioca industry. Furthermore, it was verified on-site that the open lagoon system at the project site is in full compliance with the stipulated environmental legislation prior to implementation of the project activity. However, for ethanol plant, the regulation does not permit discharge of wastewater.

Implementation Barrier: Under step 2 (implementation barrier), investment barrier, technical barriers and institutional barriers are described as potential barrier in the PD^{/PD2/}. DOE has done thorough check of the literature references and background studies on these barriers provided by the project participant as referred in the PD section 2.5^{/PD2/}.

Technological barrier: The baseline scenario i.e. open lagoon system represents the common handling of wastewater from tapioca starch production in Thailand. The related technology, skills and labour are readily available in Thailand and there are few risks associated with this technology and hence the baseline technology does not face any technical barriers. Presently, only a few tapioca starch processing facilities have adopted anaerobic digester technology for wastewater treatment in Thailand. Based on the literature review^{2 3 4} cited in the VCS PD^{/PD2/} it is confirmed that the project employs a relatively rare technology. Therefore the practice requires skilled labour to operate and maintain the new wastewater system properly is not adequately available in the host country and would therefore represent performance and technology risks. Moreover the anaerobic digestion system requires ongoing precise and rigorous monitoring of a variety of parameters in order to avoid disruptions to the anaerobic treatment process. Thus it is concluded that the project faces technological barriers which is not faced by the realistic and plausible alternatives.

Institutional barrier:

Project Financing Barrier: It is argued by the PP in PD^{/PD2/} that the open lagoons require less investment and O&M cost and hence are preferable in the host country^{/ADD/}. To the contrary the anaerobic treatment technologies with biogas recovery are not common and attract more investments and hence are not preferred by the industries^{/add/}. Also it has been argued that the project faces crunch of funds to carry the project. Though relevant and justifiable; in

² Mara, D., 2003, Waste Stabilization Ponds: Time for Aggressive Marketing Page no 1
<http://www.bvsde.paho.org/bvsacd/agua2003/mar.pdf>

³ S. Prasertsan, B. Sajjakulnukit, 2005, Biomass and biogas energy in Thailand: Potential, opportunity and barriers
<http://www.energy-based.nrct.go.th/Article/Ts-3%20biomass%20and%20biogas%20energy%20in%20thailand%20potential.%20opportunity%20and%20barriers.pdf>

⁴ Seminar Document: The Promotion of Biogas from Wastewater as An Alternative Energy and for Environmental Improvement, published by the Energy Conservation and Renewable Energy Division and Energy Policy and Planning Office (EPPO), 2007

the opinion of validation team, this barrier is not convincing as significant as to be a decisive factor in demonstrating additionality.

Social Barrier:

Institutional barriers such as social barriers and safety issues associated with biogas storage and handling are adequately described in the section 2.5 of the PD. Though justifiable, this is, in opinion of the validation team, not a decisive barrier.

Investment analysis (step 3) is not opted by the PP to demonstrate additionality of the proposed project.

Common practice Analysis: Under step 4, common practice analysis has been found to be in line with chapter 7 of guidance on GHG protocol for project accounting which is an outcome of survey by project participant supplemented with data, documents and references which has been duly cited in section 2.5 of the final PD version 2. Also, the authenticity of information provided was satisfactorily reaffirmed by web research by the validation team. There are only ten starch plants in the host country out of total 85 that produce sweet starch-based sweetener. Out of these 10 plants only three have gone for anaerobic digesters. Two out of these three plants have applied for GHG benefits as evident by the citation 5 in PD duly verified by the validation team. Third project is the proposed project itself. Based on the assessment of the common practice analysis it can be assured that biogas recovery projects w-o carbon revenues is not a common practice in the starch processing sector in Thailand. The demonstration of common practice has been found to be acceptable.

The individual arguments presented in the PD (section 2.5) to justify the additionality were summarised in table 3-2. This table also includes the assessment of the validation team.

Table 3-2: Additionality assessment

Step # / Barrier	Demonstration	Assessment
(1)Regulatory	Project is not implemented to meet any	As confirmed during the site visit interviews

⁵ <http://cdm.unfccc.int/Projects/DB/DNV-CUK1218616482.16/view>

⁵ <http://www.asiafructose.com/about.htm>

Step # / Barrier	Demonstration	Assessment
Barriers	applicable local and national regulatory requirements. The proposed project activity is in compliance with all local laws and regulations from the local government and the Ministry of Industry, Thailand.	and verification of local laws it was concluded that the baseline open lagoon treatment system is also in compliance with the local legal requirements and anaerobic digesters (project case) are not mandated by any enforced regulation in Thailand⁶. Moreover the proposed project activity is in full compliance with local laws and regulations and is demonstrated by the valid operational permit.^{/SC/} ☐ Argument not justified ☐ Argument not convincing ☐ Argument justified but not a decisive barrier ☒ Argument justified / significant barrier
(2)	Implementation barriers	
Technical Barriers	Project faces technical barriers of lacking trained and skilled manpower readily available for its implementation.	On the basis of site visit, literature review cited in the VCS PD^{/PD2/} it is concluded that the project employs a relatively rare technology in tapioca starch industry in Thailand and such technologies face barriers related to shortage of skilled manpower.

⁶ Notification by the Ministry of Industry, No. 2, B.E. 2539 (1996) issued under the Factory Act B.E. 2535 (1992)

Step # / Barrier	Demonstration	Assessment
		☐ Argument not justified ☐ Argument not convincing ☐ Argument justified but not a decisive barrier ☒ Argument justified / significant barrier
Institutional Barriers Project Financing barrier	The project is not financially attractive to PPs in absence of funds. Since fund application was withdrawn due to conflict with technology provider, the project faced crunch of funds.	Anaerobic wastewater treatment systems with biogas recovery require comparatively high investments and are thus less attractive for tapioca starch industries in the host country. Further the project has faced crunch of funds and thus faces barriers related to investment. ☐ Argument not justified ☐ Argument not convincing ☒ Argument justified but not a decisive barrier ☐ Argument justified / significant barrier
Institutional Barriers Social Barrier	With the open lagoon system already able to meet the desirable quality of treated wastewater and meet applicable national standard, owners are generally reluctant to switch to a closed anaerobic treatment system for biogas recovery. Again the safety issues associated with storage and handling of biogas	Since associated infrastructure requirement and safety issues associated with biogas storage and handling are visible from site visits and interviews it can be considered as a barrier to adopt biogas recovery and utilisation projects in starch industry. ☐ Argument not justified ☐ Argument not

Step # / Barrier	Demonstration	Assessment
	requires additional investment.	convincing ☒ Argument justified but not a decisive barrier ☐ Argument justified / significant barrier
(3) Common Practice	This type of project w-o carbon revenues is not a common practice in the starch processing sector in Thailand. This project faces significant investment barrier as described under step (2) in PD. In accordance with the guidance in the GHG Protocol for Project Accounting, Chap 7 the project is not a common practice due to low market share (w-o carbon revenue) in the sector and in the region as well.	The analysis given in PD^{/PD2/} argues that the penetration rate of closed anaerobic wastewater treatment systems in starch factory with sweetener plants in Thailand is as low as 30%. This has been validated from figures provided by the PP and was cross checked through web researches. ☐ Argument not justified ☐ Argument not convincing ☐ Argument justified but not a decisive barrier ☒ Argument justified / significant barrier
Assessment of the validation team		☒ Project is additional ☐ Project is not additional

As the project is in regulatory surplus and complies with the requirements of investment barrier under step (2) of test 1 of VCS 2007.1 specification, hence the project meets the additionality requirement of small scale CDM project as part of applied methodology (AMS III.H version 13). Moreover the additionality is further supported by common practice analysis under step (3) of project test, which overall concludes that the project is additional.

However following CAR was raised and successfully closed.

	B3
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	B3			
Classification	☒ CAR	☐ FAR	☐ CL	☐ None
Findings	Following consolidated CAR is raised on section 2.5 of PD^{/PD1/}: 1. Please justify the basis of the statement “P.S.C Starch is one of the first starch factories in Thailand in which the UASB system is being implemented” in section 2.5 of the PD. 2. While describing the investment barrier, it is mentioned that proposed project is considered highly risky by the financiers and simultaneously says that PP had rejected the fund from ENKON for the proposed project, which is contradictory. Moreover pl. explain that how the rejection of the proposed fund by PP is an investment barrier. 3. Common practice analysis description needs more elaboration. Moreover some of the provided web links are not accessible.			
Corrective Action # 1	1. The references provided by tech provider back in 2003 when presenting the proposal for project implementation has no reference to any implemented project in starch industry. Even BAU (Biogas Advisory Union) had experiences in swine industry only. 2. The project was planned with a certain fund in mind and later due to conflict with technology provider, same had to be dropped making the project even more critical in terms of financial return viability. There is no contradiction between two statements, as the riskier investments need to be supported by such policies and fund to make it easier for people to adapt new ways. For new technologies, loan sanctions are difficult as there are no proven cases of implementation. 3. Common practice analysis is elaborated in revised PD.			
DOE Assessment # 1	1. Examination of the information provided by the technology supplier at the time of			

	B3
	proposal has no reference of any starch factory where a technology similar to the proposed project is being implemented. It is thus accepted that this is first project where this technology is being implemented by the technology supplier in starch industry. 2. It is clarified that the withdrawal of fund application was due to the conflict between PP and technology supplier and thus it made the project riskier. The clarification is acceptable. 3. Necessary corrections have been made in the description of Common Practice Analysis. This elaboration is accepted and CAR is closed out.
Conclusion	☐ To be checked during the first periodic verification ☒ Appropriate action was taken ☒ Project documentation was corrected correspondingly ☐ Appropriate was action not taken ☒ The project complies with the requirements

3.3 Monitoring Plan

The conclusions are as follows:

- The project applies the monitoring methodology AMS III.H version 13 which is an approved CDM methodology.
- The AMS III.H version 13 is correctly applied. The justifications on applicability conditions presented in the section 3.3 of VCS-PD are found appropriate.
- The baseline and project emission parameters that are monitored are indicated in Section 3.3 of the VCS-PD. Validation Team has verified that the list of parameters and confirms that these are in line with the requirements of AMS III.H version 13. The final disposal of the sludge will be monitored during crediting period. In case the final disposal of sludge is not used for soil application, the $PE_{s,final,y}$ (as per equation number (7) of AMS. III.H,

Version 13) will be accounted as per the input data provided in PD. In accordance with para 30 of AMS III.H version 13, the emission reduction for methane recovered and combusted would be calculated by conservative approach using the actual amount of methane produced during project operation. The formula incorporated in section 4.1 of the PD is deemed OK. However, CAR M1 & M2 were raised and successfully closed.

- The monitoring parameters will give opportunity for real measurements of achieved emission reductions.
- The data and parameters are available during the validation are correctly chosen and applied. They are checked for the suitability in the project context and found to be appropriate. The major parameters monitored *ex post* are as follows;
 - o Volume of wastewater treated in year y from the starch plant ($Q_{y, ww, starch}$)
 - o Volume of wastewater treated in year y from the sweetener plant ($Q_{y, ww, sweetener}$)
 - o Volume of wastewater treated in year y from the ethanol plant ($Q_{y, ww, Ethanol}$)
 - o COD of wastewater from starch plant ($COD_{y, ww, untreated, starch}$)
 - o COD of wastewater from sweetener plant ($COD_{y, ww, untreated, sweetener}$)
 - o COD of wastewater from Ethanol plant ($COD_{y, ww, untreated, Ethanol}$)
 - o COD of water exiting the covered lagoon 2 treatment process ($COD_{y, ww, treated, CL2}$)
 - o COD of water exiting the covered lagoon 2 treatment process ($COD_{y, ww, treated, CL3}$)
 - o Methane content in biogas (W_{CH4})
 - o Amount of biogas combusted for gainful use ($BG_{combusted}$)
 - o Electricity consumption by waste water treatment system and biogas plant (EC)

Details of the data to be collected, the frequency of data recording, format and storage type are described. Algorithms and formulae used are clearly presented and the calculations are without errors.

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- The monitoring parameters, monitoring methodologies, and equipments are deemed appropriate and in accordance with applied methodologies.
- The monitoring plan provided detailed information related to the collection and archiving of all relevant data needed to:
 - Estimate or measure emissions occurring from GHG sources, sinks and reservoirs
 - Determine the baseline emissions
 - Estimate changes in emissions from the site
- The frequency, responsibility, and authority for registration, monitoring, measurement and reporting activities are contend in section 3.4 of the VCS-PD. Following metering and measurement was verified during onsite visit^{/IM01/}:
 - 4 point COD measurements (in and out of AFFR circuit and final lagoon).The COD sampling points were verified and necessary records were found be in place.

From mid 2009 onwards following monitoring system will also be in place as described in ^{/PD2/}:

- 3 point wastewater flow meter (into AFFR system)
- 2 point gas flow meter (into hot oil boiler and gas engine-common meter for 3 gas engines).
- 3 point electricity generation by gas engine.
- CH₄% in biogas (vol, dry basis).
- Final sludge disposal.
- Ambient Temp.

Nevertheless following CARM1 is raised and closed successfully during the validation.

	M1			
Classification	☒ CAR	☐ FAR	☐ CL	☐ None
Findings	During the validation site visit it was found that there is no specific burner for the biogas application in boilers. It was just a pipe entered in the combustion chamber, which facilitates the biogas injection in combustion chamber where burning of biogas along with coal powder			

	M1
	takes place. PP needs to explain how 100% destruction of biogas is ensured.
Corrective Action # 1	Since in the old boilers there is no specific bio gas burners, a combustion efficiency factor of 50% is now introduced, in accordance to point (b) on page 3 of “Tool to determine project emissions from flaring gases containing methane” (when the flaring parameters are beyond the limits of manufacturer’s specifications i.e. worst condition) which is conservative because the applied type of combustion is under proper monitoring and efficient than the closed flaring. Moreover the temperature of combustion chamber will be monitored regularly for ensuring the proper combustion of biogas. The same has been described in the revised PD. However the project proponent plans to use all the biogas in new boiler with 21TPH capacity equipped with biogas burner. Additionally, conservativeness is ensured in ex post approach of Emission Reduction calculation by MD_y approach, under which all the biogas combusted in new boiler with burner is assumed to be combusted at 100% efficiency where as if it is burnt in old boilers it is assumed to be at an efficiency equivalent to open flare.
DOE Assessment # 1	Possibility of incomplete combustion of biogas is taken care of by adopting default closed combustion efficiency of 50% for old boilers. However, in the project, the PP has planned to install new boilers with proper biogas burners. Ex post estimation of actual net emission reductions will be done based on monitored data of temperature of exhaust gas. This argument is accepted and CAR is closed out.
Conclusion	☐ To be checked during the first periodic verification ☒ Appropriate action was taken ☐ Project documentation was corrected correspondingly ☐ Appropriate was action not taken

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	M1
	☒ The project complies with the requirements

	M2
Classification	☒ CAR ☐ FAR ☐ CL ☐ None
Findings	Following consolidated CAR is raised as per PD Version 1 against the requirement monitoring methodology described in AMS III.H ver.9 : The compliance of the para 30 and 31 of AMS III.H, version 13 is not properly addressed in section 3.3 and 4.1 of the VCS-PD.
Corrective Action # 1	The compliance of para 30 and 31 of AMS III.H version 13 has been address in section 4.1 of VCS-PD
DOE Assessment # 1	Necessary corrections have been made at appropriate places in the PD and hence CAR is closed out.
Conclusion	☐ To be checked during the first periodic verification ☒ Appropriate action was taken ☒ Project documentation was corrected correspondingly ☐ Appropriate was action not taken ☐ The project complies with the requirements

	M3
Classification	☒ CAR ☐ FAR ☐ CL ☐ None
Findings	Following consolidated CAR is raised on the description provided in section 3.3 of VCS PD version 1^{/PD1/}: 1. In section 3.3, value applied for various parameters i.e. $Q_{y, ww \text{ from starch}}$, $Q_{y, ww \text{ from sweetener}}$, $Q_{y, ww \text{ from Ethanol}}$, $COD_{y, ww, \text{untreated, starch}}$, $COD_{y, ww, \text{untreated, sweetener}}$, $COD_{y, ww, \text{untreated, Ethanol}}$, $COD_{y, ww, \text{treated, CL1}}$, $COD_{y, ww, \text{treated, CL3}}$, $COD_{y, ww, \text{CL2}}$, is not matching with the ER calculation sheet. Need to be corrected. 2. The estimation of $Q_{y, ww \text{ from starch}}$, $Q_{y, ww \text{ from sweetener}}$ and $Q_{y, ww \text{ from Ethanol}}$, the design value has been taken in the PD, section 3.3, whereas in ER sheet, the internal plan has been considered and thus there is a

	M3
	significant difference in values. 3. For the estimation of the project emission (PE_{power}), In spread sheet, rated capacity of the equipments (based on other UASB) has been considered for calculation of $W_{pel,y}$, whereas, In PD, section 3.3, a monitored value from energy meter is discussed. 4. Basis for assumed 55% CH_4 content in biogas need to be explained and supporting documents need to be provided to the DOE.
Corrective Action # 1	1. The value in section 3.3 had been corrected to match with the calculation of GHG in the calculation sheet. 2. The value of $Q_{y, ww \text{ from starch}}$, $Q_{y, ww \text{ from sweetener}}$ and $Q_{y, ww \text{ from Ethanol}}$ are corrected to average 75% of the design value for normal operation during a particular year. 3. As the calculation for ex-ante, rated capacity of equipment from other UASB is used but during the monitoring period actual value from meter installed shall be used. 4. The percentage of methane come from the following link http://www.oregon.gov/ENERGY/RENEW/Biomass/biogas.shtml. During the monitoring period, actual percentage of methane will be measured by methane analyzer which is already ordered.
DOE Assessment # 1	1. Revised PD^{/PD2/} contains the necessary Corrections in section 3.3. 2. Necessary correction has been applied in the respective estimations. 3. Monitored data shall be used for ex-post estimations and shall be checked at the time of verification for power consumption in UASB operation, as per the monitoring plan provided in PD section 3.3. 4. Methane percentage source is accepted for ex ante estimation. However ex-post calculations will be based on monitored data from online methane analyzer. This will be checked during first verification. CAR is closed out.
Conclusion	☒ To be checked during the first periodic verification ☒ Appropriate action was taken ☒ Project documentation was corrected

	M3
	correspondingly ☐ Appropriate was action not taken ☒ The project complies with the requirements

	M4
Classification	☐ CAR ☒ FAR ☐ CL ☐ None
Findings	Following consolidated FAR is raised: 1. During validation site visit, measurement equipment for following parameters were not evidence; - for measurement of biogas utilisation in boilers - %CH₄ of methane in biogas The monitoring mechanism and accuracy of the measurement method need to be in place for verifications.
Corrective Action # 1	The required monitoring equipment had been ordered but at the moment the installations are not finish. The system shall be implemented shortly.
DOE Assessment # 1	The proposed corrective action deemed appropriate.
Conclusion	☒ To be checked during the first periodic verification ☐ Appropriate action was taken ☐ Project documentation was corrected correspondingly ☐ Appropriate was action not taken ☐ The project complies with the requirements

3.4 Calculation of GHG Emissions

The conclusions are as follows:

- As per the final PD^{/PD2/} the project is expected to reduce emissions of 369,730 tCO₂e over a 10 year crediting period.
- The source, sink and reservoir for the project activity are appropriately mentioned (Cp section 2.3 of VCS-PD)
- The formulae and factors used in the calculations of emission reductions are in

accordance to the approved baseline methodology AMS III.H, version 13. All aspects related to the direct and indirect GHG emissions relevant to the project activity have been addressed and calculations are presented in a transparent manner and in line with the applied methodologies and tool.

- No leakage is involved in the project activity.
- The set of calculations for the estimation of expected emission reductions are transparently documented (in the PD and the spread sheet of VER calculation with the reference sources of data) and correct and appropriate assumptions; default values; correction factors in accordance with AMS III.H version 13 (including grid emission factor for project emission in accordance with AMS I.D Ver 14) have been applied. The sources of project specific data were cross-checked and found to be correct based on the evidence provided by the project developer (Table 5.1 of Annexure-2).
- The validation team has checked the underlying input values as well as the computation in the spreadsheet^{/XLS1//XLS2/}. The estimation of the baseline emission, project emission was realized in a transparent and conservative manner. The VER sheet contains the estimated emission reduction under first crediting period of ten years starting from 1st December 2009.
- However few uncertainties are found and were appropriately resolved, which is summarised as follows;

	C1			
Classification	☒ CAR	☐ FAR	☐ CL	☐ None
Findings	Following consolidated CAR is raised: 1. How treatment efficiency for covered lagoon-1 and covered lagoon-3 is assumed as 70% whereas efficiency of covered lagoon-2 is assumed to be 60%. Pl. explain. Also specify the reference for assuming 70% removal efficiency for UASB. 2. Provide the source for applied value of COD_{in} in covered lagoon-3. Also pl. specify the basis for assuming COD value 1,590 mg/lit. for the outlet from covered lagoon -2. 3. Pl. explain why only waste waster from UASB is			

	C1
	considered for baseline emission while covered lagoon-2 takes water from both UASB and sweetener plant. 4. In ER sheet in calculation of PE_{discharge} the flow of wastewater discharge is much higher (by 50%) than the inlet flow which is not possible. Moreover as per the section 1.4 and the figure in section 2.3 of PD the treated wastewater is 100% utilised for plantation within the premises. Pl. correct.
Corrective Action # 1	1. The reduction efficiency of each individual covered lagoon and UASB can vary depending on type of COD loading and type of waste water. References for efficiency have been provided to the DOE. 2. The COD_{in} value to covered lagoon 3 is provided by the PP as the expectation from ethanol production process in consultation with tech provider and experience. 3. The calculation approach is revised, to be more coherent and in line with the waste water generation processes. 4. The value of flow of wastewater discharge had been corrected in the calculation.
DOE Assessment # 1	1. The COD removal efficiency has been crosschecked from the references^{/TD/} provided by the PP and found satisfactory. CAR is thus closed out. 2. The COD_{in} value to covered lagoon 3 is checked from the document^{/TD/} submitted by the PP and was found correct. 3. Both, UASB and Covered Lagoon 2 (treating wastewater from sweetener plant) have been considered for calculation of emission reductions in the revised PD^{/PD2/}. The calculation is checked and found correct. 4. In the revised PD and calculation sheet, the treated wastewater discharge has been taken as zero which is justifiable due to complete utilization of treated wastewater for the plantation purpose within the premises. Since, necessary corrections have not been applied in revised PD^{/PD2/} and GHG emission reduction calculation sheet^{/XLS2/}, CAR is closed out.
Conclusion	☐ To be checked during the first periodic verification ☒ Appropriate action was taken ☒ Project documentation was corrected correspondingly ☐ Appropriate was action not taken ☒ The project complies with the requirements

3.5 Environmental Impact

Social and environmental impacts of the project have been sufficiently addressed. No adverse environmental impacts compared to baseline situations as well as trans-boundary impacts have been envisaged from this project activity. Compliance as per ISO 14064-2: 5.2.k has been checked and found satisfactory. As per the national law no requirement of carrying out EIA is prescribed for such kind of project.

3.6 Comments by stakeholders

Stakeholders have been directly asked to comment on the project through an open meeting among local stakeholders, project proponent; local authorities on 23rd September 2008 ^{/LSHC/}.

A summary of the comments received and a note (through meeting and feedback questionnaire) on how due account was taken of the concerns raised in the above public consultation are included in PD. All comments are positive in nature. No adverse comments were received and this is addressed in the PD^{/PD2/}.

4 Validation conclusion

The M/s South Pole Carbon Asset Management Ltd on behalf of M/s P.S.C. Starch Products Public Company Limited, has commissioned the TÜV NORD JI/CDM Certification Program to validate the project: “P.S.C Starch wastewater treatment and biogas utilization project”, with regard to the relevant requirements of the VCS 2007.1 Guidelines/ VCSA Rules for project activities, as well as criteria for consistent project operations, monitoring and reporting.

- The purpose of this project activity is to recover methane using an Upflow Anaerobic Sludge Blanket (UASB) system and covered lagoons. The biogas will be utilized as fuel for a boiler to produce steam in order to produce electricity and heat, thereby replacing the previous fuel mix based on biomass and coal used earlier by the project proponent. However, GHG emission reduction is not claimed for the heat and electricity generated.
- The review of the VCS PD and additional documents related to baseline and monitoring methodology; the subsequent background investigation, follow-up interviews and review of comments by parties, stakeholders have provided TÜV NORD JI/CDM CP with sufficient evidence to validate the fulfilment of the stated criteria.
- A risk-based approach has been followed to perform this validation. In the course of the validation, Thirteen (13) Corrective Action Requests (CARs) and one (1) clarification request (CL) were raised and successfully closed. Two (02) Forward Action Requests (FARs) are raised, which will be verified during the next verification.

The validation is based on the VCS PD^{/PD2/}, proof of title^{/PT/}, additional documents related to baseline and monitoring methodology; the subsequent background investigation, follow-up interviews and supporting documents made available to the validation team by the project proponent.

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

- The project fulfils criteria of VCS 2007.1 provided.
- The project additionality is sufficiently justified in the PD.
- The monitoring plan is transparent, adequate and in line with the applied baseline and monitoring methodology AMS III.H/Version 13: “Methane Recovery in

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Wastewater Treatment”. The approved small scale methodology of UNFCCC CDM program is correctly applied.

- The calculation of the project emission reductions is carried out in a transparent and conservative manner, so that the estimated emission reductions of 369,730 tCO₂e is most likely to be achieved from 15 July, 2009 onwards till end of 1st ten(10) years (renewable) crediting period.
- There are no restrictions or uncertainties faced related to the validation of the project.

Baroda, 2009-11-18



Pankaj Patel
TUV India Pvt. Ltd.

Essen, 2009-11-18



Rainer Winter
TÜV NORD JI/CDM
Certification Program

Appendix-1

Table 4-2: Summary of Deviations taken from methodology

Data/Parameters/ Variables/	Reference of methodology	Description of Deviations	Assessment by Validation Team
Flare efficiency is assumed 100% in case of combustion MDy (i.e. gainful utilisation of biogas in boiler and gas engine. Whereas it need to be measured as per the applied methodology.	Paragraph 32 and equation 16 of of AMS III.H. Ver.13	In the case that biogas is combusted for a gainful use of the released energy, flare efficiency (combustion efficiency in boiler and gas engines.) can be assumed to be 100% in case calculation of MD _y .	This approach has been confirmed by the SSC WG on 29th July 2009, who agreed to include such approach in a future revision of AMS III.H. (http://cdm.unfccc.int/UserManagement/FileStorage/VNWAGY8MS92ZXDKUHEF5LB07QICT1P) Based on this reference, it can be concluded that the adopted approach is appropriate and acceptable.

Annexure 1: Abbreviations

BAU	Biogas Advisory Union Foundation
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CH₄	Methane
CL	Clarification Request
CO₂	Carbon dioxide
CO₂e	Carbon dioxide equivalent
COD	Chemical oxygen demand
CP	Certification Program
GHG	Greenhouse gas(es)
IPCC	Intergovernmental Panel on Climate Change
ISO	International Standards Organization
kW	Kilowatt
kWh	Kilowatt hour
MP	Monitoring Plan
Nm³	Normal Cubic Meter (Normal = 2730 K and 1 atm)
PD	Project Document
PP	Project Proponent
QC/QA	Quality control/Quality assurance
SSC	Small-Scale
UASB	Upflow Anaerobic Sludge Blanket
UNFCCC	United Nations Framework Convention on Climate Change
VCS	Voluntary Carbon Standard
VCSA	VCS Association
VER	Voluntary Emission Reductions
VCU	Voluntary Carbon Units
VVM	Validation Verification Manual

Annexure 2: References

Documents referred during the course of validation:

Table 5.1: Documents provided by the project proponent:

Reference	Document
/ADD/	- Biogas Advisory Union Foundation (BAU) register of foundation date 14.11.2002 - Contract with BAU, contact number PSC/01/2546 in January 2003 - Delivery plan for construction, letter number 004/2546 date 20.02.2003 - Response for first payment of 1,500,000, letter number 010/2546 date 03.04.2003 - Second and third payment due to the delay of construction, letter number 061/2547 date 06.09.2004 - Letter from PSC to BAU date 18.02.2005 for cancel the contract with development of biogas in wastewater treatment in starch factory - Letter number 140/2548, BAU response to the cancellation letter of PSC - List of wastewater treatment used UASB reactor in Thailand - Wastewater Engineering: Treatment, Disposal, Reuse: Third Edition by George Tchobanoglous, Frank Burton, and Metcalf & Eddy (Paperback – 1991)
/BLS/	Methodology and project specific baseline study related evidences: Document supporting as follow; Total 8 ponds. • Lagoon number 1 to 8 are open anaerobic lagoon depth 4.5 m.
/INVOICE/	Invoice related PO and certificated of Wastewater Flow meter, Gas Flow meter, Gas Analyzer - 2 Gas flow meter - 2 Wastewater flow meter - CH4 Gas analyzer Purchase order details of cover lagoon, coating of HDPE, 1 Hot-oil boiler, 4 steam boiler and steam turbine. No flare.
/CR/	Commissioning report of UASB with date.
/CON/	The signed contract between TUV-NORD and South pole to carry out the validation and verification dated 18 Nov'2008.
/LSHC/	Proof of Local stake holder consultation process on 09.12.2008.
/MET/	Local met data on annual average ambient temperature.

Reference	Document
/O&M/	O&M record of waste water treatment plant, gas destruction/utilisation equipments
/ORG/	Organisation Chart describing the project activity
/PHOTO/	Photograph of the project activity site, major equipment installed and baseline activity.
/PD1/	Draft PD version 1 which forms the basis for validation.
/PD2/	Final PD version 2 which forms the basis for validation opinion.
/PT/	Proof of title /actual ownership (Cp section 8.1 of the VCS-PD template) 1. Company affidavit dated 10.03.2005. 2. PO or invoice of UASB & Gas engine.
/QA-QC/	The QA-QC procedure on data acquisition and storage
/SC/	Statutory clearance for disposal of waste water and sludge. - Copy of Effluent Discharge Standard set by Local/ National Environmental Authorities (Cp p 3 of PD)(Weblink : www.diw.go.th) - Valid Operation permit from the Local Government and Ministry of Industry, Thailand date 24.06.2002 and valid date is 31.12.2012. - Extract of historic COD measurements of treated at the final lagoon by External lab on 25.12.2008 - Operating licence of Sweetener product number 3-11(6)-1/45 date 24.06.2002 - Operating licence of Ethanol product number 3-17-1/51 date 01.02.2008
/SLD/	Single line diagram for metering system and electricity flow for the project activity
/WPC/	Wastewater Treatment System Performance conclusion
/TD/	Technical data/document related to the project plant: • Technical details of key equipment used in the wastewater treatment plant provided by the technology supplier 1. Volumetric capacity of the cover lagoon. 2. Total capacity of the auxiliary drives 3. COD removal efficiency • Technical specifications of 1 hot oil boiler, 4 steam boiler, steam turbine and flare.

Reference	Document
/TR/	Sample laboratory reports for treated waste water and sample biogas generation
/TRG/	Training procedure and record of the plant personal to operate.
/XLS1/	Supporting Excel sheets for calculation of emission reduction related to PD1
/XLS2/	Supporting Excel sheets for calculation of emission reduction related to PD2

Table 5.2 : Background investigation and assessment documents:

Reference	Document
/AMS.III.H./	SSC-CDM methodology “Methane Recovery in Wastewater Treatment” Ver 13.
/CPM/	TÜV NORD JI / CDM CP Manual (incl. CP procedures and forms)
/VCS/	Voluntary Carbon Standard 2007.1; Program Guidelines; VCSA Rules ;and VCS Guidance Document
/VVM/	CDM Validation and Verification Manual
/ISO/	ISO 14064-2; ISO 14064-3, ISO 14065
/GHG-P/	GHG Protocol for project accounting Chap 7.

Table 5.3: Websites used:

Reference	Link	Organisation
/add/	http://www.irc.nl/page/8237 http://www.bvsde.paho.org/bvsacd/agua2003/mar.pdf	Cinara, 2004, “Waste stabilization ponds for wastewater treatment, International Water and Sanitation Centre”, Mara, D., 2003, Waste Stabilization Ponds: Time for Aggressive Marketing

Reference	Link	Organisation
/egat/	http://www.egat.co.th/en/	EGAT, Thailand
/unfccc/	http://cdm.unfccc.int	UNFCCC
/vcs/	http://www.v-c-s.org/	VCS
/pcb/	www.diw.go.th	Department of Industrial Works, Thailand

Table 5.4: List of interviewed persons:

Reference	Mol ¹		Name	Organisation / Function
/IM01/	V	☒ Mr. ☐ Ms.	Sarun Sereethoranakul	Production Engineer, P.S.C. Starch Products Public Company Limited
/IM02/	V	☒ Mr. ☐ Ms.	Siam Phoolcharoen	CDM Project Manager, South Pole Carbon Asset Management Limited

1) Means of Interview: (Telephone, E-Mail, Visit)