



# CHOL CHAROEN GROUP WASTEWATER TREATMENT WITH BIOGAS SYSTEM I (CHOLBURI)



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|               |                                                                         |
|---------------|-------------------------------------------------------------------------|
| Project Title | Chol Charoen Group Wastewater Treatment with Biogas System I (Cholburi) |
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|                        |                                                                                                  |
|------------------------|--------------------------------------------------------------------------------------------------|
| Report Title           | Chol Charoen Group Wastewater Treatment with Biogas System I (Cholburi)                          |
| Client                 | South Pole Carbon Asset Management Ltd.                                                          |
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#### Summary:

4KES, commissioned by South Pole Carbon Asset Management Ltd., has verified the greenhouse gas emission reductions reported for the project activity “Chol Charoen Group Wastewater Treatment with Biogas System I (Cholburi)” in Thailand, VCS Registration Reference N° 430, for the period 01/01/2020 to 02/03/2020 (both dates included) with regard to the relevant requirements for VCS activities.

The project activity involves the installation and operation of a biogas recovery and utilization system (an open anaerobic effluent treatment system) at Chol Charoen Co. Ltd., a tapioca starch factory in Cholburi, Thailand.

The objective of the verification is to have an independent review ex-post determination of the monitored reductions in GHG emission reductions. Verification was conducted using 4KES procedures in line with the requirements specified in the VCS program guide v 4.0, VCS standard v4.1, CDM M&P, the latest version of the VCS Validation and Verification manual v3.2 and relevant decisions of the COP/MOP and the CDM EB and applying standard auditing techniques. The verification consisted of desk review, online interviews and the resolution of outstanding issues and the issuance of the final verification report and certification.

The verification shall ensure that reported emission reductions are complete and accurate in accordance with applicable VCS / CDM requirements in order to be certified.

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The project was validated by TUV Nord (validation report N° 53208109-08/510 of 14/11/2009) and it was registered under the VCS registration reference N° 430. The validation on renewal of crediting period was done by KBS Certification Services Pvt. Ltd. (VCS.18.VER.010\_Crediting period renewal) dated 28/05/2018.

The GHG emission reductions were calculated on the basis of the approved methodology AMS-III.H 'Methane Recovery in Wastewater Treatment' version 18, AMS-I.C 'Thermal energy production with or without electricity' version 20 and AMS-I.D 'Grid connected renewable electricity generation' version 18 and the monitoring plan included in the registered Project Description, version 03 of 21/05/2018.

During this verification, 00 Corrective Action Request (CAR) and 03 Clarification Requests (CLs) were identified related to operation, GHG emission reduction estimation, monitoring and baseline scenario of the VCS project activity in relation to all relevant VCS requirements for the project activity and the applied baseline and monitoring methodology, and these CARs and CLs are successfully closed after necessary corrections/clarifications by the client. The same has been discussed in Appendix B of this verification report.

In conclusion, it is 4KES's opinion that the project activity "Chol Charoen Group Wastewater Treatment with Biogas System I (Cholburi), VCS project ID 430, meets all relevant requirements for VCS standard and guidelines and correctly applies the baseline and monitoring methodology AMS-III.H. version 18, AMS-I.C. version 20 and AMS-I.D. version 18.0. The monitoring system is in place and the emission reductions are calculated without material misstatement. Hence, 4KES is able to certify that the emission reductions from the project during the monitoring period 01/01/2020 to 02/03/2020 (both days included) amount to 7,562 tCO<sub>2</sub>e.

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# 1 INTRODUCTION

## 1.1 Objective

4KES has been commissioned by “South Pole Carbon Asset Management Ltd.” to perform an independent verification of its VCS project, “Chol Charoen Group Wastewater Treatment with Biogas System I (Cholburi)”, already registered under VCS with Project ID. 430 for the reported GHG emission reductions for the given monitoring period 01/01/2020 up to 02/03/2020 (both dates included) under the second crediting period 01/01/2017 to 31/12/2026. The VCS projects must undergo independent third-party verification and certification of emission reductions as the basis for issuance of Verified Carbon Units (VCUs).

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 Verified Carbon Units (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:

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

The project is assessed against the of VCS program guide v 4.0, VCS standard v4.1. 4KES has, based on the recommendations in the latest version of VCS Validation and Verification Manual v 3.2, 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.

Verification is not meant to provide any consultancy towards the project participants. However, stated requests for clarifications and/or corrective actions may have provided input for improvement of the monitoring.

## 1.3 Level of Assurance

The final verification report before being submitted to the client were subjected to an independent internal technical review to confirm that all verification activities had been completed according to the pertinent 4KES instructions, with reasonable level of assurance.

The technical review was performed by a technical reviewer(s) qualified in accordance with 4KES qualification scheme for VCS and CDM validation and verification.

The verification team and the technical reviewers consist of the following personnel.

| Role                                                  | Last Name | First Name | Country |
|-------------------------------------------------------|-----------|------------|---------|
| Team Leader, Technical Expert and Host country Expert | Menon     | Rekha      | India   |
| Technical Reviewer                                    | C         | Indumathi  | India   |

## 1.4 Summary Description of the Project

The project activity involves the installation and operation of a biogas recovery and utilization system (an open anaerobic effluent treatment system) at Chol Charoen Co. Ltd., a tapioca starch factory in Cholburi, Thailand. The system has been in operation since 7<sup>th</sup> January 2006 (project start date).

The starch factory has a design daily production capacity of 240 ton of dried starch, generating 2,400 m<sup>3</sup> of wastewater per operational day. Under the previous system, wastewater released from the plant was treated in 13 cascading open anaerobic lagoons. With the depths of these ponds being more than 2 meter from the water surface and the mean temperature of the region being 29°C, there is a suitable anaerobic environment within the ponds. Anaerobic bacteria in the ponds break down organic compounds in the wastewater, resulting in the release of biogas. The resulting biogas is characterised by the chemical oxygen demand or COD of the wastewater.

The project activity involves modification of the existing open anaerobic lagoon-based process into a closed anaerobic system for treatment of high organic matter wastewater. This is based on anaerobic fixed film reactor (AFFR) technology, which is a technology. In addition, three open lagoons at the outlet of the AFFRs were redesigned and converted to covered lagoons in order to 1) increase gas storage capacity and 2) serve as an emergency wastewater treatment system in case the AFFR system malfunctions.

The implementation of AFFR system enables the recovery of biogas that would have been released to the atmosphere and the utilization of the recovered biogas for thermal and electricity generation. Excess biogas (if any) sent to the enclosed flare system. The hot oil boiler in the existing plant was originally designed to burn fuel oil for heat generation. Under the project activity, the burner is retrofitted with a combination fuel burner, which allows the boiler to be co-fired using both fuel oil and the biogas collected from the reactors. The power produced by the captured biogas augments the electricity requirement of the plant and may, in the future be fed to national grid, under the pending power purchase agreement with Provincial electricity Authority (PEA). With such utilization of biogas, the project activity achieves GHG emission reduction through avoidance of methane being released to the atmosphere and also through reduction of fossil fuel consumption (with fuel oil and grid electricity being replaced). Verification team has checked the project activity equipment's installed at the project site and found in compliance with registered VCS PD version 03 of 21/05/2018.

The project site is located in the compound of Chol Charoen Co., Ltd., located in Banbung district, Choburi province, Thailand, about 250 km away from Bangkok. Geographical coordinates: 13° 17.736'N latitude 101° 09.108'E longitude.

As per the registered VCS PD (VCS Ref. No: 430) of the VCS project, baseline emissions are calculated as the sum of fugitive methane emissions from lagoons in the baseline case in the absence of the project activity and CO<sub>2</sub> emissions from burning of fossil fuel. Project emissions are calculated as the fugitive methane emissions from the project activity, the electricity consumption to run the project activity in present scenario. The emission reduction is calculated as the difference of baseline emissions and the project emissions as the leakage emissions are considered to be negligible for the project activity as per the applied methodologies.

The project covers the monitoring period from 01/01/2020 - 02/03/2020 under the second crediting period, which starts from (01/01/2017 to 31/12/2026) with emission reductions 7,562 tCO<sub>2e</sub>. The emission reductions are calculated conservatively as per the applied methodologies.

Main components of the project activity include AFFR, Thermal oil boilers, gas engines, gas storage system, Cascading open lagoons system and enclosed flaring system.

The main information of the project activity is summarized in the table below:

|                                      |                                                                                                                                                                                                                                           |
|--------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Project Participant (s)              | Chol Charoen Co., Ltd.<br>South Pole Carbon Asset Management Ltd.                                                                                                                                                                         |
| Project Title                        | Chol Charoen Group Wastewater Treatment with Biogas System I (Cholburi)                                                                                                                                                                   |
| Location of the project              | The project site is located in the compound of Chol Charoen Co., Ltd., located in Banbung district, Cholburi province, Thailand, about 250 km away from Bangkok. Geographical co-ordinates: 13° 17.736'N latitude 101° 09.108'E longitude |
| Methodology(ies)                     | AMS-III.H 'Methane Recovery in Wastewater Treatment' version 18, AMS-I.C 'Thermal energy production with or without electricity' version 20 and AMS-I.D 'Grid connected renewable electricity generation' version 18.                     |
| Sectoral Scope(s)                    | 13 & 1                                                                                                                                                                                                                                    |
| Registered PDD                       | Version 3 of 21/05/2018                                                                                                                                                                                                                   |
| Startingdate of the crediting period | 01/01/2007 (Under first crediting period of 10 years)<br>01/01/2017 (Under second crediting period of 10 years)                                                                                                                           |
| Monitoring period                    | 01/01/2020 to 02/03/2020                                                                                                                                                                                                                  |

## 2 VERIFICATION PROCESS

### 2.1 Method and Criteria

Verification was conducted using 4KES procedures in line with the requirements specified in the VCS Requirements and VVB guidance, i.e. VCS Program Guide, Version 4.0 of 19/09/2019, VCS Standard, Version 4.1 of 22/04/2021 and Validation and Verification Manual, VCS Version 3.2 of 19/10/2016. The GHG emission reductions are on the basis of the approved Baseline and monitoring methodology "AMS-III.H", "Methane Recovery in Wastewater Treatment version 18.

The verification consisted of the following three phases

- Document review;
- Desk assessment including online Interviews;
- Resolution of Any Material Discrepancy and the issuance of the final verification report and certification.

The following sections outline each step in more detail.

## 2.2 Document Review

The monitoring report (MR), version 03.1 of 15/10/2021 /01/, the emission reduction calculations spreadsheet (VCS430Cholburi\_WWT\_4thER\_01012020to02032020nonPAF\_v03 20072020.xlsx) version 03 of 20/07/2021 /03/, were assessed as part of the verification. In addition, the registered VCS-PD /02/ in particular the baseline estimations and the monitoring plan for the project were reviewed.

The following table lists the documentation that was reviewed during the verification.

|      |                                                                                                                                                                                                                            |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| /01/ | South Pole Carbon Asset Management Ltd.: VCS monitoring report for the project activity “Chol Charoen Group Wastewater Treatment with Biogas System I (Cholburi)”, version 03 of 20/07/2021 and version 03.1 of 15/10/2021 |
| /02/ | South Pole Carbon Asset Management Ltd.: VCS project description for project activity “Chol Charoen Group Wastewater Treatment with Biogas System I (Cholburi)” in Thailand, version 3 of 21/05/2018                       |
| /03/ | South Pole Carbon Asset Management Ltd.: VCS430Cholburi_WWT_4thER_01012020to02032020nonPAF_v03 20072020.xlsx submitted on 20/07/2021                                                                                       |
| /04/ | VCS: VCS Program Guide, VCS Version 4.0 of 19/09/2019                                                                                                                                                                      |
| /05/ | VCS: VCS Standard, VCS Version 4.1 of 22/04/2021                                                                                                                                                                           |
| /06/ | CDM Executive Board: Approved consolidated baseline and monitoring methodology “AMS”-III.H, Methane Recovery in Wastewater Treatment, version 18 .                                                                         |
| /07/ | CDM Executive Board: AMS-I.C ‘Thermal energy production with or without electricity’ version 20                                                                                                                            |
| /08/ | CDM Executive Board: AMS-I.D ‘Grid connected renewable electricity generation’ version 18                                                                                                                                  |
| /09/ | VCS: Chol Charoen Group Wastewater Treatment with Biogas System I (Cholburi) (ID: 430) <a href="https://www.vcsprojectdatabase.org/#/project_details/430">https://www.vcsprojectdatabase.org/#/project_details/430</a>     |
| /10/ | VCS: Monitoring report form, version 04.0 dated 19/09/2019                                                                                                                                                                 |

|      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| /11/ | TUV Nord: Validation report (validation report N°53219108-08/ 510 of 14/11/2009) for the project activity “Chol Charoen Group Wastewater Treatment with Biogas System I (Cholburi)”                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| /12/ | KBS Certification Services Pvt. Ltd.: Validation report on renewal of crediting period (VCS.18.VER.010_Crediting period renewal) dated 28/05/2018                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| /13/ | TUV SUD: Verification report for the project activity ‘Chol Charoen Group Wastewater Treatment with Biogas System I (Cholburi)’ covering the monitoring period 01/04/2019 to 31/12/2019                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| /14/ | <p>Daily log sheets of of Chol Charoen Co., Ltd:</p> <ol style="list-style-type: none"> <li>1.Wastewater flow meter readings for the period 01/01/2020 to 02/03/2020.</li> <li>2.Methane content (% CH<sub>4</sub>) in biogas for the period 01/01/2020 to 02/03/2020.</li> <li>3.COD measurement of wastewater for the period 01/01/2020 to 02/03/2020.</li> <li>4. Biogas consumption for boilers and gas engine (GM 1 &amp; GM 3) for the period 01/01/2020 to 02/03/2020.</li> <li>5. Biogas consumption for flare for the period 01/01/2020 to 02/03/2020.</li> <li>6. Electricity generation record during the period 01/01/2020 to 02/03/2020.</li> <li>7.Daily Starch production records from 01/01/2020 to 02/03/2020.</li> <li>8.Fuel oil consumption records from 01/01/2020 to 02/03/2020.</li> </ol>                                                                                                                                                                                                                                               |
| /15/ | <p>Calibration Reports:</p> <ol style="list-style-type: none"> <li>1. Flowmeter (KCA4726)- FM1 calibrated on 11/04/2019 by Miracle International Technology Co. Ltd.</li> <li>2. Flowmeter (YAL1624)- FM2 calibrated on 11/04/2019 and 12/04/2020 by Miracle International Technology Co. Ltd.</li> <li>3. Flowmeter (YAL1625)- FM3 calibrated on 11/04/2019 and 12/04/2020 by Miracle International Technology Co. Ltd.</li> <li>4. Colorimeter (HAC160600001037): Calibrated on 29/02/2016 and 09/04/2020 by HACH Flowmeter</li> <li>5. GM 1 (V9107-03.1): Calibrated on 17/04/2019 and 10/04/2020 by Miracle International Technology Co. Ltd.</li> <li>6. Flowmeter (20880)- GM 3: Calibrated on 17/04/2019 and 10/04/2020 by Miracle International Technology Co. Ltd.</li> <li>7. Methane analyser (12368): By Gas Data on 12/03/2019.</li> <li>8. Flow meter (20320)-OM 1: By Miracle International Technology Co. Ltd. On 23/06/2017 and 09/04/2020.</li> <li>9. Weighing bridge (B70153544): By Metler Toledo Central Bureau of Weights and</li> </ol> |

|      |                                                                                                                                                                                                                                                                                                                                                                                |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|      | Measures on 06/12/2019<br><br>10. Flowmeter (VERIS/ C100-05-H-WCFS-CXXX/ V9107-03.1)- GM 1: Calibrated on 17/04/2019 and 10/04/2020 by Miracle International Technology Co. Ltd.<br><br>11. Truck Scale: S.No 2006220, calibrated by Central Bureau of Weights and Measures , dated 30/05/2019                                                                                 |
| /16/ | VERRA: <a href="https://verra.org/covid-19-travel-guidance/">https://verra.org/covid-19-travel-guidance/</a> last accessed on 15/04/2020                                                                                                                                                                                                                                       |
| /17/ | Department of Alternative Energy Development and Efficiency (DEDE) : Thailand Energy Balance 2020.                                                                                                                                                                                                                                                                             |
| /18/ | List of Accredited Laboratories; webpage <a href="https://www.tisi.go.th/home/en">https://www.tisi.go.th/home/en</a> in English language retrieved on 25/06/2021                                                                                                                                                                                                               |
| /19/ | CDM Executive Board: “Project emissions from flaring”, version 3.0 (Tool06)                                                                                                                                                                                                                                                                                                    |
| /20/ | CDM Executive Board: “Tool to calculate project or leakage CO2 emissions from fossil fuel combustion”, version 3.0 (Tool03)                                                                                                                                                                                                                                                    |
| /21/ | CDM Executive Board: “Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation” version 3.0 (Tool05)                                                                                                                                                                                                                   |
| /22/ | CDM Executive Board: “Tool to calculate the emission factor for an electricity system” version 7.0 (Tool07)                                                                                                                                                                                                                                                                    |
| /23/ | ERPA between Chol Charoen Group and South Pole Carbon Asset Management Ltd, dated 21/12/2017                                                                                                                                                                                                                                                                                   |
| /24/ | PEA report for the period 01/01/2020 to 31/03/2020                                                                                                                                                                                                                                                                                                                             |
| /25/ | Chol Charoen Group: starch sales records for the period 01/01/2020 to 02/03/2020                                                                                                                                                                                                                                                                                               |
| /26/ | Videos and pictures of the plant, instruments and meters.                                                                                                                                                                                                                                                                                                                      |
| /27/ | PEA meters from EDM- accuracy class- <a href="https://www.edm-meters.com/product/meters/electricity-metering-devices/mk6e/#:~:text=The%20Mk6E%20is%20an%20enhanced,at%20high%2Dend%20consumer%20facilities.">https://www.edm-meters.com/product/meters/electricity-metering-devices/mk6e/#:~:text=The%20Mk6E%20is%20an%20enhanced,at%20high%2Dend%20consumer%20facilities.</a> |
| /28/ | Complete report Project to promote biogas production for renewable energy in tapioca starch industry King Mongkut's University of Technology Thonburi at Chol Charoen plant.                                                                                                                                                                                                   |
| /29/ | Boiler name plate.                                                                                                                                                                                                                                                                                                                                                             |
| /30/ | Specifications of 500GF-RZ Genset and 600 Genset.                                                                                                                                                                                                                                                                                                                              |
| /31/ | Confirmation letter from PP stating that flare system is no longer used since 04/06/2006, dated 10/07/2009.                                                                                                                                                                                                                                                                    |

## 2.3 Interviews

|     | Date       | Name and Role                 | Organization                           | Topic               |
|-----|------------|-------------------------------|----------------------------------------|---------------------|
| /a/ | 02/06/2021 | Sirinut Raya, Project Manager | South Pole Carbon Asset Management Ltd | project description |
| /b/ |            |                               |                                        | Project             |

|     |  |                                                                     |                                                          |                                                                                                                                                  |
|-----|--|---------------------------------------------------------------------|----------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
|     |  |                                                                     |                                                          | Implementation status, Operation and Maintenance, Data storage and Archiving procedures, Trainings                                               |
| /c/ |  | Kamontorn Muckvichit; Quality Control Manager of Cholburi Co., Ltd. | Chol Charoen Group                                       | Technology involved, AFFR and flare specification, Monitoring parameters, data collection and QA/QC procedures. Health and safety related topics |
| /d/ |  | Panya Wisetchad; Quality Control Officer of Cholburi Co., Ltd.      |                                                          |                                                                                                                                                  |
| /e/ |  | Ayoy Wisetchad; Quality Control Officer of Cholburi Co., Ltd.       |                                                          |                                                                                                                                                  |
| /f/ |  | Vichan Silapasart ; Staff production                                |                                                          |                                                                                                                                                  |
| /g/ |  |                                                                     |                                                          | Project Implementation status, Operation and Maintenance and monitoring parameters.                                                              |
| /h/ |  | Surachai Kompai                                                     | Stakeholder living in the community, Moo.3, Ban Nongchak | Stakeholder consultation                                                                                                                         |

## 2.4 Site Inspections

The verification team could not visit the site due to COVID-19 pandemic and subsequent travel restrictions. As per the Emission Reduction Purchase Agreement (ERPA) dated 20/12/2017 /23/, the client is committed to deliver the VERs until 31/12/2027.

Based on the above mentioned justification, the DOE could not postpone the site visit. The same is as per the VCS- COVID travel guidance (<https://verra.org/covid-19-travel-guidance/>) /16/.

All information provided in the revised MR /01/ was verified during the desk-review phase against credible sources and interviews with concerned stakeholders. It is to be also noted that more than three years have not elapsed since the last onsite inspection was conducted. Since an onsite inspection is avoided, the verification team decided to carry out the audit by other means of standard auditing techniques, which included video conference calls, videos of the site, videos of the equipment's installed and measuring devices in place, pictures of the meters , emails, raw data and telephonic interviews.

## 2.5 Resolution of Findings

The objective of this phase of the verification is to resolve any outstanding issues which need to be clarified for 4KES positive conclusion on the project description. To guarantee transparency any findings raised during the verification are incorporated in the Appendix B to this report. A corrective action request (CAR) is raised if one of the following occurs:

- The project participants have made mistakes that will influence the ability of the project activity to achieve real, measurable additional emission reductions.
- The VCS Version 4.1 standard have not been met.
- There is a risk that the emission reductions cannot be monitored or calculated.

A clarification request (CL) is raised if information is insufficient or not clear enough to determine whether the applicable VCS Version 4.1 standard have been met.

The No. of CARs/CLs raised by 4KES are the following

CAR:0, CL: 03 and FAR: 0

All the above-mentioned CARs/CLs have been successfully closed. For more information, please refer to Appendix-B.

### 2.5.1 Forward Action Requests

Based on the review of the previous verification report, no FAR was raised during the previous verification.

No FARs raised during this verification.

## 2.6 Eligibility for Validation Activities

4KES is accredited for validating and verifying GHG emission reduction project activities falling under sectoral scope 13 and 1, waste handling and disposal and Energy industries (renewable - / non-renewable sources).

# 3 VALIDATION FINDINGS

## 3.1 Participation under Other GHG Programs

Since this is a verification activity, this section is not applicable.

### 3.2 Methodology Deviations

The methodology deviation applied in the previous monitoring, verified and assessed in the previous verification was accepted by VCS board, which remains still valid in this verification too. The deviation is also discussed in section 3.2.1 of the MR. The same is checked and accepted by the verification team.

There is no methodology deviation specific to this monitoring period.

### 3.3 Project Description Deviations

The electricity exported to the grid (EG<sub>grid</sub>) is measured by means of internal meters, which is now revised to PEA meters, which measures the electricity exported to the national grid continuously. The readings are recorded monthly with both the parties from the PP and state utility signing on it. The change of meters from internal to third-party (PEA) meters was accepted in the previous verification. It is also confirmed that deviation does not impact the applicability of the methodology, additionality or the appropriateness of the baseline scenario. The project remains in compliance with the VCS Program rules and the deviation is applicable for the whole second crediting period.

### 3.4 Grouped Project

The verification team confirms that the project is not a grouped project and hence this is not applicable to the project activity.

## 4 VERIFICATION FINDINGS

### 4.1 Project Implementation Status

On the basis of the online interviews and the reviewed project documentation, the verification team confirms that the project was implemented as described in the registered VCS PD version 03. All the physical components and project boundary are in conformity with the description in registered VCS PD. The project activity was implemented in January 2006 and in operation since then. Based on the VCS PD and the available information at VCS database it is confirmed that the project's first crediting period is from 01/01/2007 – 31/12/2016. It is checked that all the verifications under first crediting period is completed and the second crediting period is from 01/01/2017 – 31/12/2026. The proposed Monitoring Period is from 01/01/2020 to 02/03/2020 and during this period there was no plant operation and maintenance shutdown noted.

The project activity involves capturing of methane generated from the wastewater treatment through AFFR technology and covered lagoons and the utilization of the recovered biogas for thermal and electricity generation.

As per the applied methodologies; AMS-III.H, version 18 /06/, AMS-I.C , version 20 /07/ and AMS-I.D , version 18 /08/ , the project boundary is defined as below:

“The project boundary is the physical, geographical site where the wastewater and sludge treatment takes place in baseline and project situation. It covers all facilities affected by the project activity including sites where the processing, transportation and application or disposal of waste products as well as biogas takes place”.

The methodology deviations and project description deviation has been explained in 3.2 and 3.3 respectively.

4KES confirms that the project is not part of any emissions trading program or any other mechanism that includes GHG allowance trading. Further, the project has not received or sought any other form of environmental credit or has become eligible to do so since validation or previous verification. It is also checked that the project has not participated or been rejected under any other GHG programs since validation or previous verification.

**Data parameters fixed ex-ante and available at validation are given below:**

| DATA/PARAMETER & Unit                                                         | Source of data                                              | Reported value for the project period | Assessment/Observation                                                                                                                                                                             |
|-------------------------------------------------------------------------------|-------------------------------------------------------------|---------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Global Warming Potential for Methane ( $GWP_{CH_4}$ ) in $tCO_2e/tCH_4$       | Data based on renewed PD /02/ and validation report /12/    | 25                                    | The value is ex-ante fixed for 10 years crediting period as per the registered PD. The value considered is appropriate.                                                                            |
| Methane producing capacity of the wastewater ( $B_{0,ww}$ ); $kg CH_4/kg COD$ | Data based on registered PD /02/ and validation report /12/ | 0.25                                  | The value is ex-ante fixed for 10 years crediting period as per the registered PD, which has been justified and validated by validation DOE to follow the applied methodology and tool /02/, /12/. |
| Model correction factor to account for model uncertainties ( $UF_{BL}$ )      | Data based on registered PD /02/ and validation report /12/ | 0.89                                  | The value is ex-ante fixed for 10 years crediting period as per the registered PD, which has been justified and validated by validation DOE to follow the applied methodology and tool /02/, /12/. |
| Model correction factor to account for model uncertainties ( $UF_{PJ}$ )      | Data based on registered PD /02/ and validation report /12/ | 1.12                                  | The value is ex-ante fixed for 10 years crediting period as per the registered PD, which has been justified and validated by validation DOE to follow the applied methodology and tool /02/, /12/. |
| Methane correction factor for baseline wastewater treatment                   | Data based on registered PD and renewed /02/ and            | 0.8                                   | The value is ex-ante fixed for 10 years crediting period as per the registered PD, which has been                                                                                                  |

|                                                                                                                                               |                                                                         |        |                                                                                                                                                                                                    |
|-----------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| systems i<br>( $MCF_{ww,treatment,BLi}$ )                                                                                                     | validation report<br>/12/                                               |        | justified and validated by validation DOE to follow the applied methodology and tool /02/, /12/.                                                                                                   |
| Methane correction factor for project wastewater treatment systems k equipped with biogas recovery equipment<br>( $MCF_{ww,treatment,PJ,k}$ ) | Data based on registered PD /02/ and validation report /12/             | 0.8    | The value is ex-ante fixed for 10 years crediting period as per the registered PD, which has been justified and validated by validation DOE to follow the applied methodology and tool /02/, /12/. |
| Capture efficiency of the biogas recovery equipment in the wastewater treatment systems ( $CFE_{ww}$ )                                        | Data based on registered PD /02/ and validation report /12/             | 0.9    | The value is ex-ante fixed for 10 years crediting period as per the registered PD, which has been justified and validated by validation DOE to follow the applied methodology and tool /02/, /12/. |
| COD removal efficiency of baseline treatment system for the starch plant<br>( $\eta_{COD,BLi}$ ); %                                           | Data based on registered PD, /02/ and validation report /12/            | 87%    | The value is ex-ante fixed for 10 years crediting period as per the registered PD, which has been justified and validated by validation DOE to follow the applied methodology and tool /02/, /12/. |
| $\eta_{flare, m}$ (FE)                                                                                                                        | Data based on registered PD, renewed PD /02/ and validation report /12/ | 0%     | The value is ex-ante fixed for 10 years crediting period as per the registered PD, which has been justified and validated by validation DOE to follow the applied methodology and tool /02/, /12/. |
| Destruction efficiency of the electricity generator (DE; %)                                                                                   | Data based on registered PD /02/ and validation report /12/             | 100%   | The value is ex-ante fixed for 10 years crediting period as per the registered PD, which has been justified and validated by validation DOE to follow the applied methodology and tool /02/, /12/. |
| CO <sub>2</sub> emission factor for grid power ( $EF_{grid,CM,Y}$ ); tCO <sub>2</sub> /MWh                                                    | Data based on registered PD, /02/ and validation report /12/            | 0.5637 | The value is ex-ante fixed for 10 years crediting period as per the registered PD, which has been justified and validated by validation DOE.                                                       |
| Emission factor of fossil fuel replaced – Residual Fuel oil ( $EF_{CO2,i,y}$ ); tCO <sub>2</sub> /TJ                                          | Data based on registered PD /02/ and validation report /12/             | 77.4   | The value is ex-ante fixed for 10 years crediting period as per the registered PD, which has been                                                                                                  |

|                                                                                                                                        |                                                             |        |                                                                                                                                                                                                    |
|----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                        |                                                             |        | justified and validated by validation DOE to follow the applied methodology and tool /02/, /12/.                                                                                                   |
| Density of methane gas at reference conditions ( $\rho_{CH_4,n}$ ); kg/m <sup>3</sup>                                                  | Data based on registered PD /02/ and validation report /12/ | 0.716  | The value is ex-ante fixed for 10 years crediting period as per the registered PD, which has been justified and validated by validation DOE to follow the applied methodology and tool /02/, /12/. |
| Efficiency of the boiler using fossil fuel that would have been used in the absence of the project activity ( $\eta_{BL,thermal}$ ); % | Data based on registered PD /02/ and validation report /12/ | 100%   | The value is ex-ante fixed for 10 years crediting period as per the registered PD, which has been justified and validated by validation DOE to follow the applied methodology and tool /02/, /12/. |
| NCV of fuel oil i.e. fossil fuel displaced by biogas ( $NCV_{i,y}$ ); TJ/tonne                                                         | Data based on registered PD /02/ and validation report /12/ | 0.0404 | The value is ex-ante fixed for 10 years crediting period as per the registered PD, which has been justified and validated by validation DOE to follow the applied methodology and tool /02/, /12/. |
| Liters of fossil fuel required per tonne of dry starch historically ( $Q_{FO,starch}$ ); L/tonne                                       | Data based on registered PD /02/ and validation report /12/ | 34.3   | The value is ex-ante fixed for 10 years crediting period as per the registered PD, which has been justified and validated by validation DOE to follow the applied methodology and tool /02/, /12/. |
| Density of fuel oil ( $D_{FO}$ ); Kg/litre                                                                                             | Data based on registered PD /02/ and validation report /12/ | 0.93   | The value is ex-ante fixed for 10 years crediting period as per the registered PD, which has been justified and validated by validation DOE to follow the                                          |

|                                                                                               |                                                             |        |                                                                                                                                                                                                  |
|-----------------------------------------------------------------------------------------------|-------------------------------------------------------------|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                               |                                                             |        | applied methodology and tool /02/, /12/.                                                                                                                                                         |
| Total electrical capacity of the equipment installed in the project activity ( $P_{el}$ ; kW) | Data based on registered PD /02/ and validation report /12/ | 139.25 | The value is ex-ante fixed for 10 years crediting period as per the registered PD, which has been justified and validated by validation DOE to follow the applied methodology and tool /02/ /12/ |

4KES is able to confirm that the Data and Parameters fixed ex-ante have been implemented in full compliance with registered monitoring plan.

| Data/Parameter                                                                                                                                             | Assessment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                            |                         |                          |         |               |         |       |         |     |     |               |         |       |           |     |     |               |         |       |           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|--------------------------|---------|---------------|---------|-------|---------|-----|-----|---------------|---------|-------|-----------|-----|-----|---------------|---------|-------|-----------|
| Data Unit                                                                                                                                                  | $Q_{ww,l,y}$ ; m <sup>3</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                            |                         |                          |         |               |         |       |         |     |     |               |         |       |           |     |     |               |         |       |           |
| Description                                                                                                                                                | Volume of wastewater treated in the year y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                            |                         |                          |         |               |         |       |         |     |     |               |         |       |           |     |     |               |         |       |           |
| Source of data to be used                                                                                                                                  | Measured – Volumetric flow meters-FM1, FM2 and FM3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                            |                         |                          |         |               |         |       |         |     |     |               |         |       |           |     |     |               |         |       |           |
| Value of monitored parameter for the monitoring period                                                                                                     | <table border="1"> <tr> <td>Period</td><td>Value (m<sup>3</sup>)</td></tr> <tr> <td>01/01/2020 to 02/03/2020</td><td>135,984</td></tr> </table> <p>The values mentioned in the monitoring report and ER sheet have been verified with the daily logbook reports /14/. The reported values in the MR and ER sheet were found to be consistent with the daily reports and the operator log sheet information.</p>                                                                                                                                                                                                  | Period                                                                                                                                                     | Value (m <sup>3</sup> ) | 01/01/2020 to 02/03/2020 | 135,984 |               |         |       |         |     |     |               |         |       |           |     |     |               |         |       |           |
| Period                                                                                                                                                     | Value (m <sup>3</sup> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                            |                         |                          |         |               |         |       |         |     |     |               |         |       |           |     |     |               |         |       |           |
| 01/01/2020 to 02/03/2020                                                                                                                                   | 135,984                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                            |                         |                          |         |               |         |       |         |     |     |               |         |       |           |     |     |               |         |       |           |
| Monitoring equipment                                                                                                                                       | <table border="1"> <tr> <td colspan="2">Magnetic flow meter. The meter with tag FM1 measures the wastewater treated in the year y from the starch plant, entering to biogas system of the project.</td></tr> <tr> <td>Tag</td><td>FM1</td></tr> <tr> <td>Serial number</td><td>KCA4726</td></tr> <tr> <td>Model</td><td>MC 608A</td></tr> <tr> <td>Tag</td><td>FM2</td></tr> <tr> <td>Serial number</td><td>YAL1624</td></tr> <tr> <td>Model</td><td>MUT1000EL</td></tr> <tr> <td>Tag</td><td>FM3</td></tr> <tr> <td>Serial number</td><td>YAL1625</td></tr> <tr> <td>Model</td><td>MUT1000EL</td></tr> </table> | Magnetic flow meter. The meter with tag FM1 measures the wastewater treated in the year y from the starch plant, entering to biogas system of the project. |                         | Tag                      | FM1     | Serial number | KCA4726 | Model | MC 608A | Tag | FM2 | Serial number | YAL1624 | Model | MUT1000EL | Tag | FM3 | Serial number | YAL1625 | Model | MUT1000EL |
| Magnetic flow meter. The meter with tag FM1 measures the wastewater treated in the year y from the starch plant, entering to biogas system of the project. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                            |                         |                          |         |               |         |       |         |     |     |               |         |       |           |     |     |               |         |       |           |
| Tag                                                                                                                                                        | FM1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                            |                         |                          |         |               |         |       |         |     |     |               |         |       |           |     |     |               |         |       |           |
| Serial number                                                                                                                                              | KCA4726                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                            |                         |                          |         |               |         |       |         |     |     |               |         |       |           |     |     |               |         |       |           |
| Model                                                                                                                                                      | MC 608A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                            |                         |                          |         |               |         |       |         |     |     |               |         |       |           |     |     |               |         |       |           |
| Tag                                                                                                                                                        | FM2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                            |                         |                          |         |               |         |       |         |     |     |               |         |       |           |     |     |               |         |       |           |
| Serial number                                                                                                                                              | YAL1624                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                            |                         |                          |         |               |         |       |         |     |     |               |         |       |           |     |     |               |         |       |           |
| Model                                                                                                                                                      | MUT1000EL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                            |                         |                          |         |               |         |       |         |     |     |               |         |       |           |     |     |               |         |       |           |
| Tag                                                                                                                                                        | FM3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                            |                         |                          |         |               |         |       |         |     |     |               |         |       |           |     |     |               |         |       |           |
| Serial number                                                                                                                                              | YAL1625                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                            |                         |                          |         |               |         |       |         |     |     |               |         |       |           |     |     |               |         |       |           |
| Model                                                                                                                                                      | MUT1000EL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                            |                         |                          |         |               |         |       |         |     |     |               |         |       |           |     |     |               |         |       |           |
| Accuracy of the monitoring equipment                                                                                                                       | PP has installed electromagnetic flow meter with an accuracy class of 0.2% respectively. The accuracy of the meters represents good monitoring practice.                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                            |                         |                          |         |               |         |       |         |     |     |               |         |       |           |     |     |               |         |       |           |
| Measuring/Reading/Recording frequency                                                                                                                      | Continuous monitoring, record on the daily basis. The practice found to be followed in the log records during the online interviews and consistent with registered monitoring plan.                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                            |                         |                          |         |               |         |       |         |     |     |               |         |       |           |     |     |               |         |       |           |
| Calculation method (if applicable)                                                                                                                         | N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                            |                         |                          |         |               |         |       |         |     |     |               |         |       |           |     |     |               |         |       |           |
| Calibration                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                            |                         |                          |         |               |         |       |         |     |     |               |         |       |           |     |     |               |         |       |           |

|                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                          |                    |                      |  |     |       |                   |                    |                      |     |          |            |     |          |     |         |                          |     |          |     |         |                          |     |          |
|-----------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------|----------------------|--|-----|-------|-------------------|--------------------|----------------------|-----|----------|------------|-----|----------|-----|---------|--------------------------|-----|----------|-----|---------|--------------------------|-----|----------|
| Calibration frequency/interval<br>Is the calibration interval in line with the monitoring plan of the PD? | The flow meter is calibrated at least once every 3 years, this is also consistent with registered monitoring plan and the previous verifications. Hence accepted.                                                                                                                                                                                                                                                                                                      |                          |                    |                      |  |     |       |                   |                    |                      |     |          |            |     |          |     |         |                          |     |          |     |         |                          |     |          |
| Does the calibration cover the monitoring period?<br>Has the calibration frequency been respected?        | <table><tr><td>Tag</td><td>Se.no</td><td>Calibration dates</td><td>Calibration entity</td><td>Does it cover the MP</td></tr><tr><td>FM1</td><td>KCA47267</td><td>11/04/2019</td><td>MIT</td><td>Yes /15/</td></tr><tr><td>FM2</td><td>YAL1624</td><td>11/04/2019<br/>12/04/2020</td><td>MIT</td><td>Yes /15/</td></tr><tr><td>FM3</td><td>YAL1625</td><td>11/04/2019<br/>12/04/2020</td><td>MIT</td><td>Yes /15/</td></tr></table><br>No delay in calibration noticed. |                          |                    |                      |  | Tag | Se.no | Calibration dates | Calibration entity | Does it cover the MP | FM1 | KCA47267 | 11/04/2019 | MIT | Yes /15/ | FM2 | YAL1624 | 11/04/2019<br>12/04/2020 | MIT | Yes /15/ | FM3 | YAL1625 | 11/04/2019<br>12/04/2020 | MIT | Yes /15/ |
| Tag                                                                                                       | Se.no                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Calibration dates        | Calibration entity | Does it cover the MP |  |     |       |                   |                    |                      |     |          |            |     |          |     |         |                          |     |          |     |         |                          |     |          |
| FM1                                                                                                       | KCA47267                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 11/04/2019               | MIT                | Yes /15/             |  |     |       |                   |                    |                      |     |          |            |     |          |     |         |                          |     |          |     |         |                          |     |          |
| FM2                                                                                                       | YAL1624                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 11/04/2019<br>12/04/2020 | MIT                | Yes /15/             |  |     |       |                   |                    |                      |     |          |            |     |          |     |         |                          |     |          |     |         |                          |     |          |
| FM3                                                                                                       | YAL1625                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 11/04/2019<br>12/04/2020 | MIT                | Yes /15/             |  |     |       |                   |                    |                      |     |          |            |     |          |     |         |                          |     |          |     |         |                          |     |          |
| Calibration certificates                                                                                  | Please refer above                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                          |                    |                      |  |     |       |                   |                    |                      |     |          |            |     |          |     |         |                          |     |          |     |         |                          |     |          |
| Does the calibration of meters have be done by an accredited person or institution?                       | (MIT) is accredited calibration laboratory for flow measurement in accordance with ISO/IEC17025 No. 0147 issued by the Thai Industrial Standards Institute (TISI) /18/                                                                                                                                                                                                                                                                                                 |                          |                    |                      |  |     |       |                   |                    |                      |     |          |            |     |          |     |         |                          |     |          |     |         |                          |     |          |

| Data/Parameter                                         | Assessment                                                                                                                                                                                                                                       |       |        |
|--------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|
| Data Unit                                              | COD <sub>ww,untreated,y</sub> ; tCOD/m <sup>3</sup>                                                                                                                                                                                              |       |        |
| Description                                            | COD of wastewater before entering treatment system affected by the project activity CS1, CS2                                                                                                                                                     |       |        |
| Source of data to be used                              | Measured using colorimetric method                                                                                                                                                                                                               |       |        |
| Value of monitored parameter for the monitoring period | Period                                                                                                                                                                                                                                           | Value |        |
|                                                        |                                                                                                                                                                                                                                                  | Lower | Higher |
|                                                        | 01/01/2020 to 02/03/2020<br>For AFFR system                                                                                                                                                                                                      | 0.020 | 0.025  |
|                                                        | 01/01/2020 to 02/03/2020<br>For CL system                                                                                                                                                                                                        | 0.019 | 0.024  |
|                                                        | The values mentioned in the monitoring report and ER sheet have been verified with the daily reports /14/. The reported values in the MR and ER sheet were found to be consistent with the daily reports and the operator log sheet information. |       |        |
| Monitoring equipment                                   | Colorimeter                                                                                                                                                                                                                                      |       |        |
| Accuracy of the monitoring equipment                   | 2%                                                                                                                                                                                                                                               |       |        |
| Measuring/Reading/Recording                            | Daily.                                                                                                                                                                                                                                           |       |        |

|                                                                                                           |                                                                                                                                                                                                                                                                     |                 |                           |                    |                      |
|-----------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------|--------------------|----------------------|
| frequency                                                                                                 | However, PP has done periodic analysis following 90/10 confidence/precision level which is consistent with the applied methodology AMS-III.H, version 18. Hence, accepted. The Colorimetric method is well documented and well accepted by international standards. |                 |                           |                    |                      |
| Calculation method (if applicable)                                                                        | N/A.                                                                                                                                                                                                                                                                |                 |                           |                    |                      |
| Calibration                                                                                               |                                                                                                                                                                                                                                                                     |                 |                           |                    |                      |
| Calibration frequency/interval<br>Is the calibration interval in line with the monitoring plan of the PD? | Calibration frequency is defined least once in every 3 years. This is consistent with registered monitoring plan and previous verifications and hence accepted.                                                                                                     |                 |                           |                    |                      |
| Does the calibration cover the monitoring period?<br>Has the calibration frequency been respected?        | Tag                                                                                                                                                                                                                                                                 | Se.no           | Calibration dates         | Calibration entity | Does it cover the MP |
|                                                                                                           | CS1, CS2                                                                                                                                                                                                                                                            | HAC160600001037 | 29/02/2016 and 09/04/2020 | HACH               | NO /15/              |
|                                                                                                           | Noted a calibration delay for the entire monitoring period from 01/01/2020 until 02/03/2020. Thus, a calibration error of 2.1% /15/ was applied and adjusted in the ER calculations.                                                                                |                 |                           |                    |                      |
| Calibration certificates                                                                                  | Please refer above.                                                                                                                                                                                                                                                 |                 |                           |                    |                      |
| Does the calibration of meters have be done by an accredited person or institution?                       | HACH is the manufacturer of the instrument and hence credible to calibrate.                                                                                                                                                                                         |                 |                           |                    |                      |

| Data/Parameter                                         | Assessment                                                                                                              |        |        |
|--------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|--------|--------|
| Data Unit                                              | COD <sub>ww,treated,y</sub> ; tCOD/m <sup>3</sup>                                                                       |        |        |
| Description                                            | COD of wastewater after the treatment system affected by the project activity CS3                                       |        |        |
| Source of data to be used                              | Measured using colorimetric method                                                                                      |        |        |
| Value of monitored parameter for the monitoring period | Period                                                                                                                  | Value  |        |
|                                                        |                                                                                                                         | Lower  | Higher |
|                                                        | 01/01/2020 to 02/03/2020                                                                                                | 0.0012 | 0.0017 |
|                                                        | The values mentioned in the monitoring report and ER sheet have been verified with the daily reports /14/. The reported |        |        |

|                                                                                                           |                                                                                                                                                                                                                                                                              |                     |                          |                           |                            |
|-----------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|--------------------------|---------------------------|----------------------------|
|                                                                                                           | values in the MR and ER sheet were found to be consistent with the daily reports and the operator log sheet information.                                                                                                                                                     |                     |                          |                           |                            |
| Monitoring equipment                                                                                      | Colorimeter                                                                                                                                                                                                                                                                  |                     |                          |                           |                            |
| Accuracy of the monitoring equipment                                                                      | 2%                                                                                                                                                                                                                                                                           |                     |                          |                           |                            |
| Measuring/Reading/Recording frequency                                                                     | Daily.<br>However, PP has done periodic analysis following 90/10 confidence/precision level which is consistent with the applied methodology AMS-III.H, version18. Hence, accepted. The Colorimetric method is well documented and well accepted by international standards. |                     |                          |                           |                            |
| Calculation method (if applicable)                                                                        | N/A.                                                                                                                                                                                                                                                                         |                     |                          |                           |                            |
| Calibration                                                                                               |                                                                                                                                                                                                                                                                              |                     |                          |                           |                            |
| Calibration frequency/interval<br>Is the calibration interval in line with the monitoring plan of the PD? | Calibration frequency is defined least once in every 3 years. This is consistent with registered monitoring plan and previous verifications and hence accepted.                                                                                                              |                     |                          |                           |                            |
| Does the calibration cover the monitoring period?<br>Has the calibration frequency been respected?        | Tag                                                                                                                                                                                                                                                                          | Se.no               | Calibr<br>ation<br>dates | Calibrati<br>on<br>entity | Does it<br>cover the<br>MP |
|                                                                                                           | CS3                                                                                                                                                                                                                                                                          | HAC16060000<br>1037 | 29/02<br>/2016           | HACH                      | NO                         |
|                                                                                                           | Noted a calibration delay for the entire monitoring period from 01/01/2020 until 02/03/2020. Thus, a calibration error of 2.1% /15/ was applied and adjusted in the ER calculations.                                                                                         |                     |                          |                           |                            |
| Calibration certificates                                                                                  | Please refer above.                                                                                                                                                                                                                                                          |                     |                          |                           |                            |
| Does the calibration of meters have be done by an accredited person or institution?                       | HACH is the manufacturer of the instrument and hence credible to calibrate. Further the COD reagent are certified by HACH, which is within the expiry /28/.                                                                                                                  |                     |                          |                           |                            |

| Data/Parameter                   | Assessment                                            |
|----------------------------------|-------------------------------------------------------|
| Data Unit                        | $S_{final, PJ, y}$ ; tonnes                           |
| Description                      | Amount of dry matter in the sludge                    |
| Source of data to be used        | Plant records                                         |
| Value of monitored parameter for | Zero (0). No sludge was removed during the monitoring |

|                                                                                                           |                                                                                                                                                                                    |             |  |
|-----------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|--|
| the monitoring period                                                                                     | period. This is confirmed through interviews and plant records.                                                                                                                    |             |  |
| Monitoring equipment                                                                                      | Tag                                                                                                                                                                                | Truck Scale |  |
|                                                                                                           | Brand                                                                                                                                                                              | Linear      |  |
|                                                                                                           | Model                                                                                                                                                                              | PM02        |  |
|                                                                                                           | Serial number                                                                                                                                                                      | 2006220     |  |
| Accuracy of the monitoring equipment                                                                      | 1%                                                                                                                                                                                 |             |  |
| Measuring/Reading/Recording frequency                                                                     | Whenever the sludge is removed, the quantity shall be recorded and documented. However, no sludge was removed during the monitoring period.                                        |             |  |
| Calculation method (if applicable)                                                                        | N/A.                                                                                                                                                                               |             |  |
| Calibration                                                                                               |                                                                                                                                                                                    |             |  |
| Calibration frequency/interval<br>Is the calibration interval in line with the monitoring plan of the PD? | The calibration and the accuracy of truck scale is controlled and verified by Central Bureau of Weights and Measures. The calibration certificate is valid for 2 years.            |             |  |
| Does the calibration cover the monitoring period?<br>Has the calibration frequency been respected?        | The calibration doesn't cover the monitoring period. However, since there is no sludge removed in the current monitoring period. There is no error applied in the ER calculations. |             |  |

| Data/Parameter                                         | Assessment                                               |                         |
|--------------------------------------------------------|----------------------------------------------------------|-------------------------|
| Data Unit                                              | $BG_{\text{burnt,combusted,y}}; \text{Nm}^3$             |                         |
| Description                                            | Amount of biogas combusted for gainful use in the year y |                         |
| Source of data to be used                              | Measured using Gas flow meters (GM1 and GM 3)            |                         |
| Value of monitored parameter for the monitoring period | Period                                                   | Value ( $\text{Nm}^3$ ) |
|                                                        | 01/01/2020 to 02/03/2020                                 | 1,036,052               |

|                                                                                                           |                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                    |                               |                                |                      |
|-----------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|-------------------------------|--------------------------------|----------------------|
|                                                                                                           | Total biogas combusted in hot oil boiler (GM1) and gas engine (GM3) is considered. Monitored values of GM 1 and GM 3 mentioned in the monitoring report and ER sheet have been verified with the daily reports /14/. The reported values in the MR and ER sheet were found to be consistent with the daily reports and the operator log sheet information. |                                                                                                                    |                               |                                |                      |
| Monitoring equipment                                                                                      |                                                                                                                                                                                                                                                                                                                                                            | Tag No.                                                                                                            | Serial Number                 | Model                          |                      |
|                                                                                                           |                                                                                                                                                                                                                                                                                                                                                            | GM1                                                                                                                | V9107-03.1                    | C100-05-H-WCFS-CXXX/V9107-03.1 |                      |
|                                                                                                           |                                                                                                                                                                                                                                                                                                                                                            | GM3                                                                                                                | 20880                         | FT2A-09ISSSTE3B0               |                      |
| Accuracy of the monitoring equipment                                                                      | GM1 – 1%<br>GM3- 1%                                                                                                                                                                                                                                                                                                                                        |                                                                                                                    |                               |                                |                      |
| Measuring/Reading/Recording frequency                                                                     | Continuous monitoring and daily recording for emission reduction calculation.                                                                                                                                                                                                                                                                              |                                                                                                                    |                               |                                |                      |
| Calculation method (if applicable)                                                                        | N/A.                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                    |                               |                                |                      |
| Calibration                                                                                               |                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                    |                               |                                |                      |
| Calibration frequency/interval<br>Is the calibration interval in line with the monitoring plan of the PD? | The flow meter is calibrated at least once every 3 years as per registered monitoring plan.                                                                                                                                                                                                                                                                |                                                                                                                    |                               |                                |                      |
| Does the calibration cover the monitoring period?<br>Has the calibration frequency been respected?        | Tag                                                                                                                                                                                                                                                                                                                                                        | Se.no                                                                                                              | Calibration dates             | Calibration entity             | Does it cover the MP |
|                                                                                                           | GM1                                                                                                                                                                                                                                                                                                                                                        | VERIS/ C100-05-H-WCFS-CXXX/ V9107-03.1 (detector)<br>Siemens/ 7MF4411BA<br>22-1AC6-Z/ N1-87309470592 (transmitter) | 17/04/2019<br>10/04/2020 /15/ | MIT                            | Yes                  |

|                                                                                     |                                                                             |       |                               |     |     |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|-------|-------------------------------|-----|-----|
|                                                                                     | GM3                                                                         | 20880 | 17/04/2019<br>10/04/2020 /15/ | MIT | Yes |
| Calibration certificates                                                            | Please refer above.                                                         |       |                               |     |     |
| Does the calibration of meters have be done by an accredited person or institution? | HACH is the manufacturer of the instrument and hence credible to calibrate. |       |                               |     |     |

| Data/Parameter                                         | Assessment                                                                                                                                                                                                                                                                                                                  |
|--------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data Unit                                              | $BG_{\text{burnt, to Flare, y}} / V_{\text{RG, m}}; \text{ Nm}^3$                                                                                                                                                                                                                                                           |
| Description                                            | Amount of biogas sent to flare system in the year y                                                                                                                                                                                                                                                                         |
| Source of data to be used                              | Measured using Gas flow meters (GM2)                                                                                                                                                                                                                                                                                        |
| Value of monitored parameter for the monitoring period | 0 (Zero).<br><br>During the monitoring period no flaring was recorded as verified with the daily reports /14/. The reported values in the MR and ER sheet were found to be consistent with the daily reports and the operator log sheet information.                                                                        |
| Monitoring equipment                                   | No flow meter installed. However, as per PP's justification and verification team's judgment, no flaring was done during the monitoring period. It is checked that the biogas consumption is more than the biogas generation, which confirms that no extra biogas is flared in the proposed Monitoring Period /29/ to /31/. |
| Accuracy of the monitoring equipment                   | N/A                                                                                                                                                                                                                                                                                                                         |
| Measuring/Reading/Recording frequency                  | N/A                                                                                                                                                                                                                                                                                                                         |
| Calculation method (if applicable)                     | N/A.                                                                                                                                                                                                                                                                                                                        |

| Data/Parameter | Assessment               |
|----------------|--------------------------|
| Data Unit      | $W_{\text{CH}_4, y}; \%$ |

|                                                                         |                                                                                                                                                                                                                                                         |       |                   |                     |                      |
|-------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------------------|---------------------|----------------------|
| Description                                                             | Methane content in the biogas in the year y                                                                                                                                                                                                             |       |                   |                     |                      |
| Source of data to be used                                               | Measured using portable gas analyzer (MS1, MS2 and MS3)                                                                                                                                                                                                 |       |                   |                     |                      |
| Value of monitored parameter for the monitoring period                  | Period                                                                                                                                                                                                                                                  |       | Lower Value       | Higher Value        |                      |
|                                                                         | 01/01/2020 to 02/03/2020 -MS1                                                                                                                                                                                                                           |       | 54.5 %            | 56.8 %              |                      |
|                                                                         | 01/01/2020 to 02/03/2020 -MS2                                                                                                                                                                                                                           |       | 52.9 %            | 54.3 %              |                      |
|                                                                         | 01/01/2020 to 02/03/2020- MS3                                                                                                                                                                                                                           |       | 50.6 %            | 51.7 %              |                      |
|                                                                         | The average value mentioned in the monitoring report and ER sheet have been verified with the daily reports /14/. The reported values in the MR and ER sheet were found to be consistent with the daily reports and the operator log sheet information. |       |                   |                     |                      |
| Monitoring equipment                                                    | Serial number                                                                                                                                                                                                                                           |       | 12368             |                     |                      |
|                                                                         | Model/Brand                                                                                                                                                                                                                                             |       | GFM406/Gas Data   |                     |                      |
| Accuracy of the monitoring equipment                                    | VCS PD does not specify the accuracy of monitoring equipment. However, the accuracy of gas analyser is 2% as per the specification of the equipment.                                                                                                    |       |                   |                     |                      |
| Measuring/Reading/Recording frequency                                   | Periodic using a portable gas analyser. Measurement follows 95% confidence interval which is consistent with the applied methodology.                                                                                                                   |       |                   |                     |                      |
| Calculation method (if applicable)                                      | N/A.                                                                                                                                                                                                                                                    |       |                   |                     |                      |
| Calibration                                                             |                                                                                                                                                                                                                                                         |       |                   |                     |                      |
| Calibration frequency/interval                                          | The analyser is calibrated at least once every 3 years as per registered monitoring plan.                                                                                                                                                               |       |                   |                     |                      |
| Is the calibration interval in line with the monitoring plan of the PD? |                                                                                                                                                                                                                                                         |       |                   |                     |                      |
| Does the calibration cover the monitoring period?                       | Tag                                                                                                                                                                                                                                                     | Se.no | Calibration dates | Calibrati on entity | Does it cover the MP |
| Has the calibration frequency been                                      |                                                                                                                                                                                                                                                         |       |                   |                     |                      |

|                                                                                       |                                                                                                |       |                    |          |     |
|---------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|-------|--------------------|----------|-----|
| respected?                                                                            | MS1,<br>MS2<br>and<br>MS3                                                                      | 12368 | 12/03/2019<br>/15/ | GAS Data | Yes |
| Calibration certificates                                                              | Please refer above.                                                                            |       |                    |          |     |
| Does the calibration of meters have been done by an accredited person or institution? | Gas Data is the manufacturer of the analyzer and hence credible to calibrate the gas analyser. |       |                    |          |     |

| Data/Parameter                                         | Assessment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data Unit                                              | $\eta_{\text{Flare-m}}$ ; %                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Description                                            | Flare efficiency                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Source of data to be used                              | Default value as per “Tool to determine project emissions from flaring gases containing methane” for the first crediting period and for the second crediting period as per Project emissions from flaring” version 02.0.0.                                                                                                                                                                                                                                                                                                   |
| Value of monitored parameter for the monitoring period | 0%. The flare efficiency shall be determined based on the flame detection period. According to the monitoring plan of the VCS- PD, “The default factor of 50% might be only applied if a flame is detected at the flare for more than 20 minutes in hour h, whenever biogas is sent to the flare system. If these conditions are not met, 0% default value should be used for this period”.<br><br>Since no flaring was done during the monitoring period, 0% flare efficiency is considered conservatively as per the tool. |
| Monitoring equipment                                   | N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Accuracy of the monitoring equipment                   | N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Measuring/Reading/Recording frequency                  | N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Calculation method (if applicable)                     | N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Calibration                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

|                                                                                                           |     |
|-----------------------------------------------------------------------------------------------------------|-----|
| Calibration frequency/interval<br>Is the calibration interval in line with the monitoring plan of the PD? | N/A |
| Does the calibration cover the monitoring period?<br>Has the calibration frequency been respected?        | N/A |
| Calibration certificates                                                                                  | N/A |
| Does the calibration of meters have been done by an accredited person or institution?                     | N/A |

| Data/Parameter                                         | Assessment                                                                                                                                                                                                                                                                                                                                                                   |        |             |                          |        |
|--------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------------|--------------------------|--------|
| Data Unit                                              | EC <sub>PJ,j,y</sub> ; MWh                                                                                                                                                                                                                                                                                                                                                   |        |             |                          |        |
| Description                                            | Electricity consumption by wastewater treatment system and biogas plant in year y                                                                                                                                                                                                                                                                                            |        |             |                          |        |
| Source of data to be used                              | Maximum rated consumption is calculated by multiplying total electrical capacity with actual operational days and 24 hours each day and 6.11% additional factor to be conservative for the second crediting period. Also, the load factor of 10% has been added to actual rated capacity of equipment's connected to the project activity which is as per registered VCS-PD. |        |             |                          |        |
| Value of monitored parameter for the monitoring period | <table border="1"> <tr> <th>Period</th><th>Value (MWh)</th></tr> <tr> <td>01/01/2020 to 02/03/2020</td><td>310.20</td></tr> </table>                                                                                                                                                                                                                                         | Period | Value (MWh) | 01/01/2020 to 02/03/2020 | 310.20 |
| Period                                                 | Value (MWh)                                                                                                                                                                                                                                                                                                                                                                  |        |             |                          |        |
| 01/01/2020 to 02/03/2020                               | 310.20                                                                                                                                                                                                                                                                                                                                                                       |        |             |                          |        |
| Monitoring equipment                                   | N/A                                                                                                                                                                                                                                                                                                                                                                          |        |             |                          |        |
| Accuracy of the monitoring equipment                   | N/A                                                                                                                                                                                                                                                                                                                                                                          |        |             |                          |        |
| Measuring/Reading/Recording frequency                  | N/A                                                                                                                                                                                                                                                                                                                                                                          |        |             |                          |        |

|                                                                                                           |      |
|-----------------------------------------------------------------------------------------------------------|------|
| Calculation method (if applicable)                                                                        | N/A. |
| Calibration                                                                                               |      |
| Calibration frequency/interval<br>Is the calibration interval in line with the monitoring plan of the PD? | N/A  |
| Does the calibration cover the monitoring period?<br>Has the calibration frequency been respected?        | N/A  |
| Calibration certificates                                                                                  | N/A  |
| Does the calibration of meters have been done by an accredited person or institution?                     | N/A  |

| Data/Parameter                                         | Assessment                                                                                                                                                    |
|--------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data Unit                                              | TDL <sub>j,y</sub> ; %                                                                                                                                        |
| Description                                            | Average technical transmission and distribution losses for providing electricity to source j in year y                                                        |
| Source of data to be used                              | Recent data available for the host country                                                                                                                    |
| Value of monitored parameter for the monitoring period | 7.68 % as Thailand Energy Balance 2020 published by Department of Alternative Energy Development and Efficiency (DEDE) /17/.                                  |
| Monitoring equipment                                   | N/A                                                                                                                                                           |
| Accuracy of the monitoring equipment                   | N/A                                                                                                                                                           |
| Measuring/Reading/Recording frequency                  | Annual as per registered monitoring plan /02/. In the absence of data from the relevant year, most recent figures should be used, but not older than 5 years. |
| Calculation method (if applicable)                     | N/A                                                                                                                                                           |

| Data/Parameter | Assessment |
|----------------|------------|
|----------------|------------|

|                                                                         |                                                                                                                                                                                                           |                          |                       |
|-------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-----------------------|
| Data Unit                                                               | EG <sub>PJ,y</sub> ; MWh                                                                                                                                                                                  |                          |                       |
| Description                                                             | Quantity of net electricity generation supplied by the project plant/unit to the grid in year y                                                                                                           |                          |                       |
| Source of data to be used                                               | PEA meters                                                                                                                                                                                                |                          |                       |
| Value of monitored parameter for the monitoring period                  |                                                                                                                                                                                                           | Monitoring period        | Value monitored (MWh) |
|                                                                         |                                                                                                                                                                                                           | 01/01/2020 to 02/03/2020 | 109.39 /24/           |
|                                                                         | Continuously monitored and monthly recorded. The readings are recorded monthly once in PEA joint meter reading reports, which are signed by the representatives of both parties i.e. the PP and PEA /24/. |                          |                       |
| Monitoring equipment                                                    |                                                                                                                                                                                                           |                          |                       |
|                                                                         | Tag                                                                                                                                                                                                       | PEA EXPORT METER         |                       |
|                                                                         | Model                                                                                                                                                                                                     | Genius                   |                       |
|                                                                         | S.no                                                                                                                                                                                                      | 18324073                 |                       |
| Accuracy of the monitoring equipment                                    | 0.2% /27/                                                                                                                                                                                                 |                          |                       |
| Measuring/Reading/Recording frequency                                   | Continuously measured and recorded monthly once.                                                                                                                                                          |                          |                       |
| Calculation method (if applicable)                                      | N/A.                                                                                                                                                                                                      |                          |                       |
| Calibration                                                             |                                                                                                                                                                                                           |                          |                       |
| Calibration frequency/interval                                          | Calibration is under the control of PEA.                                                                                                                                                                  |                          |                       |
| Is the calibration interval in line with the monitoring plan of the PD? |                                                                                                                                                                                                           |                          |                       |
| Does the calibration cover the monitoring period?                       | N/A                                                                                                                                                                                                       |                          |                       |
| Has the calibration frequency been respected?                           |                                                                                                                                                                                                           |                          |                       |
| Calibration certificates                                                | N/A                                                                                                                                                                                                       |                          |                       |
| Does the calibration of meters have be done by an accredited person or  | N/A                                                                                                                                                                                                       |                          |                       |

|              |  |
|--------------|--|
| institution? |  |
|--------------|--|

| Data/Parameter                                                                | Assessment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                               |          |                                                                               |         |
|-------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|----------|-------------------------------------------------------------------------------|---------|
| Data Unit                                                                     | EG <sub>thermal,y</sub> ; TJ/year                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                               |          |                                                                               |         |
| Description                                                                   | Net quantity of thermal energy supplied by the project activity.                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                               |          |                                                                               |         |
| Source of data to be used                                                     | In this monitoring period, the direct measurement of temperature (in and out) and the flow of the thermal fluid was not conducted and deviation approach as explained in section 3.2 of the MR is applied. Therefore, the amount of dry starch is the monitored parameter in order to calculate the thermal energy required in the project activity                                                                                                                                                   |                                                                               |          |                                                                               |         |
| Value of monitored parameter for the monitoring period                        | <table border="1"> <tr> <td>01/01/2020 to 02/03/2020<br/>(Historical data based on Q<sub>starch,y</sub>)</td><td>13.60 TJ</td></tr> <tr> <td>01/01/2020 to 02/03/2020<br/>(Fuel Energy Input based on FC<sub>i,j,y</sub>)</td><td>5.19 TJ</td></tr> </table> <p>The values in the MR and ER sheet were verified with the log records starch production/14/. The reported values in the MR and ER sheet were found to be consistent with the daily reports and the operator log sheet information.</p> | 01/01/2020 to 02/03/2020<br>(Historical data based on Q <sub>starch,y</sub> ) | 13.60 TJ | 01/01/2020 to 02/03/2020<br>(Fuel Energy Input based on FC <sub>i,j,y</sub> ) | 5.19 TJ |
| 01/01/2020 to 02/03/2020<br>(Historical data based on Q <sub>starch,y</sub> ) | 13.60 TJ                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                               |          |                                                                               |         |
| 01/01/2020 to 02/03/2020<br>(Fuel Energy Input based on FC <sub>i,j,y</sub> ) | 5.19 TJ                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                               |          |                                                                               |         |
| Monitoring equipment                                                          | N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                               |          |                                                                               |         |
| Accuracy of the monitoring equipment                                          | N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                               |          |                                                                               |         |
| Measuring/Reading/Recording frequency                                         | N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                               |          |                                                                               |         |
| Calculation method (if applicable)                                            | <p>This parameter is calculated based on the quantity of dry starch production and average HFO consumption for starch production as estimated conservatively from historical data.</p> <p>This approach is explained in section 3.2 of this report in detail.</p>                                                                                                                                                                                                                                     |                                                                               |          |                                                                               |         |
| Calibration                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                               |          |                                                                               |         |

|                                                                                     |     |
|-------------------------------------------------------------------------------------|-----|
| Calibration frequency/interval                                                      | N/A |
| Is the calibration interval in line with the monitoring plan of the PD?             |     |
| Does the calibration cover the monitoring period?                                   | N/A |
| Has the calibration frequency been respected?                                       |     |
| Calibration certificates                                                            | N/A |
| Does the calibration of meters have be done by an accredited person or institution? | N/A |

| Data/Parameter                                         | Assessment                                                                                       |               |                          |  |
|--------------------------------------------------------|--------------------------------------------------------------------------------------------------|---------------|--------------------------|--|
| Data Unit                                              | FC <sub>i,j,y</sub> ; Liters/y                                                                   |               |                          |  |
| Description                                            | Quantity of fossil fuel used in boiler in year y                                                 |               |                          |  |
| Source of data to be used                              | Measured by continuous Fuel oil meter                                                            |               |                          |  |
| Value of monitored parameter for the monitoring period | Monitoring period                                                                                |               | Value monitored (Litres) |  |
|                                                        | 01/01/2020 to 02/03/2020                                                                         |               | 34,604                   |  |
|                                                        | The reported values were checked from log book records, purchase records and stock records /14/. |               |                          |  |
| Monitoring equipment                                   | Tag No.                                                                                          | Serial Number | Model                    |  |
|                                                        | OM 1                                                                                             | 20320         | VZF20                    |  |
| Accuracy of the monitoring equipment                   | ±1% as per equipment specification.                                                              |               |                          |  |
| Measuring/Reading/Recording frequency                  | Defined frequency is continuous measurement and monthly recording.                               |               |                          |  |
| Calculation method (if applicable)                     | N/A.                                                                                             |               |                          |  |
| Calibration                                            |                                                                                                  |               |                          |  |

|                                                                                                               |                                                                                                                                                                                                                   |                          |                      |  |     |       |                  |                      |  |     |       |                          |     |  |
|---------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|----------------------|--|-----|-------|------------------|----------------------|--|-----|-------|--------------------------|-----|--|
| Calibration frequency/interval<br><br>Is the calibration interval in line with the monitoring plan of the PD? | Calibration frequency is once in three years.                                                                                                                                                                     |                          |                      |  |     |       |                  |                      |  |     |       |                          |     |  |
| Does the calibration cover the monitoring period?<br><br>Has the calibration frequency been respected?        | <table><tr><td>Tag</td><td>Se.no</td><td>Calibration date</td><td colspan="2">Does it cover the MP</td></tr><tr><td>OM1</td><td>20320</td><td>23/06/2017<br/>09/04/2020</td><td colspan="2">Yes</td></tr></table> |                          |                      |  | Tag | Se.no | Calibration date | Does it cover the MP |  | OM1 | 20320 | 23/06/2017<br>09/04/2020 | Yes |  |
| Tag                                                                                                           | Se.no                                                                                                                                                                                                             | Calibration date         | Does it cover the MP |  |     |       |                  |                      |  |     |       |                          |     |  |
| OM1                                                                                                           | 20320                                                                                                                                                                                                             | 23/06/2017<br>09/04/2020 | Yes                  |  |     |       |                  |                      |  |     |       |                          |     |  |
| Calibration certificates                                                                                      | By Miracle International Technology Co. Ltd. on 23/06/2017 and on 09/04/2020/15/                                                                                                                                  |                          |                      |  |     |       |                  |                      |  |     |       |                          |     |  |
| Does the calibration of meters have be done by an accredited person or institution?                           | Miracle International Technology Co. Ltd. is accredited to calibrate the flow meter /18/.                                                                                                                         |                          |                      |  |     |       |                  |                      |  |     |       |                          |     |  |

| Data/Parameter                                         | Assessment                                                                                                                                                                                                                             |        |                 |                          |           |             |               |
|--------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------|--------------------------|-----------|-------------|---------------|
| Data Unit                                              | $Q_{\text{starch},y}$ ; Tonnes                                                                                                                                                                                                         |        |                 |                          |           |             |               |
| Description                                            | Quantity of dry starch produced                                                                                                                                                                                                        |        |                 |                          |           |             |               |
| Source of data to be used                              | Based on operational log sheet at the plant                                                                                                                                                                                            |        |                 |                          |           |             |               |
| Value of monitored parameter for the monitoring period | <table> <tr> <th>Period</th><th>Value (Ton)</th></tr> <tr> <td>01/01/2020 to 02/03/2020</td><td>11,558</td></tr> </table> <p>This was checked with the starch production logbook records and cross checked with sales records /25/</p> | Period | Value (Ton)     | 01/01/2020 to 02/03/2020 | 11,558    |             |               |
| Period                                                 | Value (Ton)                                                                                                                                                                                                                            |        |                 |                          |           |             |               |
| 01/01/2020 to 02/03/2020                               | 11,558                                                                                                                                                                                                                                 |        |                 |                          |           |             |               |
| Monitoring equipment                                   | <table> <tr> <th>Type</th><th>Weighing bridge</th></tr> <tr> <td>Sl. Number</td><td>B70153544</td></tr> <tr> <td>Brand/Model</td><td>Metler Toledo</td></tr> </table>                                                                  | Type   | Weighing bridge | Sl. Number               | B70153544 | Brand/Model | Metler Toledo |
| Type                                                   | Weighing bridge                                                                                                                                                                                                                        |        |                 |                          |           |             |               |
| Sl. Number                                             | B70153544                                                                                                                                                                                                                              |        |                 |                          |           |             |               |
| Brand/Model                                            | Metler Toledo                                                                                                                                                                                                                          |        |                 |                          |           |             |               |
| Accuracy of the monitoring equipment                   | + - 30 g                                                                                                                                                                                                                               |        |                 |                          |           |             |               |

|                                                                                                        |                                                                       |               |                    |                      |
|--------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|---------------|--------------------|----------------------|
| Measuring/Reading/Recording frequency                                                                  | Defined frequency is daily measurement and daily recording.           |               |                    |                      |
| Calculation method (if applicable)                                                                     | N/A.                                                                  |               |                    |                      |
| Calibration                                                                                            |                                                                       |               |                    |                      |
| Calibration frequency/interval                                                                         | Calibration frequency is once in a year.                              |               |                    |                      |
| Is the calibration interval in line with the monitoring plan of the PD?                                |                                                                       |               |                    |                      |
| Does the calibration cover the monitoring period?<br><br>Has the calibration frequency been respected? | Tag                                                                   | Se.no         | Calibration date   | Does it cover the MP |
|                                                                                                        | Weight bridge                                                         | B7015<br>3544 | 06/12/2019<br>/15/ | Yes                  |
|                                                                                                        | No calibration delay noted.                                           |               |                    |                      |
| Calibration certificates                                                                               | Please refer above.                                                   |               |                    |                      |
| Does the calibration of meters have be done by an accredited person or institution?                    | Calibrations has been performed by the manufacturer “Metler Toledo “. |               |                    |                      |

## 4.2 Safeguards

### 4.2.1 No Net Harm

The project activity", involves the installation and operation of a biogas recovery and utilization system (an open anaerobic effluent treatment system) at Chol Charoen Co. Ltd., a tapioca starch factory in Cholburi. The biogas captured from the treatment system is used replacing the HFO from boilers. Thus, the project avoids methane and CO<sub>2</sub> emissions. Thus, the project will not result in negative environmental impacts. Moreover, the project has positive socio-economic impacts by creating jobs to the villagers and supporting the locals by many several CSR activities. The same was confirmed by interviewing the project owner and local villagers.

### 4.2.2 Local Stakeholder Consultation

Local stakeholder consultation is not applicable for the project proponent during verification. PP organized stakeholders' consultation during validation of the project activity, which was validated by the validation agency /11/. The verification team interacted with local stakeholders via online interview and there was no negative comment or feedback from local stakeholders recorded.

## 4.3 AFOLU-Specific Safeguards

The project is not a forestry project. Hence this section is not applicable.

## 4.4 Accuracy of GHG Emission Reduction and Removal Calculations

GHG emissions reductions for the project and the baseline scenario were correctly calculated using the formulae described in the applied methodology for this project. The verification team has reviewed the emission reduction (ER) spread sheet and checked all the formulae and found they are correct and in line with the monitoring plan of the registered PD and the applied monitoring methodology.

The emission reduction due to methane capturing and utilization in onsite boilers was estimated by measuring the required parameters using appropriate monitoring equipment and using the formulae described in the methodologies; AMS III.H., version 18 and the VCS PD. All the ex-ante parameters which are used in the calculation of emission reduction are presented in section 4.1 of this report. It is confirmed that all the ex-ante parameters have been correctly used in the emission reduction calculation. 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.

### Baseline Emissions:

Baseline emissions related to methane avoidance as per AMS-III.H, version 18 is calculated as below:

$$BE_y = BE_{power,y} + BE_{ww, treatment,y} + BE_{s,treatment,y} + BE_{ww,discharge,y} + BE_{s,final,y}$$

As per the registered PD, the parameter of  $BE_{power,y}$ ,  $BE_{s,treatment,y}$ ,  $BE_{ww,discharge,y}$  and  $BE_{s,final,y}$  are considered to be zero. Thus, the baseline emission can be summarised as following;

$$BE_y = BE_{ww,treatment,y}$$

$$BE_{ww, treatment, y} = \sum Q_{ww,i,y} * COD_{inflow,i,y} * \eta_{COD,BL,i} * MCF_{ww, treatment, BL, i} * B_{o,ww} * UF_{BL} * GWP_{CH4}$$

| Parameter                   | Details                                                                                                                                                                                                | Quantification                                                                   |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| $BE_{ww, treatment, y}$     | Baseline emissions of the wastewater treatment systems affected by the project activity in year y (tCO <sub>2</sub> e)                                                                                 | 01/01/2020 to 02/03/2020 = 10,169                                                |
| $Q_{ww, i, y}$              | Volume of wastewater treated in baseline wastewater treatment system i in year y (m <sup>3</sup> )                                                                                                     | 01/01/2020 to 02/03/2020 = 135,984                                               |
| $COD_{inflow, i, y}$        | Chemical oxygen demand of the wastewater inflow to the baseline treatment system i in year y. Average value may be used through sampling with the confidence/precision level 90/10 (t/m <sup>3</sup> ) | 01/01/2020 to 02/03/2020 (AFFR) = 0.020<br>01/01/2020 to 02/03/2020 (CL) = 0.019 |
| $\eta_{COD,BL,i}$           | COD removal efficiency of the baseline treatment system I                                                                                                                                              | 87%                                                                              |
| $MCF_{ww, treatment, BL,i}$ | Methane correction factor for the baseline treatment system I                                                                                                                                          | 0.8                                                                              |
| i                           | Index for baseline wastewater treatment system                                                                                                                                                         | -                                                                                |
| $B_{o, ww}$                 | Methane producing capacity of the wastewater                                                                                                                                                           | 0.25                                                                             |

| Parameter          | Details                                                    | Quantification |
|--------------------|------------------------------------------------------------|----------------|
| UF <sub>BL</sub>   | Model correction factor to account for model uncertainties | 0.89           |
| GWP <sub>CH4</sub> | Global Warming Potential for methane                       | 25             |

According to AMS-III.H, version 18, emission reduction achieved by the project activity is limited to the ex-post calculated baseline emissions minus project emission using the actual monitored data for the project activity. The emission reductions achieved in any year are the lowest value of the following:

$$ER_{y,ex-post} = \min((BE_{y,ex-post} - PE_{y,ex-post} - LE_{y,ex-post}), (MD_y - PE_{power,y} - PE_{biomass,y} - LE_{y,ex-post}))$$

As per paragraph 46 of AMS III.H., in case of flaring/combustion MD<sub>y</sub> will be measured using the conditions of the flaring process:

$$MD_y = BG_{bunt,y} * w_{CH4,y} * D_{CH4} * FE * GWP_{CH4}$$

Where:

| Parameter               | Details                                                                                                  | Quantification                       |
|-------------------------|----------------------------------------------------------------------------------------------------------|--------------------------------------|
| MD <sub>y</sub>         | Methane captured and destroyed/gainfully used by the project activity in the year y (tCO <sub>2</sub> e) | 01/01/2020 to 02/03/2020 = 9,386     |
| W <sub>CH4, y</sub>     | Methane content in the biogas in the year y (mass fraction)                                              | 01/01/2020 to 02/03/2020 = 51%       |
| D <sub>CH4</sub>        | Density of methane at the temperature and pressure of the biogas in the year y (tonnes/m <sup>3</sup> )  | 0.00072                              |
| GWP <sub>CH4</sub>      | Methane producing capacity of the wastewater                                                             | 25                                   |
| BG <sub>toflare,y</sub> | Biogas sent to flared in year y (Nm <sup>3</sup> )                                                       | 0                                    |
| BG <sub>burnt,y</sub>   | Biogas volume in year (utilized)                                                                         | 01/01/2020 to 02/03/2020 = 1,036,052 |

|                                     |                                     |    |
|-------------------------------------|-------------------------------------|----|
|                                     | for gainful use) (Nm <sup>3</sup> ) |    |
| $\eta_{\text{flare,m}} / \text{FE}$ | Flare efficiency in year y          | 0% |

#### Baseline emissions calculation as per AMS I.C

For thermal energy produced using fossil fuels and/or grid electricity the baseline emissions are calculated as follows:

$$BE_{\text{thermal,CO2,y}} = (EG_{\text{thermal,y}} / \eta_{\text{BL,thermal}}) * EF_{\text{FF,CO2}}$$

As explained in section 3.2 of this report (deviation 2),  $BE_{\text{thermal,CO2,y}}$  is determined from the amount of fossil fuel consumed in boiler for starch production and quantity of starch production.

Where:

| Parameter | Details | Quantification |
|-----------|---------|----------------|
|-----------|---------|----------------|

|                       |                                                                                                                                                                       |                                                                                           |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| $BE_{thermal,CO_2,y}$ | Baseline emissions from thermal energy displaced by the project activity during the year y (t CO <sub>2</sub> )                                                       | 401                                                                                       |
| $EG_{thermal,y}$      | Net quantity of thermal energy supplied by the project activity during the year y (TJ)                                                                                | $EG_{thermal,y}$ – Historical data = 13.60<br>$EG_{thermal,y}$ – Fuel energy input = 5.19 |
| $EF_{FF,CO_2}$        | CO <sub>2</sub> emission factor of the fossil fuel that would have been used in the baseline plant. IPCC default emission factors can be used (t CO <sub>2</sub> /TJ) | 77.40                                                                                     |
| $Q_{starch,y}$        | Quantity of dry starch produced in year y (tonnes)                                                                                                                    | $Q_{starch,y} = 11,558$                                                                   |
| $q_{FO,starch}$       | Quantity of fossil fuel per unit of dry starch (liter/tonne)                                                                                                          | 34.30                                                                                     |
| $q_{FO,y}$            | Quantity of fossil fuel used in the project activity (litre)                                                                                                          | 34,604                                                                                    |
| $NCV_{FO}$            | Net calorific value of the fuel oil (TJ/tonne)                                                                                                                        | 0.0404                                                                                    |
| $D_{FO}$              | Density of fuel oil in the year y (tonnes/m <sup>3</sup> )                                                                                                            | 0.93                                                                                      |
| $\eta_{BL,thermal}$   | Efficiency of the plant using fossil fuel that would have been used in the absence of the project activity determined as per paragraph 39 or 40                       | 78%                                                                                       |

#### Baseline emissions calculation as per AMS I.D

Baseline emissions include only CO<sub>2</sub> emissions from electricity generation in power plants that are displaced due to the project activity.

$$BE_y = BE_{gen,y} = EF_y * EG_y$$

Where:

| Parameter            | Details                                                                                                                                                                                                                              | Quantification |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| BE <sub>gen,y</sub>  | Baseline emissions in year y (t CO <sub>2</sub> e)                                                                                                                                                                                   | 61             |
| EG <sub>PJ,y</sub>   | Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the project activity in year y (MWh)                                                                              | 109.39         |
| EF <sub>grid,y</sub> | Combined margin CO <sub>2</sub> emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (t CO <sub>2</sub> e/MWh) | 0.5637         |

### Project Emissions:

Project emissions related to methane avoidance component as per AMS-III.H, version 18 is calculated as below:

$$PE_{,y} = \{PE_{power,y} + PE_{ww,treatment} + PE_{s,treatment} + PE_{ww,discharge,y} + PE_{s,final,y} + PE_{fugitive,y} + PE_{biomass,y} + PE_{flaring,y}\}$$

Since the project activity does not involve sludge treatment,  $PE_{s,treatment}$ ,  $PE_{s,final,y}$  are considered to be zero.

In the proposed project activity, there is no treated water discharged to sea, river and lakes. Thus,  $PE_{ww,discharge,y}$  is considered to be 0.

Emissions from electricity consumption in the year y ( $PE_{power,y}$ ) is calculated as follows:

$$PE_{power,y} = EC_{PJ,j,y} * EC_{PJ,j,y} * EF_{EF,j,y} * (1 + TDL_{j,y})$$

| Parameter             | Details                                                                                              | Quantification                    |
|-----------------------|------------------------------------------------------------------------------------------------------|-----------------------------------|
| PE <sub>y</sub>       | Project activity emissions in year y (tCO <sub>2</sub> e)                                            | 01/01/2020 to 02/03/2020 = 3,069  |
| PE <sub>power,y</sub> | Emissions from electricity or fuel consumption in the year y (tCO <sub>2</sub> e)                    | 01/01/2020 to 02/03/2020 = 189    |
| EC <sub>PJ,j,y</sub>  | Quantity of electricity consumed by the project electricity consumption source j in year y (MWh/yr). | 01/01/2020 to 02/03/2020 = 310.20 |
| EF <sub>y</sub>       | Thailand National Grid Emission Factor                                                               | 0.5637                            |

|                     |                                                                                                        |       |
|---------------------|--------------------------------------------------------------------------------------------------------|-------|
|                     | (tCO <sub>2</sub> e/MWh)                                                                               |       |
| TDL <sub>j, y</sub> | Average technical transmission and distribution losses for providing electricity to source j in year y | 7.68% |

Methane emissions from wastewater treatment systems affected by the project activity, and not equipped with biogas recovery in the project situation (PE<sub>ww, treatment, y</sub>)

Methane emissions from wastewater treatment systems affected by the project activity and not equipped with biogas recovery in the project The following equation is used.

$$PE_{ww, treatment, y} = \sum (Q_{ww, y} * COD_{ww, treated, y} * \eta_{PJ, k, y} * MCF_{ww, treatment, PJ, k}) * B_{o, ww} * UF_{PJ} * GWP_{CH_4}$$

| Parameter                      | Details                                                                                                                                                                                 | Quantification                     |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
| PE <sub>ww, treatment, y</sub> | Methane emissions from wastewater treatment systems affected by the project activity, and not equipped with biogas recovery in the project situation (tCO <sub>2</sub> e)               | 01/01/2020 to 02/03/2020 = 1,140   |
| Q <sub>ww, k, y</sub>          | Volume of wastewater treated in project wastewater treatment system k in year y (m <sup>3</sup> )                                                                                       | 01/01/2020 to 02/03/2020 = 135,984 |
| COD <sub>ww treated y</sub>    | COD of the wastewater inflow to the baseline treatment system i in year y (t/m <sup>3</sup> ). An average value may be used through sampling with a confidence/precision level of 90/10 | 01/01/2020 to 02/03/2020 = 0.0017  |
| B <sub>o, ww</sub>             | Methane producing capacity of the wastewater (IPCC default value of 0.25 kg                                                                                                             | 0.25                               |

|                                  |                                                                                                                    |      |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------|------|
|                                  | CH <sub>4</sub> /kg COD)                                                                                           |      |
| MCF <sub>ww,treatment,PJ,k</sub> | Methane correction factor for the project wastewater treatment system k                                            | 0.8  |
| η <sub>PJ,k,y</sub>              | COD removal efficiency of the project activity;<br><br>100% is used. The same is accepted since it is conservative | 100% |
| UF <sub>PJ</sub>                 | Model correction factor to account for model uncertainties                                                         | 1.12 |
| GWP <sub>CH<sub>4</sub></sub>    | Global Warming Potential for methane                                                                               | 25   |

#### Methane fugitive emissions on account of inefficiencies in capture systems (PE<sub>fugitive, y</sub>)

Project activity emissions from methane release in capture systems are determined as per AMS III.H as given below.

$$PE_{fugitive,y} = PE_{fugitive,ww,y} + PE_{fugitive,s,y}$$

$$PE_{fugitive,ww,y} = (1 - CEF_{ww,y}) * MEP_{ww,treatment,y} * GWP_{CH_4}$$

$$MEP_{ww,treatment,y} = Q_{y,ww} * B_{o,ww} * UF_{PJ} * \Sigma COD_{removed,PJ,k,y} * MCF_{ww,treatment,PJ,k}$$

Where:

| Parameter                   | Details                                                                                                                   | Quantification                                        |
|-----------------------------|---------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|
| PE <sub>fugitive,ww,y</sub> | Fugitive emission through capture inefficiencies in the anaerobic wastewater treatment in the year y (tCO <sub>2</sub> e) | 01/01/2020 to 02/03/2020 = 1,740                      |
| PE <sub>fugitive,s,y</sub>  | Fugitive emission through capture inefficiencies in the anaerobic sludge treatment in the year y (tCO <sub>2</sub> e)     | There is no sludge treatment in the project activity. |

|                                  |                                                                                                                                                           |                                  |
|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| CFE <sub>ww,y</sub>              | Capture efficiency of the biogas recovery equipment in the wastewater treatment systems                                                                   | 0.9 (default value)              |
| COD <sub>removed, PJ, k, y</sub> | The chemical oxygen demand removed by the treatment system k of the project activity equipped with biogas recovery in the year y (tonnes/m <sup>3</sup> ) | 01/01/2020 to 02/03/2020 = 0.025 |
| MEP <sub>ww, treatment,y</sub>   | Methane emission potential of wastewater treatment systems equipped with biogas recovery system in year y (t)                                             | 01/01/2020 to 02/03/2020 = 696   |

Since there is no sludge generation in this monitoring period, the emission from sludge treatment is not considered in the calculations thus PE<sub>s, treatment</sub> and PE<sub>s, final, y</sub> is considered zero “0” in project activity. In addition, PE<sub>ww discharge, y</sub> is also considered “0”, since the project doesn’t the treated water into river, sea or lake.

#### Methane emissions due to incomplete flaring (PE<sub>flaring, y</sub>)

Project emissions from flaring is considered 0. Since there was no flaring in the current monitoring period.

#### **Leakage Emissions**

In line with applied methodologies and registered VCS-PD, there is no leakage emissions. Hence, LE<sub>y</sub> is zero.

#### **Emission Reductions:**

$$\begin{aligned}
 ER_{y,ex\ post} &= \min((BE_{y,ex\ post} - PE_{y,ex\ post} - LE_{y,ex\ post}), (MD_y - PE_{power,y} - LE_{y,ex\ post})) \\
 &= \min(7,562), (9,659) \\
 &= 7,562\ tCO_2e
 \end{aligned}$$

## 4.5 Quality of Evidence to Determine GHG Emission Reductions and Removals

During the desk review, 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. Inlet and outlet COD, quantity of wastewater, biogas production, biogas consumption for boilers, biogas for flaring, methane concentration of biogas, electricity consumption, electricity generation etc. were verified with the logbook values and meter reports to ensure that there is no over estimation of the VCUs. The provided data was found to be of adequate quality.

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 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. All the roles and responsibilities for monitoring and reporting have been clearly defined. Based on document review /01/ to /31/ and interview, it was found that the management and operational structure is in line with that stated in the registered monitoring plan.

All the meters (wastewater flow meter, biogas flow meters, COD values, and power meter, gas analyser, fuel oil meter) were calibrated at appropriate calibration frequency (described in section 4.1) to ensure the quality of the data. For any delay in calibration, maximum error factor of the instrument is applied over the measured value to estimate emission reductions conservatively.

It was verified through online 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.

4KES is of the opinion that this method of estimation is accurate and results in conservative estimation of emission reduction and is line with the applicable VCS requirements.

## 4.6 Non-Permanence Risk Analysis

The project is not a forestry project. Hence this section is not applicable

# 5 VERIFICATION CONCLUSION

4KES has performed verification of the emission reductions reported for the project activity "Chol Charoen Group Wastewater Treatment with Biogas System I (Cholburi)" in Thailand, VCS Registry Project ID 430, for the period 01/01/2020 to 02/03/2020 (both dates included), with regard to the relevant requirements for VCS activities. The project participants of the

“Chol Charoen Group Wastewater Treatment with Biogas System I (Cholburi)” project are responsible for:

- the preparation of greenhouses gas emissions data and the reported greenhouse gas emission reductions from the project on the basis set out in the monitoring plan contained in the registered VCS PD, version 03 of 21/05/2018.
- the development and maintenance of records and reporting procedures in accordance with that plan, including the calculation and determination of greenhouse gas emission reductions of the project.

It is the responsibility of 4KES to express an independent verification opinion about the project’s conformity with the requirements of VCS Standard version 4.1 and GHG program applied, on the reported greenhouse gas emission reductions from the project.

Based on documented evidence and corroborated by an online interview with stakeholders, 4KES can confirm that:

- the project has been implemented and operated as per the registered VCS-PD;
- the monitoring report and other supporting documents provided are complete and verifiable and in accordance with the applicable VCS Standard version 4.1 and program guide v4.0;
- the monitoring is in place as per the applied baseline and monitoring methodology;
- the monitoring plan in the registered VCS-PD is as per the applied baseline and monitoring methodology.

It is 4KES opinion that the GHG emission reduction stated in the monitoring report version 02 of 08/07/2020 for the “Chol Charoen Group Wastewater Treatment with Biogas System I (Cholburi)” in Thailand for the period 01/01/2020 to 02/03/2020 are fairly stated. The GHG emission reductions were calculated correctly on the basis of the approved monitoring methodology CDM Executive Board: AMS-III.H ‘Methane Recovery in Wastewater Treatment’ version 18, AMS-I.C ‘Thermal energy production with or without electricity’ version 20 and AMS-I.D ‘Grid connected renewable electricity generation’ version 18 and the monitoring plan contained in the registered VCS-PD.

Hence 4KES is able to certify that the emission reduction from the project during the verification period: From 01/01/2020 to 02/03/2020

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

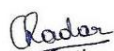
| Year | Baseline emissions or | Project emissions or | Leakage emissions | Net GHG emission reductions or removals |
|------|-----------------------|----------------------|-------------------|-----------------------------------------|
|------|-----------------------|----------------------|-------------------|-----------------------------------------|

|                             | removals<br>(tCO <sub>2</sub> e) | removals<br>(tCO <sub>2</sub> e) | (tCO <sub>2</sub> e) | (tCO <sub>2</sub> e) |
|-----------------------------|----------------------------------|----------------------------------|----------------------|----------------------|
| 01/01/2020 to<br>02/03/2020 | 10,631                           | 3,069                            | 0                    | 7,562                |
| Total                       | 10,631                           | 3,069                            | 0                    | 7,562                |

**Approved by**

Chandrakala R.

Director



4K Earth Science Private Limited

Date: 18-October-2021

Place: Bangalore, India

# APPENDIX A: <ABBREVIATIONS>

| Abbreviations     | Full texts                                            |
|-------------------|-------------------------------------------------------|
| BE                | Baseline Emissions                                    |
| CAR               | Corrective Action Request                             |
| CDM               | Clean Development Mechanism                           |
| CDM M&P           | Modalities and Procedures CDM                         |
| CER(s)            | Certified Emission Reduction(s)                       |
| CH <sub>4</sub>   | Methane                                               |
| CL                | Clarification Request                                 |
| CO <sub>2</sub>   | Carbon dioxide                                        |
| CO <sub>2</sub> e | Carbon dioxide equivalent                             |
| DNA               | Designated National Authority                         |
| DOE               | Designated Operational Entity                         |
| EB                | Executive Board                                       |
| ER                | Emission Reductions                                   |
| FAR               | Forward Action Request                                |
| GHG(s)            | Greenhouse gas(es)                                    |
| GWP               | Global Warming Potential                              |
| IPCC              | Intergovernmental Panel on Climate Change             |
| LoA               | Letter of Approval                                    |
| MoV               | Means of Verification                                 |
| MR                | Monitoring Report                                     |
| NGO               | Non-governmental Organization                         |
| NR                | Nepalese Rupee                                        |
| ODA               | Official Development Assistance                       |
| PDD               | Project Design Document                               |
| PE                | Project Emission                                      |
| PEA               | Provincial Electricity Authority                      |
| PP(s)             | Project Participant(s)                                |
| PPA               | Power Purchase Agreement                              |
| Ref.              | Document Reference                                    |
| SS(s)             | Sectoral Scope(s)                                     |
| TA(s)             | Technical Area(s)                                     |
| UNFCCC            | United Nations Framework Convention on Climate Change |
| VVS               | Validation and Verification Standard                  |

# APPENDIX B: <CLARIFICATION REQUESTS, CORRECTIVE ACTION REQUESTS AND FORWARD ACTION REQUEST>

**Table 1. Remaining FAR from validation and/or previous verifications**

|                                                      |     |                    |  |                         |
|------------------------------------------------------|-----|--------------------|--|-------------------------|
| <b>FAR ID</b>                                        | N/A | <b>Section no.</b> |  | <b>Date:</b> 03/06/2021 |
| <b>Description of FAR</b>                            |     |                    |  |                         |
|                                                      |     |                    |  |                         |
| <b>Documentation provided by project participant</b> |     |                    |  |                         |
|                                                      |     |                    |  |                         |
| <b>DOE assessment</b>                                |     |                    |  | <b>Date:</b> dd/mm/yyyy |
|                                                      |     |                    |  |                         |

**Table 2. CL from this verification**

|                          |    |                    |     |                         |
|--------------------------|----|--------------------|-----|-------------------------|
| <b>CL ID</b>             | 01 | <b>Section no.</b> | 4.1 | <b>Date:</b> 03/06/2021 |
| <b>Description of CL</b> |    |                    |     |                         |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| <p>1. Section 3.1 of the MR is not transparent on the plant shut down and maintenance details. PP is also requested to provide evidence for the same.</p> <p>2. As per the remote audit observations, the gas engine -4 stopped operations. However, the same is not transparent in the MR and also provide evidence for the same.</p> <p>3. PP is requested to provide the log sheets of FM1, FM2, FM3, GM1, GM3, QStarch and Fuel oil consumption log sheets for the proposed MP.</p> <p>4. As per the log sheets provided, it was checked that the COD and Wch4 was not measured all the days, though there was wastewater flow. PP is requested to clarify.</p> <p>5. PP is requested to provide the PEA reports to confirm the values of electricity exported to the Grid and also revise the values in the ER sheets as per the PEA meter reports.</p> <p>6. Section 3.5 of the MR at many places refer to the calibration delay for the year 2019. However, the proposed MP does not contain 2019. PP is requested to correct the same.</p> <p>7. As per the audit observation, no flare flow meter is installed, since no gas is flared. However, PP to clarify, what happens to the gas in case of exigencies. Further, the PP has confirmed that the total biogas consumption rate and the biogas storage capacity can be checked against the monitored biogas generation values. PP to justify the same with evidence.</p> <p>8. Noted that the notation used in data/parameters monitored are not the same used in the ER calculations. PP is requested to make the same consistent.</p> |                  |
| Project participant response                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Date: 13/07/2021 |

1. During the monitoring period from 01/01/2020 to 02/03/2020, there is no plant shut down for maintenance. Kindly see Att1 log sheet. The update to the section 3.1 is not necessary.
2. The GM4 stopped operation in February 2021. During the monitoring period (01/01/2020 to 02/03/2020), all four gas engines were in operation. Thus, no further clarification is needed.
3. The log sheet covered monitoring parameters of FM1, FM2, FM3, GM1, GM3, Q<sub>Starch</sub> and Fuel oil has been provided in Att01 folder.
4. The COD and the methane value are not measured all the days, though the average value from the project has been taken with the confidence level of 90/10. The lower value has been selected for the baseline emission calculation and higher bound for the project emission calculation.
5. The PEA meter reading reports have been provided in the Att01 folder. The number used for the power exported has been used as per the report.
6. The MR has been updated and all the clause relevant to the previous monitoring period has been removed.
7. The justification for no excess biogas would be generated in the project, can be referred to the comparison between the biogas generation and biogas consumption rate.

#### Biogas generation

The design value of the AFFR digester tank is 735.83 Nm<sup>3</sup>/hr<sup>1</sup>. To be more transparent, the monitoring value of the biogas generation has been considered as well, it was noted that in 2020 the average biogas generation is 863.38 Nm<sup>3</sup>/hr.

| Biogas Generation |                  |                        |                                                                   |
|-------------------|------------------|------------------------|-------------------------------------------------------------------|
| Scenario 1        | Monitoring Value | 2020                   |                                                                   |
|                   |                  | 01/04 to 31/12         |                                                                   |
|                   |                  | Biogas generation rate | 20,721.04 Nm <sup>3</sup> / day, average value                    |
|                   |                  |                        | 863.38 Nm <sup>3</sup> / hr, calculation - dividing by 24 (hours) |
| Scenario 2        | Design Value     |                        |                                                                   |
|                   |                  | Design value og biogas | 17,660 Nm <sup>3</sup> /day, design value                         |
|                   |                  |                        | 735.83 Nm <sup>3</sup> / hr, calculation - dividing by 24 (hours) |

#### Biogas consumption

For the biogas consumption rate at the utilization points and the storage capacity of the three covered lagoons could be described as following tables.

| Biogas Consumption and Storage Capacity |                    |                     |
|-----------------------------------------|--------------------|---------------------|
| Biogas consumption rate                 |                    |                     |
|                                         | m <sup>3</sup> /hr | Nm <sup>3</sup> /hr |
| Boiler                                  | 250                | 225.98              |
| Generator -1                            | 245                | 221.46              |
| Generator -2                            | 245                | 221.46              |
| Generator -3                            | 260                | 235.01              |
| Generator -4                            | 260                | 235.01              |
| <b>Total</b>                            | <b>1,260</b>       | <b>1,138.92</b>     |
| Biogas Storage Capacity                 |                    |                     |
| Covered lagoon designed va              | Nm <sup>3</sup>    |                     |
| CL-1                                    | 20,000             |                     |
| CL-2                                    | 20,000             |                     |
| CL-3                                    | 20,000             |                     |
| <b>Total</b>                            | <b>60,000</b>      |                     |

From the tables above, it shows that the average daily biogas consumption is 1,138.92 Nm<sup>3</sup> which is higher than the biogas generation rate at 863.38 Nm<sup>3</sup>/hr in this monitoring period. This could already be confirmed that there would be no excess biogas being generated from the project activity. The supportive documents could be found in Att02 folder.

8. The notation used in data/parameters monitored have been updated and are shown consistent with the ER calculations, as well as the revised RCP PD. Kindly refer to the update MR.

<sup>1</sup> The design value for the AFFR tank is 17,660 Nm<sup>3</sup>/day of biogas generation, after taking 24 hours of operation. The design value for the

| Documentation provided by project participant                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| Att01 Log sheet<br>Att02 Justification for Gas Flare Meter<br>VCS430Cholburi_4thER_01012020to02032020nonPAF_v02_13072021<br>VCS430Cholburi_4thMR_01012020to02032020nonPAF v02_13072021                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |
| DOE assessment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Date: 19/07/2021. |
| <ol style="list-style-type: none"> <li>1. It is checked that in the proposed MP there is no plant shutdown and maintenance and the same was checked with the log sheets.</li> <li>2. Yes, it is confirmed that the gas engine -4 stopped operation in 02/2021, which is not applicable to the proposed MP.</li> <li>3. PP provided the log sheets and the same was crosschecked with the ER sheets and found to be appropriate.</li> <li>4. Yes, it is checked that since the COD and methane was not sampled every day. PP has performed 90/10 confidence level and lower bound values were used in baseline emission calculation and higher bound for project emissions calculation.</li> <li>5. It is checked that the electricity exported is taken as per the per meter reading reports. The same was checked and accepted. Further for the month of march 2020 , the pp has considered apportioned figures for the 1<sup>st</sup> two days of March 2020, which is accepted.</li> <li>6. The calibration delays specific to the proposed MP has been corrected in the updated MR.</li> <li>7. it is checked the biogas consumption is more than the biogas generation. Thus, there is no excess gas that is flared. The verification team accepts the justification provided by the PP.</li> <li>8. Updated MR checked and the same is accepted.</li> </ol> CL01 is closed. |                   |

| CL ID                                                                                                                                                                                                                                                                                                                                                                                                              | 02 | Section no. | 4.2.2 | Date: 03/06/2021 |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-------------|-------|------------------|
| Description of CL                                                                                                                                                                                                                                                                                                                                                                                                  |    |             |       |                  |
| <ol style="list-style-type: none"> <li>1. Section 2.2 of the MR is not transparent on, how due account of all and any input received during ongoing communication has been taken. Include details on any updates to the project design or justify why updates are not appropriate.</li> <li>2. PP is requested to provide evidence of the on-going communication and evidence of any comments received.</li> </ol> |    |             |       |                  |
| Project participant response                                                                                                                                                                                                                                                                                                                                                                                       |    |             |       | Date: 07/07/2021 |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| <p>1. There is no update of the project design during the monitoring period, 01/01/2020 to 02/03/2020. Thus, the update to the section 2.2. is not applicable.</p> <p>2. It has been confirmed during the virtual site inspection included with the stakeholder interview that there are no comments received during the monitoring period. Though the registry form for any comments which the plant may receive, has been maintained at the project site, evidence has been submitted in Att03.</p> |                         |
| <b>Documentation provided by project participant</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                         |
| Att03 EHS related (3.3ongoing communication)                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                         |
| <b>DOE assessment</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>Date: 19/07/2021</b> |
| <p>1. Since the project has not received any comments, there was no need to update the project design.</p> <p>2. The verification team checked the complaint register and interacted with the stakeholders during the audit and confirms that no complaint was recorded in the proposed monitoring period.</p> <p>Based on the above justification, CL02 is closed.</p>                                                                                                                               |                         |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |    |                    |     |                         |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|--------------------|-----|-------------------------|
| <b>CL ID</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 03 | <b>Section no.</b> | 4.4 | <b>Date: 03/06/2021</b> |
| <b>Description of CL</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |    |                    |     |                         |
| It is checked that the actual emission reductions reported for the proposed MP is higher the ex-ante emissions estimated. PP is requested to clarify, how the value of ex-ante estimates for proposed MP calculated and justify, the increase in emission reduction reported with evidence.                                                                                                                                                                                                                                        |    |                    |     |                         |
| <b>Project participant response</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |    |                    |     | <b>Date: 13/07/2021</b> |
| The reason of the higher emission reduction came from the higher COD load (quantity of wastewater and the COD value) for the monitoring period is 59,567 kg COD <sup>2</sup> as compared to baseline estimation of 55,200 kg COD <sup>3</sup> . It may also happen that in the future verification, the COD load of the project may go lower. Therefore, it can be concluded that the increase in emission reductions is not permanent but dependent on various factors, which can neither be controlled nor predicted in advance. |    |                    |     |                         |
| <b>Documentation provided by project participant</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |    |                    |     |                         |
| VCS430Cholburi_4thMR_01012020to02032020nonPAF v02_13072021                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |    |                    |     |                         |
| <b>DOE assessment</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |    |                    |     | <b>Date: 19/07/2021</b> |
| The verification team accepts the justification provided by the PP. The same is also updated in the revised MR. CI03 is closed.                                                                                                                                                                                                                                                                                                                                                                                                    |    |                    |     |                         |

<sup>2</sup> Average quantity of wastewater in the monitoring period is 2,720 m<sup>3</sup>/day, Average COD<sub>inflow,ly</sub> is the average of 22,639 & 21,165 and the results is 21,902 mg/l, thus COD load [(2,720\*21,902)/1000] = 59,567 kg COD.

<sup>3</sup> Average quantity of wastewater in the baseline estimation is 2,400 m<sup>3</sup>/day, Average COD<sub>inflow,ly</sub> is 23,000 mg/l COD load [(2,400\*23,000)/1000] = 55,200 kg COD.

Table 3. CAR from this verification

| CAR ID                                        | N/A | Section no. |  | Date: dd/mm/yyyy |
|-----------------------------------------------|-----|-------------|--|------------------|
| Description of CAR                            |     |             |  |                  |
| N/A                                           |     |             |  |                  |
| Project participant response                  |     |             |  | Date: dd/mm/yyyy |
|                                               |     |             |  |                  |
| Documentation provided by project participant |     |             |  |                  |
|                                               |     |             |  |                  |
| DOE assessment                                |     |             |  | Date: dd/mm/yyyy |
|                                               |     |             |  |                  |

Table 4. FAR from this verification

| CAR ID                                        | N/A | Section no. |  | Date: dd/mm/yyyy |
|-----------------------------------------------|-----|-------------|--|------------------|
| Description of CAR                            |     |             |  |                  |
| No FAR raised during this verification        |     |             |  |                  |
| Project participant response                  |     |             |  | Date: dd/mm/yyyy |
|                                               |     |             |  |                  |
| Documentation provided by project participant |     |             |  |                  |
|                                               |     |             |  |                  |
| DOE assessment                                |     |             |  | Date: dd/mm/yyyy |
|                                               |     |             |  |                  |

## APPENDIX C: <COMPETENCE OF TEAM MEMBERS AND TECHNICAL REVIEWERS>

| <u><b>Certificate of Competence</b></u>            |                                                                                                                                           |                    |                                        |                         |                           |                         |
|----------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|--------------------|----------------------------------------|-------------------------|---------------------------|-------------------------|
| <b>Name</b>                                        | <input type="checkbox"/> Mr.<br><input checked="" type="checkbox"/> Ms.                                                                   | <b>Rekha Menon</b> |                                        |                         |                           |                         |
| <b>Qualification Procedure</b>                     | Fulfils the requirement as per the appointment of personnel procedure of 4KES for Validation and Verification of CDM/VCS/GS/GHG Projects. |                    |                                        |                         |                           |                         |
| <b>Appointed to work as:</b>                       |                                                                                                                                           |                    |                                        |                         |                           |                         |
|                                                    | <b>CDM Validator/Verifier</b>                                                                                                             | <b>Team Leader</b> | <b>Team Member</b>                     | <b>Technical Expert</b> | <b>Technical Reviewer</b> | <b>Financial Expert</b> |
| <i>Appointed</i>                                   | Yes                                                                                                                                       | Yes                | Yes                                    | Yes                     | Yes                       | No                      |
| <i>Appointed Date</i>                              | 01-10-2019                                                                                                                                |                    |                                        |                         |                           |                         |
| <b>Authorized to work as Technical Expert for:</b> |                                                                                                                                           |                    |                                        |                         |                           |                         |
| <i>Authorized Technical Area</i>                   | <b>Sectoral Scope</b>                                                                                                                     | <b>TA Code</b>     | <b>Technical Area within the scope</b> |                         |                           |                         |
|                                                    | Energy industries (renewable - / non-renewable sources)                                                                                   | 1.1                | Thermal energy generation              |                         |                           |                         |
|                                                    | Energy industries (renewable - / non-renewable sources)                                                                                   | 1.2                | Renewables                             |                         |                           |                         |
|                                                    | Energy demand                                                                                                                             | 3.1                | Energy demand                          |                         |                           |                         |
|                                                    | Waste handling and disposal                                                                                                               | 13.1               | Solid waste and wastewater             |                         |                           |                         |
|                                                    | Afforestation and reforestation                                                                                                           | 14.1               | Afforestation and reforestation        |                         |                           |                         |
|                                                    |                                                                                                                                           |                    |                                        |                         |                           |                         |
|                                                    |                                                                                                                                           |                    |                                        |                         |                           |                         |

|                                                |       |
|------------------------------------------------|-------|
| <b>Authorized to work as Local Expert for:</b> |       |
| Country/Countries                              | India |
| <b>Compliance check by:</b> Anand S. R.        |       |

|                                                    |                                                                                                                                            |                    |                                        |                         |                           |                         |
|----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|--------------------|----------------------------------------|-------------------------|---------------------------|-------------------------|
| <b><u>Certificate of Competence</u></b>            |                                                                                                                                            |                    |                                        |                         |                           |                         |
| <b>Name</b>                                        | <input type="checkbox"/> Mr.<br><input checked="" type="checkbox"/> Ms.                                                                    | Indumathi .C       |                                        |                         |                           |                         |
| <b>Qualification Procedure</b>                     | Fulfills the requirement as per the appointment of personnel procedure of 4KES for Validation and Verification of CDM/VCS/GS/GHG Projects. |                    |                                        |                         |                           |                         |
| <b>Appointed to work as:</b>                       |                                                                                                                                            |                    |                                        |                         |                           |                         |
|                                                    | <b>CDM Validator/Verifier</b>                                                                                                              | <b>Team Leader</b> | <b>Team Member</b>                     | <b>Technical Expert</b> | <b>Technical Reviewer</b> | <b>Financial Expert</b> |
| Appointed                                          | Yes                                                                                                                                        | Yes                | Yes                                    | Yes                     | Yes                       | No                      |
| Appointed Date                                     | 29-07-2019                                                                                                                                 |                    |                                        |                         |                           |                         |
| <b>Authorized to work as Technical Expert for:</b> |                                                                                                                                            |                    |                                        |                         |                           |                         |
| <b>Authorized Technical Area</b>                   | <b>Sectoral Scope</b>                                                                                                                      | <b>TA Code</b>     | <b>Technical Area within the scope</b> |                         |                           |                         |
|                                                    | Energy industries (renewable - / non-renewable sources)                                                                                    | 1.1                | Thermal energy generation              |                         |                           |                         |
|                                                    | Energy industries (renewable - / non-renewable sources)                                                                                    | 1.2                | Renewables                             |                         |                           |                         |
|                                                    | Energy demand                                                                                                                              | 3.1                | Energy demand                          |                         |                           |                         |
|                                                    | Waste handling and disposal                                                                                                                | 13.1               | Solid waste and wastewater             |                         |                           |                         |
|                                                    |                                                                                                                                            |                    |                                        |                         |                           |                         |

|                                                |       |
|------------------------------------------------|-------|
| <b>Authorized to work as Local Expert for:</b> |       |
| Country/Countries                              | India |
|                                                |       |
| <b><u>Compliance check by:</u></b> Anand S. R. |       |