

VALIDATION REPORT THE RENEWAL OF THE CREDITING PERIOD 'SD BIOSUPPLY WASTEWATER TREATMENT AND BIOGAS UTILIZATION PROJECT'



Document Prepared By RINA Services S.p.A. (RINA)

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Summary:

RINA Services S.p.A. (RINA), commissioned by South Pole Carbon Asset Management Ltd., has validated the renewal of the crediting period of the project “SD Biosupply Wastewater Treatment and Biogas Utilization Project” in Thailand, with regard to the relevant requirements for VCS activities. The project activity involves installation of an anaerobic wastewater treatment facility, based on Upflow Anaerobic Sludge Blanket (UASB) biogas reactor technology at the existing starch plant, replacing the open anaerobic lagoon based system. The UASB system generates and recovers biogas for energy generation purposes, avoiding methane emissions to the atmosphere.

The objective of the validation is to have an independent evaluation of a project activity by a designated operational entity against the requirements of the VCS guide version 3.7 and GHG program applied, on the basis of the project design document. The validation scope is to review the VCS PD against the UNFCCC criteria for application of applied methodology, tools guidelines and VCS Version 3.7 Requirements.

Validation was conducted using RINA procedures in line with the requirements specified in the CDM M&P, the latest version of the CDM Validation and Verification Standard, and relevant decisions of the COP/MOP and the CDM EB and applying standard auditing techniques. The validation consisted of desk review, on-site assessment and the resolution of outstanding issues and the issuance of the final validation report.

During this validation, 05 Corrective Action Request (CAR) and 1 Clarification Requests (CRs) 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 CRs are successfully closed after necessary corrections/clarifications by the client. The same has been discussed in Appendix B of this validation report

In conclusion, it is RINA’s opinion that the project activity “SD Biosupply Wastewater Treatment and Biogas Utilization Project”, in “Thailand”, as described in the VCS-PD version 2 of 23/11/2017, meets all relevant requirements for VCS activities and all relevant host Party criteria and correctly applies the baseline and monitoring methodology “AMS-III.H, ‘Methane Recovery in Wastewater Treatment’, version 18.0 of 16/10/2015 and AMS-I.C, ‘Thermal energy for user with or without electricity’ version 20 of 01/06/2014.

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1 INTRODUCTION

1.1 Objective

South Pole Carbon Asset Management Ltd. has commissioned RINA to carry out the validation of renewal of crediting period of the project “SD Biosupply Wastewater Treatment and Biogas Utilization Project” project in Thailand.

This report summarizes the findings of the validation of the project, performed on the basis of VCS Requirements and UNFCCC criteria for applied methodology, tools, as well as criteria given to provide for consistent project operations, monitoring and reporting.

The objective of the validation is to have an independent evaluation of a project activity by a designated operational entity against the requirements of the VCS Version 3.7 and GHG program applied, on the basis of the project design document. In particular, the validity of project's baseline and regulatory surplus are validated in order to confirm the compliance as outlined under paragraph 3.8.5 of VCS standard version 3.7. Validation is a requirement for all VCS projects and is seen as necessary to provide assurance to stakeholders of the quality of the project and its intended generation of Voluntary Carbon Units (VCUs).

1.2 Scope and Criteria

The validation scope is to review the VCS PD against the UNFCCC criteria for CDM and VCS Version 3.7 Requirements.

Validity of the original baseline scenario reviewing the following criteria:

- Evaluation of the impact of new relevant national and/or sectoral policies and circumstances on the validity of the baseline scenario.
- Assessment of the GHG emissions associated with original baseline scenario using the latest version of the CDM Tool to assess the validity of the original/ current baseline.
- If the original baseline scenario is no longer valid, whether current baseline scenario is established in accordance with the VCS rules.
- The project description, containing updated information with respect to the baseline, the estimated GHG emission reductions or removals and the monitoring plan, submitted for validation is based upon the latest approved version of the methodology or its replacement.

UNFCCC criteria for CDM refer to Article 12 of the Kyoto Protocol, the CDM modalities and procedures, the procedures for registration of program of activity as a single CDM and the subsequent decisions by the CDM Executive Board.

Validation 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 project design.

1.3 Level of Assurance

All the revisions of the validation report before being submitted to the client were subjected to an independent internal technical review to confirm that all validation activities had been completed according to the pertinent RINA instructions, with reasonable level of assurance.

The technical review was performed by a technical reviewer(s) qualified in accordance with RINA's qualification scheme VCS VER validation and verification. The validation team and the technical reviewers consist of the following personnel:

Role/Qualification	Last Name	First Name	Country
VCS Team Leader & Technical Expert (TA 13.1)	Buragohain	Champok	India
VCS Validator	Menon	Rekha	India
Technical Reviewer	Liu	Hui Feng	RINA China

1.4 Summary Description of the Project

The project activity involves installation of an anaerobic wastewater treatment facility at Somdej Flour Mill. The starch plant has a total production capacity of 300 tones of native starch per day. Prior to project implementation, the waste water was treated with an open lagoon based pond system with gravitational flow (cascading flow through 8 lagoons). The minimum depth of these ponds being more than 2m and the average atmospheric temperature in the region about 28°C, these conditions resulted in anaerobic environment within the ponds resulting in methane generation from the organic content of the wastewater, characterized by its COD, which was released into the atmosphere.

The use of UASB technology to treat wastewater enables not only the avoidance of methane into the atmosphere but also capturing of methane produced and meeting the effluent standards. The captured methane (or biogas) is utilized as fuel in existing heat generating devices (boilers) in the plant replacing heavy fuel oil and the surplus biogas, if any, is flared into the atmosphere through an open flare, thereby contributing to greenhouse gas (GHG) emission reduction.

The project site is located on the site of the SD Starch factory, located at address: 99 Moo 10, Somdej-Khuchinarai Road, Kambong sub-district, Huai Phueng district, Kalasin, approx. 580 km from Bangkok. The project coordinates are 16° 40'40.20"N and 103° 48' 19.67"E.

The project is already registered under VCS (VCS Ref. No: 416) and the project was fully operational during the first crediting period from 28/03/2006 to 27/03/2016.

2 VALIDATION PROCESS

2.1 Method and Criteria

Validation was conducted using RINA procedures in line with the VCS Version 3.7 requirements and the requirements specified in the CDM M&P, the latest version of the CDM Validation and Verification Standard, and relevant decisions of the COP/MOP and the CDM EB and applying standard auditing techniques.

The validation consisted of the following three phases:

- Document review;
- On-site assessment;
- The resolution of outstanding issues and the issuance of the final validation report and certification.

2.2 Document Review

The validation is performed primarily as a document review of the registered VCS PD /01/, the updated VCS PD version 01 of 28/03/2017 and version 02 of 23/11/2017/02/, in particular the applicability of the methodology, the baseline determination, the additionality of the project activity, the monitoring plan, the emission reduction calculations provided in the form of a spreadsheet “3VCS416_SD_ex-ante_ERCal_2ndCP_28032017_SPG” of 28/03/2017 and ‘VCS416_SD_ex-ante_ERCal_2ndCP_v01_23112017_SP.xlsx’ /03/, were assessed as part of the validation. In addition, the validation report applicable for the first crediting period /13/, previous verification report /14/ were reviewed.

The following table lists the documentation that was reviewed during the validation:

/1/	South Pole Carbon Asset Management Ltd.: Registered VCS PD for “SD Biosupply Wastewater Treatment and Biogas Utilization Project” in Thailand, version 6.4 of 19/11/2009
/2/	South Pole Carbon Asset Management Ltd.: Revised VCS PD for “SD Biosupply Wastewater Treatment and Biogas Utilization Project” in Thailand, version 01 of 28/03/2017 and version 02 of 23/11/2017
/3/	South Pole Carbon Asset Management Ltd: Emission reduction calculation Spreadsheet “3VCS416_SD_ex-ante_ERCal_2ndCP_28032017_SPG”, version 01 of 28/03/2017 and ‘VCS416_SD_ex-ante_ERCal_2ndCP_v01_23112017_SP.xlsx’ of 23/11/2017
/4/	VCS Verified Carbon Standard: VCS Program Guide, VCS Version 3.7 of 21/06/2017
/5/	VCS Verified Carbon Standard: VCS Standard, VCS Version 3.7 of 21/06/2017
/6/	VCS Verified Carbon Standard: VCS Validation Report Template VCS Version 3.4 of 19/10/2016
/7/	VCS Verified Carbon Standard: VCS Project Description Template VCS Version 3.3 of 19/10/2016
/8/	VCS Verified Carbon Standard: VCS Validation and Verification Manual VCS Version 3.2 of 19/10/2016
/9/	CDM Executive Board: Clean Development Mechanism Project Standard for project activities, version 01 of 03/03/2017, Annex 5 of EB93
/10/	CDM Executive Board: Clean Development Mechanism Validation and Verification Standard for project activities, version 01 of 03/03/2017, Annex 5 of EB93
/11/	CDM Executive Board: Small-scale Methodology; AMS-III.H: Methane recovery in wastewater treatment, Version 18.0 of 16/10/2015
/12/	CDM Executive Board: Small-scale Methodology AMS-I.C ‘Thermal energy production with or without electricity’, Version 20.0 of 01/06/2014
/13/	SGS: Validation report for ‘SD Biosupply Wastewater Treatment and Biogas Utilization Project’ in Thailand (CCP.VOL0307 VCS VAL), version 02 of 19/11/2009
/14/	RINA: Verification report (2017-IQ-10-MD) (4 th Verification) covering monitoring period from 15/09/2014 to 27/03/2016 for the project activity ‘SD Biosupply Wastewater Treatment and Biogas Utilization Project’ version 1.1Aa of 08/06/2017

/15/	VCS Board: VCS webpage for the project 'SD Biosupply Wastewater Treatment and Biogas Utilization' Website http://www.vcsprojectdatabase.org/#/project_details/416 in English language retrieved on 12/07/2017
/16/	Website: https://mer.markit.com/br-reg/public/index.jsp?entity=project&sort=project_name&dir=ASC&start=0&entity_domain=MarkitGoldStandard Argument: Gold Standard Registry Language: English, Retrieved on: 12/07/2017
/17/	Website: http://cdm.unfccc.int/Projects/projsearch.html Argument: UNFCCC CDM project search Language: English, retrieved on 12/07/2017
/18/	SD Biosupply Co. Ltd.: Plant daily log sheet from August 2005 to November 2005
/19/	Papop Co. Ltd.: Technical and financial proposal of biogas generation project at SD Biosupply Co. Ltd. dated July 2014
/20/	SD Biosupply Co. Ltd.: Log book records of COD analysis of inlet and outlet wastewater from 28/08/2004, September 2004 and October 2004
/21/	Papop Co. Ltd.: Flare specifications
/22/	Industrial Ministry: Operational license issued to SD Biosupply Co. Ltd. for biogas production valid until 01/06/2018
/23/	Agreement between SD Biosupply Co., Ltd. and South Pole Carbon Asset Management Ltd. dated 20/02/2008
/24/	Papop Co. Ltd.: Declaration of technical life of biogas plant at SD Biosupply Co. Ltd. dated 01/01/2017
/25/	Papop Co. Ltd.: Commissioning report and biogas start up report dated 18/08/2005
/26/	Scherrer Industrieheizanlagen e.k.: Technical specification of boiler S/N number: 12/012 (Manuf.no. 64784)
/27/	Hitech MFG.Co.Ltd.: Technical specification of boiler S/N number: MJ53002
/28/	Biogas purchase agreement between SD Biosupply Co. Ltd. (supplier) and Somdej Starch Factory (purchaser) dated 01/09/2015
/29/	Ministry of Industry: Factory Act B.E. 2535 "Notification of Ministry of Industry regarding Industrial Effluent Standards B.E. 2560"
/30/	Industrial Ministry: Operational license issued to Somdej Starch Co. Ltd. for starch production valid until 28/06/2018
/31/	Ministry of Natural Resources and Environment: Thailand Grid Emission Factor for GHG Reduction Project/Activity announced on 28/09/2007
/32/	The World Bank: Electric power transmission and distribution losses (% of output) in Thailand 2014 (https://data.worldbank.org/indicator/EG.ELC.LOSS.ZS?locations=TH&view=chart)
/33/	IPCCC: Fourth assessment report
/34/	UNFCCC: Methodological tool "project emissions from flaring" version 02, Annex 15, EB 68

2.3 Interviews

The key personnel interviewed and the main topics of the interviews are summarized in the table below:

	Date	Name and Role	Organization	Topic
/a/	30/03/2017-31/03/2017	Ms. Ladaporn Kat Khunikakorn- Project Manager	South Pole Carbon Asset Management Ltd.	Monitoring report, emission reduction calculations, records of monitoring parameters, VCS rules, application of methodology etc.
/b/	30/03/2017-31/03/2017	Ms. Sirinut Raya- Project Manager		
/c/	30/03/2017-31/03/2017	Mr. Santosh Kumar Singh- Director SE Asia		
/d/	30/03/2017-31/03/2017	Ms. Ubonnan Utachkal- Project co-ordinator	Papop Co. Ltd.	Technical aspects of the project activity. Operational life, environmental aspects etc.
/e/	30/03/2017-31/03/2017	Mr. Suchai Rattananadhekul – Engineering Manager		
/f/	30/03/2017-31/03/2017	Mr. Narone Tiyanich- Factory Manager	SD Bio Energy	Operational details of the project, management structure, legal compliance, health, safety and environmental aspects, data monitoring and recording procedure, safety practices, production controls, internal audits etc.
/g/	30/03/2017-31/03/2017	Mr. Vallop Suricha- Safety Officer		
/h/	30/03/2017-31/03/2017	Mr. Kamtan Muangpan- Mayor of Huayphung sub-district	Mayor of Huayphung sub-district	Stakeholder interaction regarding views and impact from project activity in local area including health, safety and environmental aspects.
/i/	30/03/2017-31/03/2017	Boonlam Sanata	Local Resident	

2.4 Site Inspections

On 30/03/2017 and 31/03/2017, RINA visited SD Biosupply Co., Ltd. Located at 99 Moo 10, Somdej-Khuchinarai Road, Kambong sub-district, Huai Phueng district, Kalasin, approximately 580 km from Bangkok. The project coordinates are 16° 40'40.20"N and 103° 48' 19.67"E. During the on-site assessment of the project, there were no hindrance and all the equipment's and the systems were accessible. RINA assessed the implementation and operation of the proposed project activity, reviewed the information flows for generating, aggregating and reporting the monitoring parameters, interviewed key personnel of the plant to confirm the applicability of the methodology, eligibility criteria, baseline scenario, and project boundary. The quality control and quality assurance procedures were confirmed through the onsite observation and interviews with the project employee.

2.5 Resolution of Findings

The objective of this phase of the validation is to resolve any outstanding issues, which need to be clarified for RINA's positive conclusion on the project design.

To guarantee transparency a validation protocol has been customized for the project. The protocol shows in a transparent manner the requirements, means of validation and the results from validating the identified criteria. The validation protocol consists of three tables. The completed validation protocol is enclosed in 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 3.7 requirements have not been met.
- There is a risk that the emission reductions cannot be monitored or calculated.

A clarification request (CR) is raised if information is insufficient or not clear enough to determine whether the applicable VCS Version 3.7 requirements have been met.

In summary, 1 CR and 5 CARs were raised which have been discussed in detail under Appendix B of this report. All CARs and CRs are successfully closed.

2.5.1 Forward Action Requests

No FAR raised.

3 VALIDATION FINDINGS

3.1 Project Details

Project type, technologies and measures implemented, and eligibility of the project:

The project applies UNFCCC approved methodology AMS-III.H, version 18 and AMS-I.C version 20 /11/, /12/ which is used under UNFCCC CDM and therefore an approved GHG programme. The project type and eligibility as per applied methodologies are discussed as below:

Project type and eligibility: The project involves methane avoidance through treatment of wastewater in UASB digester and recovering biogas for thermal energy generation. Therefore, the project is categorised both under sectoral scope 13 (Waste handling and disposal) and sectoral scope 01 (Energy industries (renewable -/ non-renewable sources) and correctly applied methodology AMS-III.H and AMS-I.C.

Technology and measures: The project wastewater treatment system (UASB digester) is designed to treat wastewater upto 3,000 m3/day coming out of the start production process. The capacity of wastewater generation and treatment capacity is checked from technical proposal submitted by technology supplier/19/. The inlet COD is 22,972 mg/l as per 10 days campaign data prior to project operation/20/. COD removal efficiency is 90% as verified from technical proposal /19/. Expected biogas generation is 18,000m3/day as per technical proposal from technology supplier /19/.

The recovered biogas is used in two thermal oil boiler of to replace fuel oil. Any excess biogas or during emergency biogas shall be flared in a open flare. Flare specification has been verified from flare specification from technology supplier /21/.

Therefore, emissions reductions from methane avoidance is claimed as per procedure outlined in applied methodology AMS-III.H, version 18 and emission reductions achieved from substitution of fossil fuel in thermal boiler is claimed as per procedure outlined in applied methodology AMS-I.C version 20.

Project proponent

SD Biosupply Co., Ltd. is the owner of the project which has been cross checked from the valid operational license copies /22/, validation report and previous verification report /13/, /14/. Hence, project proponent is as per VCS *Program Definitions*, v3.7 and accepted by validation team. The other entity involved in the project activity is South Pole Carbon Asset Management Ltd. as buyer of the carbon credit generated from the project activity which has been cross checked from the emission reduction purchase agreement copy executed between SD Biosupply Co., Ltd. and South Pole Carbon Asset Management Ltd. /23/.

Project start date

The project start date is same as mentioned in registered VCS-PD /01/. The project start date is 16/09/2005, the date on which biogas was used in boiler or flared. The daily plant log sheet verified to confirm the start date. The date represents the first date of generating emission reductions and hence start date is correct as per VCS rule.

Project crediting period

The project was registered under VCS 2007.1 and accordingly, PP considered start date of crediting period to be 28/03/2006. First duration of crediting period was 28/03/2006 to

27/03/2016. VCS 2007.1 rule says crediting period of a maximum of 10 years which may be renewed at most two times.

The assessment team has verified the project activity against the requirements of VCS standard v3.7 section 3.8.5(3) "The updated project description shall be validated in accordance with the VCS rules. In addition, the project shall be validated against the (current) scope of the VCS. Such validation report shall be issued within two years of the end of the (previous) project crediting period. Additional time is granted for projects to complete such validation where they are switching to a new VCS methodology (new VCS methodology in this context has the same meaning as set out in Section 3.7.2) when renewing the project crediting period. Specifically, projects switching to a new VCS methodology and completing such validation within one year of the approval of the methodology by the VCSA may complete such validation within three years of the end of the (previous) project crediting period.

It is noted that previous crediting period of the project activity ended on 27/03/2016 and the validation is completed within 2 years as recommended under the above paragraph.

Therefore, the project activity in compliance with all the requirements, hence eligible for crediting period renewal. It is to be noted that the project technical life is more than 15 years as confirmed from the technology supplier /24/ and hence the second crediting period is possible up to the lifetime of the project activity.

The first crediting period considered was 28/03/2006 to 27/03/2016 and the second crediting period is from 28/03/2016 to 27/03/2027

Project scale and estimated GHG emission reductions or removals

The estimated average annual emission reductions from the project are estimated to be on the average 51,316 tCO₂e per year over the selected 10 years crediting period.

Projects are categorized by size according to their estimated average annual emission reductions or removals according to VCS Standard /05/. Since the estimated annual emission reductions resulting from the project is less than 300,000 tCO₂e, the category of the project is defined as "Project" as per the VCS Standard /05/.

Project location

The project site is located on the site of the SD Starch factory, located at address: 99 Moo 10, Somdej-Khuchinarai Road, Kambong sub-district, Huai Phueng district, Kalasin, approx. 580 km from Bangkok. The project coordinates are 16° 40'40.20"N and 103° 48' 19.67"E. This is same as registered VCS PD /01/.

Project compliance with applicable laws, statutes and other regulatory frameworks

The project is a voluntary initiative by the project proponent and has not been implemented to meet any local / national laws or regulatory compliances. The project activity is in compliance with current laws and regulations and there are no legal and/or regulatory requirements that prevent the project implementation. Also the validation team has confirmed that there is no such compliance requirement with an emission trading program or any binding limits on GHG emissions for the project activity in Thailand (host country) as it is a non-annex 1 country. The

project has obtained valid consents for the installation and operation from the state nodal agencies and is in compliance with local laws and regulations.

Ownership and other programs

Right of use: The ownership of the project belong to SD Biosupply Co., Ltd. as verified from valid operational license copies /22/. Other entity South Pole Carbon Asset Management Ltd. acts as buyer of the carbon credit generated from the project activity which has been cross checked from the emission reduction purchase agreement copy executed between SD Biosupply Co., Ltd. and South Pole Carbon Asset Management Ltd. /23/.

Emissions trading programs and other binding limits: The project is not participating in other emission trading programs. The assessment team checked other emission trading programmes (UNFCCC, Gold Standard, ACX) and found that the project is not listed in any other emission trading programme.

Participation under other GHG programs:

The project is registered only under VCS project activity.

Project ID: 416.

Other forms of environmental credit sought or received: The project is not listed in any other forms of environmental credit as confirmed by project proponent.

Rejection by other GHG programs: The project has not been rejected by other GHG programme.

Additional information relevant to the project

Eligibility criteria for grouped projects:

The project is not a grouped project in consistent with registered VCS PD.

Commercially sensitive information:

Not applicable.

Any further information:

Not applicable

3.2 Application of Methodology

3.2.1 Title and Reference

The project activity was registered using AMS-III.H 'Methane Recovery in Wastewater Treatment' version 12 and AMS-I.C 'Thermal energy production with or without electricity' version 14.

For the renewal of the crediting period, the PP has updated the applied methodologies to its latest version and below are the methodologies applied:

AMS-III.H 'Methane Recovery in Wastewater Treatment' version 18 and AMS-I.C 'Thermal energy production with or without electricity' version 20.

Tool referenced in the applied methodologies are:

- Tool to calculate project or leakage CO₂ emissions from fossil combustion
- Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation
- Project emission from flaring

Assessment team has checked the UNFCCC website it is confirmed that the selection of the applied methodology and methodological tool has been done correctly in line with the applicable requirements for the renewal of crediting period.

3.2.2 Applicability

All applicability conditions of applied methodology AMS-III.H 'Methane Recovery in Wastewater Treatment' version 18 and AMS-I.C 'Thermal energy production with or without electricity' version 20 are justified in the updated VCS-PD and further justified below:

Applicability criteria for AMS-III.H, version 18

Criteria	Means of verification	Conclusion
In cases where baseline system is anaerobic lagoon the methodology is applicable if: a) The lagoons are ponds with a depth greater than two meters, without aeration. The value for depth is obtained from engineering design documents, or through direct measurement, or by dividing the surface area by the total volume. If the lagoon filling level varies seasonally, the average of the highest and lowest levels may be taken; b) Ambient temperature above 15°C, at least during part of the year, on a monthly average basis; c) The minimum interval between two consecutive sludge removal events shall be 30 days.	In consistent with registered project design 8 anaerobic lagoons, were used to treat wastewater in the baseline scenario and the lagoons had an average depth of 3.0 m. The project location is unchanged and in consistent with registered project the average temperature of the project area is 28 degree C. Further, no sludge has been removed from the baseline anaerobic lagoons since the date of starch factory operation. The above conditions were checked during site visit.	Applicability condition justified.
The recovered biogas from the above measures may also be utilised for the following applications instead of combustion/flaring: (a) Thermal or mechanical, electrical energy generation directly;	In consistent with registered project design and first crediting period, the received biogas is used for thermal energy	Applicability condition justified.

(b) Thermal or mechanical, electrical energy generation after bottling of upgraded biogas, in this case additional guidance provided in the appendix shall be followed; or (c) Thermal or mechanical, electrical energy generation after upgrading and distribution, in this case additional guidance provided in the appendix shall be followed: (i) Upgrading and injection of biogas into a natural gas distribution grid with no significant transmission constraints; (ii) Upgrading and transportation of biogas via a dedicated piped network to a group of end users; or (iii) Upgrading and transportation of biogas (e.g. by trucks) to distribution points for end users; (d) Hydrogen production; (e) Use as fuel in transportation applications after upgrading.	generation; This was checked during site visit. Therefore, condition (a) is applicable and rest of the conditions are not applicable.	
New facilities (Greenfield projects) and project activities involving a change of equipment resulting in a capacity addition of the wastewater or sludge treatment system compared to the designed capacity of the baseline treatment system are only eligible to apply this methodology if they comply with the relevant requirements in the “General guidelines for SSC CDM methodologies”. In addition the requirements for demonstrating the remaining lifetime of the equipment replaced, as described in the general guidelines shall be followed.	The project is a new project (greenfield project) as verified from operation log books and commissioning reports /25/. The project meets the “General guidelines for SSC CDM methodologies”.	Applicability condition justified.
The location of the wastewater treatment plant as well as the source generating the wastewater shall be uniquely defined and described in the PDD.	The location of wastewater treatment plant and source of generation of wastewater is clearly defined in VCS PD. This is also consistent with registered	Applicability condition justified

	project PD. This was checked during site visit.	
Measures are limited to those that result in aggregate emissions reductions of less than or equal to 60 kt CO ₂ equivalent annually from all Type III components of the project activity.	The emission reductions estimated conservatively for the project activity is 51,316 tCO _{2e} annually and hence meets the applicability condition.	Applicability condition justified.

Applicability criteria for AMS I-C, version 20.

Criteria	Means of verification	Conclusion
Biomass-based cogeneration and trigeneration systems are included in this category.	In the project activity recovered biogas is used for thermal application as verified during site visit and consistent with registered VCS PD.	Applicability condition not applicable.
Emission reductions from a biomass cogeneration or trigeneration system can accrue from one of the following activities: (a) Electricity supply to a grid; (b) Electricity and/or thermal energy production for on-site consumption or for consumption by other facilities; (c) Combination of (a) and (b).	In the project activity recovered biogas is used for thermal application as verified during site visit and consistent with registered VCS PD.	Applicability condition not applicable.
Project activities that seek to retrofit or modify an existing facility for renewable energy generation are included in this category	The recovered biogas in the project activity is used in hot oil boiler which were existed prior to the project activity. This was verified during site visit and consistent with registered VCS PD.	Applicability condition is justified.
In the case of new facilities (Greenfield projects) and project activities involving capacity additions the relevant requirements related to determination of baseline scenario provided in the "General guidelines for SSC CDM methodologies" for Type-II and Type-III Greenfield/capacity expansion project activities also apply.	The biogas is used for thermal application in existing boiler and hence not a greenfield project. This was verified during site visit and consistent with registered VCS PD.	Applicability condition not applicable.

The total installed/rated thermal energy generation capacity of the project equipment is equal to or less than 45 MW thermal.	The installed capacity of thermal boilers are 7.27 MWth as verified from technical specifications of boilers /26/, /27/.	Applicability condition is justified.
For co-fired systems, the total installed thermal energy generation capacity of the project equipment, when using both fossil and renewable fuel, shall not exceed 45 MW thermal.	Even the boilers are co-fired the total installed capacity of the boilers are 7.27 MWth as verified from technical specifications of boilers /26/, /27/.	Applicability condition is justified.
Applicability condition 9, 10, 11, 12, 15, 16 and 17 are not applicable as the project does not involve any biomass usage.		
If electricity and/or thermal energy produced by the project activity is delivered to a third party i.e. another facility or facilities within the project boundary, a contract between the supplier and consumer(s) of the energy will have to be entered into that ensures there is no double-counting of emission reductions.	The project activity will not deliver directly the heat to the starch factory. However, the biogas which will be generated from the methane avoidance component of the project will be delivered which will be combusted in the boiler in the starch factory. The contract between supplier (SD Biosupply Co., Ltd.) and consumer (Somdej Flour Mill Co., Ltd.) is verified in this regard /28/.	Applicability condition is justified.
If the project activity recovers and utilizes biogas for producing electricity and/or thermal energy and applies this methodology on a standalone basis i.e. without using a Type III component of a SSC methodology, any incremental emissions occurring due to the implementation of the project activity (e.g. physical leakage of the anaerobic digester, emissions due to inefficiency of the flaring), shall be taken into account either as project or leakage emissions	The project recovers and utilizes biogas for thermal application and applied type III component methodology (AMS-III.H). Therefore, requirements are fulfilled.	Applicability condition is justified.

as per relevant procedures in the tool “Emissions from solid waste disposal sites” and/or “Project emissions from flaring”. In the event that the biomass fuel (solid/liquid/gas) is sourced from an existing CDM project, then the emissions associated with the production of the fuel shall be accounted with that project.		
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In view of the above consideration, the assessment team is able to conclude that the used methodologies and tools are applicable for the project activity.

3.2.3 Project Boundary

In line with the applied methodologies AMS-III.H, version 18 and AMS-I.C, version 20 the project boundary includes the wastewater generation point (the starch factory), pre-treatment process unit, the processing site (the UASB reactor, lagoons) and the biogas usage points (the boilers). The grid system supplying electricity to the project facility is also included under the project boundary to account project emissions. The project boundary found consistent with registered project activity in line with applied methodologies and confirmed from site visit observations. Project boundary is correctly described in the updated VCS PD.

	GHGs involved	Description
Baseline emissions	CH ₄	Emission from decomposition of organic matter in anaerobic conditions. In the absence of the project activity, the wastewater coming out of the starch factory would have been left to decay in anaerobic conditions in open lagoons.
	CO ₂	Emissions from consumption of fossil fuel in boiler which is replaced by biogas in the project activity.
Project emissions	CH ₄	Decomposition of organic matter in open lagoon, Physical leakage of digester, incomplete flaring
	CO ₂	On-site electricity consumed by project activity (digester pumps and other electrical equipment), which is not generated from biogas will be accounted for. Also, emissions from onsite fossil fuel consumption
Leakage	N/A	The project activity does not have any leakage emission as per the applied methodology.

By checking the information and evidences available and by the physical site, the validation team can confirm that all the emission sources and gases have been included in the project boundary and the description in the PD is accurate and complete, and also that the selected sources and gases are justified for the proposed project activity.

3.2.4 Baseline Scenario

According to VCS Standard, v3.7, paragraph 3.8.5-2) the validity of the original baseline scenario shall be demonstrated when renewing the project crediting period, by means of impacts of new relevant national and/or sectoral policies and actual circumstances.

Paragraph 3.8.5, Clause (2-a) "The validity of the original baseline scenario shall be assessed. Such assessment shall include an evaluation of the impact of new relevant national and/or sectoral policies and circumstances on the validity of the baseline scenario".

VVB assessment:

The project is implemented in a starch factory and needs to follow Factory Act B.E. 2535 under which it needs to comply the "Notification of Ministry of Industry regarding Industrial Effluent Standards B.E. 2560 /29/. The notification states the limit of COD of wastewater discharged outside factory to be 120mg/l. However, as seen during site visit the wastewater is treated and reused inside the factory area for various activities (plantation, cleaning etc.). It is further verified from valid plant operational license /22/, /30/. Therefore, the baseline scenario (wastewater is left to decay in anaerobic lagoon) is still valid as per the original registered PD. For the biogas capture and utilization for thermal application, local regulation does not prohibit the use of fossil fuel in boiler as both the boiler has valid operational license to use both biogas and fossil fuel /22/, /30/. Thus it can be concluded that original baseline scenario will remain valid for next crediting period.

Paragraph 3.8.5, Clause (2-b) "Where it is determined that the original baseline scenario is still valid, the GHG emissions associated with the original baseline scenario shall be reassessed using the latest version of the CDM Tool to assess the validity of the original/ current baseline and to update the baseline at the renewal of a crediting period".

VVB assessment:

The project participant has included the assessment of the validity of the original baseline in line with UNFCCC in section 2.4 of the revised VCS PD, including the assessment of original baseline as per the “Tool to assess the validity of the original/ current baseline and to update the baseline at the renewal of a crediting period, Version 3.0.1”, which has been concluded to be still valid and applicable for the project

The tool consists of two steps. The first step provides an approach to evaluate whether the current baseline is still valid for the next crediting period. The second step provides an approach to update the baseline in case that the current baseline is not valid anymore for the next crediting period.

Step 1: Assess the validity of the current baseline for the next crediting period

Step 1.1: Assess compliance of the current baseline with relevant mandatory national and/or sectoral policies

As verified above (Para 3.8.5 2-a), local regulation does not prohibit the disposal of wastewater in anaerobic lagoons and therefore, in the absence of the project the baseline scenario would be in compliance of national regulations.

Step 1.2: Assess the impact of circumstances

The project activity is a treatment of wastewater in anaerobic digester and biogas recovery to use in boiler for thermal energy. The wastewater would have been treated in anaerobic lagoons and boiler would have used fossil fuel (HFO). Hence methane emissions from wastewater treatment in anaerobic lagoon and CO₂ emissions from diesel consumption are appropriate baseline. There is no change observed in this regard and it can be concluded that the conditions used to determine the baseline emissions in the previous crediting period are still valid.

Step 1.3: Assess whether the continuation of use of current baseline equipment(s) or an investment is the most likely scenario for the crediting period for which renewal is requested.

The lifetime of the project activity is above 15 years as confirmed from technology supplier /24/; hence an investment is not the most likely scenario for the renewal crediting period under consideration.

Step 1.4: Assessment of the validity of the data and parameter

“Where emission factors, values or emission benchmarks are used and determined only once for the crediting period, they should be updated, except if the emission factors, values or emission benchmarks are based on the historical situation at the site of the project activity prior to the implementation of the project and cannot be updated because the historical situation does not exist anymore as a result of the CDM project activity”.

Following data parameters are updated from registered PD:

Data/Parameter	Value in registered PD	Value in updated PD	Assessment

Global Warming Potential for Methane (GWP CH ₄)	21	25	In line with VCS 3.7 standard paragraph 3.15.3 IPCC fourth assessment report is referred for GWP of methane and correctly applied the updated value.
Methane producing capacity of the wastewater (Bo)	0.21 kg CH ₄ /kg COD	0.25 kg CH ₄ /kg COD	The updated value is in consistent with latest applied methodology AMS-III.H, version 18. Hence, accepted.
Model correction factor to account for model uncertainties (UF _{BL})	0.94	0.89	The updated value is in consistent with latest applied methodology AMS-III.H, version 18. Hence, accepted.
Model correction factor to account for model uncertainties (UF _{PJ})	1.06	1.12	The updated value is in consistent with latest applied methodology AMS-III.H, version 18. Hence, accepted.
CO ₂ emission factor for grid power (EF _y)	0.521 tCO ₂ /MWh	0.5637 tCO ₂ /MWh	The updated value is determined by Ministry of Natural Resources and Environment, Thailand in line with UNFCCC methodological tool /31/ and hence accepted.

Considering the guidance provided under this step, calculation of emission factor and baseline emissions are updated for the next crediting period as per step 2.

Step 2: Update the current baseline and the data and parameters

Since, the existing baseline scenario is still valid, this step is not applicable.

Finally it can be concluded that the identified baseline scenario is justified and according to the VCS Standard v. 3.7 and the “Tool for the assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period v3.0.1.

3.2.5 *Additionality*

In accordance with the paragraph 3.8.5 clause 1 of VCS standard v 3.7, “A full reassessment of additionality is not required when renewing the project crediting period. However, regulatory surplus shall be demonstrated in accordance with Section 4.6.3) and the project description shall be updated accordingly”.

As per the above guidelines, the assessment team has reviewed the sectoral and national policies applicable for wastewater treatment projects in host country Thailand.

Factory Act B.E. 2535, the “Notification of Ministry of Industry regarding Industrial Effluent Standards B.E. 2560 were reviewed.

In view of the above assessment, it can be concluded that the proposed project is not mandated by any law, statute or other regulatory framework, or for UNFCCC non-Annex I countries, any systematically enforced law, statute or other regulatory framework and hence continued to be voluntary.

3.2.6 *Quantification of GHG Emission Reductions and Removals*

Baseline Emissions:

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

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

Where:

BE_y	=	Baseline emissions in year y (t CO ₂ e)
$BE_{power,y}$	=	Baseline emissions from electricity or fuel consumption in year y (t CO ₂ e)
$BE_{ww,treatment,y}$	=	Baseline emissions of the wastewater treatment systems affected by the project activity in year y (t CO ₂ e)
$BE_{s,treatment,y}$	=	Baseline emissions of the sludge treatment systems affected by the project activity in year y (t CO ₂ e)

- $BE_{ww,discharge,y}$ = Baseline methane emissions from degradable organic carbon in treated wastewater discharged into sea/river/lake in year y (t CO₂e). The value of this term is zero for the case 1(b)
- $BE_{s,final,y}$ = Baseline methane emissions from anaerobic decay of the final sludge produced in year y (t CO₂e). If the sludge is controlled combusted, disposed in a landfill with biogas recovery, or used for soil application in the baseline scenario, this term shall be neglected

$BE_{power,y}$: The electricity consumption rate of the baseline wastewater systems will not be changed after implementation of the project. However any additional amounts of electricity use in the project activity shall be accounted in the project emissions. Also, the thermal energy produced by using biogas in would have been fulfilled by burning of fossil fuels in absence of the project activity. This part of emission reduction will be taken into account using methodology AMS-I.C (Version 20). In brief, the emission related to difference between electricity consumption and fuel consumption of the baseline and project scenarios will be considered in project emissions and methodology AMS-I.C calculations, respectively. Hence, $BE_{power,y}$ is excluded from above equation.

$BE_{ww,discharge,y}$: In the baseline scenario, treated wastewater is not discharged into sea/lake/river, therefore methane emissions from degradable organic carbon in treated wastewater discharged ($BE_{ww, discharge, y}$) in e.g. a river, sea or lake in the baseline situation is assumed to be zero.

$BE_{s,treatment,y}$: There is no sludge treatment system in the baseline scenario, only a wastewater treatment system based on open anaerobic lagoons, hence baseline emissions from sludge treatment are not taken into consideration.

$BE_{s,final,y}$: There is no sludge treatment system in the baseline system. Hence, $BE_{s,final}$ is assumed zero.

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

Baseline emissions of the wastewater treatment systems affected by the project activity in year y ($BE_{ww,treatment,y}$) is calculated as below:

$$BE_{ww,treatment,y} = \sum_i (Q_{ww,i,y} \times COD_{inflow,i,y} \times \eta_{COD,BL,i} \times MCF_{ww,treatment,BL,i}) \times B_{o,ww} \times UF_{BL} \times GWP_{CH_4}$$

Where:

$Q_{ww,i,y}$	=	Volume of wastewater treated in baseline wastewater treatment system i in year y (m^3). For ex ante estimation, forecasted wastewater generation volume or the designed capacity of the wastewater treatment facility can be used. However, the ex post emissions reduction calculation shall be based on the actual monitored volume of treated wastewater.
$COD_{inflow,i,y}$	=	Chemical oxygen demand of the wastewater inflow to the baseline treatment system i in year y (t/m^3). Average value may be used through sampling with the confidence/precision level 90/10
$\eta_{COD,BL,i}$	=	COD removal efficiency of the baseline treatment system i , determined as per the paragraphs 38, 39 or 40 below
$MCF_{ww,treatment,BL,i}$	=	Methane correction factor for baseline wastewater treatment systems i (MCF values as per Table 2 below)
i	=	Index for baseline wastewater treatment system
$B_{o,ww}$	=	Methane producing capacity of the wastewater (IPCC value of 0.25 kg CH_4 /kg COD) ¹
UF_{BL}	=	Model correction factor to account for model uncertainties (0.89) ²
GWP_{CH_4}	=	Global Warming Potential for methane

¹ Project activities may use the default value of 0.6 kg CH_4 /kg BOD, if the parameter $BOD_{5,20}$ is used to determine the organic content of the wastewater. In this case, baseline and project emissions calculations shall use BOD instead of COD in the equations, and the monitoring of the project activity shall be based in direct measurements of $BOD_{5,20}$, i.e. the estimation of BOD values based on COD measurements is not allowed.

² Reference: FCCC/SBSTA/2003/10/Add.2, page 25.

Volume of wastewater treated ($Q_{ww,i,y}$) is taken ex-ante as the design capacity 707,405 m³ as per technical proposal /19/. Historical COD_{in} is taken an average historical value of 0.02297 tCOD/m³. COD removal efficiency of the baseline treatment system ($\eta_{COD,BL,i}$) is taken considering 10 days measurement campaign and model correction factor of 0.89 as per applied methodology. Accordingly, $\eta_{COD,BL,i}$ arrived at 87.62%. Methane producing capacity of the wastewater (Bo_{ww}) is taken default value of 0.25 as per applied methodology. GWP_{CH₄} is also as per IPCC fourth assessment report and taken as 25. Accordingly, $BE_{ww,treatment,y}$ is estimated to be 63,364 tCO₂e.

Baseline Emissions as per AMS-I.C, version 20:

According to the methodology AMS-I.C (Version 20), baseline emissions shall be calculated as the sum of emissions from the production of electricity and thermal energy:

$$ER_{ren,y} = BE_{electrical,CO_2,y} + BE_{thermal,CO_2,y}$$

Since, the project involves only thermal energy component, therefore, $ER_{ren,y} = BE_{thermal,CO_2,y}$

$BE_{thermal,CO_2,y}$ is calculated as per applied methodology as below:

$$BE_{thermal,CO_2,y} = \left(\frac{EG_{thermal,y}}{\eta_{BL,thermal}} \right) \times EF_{FF,CO_2}$$

Where:

$BE_{thermal,CO_2,y}$	=	Baseline emissions from thermal energy displaced by the project activity during the year y (t CO ₂)
$EG_{thermal,y}$	=	Net quantity of thermal energy supplied by the project activity during the year y (TJ)
EF_{FF,CO_2}	=	CO ₂ emission factor of the fossil fuel that would have been used in the baseline plant obtained from reliable local or national data if available, alternatively, IPCC default emission factors can be used (t CO ₂ /TJ)
$\eta_{BL,thermal}$	=	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

Net quantity of thermal energy supplied by the project activity during the year y ($EG_{thermal,y}$) is estimated considering the amount of biogas sent to boiler as per technical proposal /19/, percentage of methane in biogas (65%) as per technical proposal /19/, density of methane as per IPCC value and NCV of methane as per IPCC. Accordingly, $EG_{thermal,y}$ is estimates ex-ante to be 113 TJ. CO₂ emission factor of diesel (EF_{FF,CO_2}) is 77.40 tCO₂e/TJ as per IPCC and Efficiency of the plant using fossil fuel ($\eta_{BL,thermal}$) is taken 100% default value as per AMS-I.C, version 20 paragraph 41. Accordingly, $BE_{thermal,CO_2,y}$ is arrived at 8,753 tCO₂e.

Project Emissions AMS-III.H:

According to AMS-III.H, the project emissions are calculated using equation (8) of the applied methodology:

$$PE_y = \left\{ \begin{array}{l} PE_{power,y} + PE_{ww,treatment,y} + PE_{s,treatment,y} + PE_{ww,discharge,y} + PE_{s,final,y} \\ PE_{fugitive,y} + PE_{biomass,y} + PE_{flaring,y} \end{array} \right\}$$

Where:

PE_y	Project activity emissions in the year y (t CO ₂ e)
$PE_{power,y}$	Emissions from electricity or fuel consumption in the year y (t CO ₂ e). These emissions shall be calculated as per paragraph 28, for the situation of the project scenario, using energy consumption data of all equipment/devices used in the project activity wastewater and sludge treatment systems and systems for biogas recovery and flaring/gainful use
$PE_{ww,treatment,y}$	Methane emissions from wastewater treatment systems affected by the project activity, and not equipped with biogas recovery, in year y (t CO ₂ e). These emissions shall be calculated as per equation (2) in paragraph 29 using an uncertainty factor of 1.12 and data applicable to the project situation ($MCF_{ww,treatment,PJ,k}$ and $\eta_{I,PJ,k,y}$) and with the following changed definition of parameters: $MCF_{ww,treatment,t,PJ,k}$ Methane correction factor for project wastewater treatment system k (MCF values as per Table 2 above) $\eta_{I,PJ,k,y}$ Chemical oxygen demand removal efficiency of the project wastewater treatment system k in year y (t/m ³), measured based on inflow COD and outflow COD in system k
$PE_{s,treatment,y}$	Methane emissions from sludge treatment systems affected by the project activity, and not equipped with biogas recovery, in year y (t CO ₂ e). These emissions shall be calculated as per equations (3) and (4) in paragraphs 32 and 33, using an uncertainty factor of 1.12 and data applicable to the project situation ($S_{I,PJ,y}$, $MCF_{s,treatment,I}$) and with the following changed definitions of parameters: $S_{I,PJ,y}$ Amount of dry matter in the sludge treated by the sludge treatment system I in the project scenario in year y (t) $MCF_{s,treatment,I}$ Methane correction factor for the project sludge treatment system I (MCF values as per Table 2 above)
$PE_{ww,discharge,y}$	Methane emissions from degradable organic carbon in treated wastewater in year y (tCO ₂ e). These emissions shall be calculated as per equation (6) in paragraph 35, using an uncertainty factor of 1.12 and data applicable to the project conditions ($COD_{ww,discharge,PJ,y}$, $MCF_{ww,PJ,discharge}$) and with the following changed definition of parameters: $COD_{ww,discharge,e,PJ,y}$ Chemical oxygen demand of the treated wastewater discharged into the sea, river or lake in the project scenario in year y (t/m ³) $MCF_{ww,PJ,discharge,arge}$ Methane correction factor based on the discharge pathway of the wastewater in the project scenario (e.g. into sea, river or lake) (MCF values as per Table 2)
$PE_{s,final,y}$	Methane emissions from anaerobic decay of the final sludge produced in year y (t CO ₂ e). These emissions shall be calculated as per equation (7) in paragraph 37, using an uncertainty factor of 1.12 and data applicable to the project conditions ($MCF_{s,PJ,final}$, $S_{final,PJ,y}$). If the sludge is controlled combusted, disposed in a landfill with biogas recovery, or used for soil application in aerobic conditions in the project activity, this term shall be

neglected, and the sludge treatment and/or use and/or final disposal shall be monitored during the crediting period with the following revised definition of the parameters:

$MCF_{s,PJ,final}$	Methane correction factor of the disposal site that receives the final sludge in the project situation, estimated as per the procedures described in the methodological tool "Emissions from solid waste disposal sites"
$S_{final,PJ,y}$	Amount of dry matter in final sludge generated by the project wastewater treatment systems in the year y (t)
$PE_{fugitive,y}$	Methane emissions from biogas release in capture systems in year y , calculated as per paragraph 42 (t CO ₂ e)
$PE_{flaring,y}$	Methane emissions due to incomplete flaring in year y (t CO ₂ e). For ex ante estimation, baseline emission calculation for wastewater and/or sludge treatment (i.e. equation (2) and/or equation (3)) can be used but without the consideration of GWP for CH ₄ . However, the ex post emission reduction shall be calculated as per methodological tool "Project emissions from flaring"
$PE_{biomass,y}$	Methane emissions from biomass stored under anaerobic conditions. If storage of biomass under anaerobic conditions takes place in the project and does not occur in the baseline, methane emissions due to anaerobic decay of this biomass shall be considered and be determined as per the procedure in the methodological tool "Emissions from solid waste disposal sites" (t CO ₂ e)

Emissions from electricity or fuel consumption in the year y ($PE_{power,y}$) is calculated using below formula:

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

Amount of electricity consumption ($EC_{PJ,i,y}$) shall be monitored. For ex-ante, it is taken as per technical proposal to be 596 MWh /19/. Grid emission factor ($EF_{EF,i,y}$) is fixed ex-ante to be 0.5637 tCO₂/MWh as per Thai DNA /31/. Transmission and distribution loss ($TDL_{j,y}$) is taken as 6.07% as per latest information /32/. Accordingly, PE_{power} is estimated to be 357 tCO₂e.

Methane emissions from wastewater treatment systems affected by the project activity, and not equipped with biogas recovery in the project situation ($PE_{ww,treatment,y}$) is calculated using below formula:

$$BE_{ww,treatment,y} = \sum_i (Q_{ww,i,y} \times COD_{inflow,i,y} \times \eta_{COD,BL,i} \times MCF_{ww,treatment,BL,i}) \times B_{o,ww} \times UF_{BL} \times GWP_{CH4}$$

Where,

Methane correction factor for project wastewater treatment system k ($MCF_{ww,treatment,pj,k}$) is taken as 0.8 for Anaerobic deep lagoon (depth more than 2 metres) as per applied methodology.

Uncertainty factor (UF_{PJ}) is taken as 1.12 as per the applied methodology. COD removal efficiency is taken considering COD in and removal efficiency. Accordingly, $PE_{ww,treatment,y}$ is estimated to be 11,263 tCO₂e.

Methane fugitive emissions on account of inefficiencies in capture systems ($PE_{fugitive,y}$) are determined as per AMS-III.H and as follows:

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

It was seen during the site visit that there was no sludge treatment system. Hence, $PE_{fugitive,s,y}$ is considered zero.

Fugitive emissions through capture inefficiencies in the anaerobic wastewater treatment systems in the year y ($PE_{fugitive,ww,y}$) is estimated as follows:

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

Capture efficiency of the biogas recovery equipment in the wastewater treatment (CEF_{ww}) is 0.9 as per the applied methodology /11/. Global Warming Potential for methane (GWP_{CH_4}) is fixed 25 as per IPCC /33/.

Methane emission potential of wastewater treatment systems equipped with biogas recovery system in year y ($MEP_{ww,treatment,y}$) is calculated as follows:

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

Flow of wastewater treated in the year y ($Q_{ww,y}$) is 707,405 m³ as explained in above. Methane producing capacity of the wastewater ($B_{o,ww}$) is fixed ex-ante to be 0.25 kg CH₄/kg COD /11/. Model correction factor to account for model uncertainties (UF_{PJ}) is fixed ex-ante to be 1.12 /11/. Methane correction factor for wastewater treatment system k equipped with biogas recovery ($MCF_{ww,treatment,PJ,k}$) is fixed ex-ante to be 0.8 as per applied methodology /11/. $COD_{removed,PJ,k,y}$ is calculated as the difference between $COD_{ww,untreated,y}$ and $COD_{ww,treated,y}$ estimated to be 0.0207 ton/m³. $MEP_{ww,treatment,y}$ is estimated to be 3,276.08 tonnes and $PE_{fugitive,ww,y}$ is **8,190** tCO₂e.

Project Emissions from flaring in year y ($PE_{flare,y}$) is calculated as per the methodological tool “project emissions from flaring” version 02 /34/ and as follows:

$$PE_{flare,y} = GWP_{CH_4} * \sum F_{CH_4,RG,m} * (1 - \eta_{flare}) * 10^{-3}$$

Global Warming Potential for methane (GWP_{CH_4}) is fixed 25 as per IPCC /33/. Flare efficiency in hour ‘h’ ($\eta_{flare,h}$) is 50% as technical proposal from technology supplier /19/.

Mass flow rate of methane in the residual gas in hour ‘h’ ($TM_{RG,h}$) shall be calculated as per the tool ‘project emissions from flaring’ version 02. Ex-ante the same is considered to be zero.

Density of methane at normal condition ($\rho_{CH_4,n,h}$) is fixed ex-ante to be 0.716 kg/m³ as per the tool ‘project emissions from flaring’ version 02 and fixed for the entire crediting period. Therefore, PE_{flare} is zero.

Project emissions related to fossil fuel consumption as per AMS-I.C is estimated as below:

$$PE_{FC,i,y} = \sum FC_{HFO,y} * CO_{EF,i,y}$$

The quantity of fossil fuel consumption ($FC_{HFO,y}$) shall be monitored ex-post. For ex-ante estimation the HFO consumption is calculated to be 317 ton emission factor of HFO is 77.40

ton/TJ. Hence, project emissions from fossil fuel consumption is estimated ex-ante to be 992 tCO₂e.

As per applied methodology leakage emissions are zero for the project activity.

Emission reductions estimated ex-ante to be: BE_y – PE_y

BE_y = 72,117 tCO₂e and PE_y = 20,801 tCO₂e

ER_y = 51,316 tCO₂e.

3.2.7 Methodology Deviations

In determining EG_{thermal,y}, PP has applied deviation from the procedure as outlined in AMS-I.C, version 20. As per AMS-I.C, version 20, the calculation formula is:

$$BE_{\text{thermal, CO}_2,y} = (EG_{\text{thermal, y}} / \eta_{\text{BL, thermal}}) * EF_{\text{FF, CO}_2}$$

Methodology requires ‘metering the thermal and/or electrical energy produced’; (i) in the case of heat energy (e.g. hot air, hot water), direct measurement of flow and temperature is required. However, direct measurement of temperature (in and out) and flow of the thermal fluid were not conducted and deviation is applied to estimate EG_{thermal} based on amount of heat required for starch drying which in turn is estimated on heat requirements per tonne of starch based on historical data. The approach estimates the thermal energy delivered by the project activity based on historical fuel oil consumption and starch production for the given year. The conservativeness of approach is ensured by comparing the total energy delivered by the fuels burnt in the project activity and thermal energy estimate based on historical fuel oil consumption values.

Justification of acceptance: The baseline emissions due to thermal energy generation by the boilers can also be estimated based on the fuel consumption. Prior to the implementation of the project activity, HFO was used as fuel in boilers. From the available fuel consumption and dry starch production details, the specific fuel consumption is calculated to be 33.8, 34.7 and 36.5 Litres per ton of dry starch during the years 2002, 2003 and 2004 respectively. This is as per historical dry starch production and fuel oil consumption details as already verified in last verification report /14/. Therefore, the lowest value based on the historical specific fuel consumption (33.8 lit/ton) of the plant has been considered by the PPs for baseline emission calculations for thermal energy generation. It has been found from Thai Tapioca Starch Association /14/, and from previous verification report /14/, the range of HFO consumption is from 28 Litres per ton to 47 Litres per ton and the average value is 37.5 Litres per ton. On a conservative side the thermal energy required for drying of starch has been estimated by two approaches; one by the historical specific fuel consumption and the starch production during the year and the other by the actual fuel consumption (biogas and HFO) in the year. Lowest of the values during the year has been considered for calculating the baseline emissions. The validation team is of the opinion that the approach followed by the PPs is appropriate and hence the deviation is accepted.

3.2.8 Monitoring Plan

The proposed project uses CDM approved methodology AMS-III.H Version 18: 'Methane recovery in wastewater treatment' and AMS-I.C: 'Thermal energy production with or without electricity' version 20. The application of monitoring methodology is assessed as correct.

The monitoring plan in the PD provides detailed information related to the collection and archiving of all relevant data needed quality control measures as required by the applied methodologies. The monitoring arrangement and responsible personal as per the monitoring plan found effective during site visit and also confirmed from successful verification during first crediting period. The monitoring arrangements are feasible within the project design. The PP has the ability to implement the monitoring plan as per the PD.

3.3 Non-Permanence Risk Analysis

Not applicable, non-permanence risks were not identified.

4 SAFEGUARDS

4.1 No Net Harm

The project activity involves avoidance of methane emission from wastewater treatment and biogas recovery and utilization to replace fuel oil. There is no negative environmental and socio-economic impact.

4.2 Environmental Impact

The project being a renewable energy biogas based thermal project does not fall under the purview of the Environmental Impact Assessment (EIA) notification of the Ministry of Natural Resources and Environment (MORE). The government of Thailand with the type and size of projects or activities requiring EIA, which is currently regulated by Section 46 of the Enhancement and Conservation of Nation from the National Environmental Quality Act 1992.

4.3 Local Stakeholder Consultation

Not applicable since this is validation for renewal of crediting period. The stakeholder consultation conducted by PP during registration of the project activity has been outlined in the updated VCS PD.

4.4 Public Comments

Not applicable.

5 VALIDATION CONCLUSION

RINA Services Spa (RINA) has performed validation of the project activity "SD Biosupply Wastewater Treatment and Biogas Utilization Project" in Thailand, with regard to the relevant requirements for VCS Version 3.7 activities.

The review of the project design document and the subsequent follow-up interviews have provided RINA with sufficient evidence to determine the fulfillment of the stated criteria.

The project correctly applies the approved baseline and monitoring methodology “AMS-III.H”, “Methane recovery in wastewater treatment”, version 18 of 16/10/2015 and AMS-I.C, ‘Thermal energy production with or without electricity’, Version 20.0 of 01/06/2014.

By generating renewable energy from biogas recovery in wastewater treatment, the project results in reduction of CO₂ emissions that are real measurable and giving long-term benefits to the mitigation of climate change. It is demonstrated that the project is not a likely baseline scenario. Emission reductions attributable to the project are hence additional to any that would occur in the absence of the project activity.

The total emission reductions from the “SD Biosupply Wastewater Treatment and Biogas Utilization Project” are estimated to be on average 51,316 tCO₂e per year over the selected 10 years crediting period. The emission reduction forecast has been checked and it is deemed likely that the stated amount is achieved given that the underlying assumptions do not change.

The monitoring plan provides for the monitoring of the project’s emission reductions and of the sustainable development indicators. The monitoring arrangements described in the monitoring plan are feasible within the project design and it is RINA’s opinion that the project participants are able to implement the monitoring plan.

In conclusion, it is RINA’s opinion that the project activity “SD Biosupply Wastewater Treatment and Biogas Utilization Project” in Thailand, as described in the VCS PD version 2 of 23/11/2017, meets all relevant UNFCCC and VCS Version 03.7 requirements for the VCS VER and all relevant host Party criteria and correctly applies the baseline and monitoring methodology “AMS-III.H”, “Methane recovery in wastewater treatment”, version 18 of 16/10/2015 and AMS-I.C, ‘Thermal energy production with or without electricity’, Version 20.0 of 01/06/2014.

RINA thus requests registration of the project as a VCS project activity.

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 ₄	Methane
CR	Clarification Request
CO ₂	Carbon dioxide
CO ₂ e	Carbon dioxide equivalent
COD	Chemical Oxygen Demand
CRT	Coordination and Technical Control Staff
DCI	Certification Division of RINA Services Spa
DNA	Designated National Authority
DOE	Designated Operational Entity
EB	Executive Board
EF	Emission Factor
ER	Emission Reductions
FAR	Forward Action Request
GHG(s)	Greenhouse gas(es)
GWP	Global Warming Potential
HFO	Heavy Fuel Oil
IPCC	Intergovernmental Panel on Climate Change
LoA	Letter of Approval
MoV	Means of Verification
MR	Monitoring Report
NGO	Non-governmental Organization
ODA	Official Development Assistance

PDD	Project Design Document
PE	Project Emission
PEA	Provincial Electricity Authority
PP(s)	Project Participant(s)
Ref.	Document Reference
RINA	RINA Services Spa
SS(s)	Sectoral Scope(s)
TA(s)	Technical Area(s)
TPD	Tons per day
UASB	Upflow Anaerobic Sludge Blanket Reactor
UNFCCC	United Nations Framework Convention on Climate Change
VCS	Verified Carbon Standard
VCU	Verified Carbon Unit
VER	Voluntary Emission Reductions
VVS	Validation and Verification Standard

APPENDIX B: CLARIFICATION REQUESTS, CORRECTIVE ACTION REQUESTS AND FORWARD ACTION REQUEST

Table 1. CL from this validation

CL ID	01	Section no.	3.1	Date: 12/07/2017
Description of CL				

- a) Kindly provide the evidence of project ownership by SD Biosupply Co., Ltd.
- b) Kindly clarify why the start date of second crediting period is kept from 01/09/2017
- c) As per registered VCS PD, the project activity is estimated to last for 15 years and started commercial operation on 16th September 2005. Kindly clarify how the operation of the project activity is ensured during the second crediting period of 10 years.
- d) Please clarify how the project meets the regulatory requirement of COD content not exceeding 120 mg/l in discharged wastewater?
- e) PP is requested to clarify whether net GHG emission reductions or removals generated by the project will be used for compliance with an emissions trading program or to meet binding limits on GHG emissions?
- f) Kindly provide the contract copy between SD Biosupply Co. Ltd. and Somdej Flour Mill Co. Ltd. for biogas supply.
- g) Kindly provide the open lagoon depth (cross section drawing)
- h) Kindly provide the basis of technical life of boiler to be 20 years.
- i) Kindly provide the exact source which states the project is exempted from EIA

Project participant response**Date:** 23/11/2017

- a) The evidence of project ownership is referred to the operational license and the company affidavit. The evidence will be delivered to VVB soon.
- b) The start date of second crediting period has been revised to 28/03/2016.
- c) The technology applied in the project activity has a lifetime longer than 15 years. This can be referred to the confirmation statement provided by the technology providers as Att 2.6
- d) According to the regulation requirement, the COD of discharge shall be lower 120 mg/l. However, the wastewater treated by the project is not discharged out of the project activity area or through a river body. The treated wastewater at the final lagoon is utilised in plantation area of the project. Hence, the project activity is complied with local regulatory requirement.
- e) The project is a voluntary initiative and not used for meeting any compliance with an emissions trading program.
- f) The contract between SD Biosupply Co., Ltd. and Somdej Flour Mill Co., Ltd. as Att-2.1.
- g) The evidence of depth of open lagoon is submitted as Att – 2.7
- h) The evidence of technical lifetime of boilers is delivered to VVB as Att 2.5.

The reference source of the EIA exemption as Att-2.2. The reference link can be accessed as <http://www.onep.go.th/eia/images/3law/35type.PDF>

Documentation provided by project participant

Att – 2.1 Contract between SD Biosupply Co., Ltd. and Somdej Flour Mill Co., Ltd.

Att – 2.2 EIA exemption

Att – 2.3 Operational license

Att – 2.4 Company affidavit

Att – 2.5 Confirmation of technology lifetime for boilers

Att – 2.6 Confirmation of technology lifetime for biogas system

Att – 2.7 Depth of open lagoons

DOE assessment

Date: 05/02/2018

- a) Operation license for Project ownership by SD Biosupply Co., Ltd. is provided
- b) Start date of second crediting period is changed to 01/09/2017.
- c) PP has provided declaration from technology supplier which states the plant can run beyond 15 years. DOE also interviewed the technology supplier and found that the plant with regular operation and maintenance can run more than 15 years. Hence, second crediting period of the project is justified.
- d) PP has provided plant operational license which proves the project meets the regulatory requirements. In addition, the wastewater is not discharged to water body, it is reused in-house. Hence, meets the regulation requirements.
- e) PP's justification is accepted.
- f) Contract copy between SD Biosupply Co. Ltd. and Somdej Flour Mill Co. Ltd. for biogas supply is provided. This justified the applicability condition of applied methodology.
- g) PP has provided the open lagoon depth (cross section drawing) and specifications are as per the details provide in PD
- h) Technical life of boiler to be 20 years as provide by technology supplier. Hence accepted.
- i) PP has provided details of EIA applicability to projects in host country. The subject project does not fall under EIA as per the regulation. Hence, accepted.

Table 2. CAR from this validation

CAR ID	01	Section no.	3.2.4	Date: 14/07/2017
Description of CAR				
<i>The justification of compliance of national policies under step 1.1 of table 5 is not provided.</i>				
Project participant response				Date: 23/11/2017
The justification under step 1.1 has been provided in the revised PDD.				
Documentation provided by project participant				
<i>Revised PD</i>				
DOE assessment				Date: 05/02/2018
PP has updated the PD with justification of national policies applicable to the project activity. DOE has verified the same and also cross checked the valid operational licenses. Hence, CAR is closed.				

CAR ID	02	Section no.	3.2.5	Date: 14/07/2017
Description of CAR				
<i>The additionality assessment provided in updated VCS PD is not consistent with VCS standard section 3.8.5</i>				
Project participant response				Date: 23/11/2017
The additionality in section 2.5 has been revised as per the VCS standard section 3.8.5. The regulatory surplus is also demonstrated in accordance with section 4.6.3. The description of project is updated accordingly.				
Documentation provided by project participant				
<i>Revised PD</i>				
DOE assessment				Date: 05/02/2018
Necessary corrections are done and accepted. CAR is closed.				

CAR ID	03	Section no.	3.2.7	Date: 14/07/2017
Description of CAR				
a) <i>Weblink provided in Footnote 44 of the VCS PD is not working</i> b) <i>It was noticed that deviation was applied to calculate MDy in previous verification under first crediting period. Please clarify if any deviation to be followed in second verification for calculating MDy.</i>				
Project participant response				Date: 23/11/2017
a) The PD is revised. The footnote 44 is not presented in the PDD. b) The determination of MDy has been followed to the version 18 of AMS.III.H. No deviation is applied during this crediting period. The description is revised in the PD.				
Documentation provided by project participant				
<i>Revised PD and revised ER sheet</i>				
DOE assessment				Date: 05/02/2018
PP has updated the PD in consistent with applied methodology and VCS requirements. Corrections are accepted and hence CAR is closed.				

CAR ID	04	Section no.	3.2.8	Date: 14/07/2017
Description of CAR				
a) The monitoring plan in section 4.3 of the VCS PD states Papop Renewable Co., Ltd. as project developer. Please clarify. b) The gas analyser point is shown in the project boundary diagram near to GM1 which is the flow meter for total biogas recovered. As per methodology requirement, 'The methane content measurement shall be carried out close to a location in the system where a biogas flow measurement takes place'. Please clarify how this condition is met? c) The description provided in 'source of data' for the parameter $EG_{thermal,y}$ is not correct. Also the calculation method provided is not consistent with deviation approach. d) The latest flaring tool is not referred in updated VCS PD.				
Project participant response				Date: 23/11/2017
a) The monitoring plan in section 4.3 of the PD has been revised. b) The monitoring point of methane content is located in the biogas system where is nearby the location of gas flow meter installed. The description of measurement methods and procedures in the PD has been revised. This monitoring measurement is complied with the applied methodology in which the methane fraction is monitored close to a location in the system where a biogas flow measurement takes place. c) The description of 'source of data' for the parameter "$EG_{thermal,y}$" has been revised. The source of data is plant records. Also, the calculation method is revised and referred to the methodology deviation justified in section 2.6 of the revised PD. d) The description of methane emission due to incomplete flaring in the revised PD is updated as per the latest tool "project emission from flaring", version 02.				
Documentation provided by project participant				
Revised PD				
DOE assessment				Date: 05/02/2018
Monitoring plan is updated in the revised PD. Monitoring arrangements are in compliance of applied methodology. Latest tools are referred now. Hence, CAR is closed.				

CAR ID	05	Section no.	3.2.6	Date: 14/07/2017
Description of CAR				

a) The formula used in equation 2 in updated VCS PD is not consistent with latest methodology AMS-III.H, version 18 b) Model correction factor for uncertainties used for project emissions ($PE_{ww,treatment,y}$) is not consistent with latest methodology.. c) Please clarify why GWP of methane is not used as per IPCC's Fourth Assessment Report. d) $B_{o,ww}$, UF_{BL} value is not correct as per AMS-III.H, version 18	
Project participant response	Date: 23/11/2017
a) The formula used in equation 2 in updated VCS PD has been revised and update as per latest methodology AMS-III.H, version 18. b) Model correction factor for uncertainties used for project emissions ($PE_{ww,treatment,y}$) has been corrected as per the latest AMS-III.H version 18. c) The GWP of methane of 25 has been revised as per IPCC's Fourth Assessment Report. The parameter of $B_{o,ww}$, UF_{BL} value has been revised as per AMS-III.H, version 18	
Documentation provided by project participant	
Revised PD and revised ER sheet	
DOE assessment	Date: 05/02/2018
Necessary corrections are done as per applied methodologies and correct formula, emission factors are used to estimate emission reductions. Hence, CAR is closed .	

Table 3. FAR from this validation

FAR ID	xx	Section no.		Date: DD/MM/YYYY
Description of FAR				
No FAR raised.				
Project participant response				Date: DD/MM/YYYY
Documentation provided by project participant				
DOE assessment				Date: DD/MM/YYYY



CERTIFICATO DI QUALIFICA PER GLI SCHEMI VOLONTARI*
QUALIFICATION CERTIFICATE FOR VOLUNTARY SCHEMES*

Si attesta che il sig./sig.ra:
 We declare that Mr/Mrs/Ms:

Rekha Menon

è qualificato come:
 is qualified as:

TEC, VAL, VER, TL, ITRP

per le seguenti aree tecniche:
 for the following technical areas:

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

REVISIONE REVISION	DATA DATE	MOTIVAZIONI PER LA REVISIONE REASON FOR THE REVISION
0	19/07/2016	First issue with new template (this certificate is linked to CDM qualification)

Responsabile di schema
 Scheme Leader
 Rita Valoroso

Rita Valoroso

*SCHEMI VOLONTARI/ VOLUNTARY SCHEMES: ACR American Carbon Registry, CCB The Climate, Community & Biodiversity Alliance, GS Gold Standard, JI Joint Implementation, SCS Social Carbon Standard, VCS Verified Carbon Standard.

TEC: Technical expert; VAL: Validator; VER: Verifier; TL: Team leader; FIN EXP: Financial Expert; ITRP: Independent technical reviewer

RINA Services S.p.A. è accreditato/riconosciuto da

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VCSA	per condurre la Validazione e la Verifica di Progetti VCS to carry out Validation and Verification of VCS Projects
GS Foundation	per condurre la Validazione e la Verifica di Progetti GS to carry out Validation and Verification of GS Projects
Ecologica Institute	per condurre la Validazione e la Verifica di rapporti SCS to carry out Validation and Verification of SCS Reports
American Carbon Registry ACR	per condurre la Validazione e la Verifica di Progetti ACR to carry out Validation and Verification of ACR projects
The Climate, Community & Biodiversity Alliance CCB	per condurre la Validazione e la Verifica di Progetti co-benefit CCB to carry out Validation and Verification of co-benefit CCB projects



CERTIFICATO DI QUALIFICA PER GLI SCHEMI VOLONTARI*
QUALIFICATION CERTIFICATE FOR VOLUNTARY SCHEMES*

Si attesta che il sig./sig.ra:
 We declare that Mr/Mrs/Ms:

Champak Buragohain

è qualificato come:
 is qualified as:

TEC, VAL, VER, TL, ITR, Local Expert

per le seguenti aree tecniche:
 for the following technical areas:

AREE TECNICHE TECHNICAL AREAS	DESCRIZIONE DELL'AREA TECNICA TECHNICAL AREA DESCRIPTION	SCOPO SETTORIALE SECTORAL SCOPE
1.2	Renewables	1
2.1	Electricity distribution	2
13.1	Solid waste and wastewater	13
13.2	Manure	13

REVISIONE REVISION	DATA DATE	MOTIVAZIONI PER LA REVISIONE REASON FOR THE REVISION
0	19/07/2016	First issue with new template (this certificate is linked to CDM qualification)
1	11/07/2017	Qualification update

Responsabile di schema
 Scheme Leader
 Laura SEVERINO

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CERTIFICATO DI QUALIFICA PER GLI SCHEMI VOLONTARI*
QUALIFICATION CERTIFICATE FOR VOLUNTARY SCHEMES*

Si attesta che il sig./sig.ra:
 We declare that Mr/Mrs/Ms:

Hui Feng Liu

è qualificato come:
 is qualified as:

TEC, VAL, VER, TL, ITRP

per le seguenti aree tecniche:
 for the following technical areas:

AREE TECNICHE TECHNICAL AREAS	DESCRIZIONE DELL'AREA TECNICA TECHNICAL AREA DESCRIPTION	SCOPO SETTORIALE SECTORAL SCOPE
1.1	Thermal energy generation	1
1.2	Renewables	1
8.1	Mining and mineral processes	8
9.2	Iron, steel and Ferro alloy production	9
13.1	Solid waste and wastewater	13

REVISIONE REVISION	DATA DATE	MOTIVAZIONI PER LA REVISIONE REASON FOR THE REVISION
0	19/07/2016	First issue with new template (this certificate is linked to CDM qualification)

Responsabile di schema
 Scheme Leader
 Rita Valeroso

*SCHEMI VOLONTARI/ VOLUNTARY SCHEMES: ACR American Carbon Registry, CCB The Climate, Community & Biodiversity Alliance, GS Gold Standard, JI Joint Implementation, SCS Social Carbon Standard, VCS Verified Carbon Standard.

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