Binzhou Topigs Norsvin Breeding Swine Co., Ltd. Binhai Swine Farm Biogas Recovery and Utilization Project

Document Prepared by Shenzhen CTI International Certification Co., Ltd

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Report Title	Binzhou Topigs Norsvin Breeding Swine Co., Ltd. Binhai Swine Farm Biogas Recovery and Utilization Project
Client	Climate Bridge (Shanghai) Ltd.
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Summary:

Shenzhen CTI International Certification Co., Ltd (hereafter referred to as "CTI") has been commissioned by Climate Bridge (Shanghai) Ltd. to perform the validation of project activity "Binzhou Topigs Norsvin Breeding Swine Co., Ltd. Binhai Swine Farm Biogas Recovery and Utilization Project" (hereafter referred to as "the project activity") and reported in the Project Description.

The project activity uses an anaerobic animal manure management system to treat manure waste (Breeding swine) from Binhai Breeding Swine Farm, which is located in Binhai Breeding Swine Farm, Zhanhua District, Binzhou City, Shandong Province, P.R China, of which the main purpose is to use HDPE membrane enclosed anaerobic digesters to treat animal manure waste and collect the generated biogas, avoiding methane emissions. The biogas will be used for heat generation during the heating period (October to April next year) and will be destroyed in the biogas flaring system during the rest of the months (May to September). **The emission reductions generated by displacing fossil-fuel based heat supply during heating period will not be claimed by PP.** The effective volume of each HDPE membrane enclosed anaerobic digesters utilized by the project activity is 9,000m^3 (60m*70m*6m) and the total effective volume is 18000m^3. The project activity is expected to produce 828,154 m^3 biogas per year. The residual waste from the HDPE membrane enclosed anaerobic digesters will be handled aerobically to produce organic fertilizer at the project site.

During the 3*7 renewable crediting period, the project activity avoids the emission of methane that would be emitted to the atmosphere directly without any methane recovery and destruction facility. It's estimated that the project activity could achieve average annual GHG emission reductions of 11,795 tCO_2e and total GHG emission reductions of 82,563 tCO_2e during the first 7-year crediting period.

The validation objective is an independent assessment by a Third Party of a proposed project activity against all defined criteria set for the registration under the VCS. In order to confirm that the project activity, as documented, is sound reasonable and meets the identified criteria, the validation involves the assessment of: project conformance to VCS standards/programs, project conformance to the applied methodology, including the procedure for the demonstration of additionality specified in the methodology; and likelihood that methods and procedures set out in the project description will generate verifiable GHG data and information when implemented. Validation is a requirement and is seen as necessary to provide assurance to stakeholders of the quality of project and its intended generation of

VCUs. Validation is part of the VCS project cycle and will finally result in a conclusion by the executing VVB whether a project activity is valid to be submitted for registration to Verra registry.

Validation is conducted using Shenzhen CTI International Certification Co., Ltd (CTI) procedures in line with the requirements specified in the latest version of the VCS Validation and Verification Manual and applying auditing techniques. The validation team assessed the project activity's compliance against the VCS Standard Version 4.3, the selected CDM methodology and the project description. The project is eligible under non-AFOLU project. The validation criteria followed the guidance documents provided by VCS and the selected CDM methodology and tool includes:

- CDM Validation and Verification Standard for project activities version 03.0

- CDM Project Standard for project activities version 03.0

- CDM project cycle procedure for project activities version 03.0

- VCS standard v4.3

- VCS Program Guide v4.2

- AMS-III.D.: Methane recovery in animal manure management systems, Version 21.0

- Tool 06: Project emissions from flaring, Version 03.0

- Tool 14: Project and leakage emissions from anaerobic digesters, version 02.0

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 estimated verified emission reductions (VERs).

A risk-based approach has been followed to perform this validation activity. In the course of Validation, 2 Clarification Requests (CLs), 1 Corrective Action requests (CARs) and no Forward action request (FARs) was raised. The review of the project description and additional documents related to baseline and monitoring methodology; the subsequent background investigation, follow-up interviews and project owners have provided Shenzhen CTI International Certification Co., Ltd (CTI) with sufficient evidence to verify the fulfilment of the stated criteria of VCS.

Contents

1 INTRODUCTION

1.1 Objective

Climate Bridge (Shanghai) Ltd. has commissioned the CTI to carry out the Verified Carbon Standard (VCS) validation of the project "Binzhou Topigs Norsvin Breeding Swine Co., Ltd. Binhai Swine Farm Biogas Recovery and Utilization Project" (VCS ID 2880).

The objective of validation is an independent assessment by a Third Party of a proposed project activity against all defined criteria set for the registration under the VCS. In order to confirm that the project activity, as documented, is sound reasonable and meets the identified criteria, the validation involves the assessment of: project conformance to VCS standards/programs, project conformance to the applied methodology, including the procedure for the demonstration of additionality specified in the methodology; and likelihood that methods and procedures set out in the project description will generate verifiable GHG data and information when implemented. Validation is a requirement and is seen as necessary to provide assurance to stakeholders of the quality of project and its intended generation of VCUs. Validation is part of the VCS project cycle and will finally result in a conclusion by the executing VVB whether a project activity is valid to be submitted for registration to Verra registry.

1.2 Scope and Criteria

The validation scope is defined as an independent and objective review of the project design document (PD) to validate that:

(a) the project design is actual,

(b) the baseline scenario is correctly defined as per the applied methodology and relate tools,

(c) the project is additional,

(d) the monitoring plan can be implemented and is transparent and adequate and

(e) all data and information used for ex-ante calculation of emission reductions is of projected and/or hypothetical nature.

The PD is reviewed against the criteria stated in VCS standard version 4.3 and the approved baseline and monitoring methodology AMS-III.D. Version 21.0. The validation was based on the requirements of VCS Validation and Verification Manual version 3.2, VCS Program Guide version 4.2, VCS standard version 4.3, applying auditing techniques.

The validation is not meant to provide any consulting 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

The validation report is based on the VCS-PD, supporting evidences made available to the validator and information collected through performing interviews and during the on-site assessment.

The validation conclusion is assured a reasonable level of assurance.

1.4 Summary Description of the Project

Project title	Binzhou Topigs Norsvin Breeding Swine Co., Ltd. Binhai Swine Farm Biogas Recovery and Utilization Project
Project Participants	Binzhou Topigs Norsvin Breeding Swine Co., Ltd. Binhai Branch (Project Owner, host country, P. R. China) Climate Bridge (Shanghai) Ltd. (Consultancy)
Location of the project	Binhai Breeding Swine Farm, Zhanhua District, Binzhou City, Shandong Province, P.R China. Geographic coordinates: East longitude 118°10'54" and North latitude 37°52'43"
Project start date	05/08/2020, the operation start date
Applied Methodology/Version	AMS-III.D., Version 21.0
Scope/Technical Area	Sectoral Scope 1: Energy (renewable/non-renewable) Sectoral scope 13: Waste handling and disposal

The project activity uses a new anaerobic animal manure management system to treat manure waste (Breeding swine) from Binhai Breeding Swine Farm, which is located in Binhai Breeding Swine Farm, Zhanhua District, Binzhou City, Shandong Province, P.R China, of which the main purpose is to use HDPE membrane enclosed anaerobic digesters to treat animal manure waste and collect the generated biogas, avoiding methane emissions. The biogas will be used for heat generation during the heating period (October to April next year) and will be destroyed in the biogas flaring system during the rest of the months (May to September). **The emission reductions generated by displacing fossil-fuel based heat supply during heating period will not be claimed by PP.** The effective volume of the HDPE membrane enclosed anaerobic digesters utilized by the project activity is 9,000m^3 (60m*70m*6m). The project activity is expected to produce 828,154 m^3 biogas per year. The residual waste from the HDPE membrane enclosed anaerobic digesters will be handled aerobically to produce organic fertilizer at the project site.

During the 3*7 renewable crediting period, the project activity avoids the emission of methane that would be emitted to the atmosphere directly without any methane recovery and destruction facility. It's estimated that the project activity could achieve average annual GHG emission reductions of 11,795 tCO_2e and total GHG emission reductions of 82,563 tCO_2e during the first 7-year crediting period.

2 VALIDATION PROCESS

2.1 Method and Criteria

A project specific validation plan was developed to guide the validation auditing process to ensure efficiency and effectiveness.

The purpose of the validation is to present a risk assessment for determining the nature and extent of validation procedures necessary to ensure the risk of auditing error is reduces to a reasonable level. According to the ISO14064-3, the criteria are the policy, procedure or requirement used as reference against which evidence is compared. CTI completed a strategic review and risk assessment of the project's activities and processes in order to gain a full understanding of (if applicable):

- Project Details;
- Application of Methodology;
- Estimated GHG Emission Reduction and Removals;
- Monitoring;
- Safeguards etc.

CTI validate that the reported information in the Project Description are complete and accurate in question. This involved a site visit and a desk review of the Project Design. This Validation Report describes the findings of this assessment.

The information of CTI Validation Team is included in below of this report.

2.2 Document Review

The VCS PD and supporting background documents related to the project implementation were reviewed. Documents review was conducted to ensure consistency with and identify any deviation from VCS program requirements. Desk review included an examination of the project design details, baseline scenario, additionality, ex ante and monitoring data and parameters, and ex ante quantification of GHG emission reductions.

Furthermore, the validation team used additional documentation by third parties like host party legislation, technical reports referring to the project design details, baseline scenario, additionality, monitoring or to the basic conditions and technical data.

The references used in the course of this validation are summarized in Appendix 3.

The validation was performed basing on the documents check and site inspection/measurements, refer to the section 3 of this report for the validation process detail and Appendix 3 for corresponding documents review.

According to the sectoral scopes / technical area and experiences in the sectoral or national business environment, CTI has composed a project CTI Validation Team in accordance with the appointment rules in CTI. The composition of CTI Validation Team has to be approved by the CTI ensuring that the required skills are covered by the team. The four qualification levels for team members that are assigned by formal appointment rules as below:

Function	Name	Technical competence	Task Performance*
Team Leader	Du Wenjun	1, 13	☒ DR ☒ SV ☒ RP ☐ TR
Technical Reviewer	Lin Wu	1, 2, 3, 4, 5, 10, 11, 12, 13	☒ DR ☐ SV ☐ RP ☒ TR

*DR=Document review; SV=Site visit; RP=Reporting; TR=Technical review

The VCS project design version 1.0 dated 27/12/2021, version 2.0 dated 20/06/2022, version 3.0 dated 06/12/2020 were assessed as part of the validation. Relevant documents were reviewed. A detailed documents reviewed are listed in Appendix 2 of the report.

2.3 Interviews

The objective of the interview process was to solicit important information from personnel related to project and relevant to the validation process. Onsite interviews and information discussions were conducted with PP. The key personnel interviewed are summarized in the table below:

Interviewed personnel	Role	Organization	Subject
Mr. Li Mu	Plant Manager	Binzhou Topigs Norsvin Breeding Swine Co., Ltd. Binhai Branch.	Project design and operation of the project activity; Status of the project (including PPs); Project proponent and ownership; Applicability of selected methodology; Applicable laws, statutes and other regulatory frameworks and any change; Baseline of the project; Emission factors of the project; Monitoring plan; Stakeholder consultation process and its outcomes; Sustainable development contributions.
Mr. Wang Xiuhao	Management staff		
Mr. Peng Kuo	Technician	Local Environmental Protection Bureau	The process and participation of the stakeholder consultation; The impact of the project activity;
Ms. Yin Liqing	Technician	Local Environmental	

		Protection Bureau	The complaint by local stakeholders and the implementation of the mitigation measures.
Ms. Zhou Lingxian	Villager	Huaquan Village	
Mr. Zhao Er	Villager	Huaquan Village	
Mr. Zhang Zixiao	Project Manager	Climate Bridge (Shanghai) Ltd.	Data collection and ER calculation.

2.4 Site Inspections

On 23/05/2022 to 24/05/2022, CTI Validation Team visited Binzhou Topigs Norsvin Breeding Swine Co., Ltd. Binhai Branch. and performed the on-site validation at the project location (Binhai Breeding Swine Farm, Zhanhua District, Binzhou City, Shandong Province, P.R China). The interviewed personnel and objective are listed in above table.

During the on-site validation, CTI has applied standard auditing techniques to assess the quality of information provided, the implementation and current situation of the project activity, evaluate data management, QA/QC system, project technology and equipment, training provided, and monitoring etc.

2.5 Resolution of Findings

As an outcome of the validation process, the team can raise different types of findings.

Where a non-conformance arises CTI Validation Team shall raise a Corrective Action Request (CAR). A CAR is issued, where:

a) Non-compliance with the monitoring plan or methodology are found in monitoring and reporting and has not been sufficiently documented by the project participants, or if the evidence provided to prove conformity is insufficient;

b) Modifications to the implementation, operation and monitoring of the project activity has not been sufficiently documented by the project participants;

c) Mistakes have been made in applying assumptions, data or calculations of emission reductions that will impact the quantity of emission reductions;

d) Issues identified in a FAR during validation to be verified during verification or previous verification(s) have not been resolved by the project participants.

CTI Validation Team shall raise a Clarification Request (CL) if information is insufficient or not clear enough to determine whether the applicable CDM or VCS requirements have been met.

All CARs and CLs raised during validation shall be resolved prior to submitting a request for issuance.

The objective of this phase of the validation was to resolve the requests for corrective actions and clarification and any other outstanding issues which need to be clarified for Shenzhen CTI International Certification Co., Ltd (CTI)'s positive conclusion on the project design. 2 Clarification Requests (CLs), 1

Corrective Action requests (CARs) and no Forward action request (FARs) was raised by Shenzhen CTI International Certification Co., Ltd (CTI). And communications were made between the Client and Shenzhen CTI International Certification Co., Ltd (CTI) to guarantee the transparency of the validation process, the concerns raised, and responses given are summarized below in the appendix 4.

The final VCS PD version 3.0 dated 06/12/2020 serves as the basis for the final assessment presented. Additional changes to the project during the validation process are not considered to be significant with respect to the main CDM/VCS objectives. The two CDM/VCS main objectives are the reduction of anthropogenic GHG emissions and the contribution of sustainable development to the host country.

Areas of validation findings	No. of CL	No. of CAR	No. of FAR
Project Description	00	00	00
Description of project activity	1	1	00
Application of selected baseline and monitoring methodology and selected standardized baseline			
- Applicability of methodology and standardized baseline	00	00	00
- Deviation from methodology	00	00	00
- Clarification on applicability of methodology, tool and/or standardized baseline	00	00	00
- Demonstration of additionality	00	00	00
- Emission reductions	00	1	00
- Monitoring plan	1	00	00
- Stakeholders consultation process	00	00	00
- Public comments	00	00	00
Others (please specify)-Matter related to double counting- for validation	00	00	00
Total	1	2	00

The list of findings and their resolution is presented in appendix 4 of this report.

2.5.1 Forward Action Requests

None FAR was raised during the validation process.

3 VALIDATION FINDINGS

3.1 Project Details

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

The project activity uses an anaerobic animal manure management system to treat manure waste (Breeding swine) from Binhai Breeding Swine Farm, which is located in Binhai Breeding Swine Farm, Zhanhua District, Binzhou City, Shandong Province, P.R China, of which the main purpose is to use HDPE membrane enclosed anaerobic digesters to treat animal manure waste and collect the generated biogas, avoiding methane emissions. The biogas will be used for heat generation during the heating period (October to April next year) and will be destroyed in the biogas flaring system during the rest of the months (May to September). **The emission reductions generated by displacing fossil-fuel based heat supply during heating period will not be claimed by PP.** The effective volume of each HDPE membrane enclosed anaerobic digesters utilized by the project activity is 9,000m^3 (60m*70m*6m) and the total effective volume is 18000m^3. The project activity is expected to produce 828,154 m3 biogas per year. The residual waste from the HDPE membrane enclosed anaerobic digesters will be handled aerobically to produce organic fertilizer at the project site.

During the 3*7 renewable crediting period, the project activity avoids the emission of methane that would be emitted to the atmosphere directly without any methane recovery and destruction facility. It's estimated that the project activity could achieve average annual GHG emission reductions of 11,795 tCO_2e and total GHG emission reductions of 82,563 tCO_2e during the first 7-year crediting period.

The project activity is located at Binhai Breeding Swine Farm, Zhanhua District, Binzhou City, Shandong Province, P.R China. The project activity has been developed by Binzhou Topigs Norsvin Breeding Swine Co., Ltd. Binhai Branch. The geographic coordinates of the project activity is east longitude 118°10'54" and north latitude 37°52'43" which is confirmed by site visit.

By checking Environmental Impact Assessment (EIA) approval and Project Approval, CTI Validation Team confirmed that the project activity has been approved by Environmental Protection Bureau of Zhanhua District, Binzhou City on 29/11/2018 and approved by Development and Reform Bureau of Zhanhua District, Binzhou City on 27/12/2017. By checking the Construction contract /20/ signed between the project owner and construction party (Binzhou Hongda Construction and Installation Engineering Co., Ltd.) and Construction Start Confirmation Letter issued by the construction party and supervision party, CTI Validation Team confirmed that the project started construction on 16/10/2019. By checking Operation Log /34/, as well as through site interview, CTI Validation Team confirmed that the anaerobic animal manure treatment system started operation on 05/08/2020, i.e. GHG emission reductions generated since 05/08/2020. Therefore, it is confirmed that the project start date is 05/08/2020.

For the project activity, the applicability of VCS program as required in para 2.1.1 of VCS Standard (version 4.3) is justified as below:

Criteria	Justification
The scope of the VCS Program includes: 1) The six Kyoto Protocol greenhouse gases.	During the 3*7 renewable crediting period, the project activity avoids the emission of methane that would be emitted to the atmosphere directly without any methane recovery and destruction facility. Therefore, this criteria is applicable.
2) Ozone-depleting substances.	This criteria is not applicable for the project activity.
3) Project activities supported by a methodology approved under the VCS Program through the methodology approval process.	This criteria is not applicable for the project activity.
4) Project activities supported by a methodology approved under an approved GHG program, unless explicitly excluded (see the Verra website for exclusions).	The project activity applies methodology AMS-III.D (Version 21.0), a methodology approved under CDM Program, which is a VCS approved GHG program.
5) Jurisdictional REDD+ programs and nested REDD+ projects as set out in the VCS Program document Jurisdictional and Nested REDD+ (JNR) Requirements.	This criteria is not applicable for the project activity.
The scope of the VCS Program excludes projects that can reasonably be assumed to have generated GHG emissions primarily for the purpose of their subsequent reduction, removal or destruction. The VCS Program also excludes the following project activities under the circumstances indicated in Table 1 of VCS Standard (version 4.3).	The project activity uses an anaerobic animal manure management system to treat manure waste (Breeding swine) from Binhai Breeding Swine Farm, which is located in Binhai Breeding Swine Farm, Zhanhua District, Binzhou City, Shandong Province, P.R China, of which the main purpose is to use HDPE membrane enclosed anaerobic digesters to treat animal manure waste and collect the generated biogas, avoiding methane emissions. The project activity is not excluded under the circumstances indicated in Table 1 of VCS Standard (version 4.3).

Project design, including eligibility criteria for grouped projects

Through document review, i.e. EIA Report /13/ and FSR /11/, and on site inspection, the treatment process is confirmed by CTI Validation Team, which is listed as follows:

Anaerobic animal manure management system	Two HDPE membrane enclosed anaerobic digesters with effective volume of 9000m^3 (60m*70m*6m) were installed and utilized by the project activity. The total effective volume is 18000m^3. The project activity is expected to produce 828,154 m^3 biogas per year.
Biogas pre-treatment system	Before combustion, the biogas will be pre-treated to remove impurities and moisture to prevent the project facilities from corrosion. In addition, biogas is

	kept in in a stable condition before it flows into the flaring system. The biogas pre-treatment system is consistent of pre-filtration, dehumidification, dewatering, cooling and fine filtration.
Biogas heating system	The biogas will be used for heat generation during the heating period (October to April next year). During the heating period, the recovery methane will be sent to biogas heating system for combustion and supply heat for the livestock farm instead of emitting to atmosphere. **The emission reductions generated by displacing fossil-fuel based heat supply during heating period will not be claimed by PP.**
Biogas flare system	The project activity will install an enclosed flare combustion system. During non-heating period (May to September), the recovered methane will be sent to flare combustion system instead of emitting to atmosphere.
Wastewater treatment system	The outlet wastewater from HDPE membrane enclosed anaerobic digesters will be treated in an open tank. The wastewater will treated aerobically and then be used for nearby farm irrigation.
The Residual waste treatment system	The residual waste from HDPE membrane enclosed anaerobic digesters and wastewater treatment will be handled aerobically to produce organic fertilizer at the project site.

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

Project proponent and other entities involved in the project

Through document review and site interview, CTI Validation Team confirmed the details of the project proponent as:

Organization name	Binzhou Topigs Norsvin Breeding Swine Co., Ltd. Binhai Branch
Contact person	Wang Geng
Title	Project Manager
Address	Zhanhua District, Binzhou City, Shandong Province, P.R China
Telephone	+86-2162462036
Email	3542346576@qq.com

Organization name	Climate Bridge (Shanghai) Ltd.
Role in the project	Consultancy
Contact person	Gao Zhiwen
Title	General Manager
Address	Block B, Level 24, Jiangong Mansion, 33 Fushan Road, Pudong New Area, Shanghai, China 200120
Telephone	+86-21 62462036
Email	gao.zhiwen@climatebridge.com

Project Ownership

By checking business license /16/, EIA Approval /14/, and Project Approval /12/, CTI Validation Team confirmed that Binzhou Topigs Norsvin Breeding Swine Co., Ltd. Binhai Branch is the project owner and also project proponent (PP) of project activity. Therefore, Binzhou Topigs Norsvin Breeding Swine Co., Ltd. Binhai Branch. has the legal right to control and operate the project activities.

Project Start Date

By checking Operation Log /34/, CTI Validation Team confirmed that the project started operation on 05/08/2020, which is the start date of the project activity.

Project crediting period Date

The project activity adopts 3*7 renewable crediting period. CTI Validation Team confirms that the starting and ending dates of the first 7-year crediting period is as below:

Crediting Period Start date: 05/08/2020

Crediting Period End date: 04/08/2027

Project Scale and Estimated GHG Emission Reductions or Removals

Two HDPE membrane enclosed anaerobic digesters with effective volume of 9000m^3 (60m*70m*6m) were installed and utilized by the project activity. The total effective volume is 18000m^3. The project activity is expected to produce 828,154 m^3 biogas per year. As the estimated annual average GHG emission reductions or removal per year is 11,795 tCO_2e which is less than 300,000 tonnes of CO_2e per year, thus the project falls in the category of Project. Therefore, CTI Validation Team confirms that the project scale falls under Project.

Project Scale

Project	✓
Large project	

Through checking emission reductions calculation spreadsheet provided by PP, CTI Validation Team was able to confirm that the estimated GHG Emission Reductions or Removals of the project activity is as follows:

Year	Estimated GHG emission reductions or removals (tCO_2e)
05/08/2020~31/12/2020	4,814
01/01/2021~31/12/2021	11,795
01/01/2022~31/12/2022	11,795
01/01/2023~31/12/2023	11,795
01/01/2024~31/12/2024	11,795
01/01/2025~31/12/2025	11,795
01/01/2026~31/12/2026	11,795
01/01/2027~04/08/2027	6,979
Total estimated ERs	**82,563**
Total number of crediting years	**7**
Average annual ERs	**11,795**

The above estimated emission reduction is confirmed by CTI Validation Team via checking emission reduction calculation spreadsheet. CTI Validation Team confirmed that the calculation is correct and conservative.

Project location

The project activity is located at Binhai Breeding Swine Farm, Zhanhua District, Binzhou City, Shandong Province, P.R China. The project activity has been developed by Binzhou Topigs Norsvin Breeding Swine Co., Ltd. Binhai Branch. The project is located at east longitude 118°10'54" and north latitude 37°52'43" which is confirmed by site visit.

Conditions prior to project initiation

Before the implementation of the project activity, animal manure is left to decay anaerobically within the project boundary and methane is emitted to the atmosphere.

Project compliance with applicable laws, statutes and other regulatory frameworks

CTI Validation Team confirms that the Project has been approved by Chinese government by checking the Project approval and Environmental Impact Assessment (EIA) approval.

By checking laws and regulations, i.e. Environmental Protection Law of People's Republic of China, Law of the People's Republic of China on the Prevention and Control of Solid Waste Pollution, Regulations on prevention and control of pollution from large scale livestock and poultry breeding, Regulations on Environmental Protection in Shandong Province, it is confirmed that the project activity is in complicate with all laws and regulations in China.

Participation under other GHG programs

- Projects registered (or seeking registration) under other GHG program(s)

The project has neither been registered nor seeking registration under any other GHG programs. The project is seeking registration only in VCS program. A declaration from PP has been provided and checked by CTI.

CTI Validation Team checked the REC Mechanism database and Chinese Emission Trading System (Chinese ETS) and found that the project activity is not accredited / registered under REC mechanism or Chinese ETS mechanism. Also, CTI Validation Team checked the registries of CDM EB and Goldstandard through website http://cdm.unfccc.int/ and http://www.goldstandard.org/ to confirm the same.

- Rejection by other GHG programs

The Project is not rejected by other GHG programs. A declaration for the same has been provided and checked by CTI.

Also, CTI Validation Team checked the registries of CDM EB, Goldstandard and Verra through website http://cdm.unfccc.int/, http://www.goldstandard.org/ and http://verra.org/ to confirm the same.

Other forms of credit

- Emissions trading programs and other binding limits

The assessment team confirms that the Net GHG emission reductions or removals generated by the Project will not be used for compliance with an emissions trading program or to meet binding limits on GHG emissions in any Emission Trading program or other binding limits. The verification team checked the REC Mechanism database of China, Chinese Emission Trading System (Chinese ETS) and Chinese Certified Emission Reduction Mechanism, and found that the project activity is not accredited / registered under REC mechanism, Chinese ETS, or CCER mechanism. Also, CCER mechanism is currently suspended by Chinese government, the project activity will not and is not allowed to registered under CCER mechanism. Thus, the assessment team concluded that the project activity not involved on other Emissions trading programs and other binding limits.

Furthermore, as per "Notice on Strengthening Enterprise Greenhouse Gas Emission Report Management" /21/ issued by National Development and Reform Committee of P. R. China, China has a national emissions trading scheme only cover the high-emission industries, including thermal power generation, petrochemical, chemical, building materials, iron and steel, non-ferrous, paper, aviation and

other key emission industries that emitted at least 26,000 tons of CO_2e/year. By checking "List of key emissions in the national carbon emissions transaction quota management in 2019-2020" /24/ issued by Ministry of Ecology and Environment of P.R.China, the project proponent is not included in the mandatory emission control scheme and thus no emission cap was enforced for the project proponent.

- Other forms of environmental credit sought or received and eligible to be sought or received

The Project has no intension to generate any other form of GHG-related environmental credit for GHG emission reductions or removals claimed under the VCS Program. Renewable energy certificates are available for trading in the host country. However, the same is not availed by the project proponent. CTI Validation Team also checked the REC website and found the declaration to be correct.

Additional information relevant to the project

- Leakage management for AFOLU projects

The project activity is not a AFOLU project, therefore, this section is Not applicable.

- Commercially sensitive information

No commercially sensitive information has been excluded from the public version of the project description. The details are presented transparently to CTI Validation Team for analysis which lead to positive conclusion for this validation.

- Sustainable development contributions

By checking EIA Report, Staff roster, China's National Plan on Implementation of the 2030 Agenda for Sustainable Development and 17 SDGs defined by UNDP, also by interviewing stakeholders during site visit, CTI Validation Team confirmed that the project activity would contribute to sustainable development in local region and China's Sustainable Development Goals (SDG).

The employment opportunities created have been assessed through checking Staff roster /32/ and other relevant HR records. The validation process of monitoring of emission reduction related parameters have been included in section 4.1.1 of this report. The specific SDGs that the project activity could achieve have been listed as follows:

- **SDG13** "Take urgent action to combat climate change and its impacts": The project uses HDPE membrane enclosed anaerobic digesters to treat animal manure, collect and destroy the generated biogas, avoiding methane emissions. This contributes to achieve one of China's stated sustainable development priorities "Actively adapt to climate change and strengthen resistance capacity to climate risks in agriculture, forestry, water resources and other key fields, as well as cities, coastal regions and ecologically vulnerable areas".

- **SDG 8** "Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all": the project activity will increase employment opportunities for the operation of the project activity. This contributes to one of China's actions for promoting sustainable

developing: "by 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value".

- SDG 6 "Ensure availability and sustainable management of water and sanitation for all": the project activity will enhance the quality of the water, decrease odour nuisance, improve the working environment of the workers of the livestock farm, and minimize health risks of local residents. This contributes to one of China's actions for promoting sustainable developing: "Continue to implement water pollution prevention and control. Coordinate the development of high quality protection and high levels of development and continuously improve the ecological environment of the basin.

Therefore, CTI Validation Team confirmed that the PD is accurate, complete, and provides an understanding of the nature of the project.

3.2 Safeguards

3.2.1 No Net Harm

The Environmental Impact Assessment (EIA) Report of the project activity was approved by the Environmental Protection Bureau of Zhanhua District, Binzhou City on 29/11/2018 (Approval No. "Zhanhuanzi [2018] No.76"). The assessment team confirm all environmental impacts has been analyzed and no net harm was detected. Refer to section 3.2.3 of this report for detailed environmental impacts arising from the Project construction and operation.

Through interview with local stakeholders, it is confirmed by the assessment team the implementation of the project will improve local socio-economic development and contribute to the sustainable development as described in section 3.1 of this report above. Therefore, CTI Validation Team confirmed that no potential negative environmental and socio-economic impacts were identified and no net harm was detected for the project activity.

3.2.2 Local Stakeholder Consultation

As per the VCS requirements, it is necessary to invite the relevant stakeholders, prior of the validation process. CTI Validation Team checked the relevance of the dates during the validation site visit.

By checking the attendance list, CTI validation team confirmed a local stakeholder consultation survey was conducted to collect comments from local residents through distributing questionnaires on 06/05/2019 by the project owner. Through checking questionnaires, as well as interviewing with the project owner and local stakeholder, CTI Validation Team confirmed that the questionnaire includes a brief summary of the project activity, including the project design and other relevant key information. In total 30 out of 30 questionnaires were returned with a 100% response rate.

By checking the questionnaires, as well as interviewing with the project owner and local stakeholder, CTI Validation Team confirm that the local stakeholder has no negative comments for the construction of the project activity. As confirmed with PP, stakeholder meetings will be held every year to keep on-going communications with various stakeholders, besides, local government agencies and competent

authorities will conduct spot checks on the implementation of the project. Therefore, CTI Validation Team was able to confirm that the stakeholder meeting was adequate and appropriate.

3.2.3 Environmental Impact

An Environmental Impact Assessment has been conducted by the project participants. CTI Validation Team has reviewed the documentation of the presented information, eg. EIA Report and EIA Approval. The EIA Approval confirms the correctness of the approach used by PPs. In conclusion, the PPs have followed the requirements of the host country with regards to addressing environmental impacts as below:

Air Pollution

By checking EIA Report /13/ and site interview with stakeholders, the assessment team confirmed during the construction period, construction dust and road dust has a certain effect to the surrounding areas of construction site. Effective measures are taken and the management is strengthened to limited the impacts only to the surrounding area of the construction site. The influence will disappear as long as the construction is finished.

During the operation period, the air pollution mainly includes the exhaust gas of the flaring system. The exhaust gas is to be treated through biological purification equipment before being discharged into the biogas flaring system and biogas heating system. The NO_x, sulfur dioxide, H_2S, NH_3 and particulate matter in the exhaust gas of the project meets the standards of standard of " Malodorous Pollutants Emission Standards " (GB14554-93) and the standard of " Discharge standard of pollutants for livestock and poultry breeding " (DB37/534-2005).

Therefore, the emission of exhaust gas has little impact on surrounding environment.

Wastewater

During the construction period, the wastewater is mainly domestic sewage and construction wastewater. By checking EIA Report /13/ and site interview with stakeholders, the assessment team confirmed that measures were taken, including construct temporary diversion ditches on the construction site; set up a sedimentation tank and reuse the washing water for construction machinery as much as possible after simple treatment of equipment and vehicles.

During the operation period, the wastewater is mainly biogas slurry from anaerobic digesters. By checking EIA Report /13/ and site interview with stakeholders, the assessment team confirmed that most biogas slurry will be recycled in anaerobic digesters, and the rest biogas slurry will be treated in the wastewater treatment system and be then used for nearby farm irrigation.. No wastewater will be discharged to the environment.

Noise

By checking the EIA Report /13/, the assessment team confirmed that the noise generated by the project construction are mainly mechanical noise and has a slight impact on the surrounding sensitive

points, and its pollution impact is localized and short-term. Reasonable measures have been taken to reduce the noises to acceptable range. Furthermore, the project is located in no residential areas.

During the operation period, the noise is mainly the sound of pumps and fans in the animal manure treatment area. As per the EIA Report /13/ and site visit, the assessment team confirmed that measures have been taken to effectively reduce the noises to standard values, i.e. Class 2 standard in the "Environmental Noise Emission Standard for Industrial Enterprise Plant Boundaries" (GB12348-2008).

Solid Waste

By checking the EIA Report /13/ and interview with stakeholder, the assessment team confirmed during the construction period, a certain amount of construction waste and domestic waste from construction workers will be generated, of which part of the construction waste will be recycled, and the unusable waste will be handed over to the sanitation department for disposal. After the above measures are taken, the solid waste of the project will not cause pollution to the surrounding environment.

During the operation period, the solid waste of the project is mainly biogas residue, and domestic garbage. By checking the EIA Report /13/ and site visit, the assessment team confirmed the biogas residue are used as material to produce organic fertilizer. The domestic garbage will be collected and sent to disposal by local sanitation department.

In conclusion, after the above measures are performed, the negative impacts on environment will be minimized below the requirements of laws and regulations during the construction and operational period.

After the above measures are performed, the negative impacts on environment will be minimized below the requirements of laws and regulations during the construction and operational period.

3.2.4 Public Comments

CTI Validation Team noted that this project was open for public comment from 23/04/2022 to 22/05/2022. The detail was checked by CTI Validation Team in the following web platform: https://registry.verra.org/app/projectDetail/VCS/2880. During the period, no public comments were received.

3.2.5 AFOLU-Specific Safeguards

The project activity is not an AFOLU project. For non-AFOLU projects, this section is not required.

3.3 Application of Methodology

3.3.1 Title and Reference

CTI Validation Team checked that following methodology and tools are applicable for the project activity as below:

Title	Methane recovery in animal manure management systems
Type III	The project activity meets the eligibility criteria of small scale project as the estimated annual average GHG emission reductions or removal per year is 11,795 tCO_2e which is less than 60,000 tonnes of CO_2e per year.
Methodology	Methane recovery in animal manure management systems, AMS-III.D., Version 21.0
Sectoral scope(s)	13
Category	Approved Small Scale Methodology
Tools	Tools referred with above methodology and applicable for project activity are: - Tool 06: Project emissions from flaring, Version 03.0 - Tool 14: Project and leakage emissions from anaerobic digesters, version 02.0

3.3.2 Applicability

For the project activity, the applicability of baseline methodology and methodological tool is justified as below:

Applicability criteria	Justification of the project situation
This methodology covers project activities involving the replacement or modification of anaerobic animal manure management systems in livestock farms to achieve methane recovery and destruction by flaring/combustion or gainful use of the recovered methane. It also covers treatment of manure collected from several farms in a centralized plant.	By checking EIA Report /13/ and through on-site interview, CTI Validation Team confirmed that the project activity uses an anaerobic animal manure management system to treat manure waste (breeding swine) from Binhai Breeding Swine Farm, which is located in Binhai Breeding Swine Farm, Zhanhua District, Binzhou City, Shandong Province, P.R China. The project activity replaces existing anaerobic animal manure management system (open lagoon) in Binhai Breeding Swine Farm, of which the main purpose is to achieve methane recovery and destruction by flaring. Therefore, it is confirmed that this criteria is applicable.
This methodology is only applicable under the following conditions:	By checking the EIA Report /13/ and through on-site inspection, it is confirmed that all the livestock population in the farm are captive breeding, which

(a)The livestock population in the farm is managed under confined conditions; (b)Manure or the streams obtained after treatment are not discharged into natural water resources (e.g. river or estuaries), otherwise "AMS-III.H Methane recovery in wastewater treatment" shall be applied; (c)The annual average temperature of baseline site where anaerobic manure treatment facility is located is higher than 5°C; (d)In the baseline scenario the retention time of manure waste in the anaerobic treatment system is greater than one month, and if anaerobic lagoons are used in the baseline, their depths are at least 1 m; (e)No methane recovery and destruction by flaring or combustion for gainful use takes place in the baseline scenario.	is managed under confined conditions. Therefore, condition (a) is applicable. By checking the EIA Report /13/, EIA Approval /14/ and through on-site inspection, it is confirmed that manure or the streams obtained after treatment are not discharged into natural water resources, including river and estuaries. Therefore, condition (b) is applicable. By checking public information /28/, it is confirmed the annual average temperature of baseline site where anaerobic manure treatment facility is located, i.e. the project location, is 13℃, which is higher than 5°C. Therefore, condition (c) is applicable. By checking EIA Report /13/ and interviewing PP during site visit, it is confirmed that the baseline scenario the retention time of manure waste in the anaerobic treatment system (open lagoon) is greater than one month and the depth of the open lagoon is 6m, greater than 1m. Therefore, condition (e) is applicable. By checking EIA Report /13/, FSR /11/ and interview PP during site visit, it is confirmed that no methane recovery and destruction by flaring or combustion for gainful use takes place in the baseline scenario. Therefore, condition (e) is applicable.
The project activity shall satisfy the following conditions: (a)The residual waste from the animal manure management system shall be handled aerobically, otherwise the related emissions shall be taken into account as per relevant procedures of "AMS-III.AO Methane recovery through controlled anaerobic digestion". In the case of soil application, proper conditions and procedures (not resulting in methane emissions) must be ensured; (b)Technical measures shall be used (including a flare for exigencies) to ensure that all biogas produced by the digester is used or flared; (c)The storage time of the manure after removal from the animal barns, including transportation, should not exceed 45 days before being fed into the anaerobic digester. If the project proponent can demonstrate that the dry matter content of the manure when removed from the animal barns is larger than 20%, this time constraint will not	By checking the EIA Report /13/, FSR /11/ and interviewing with PP during site visit, and through site inspection, it is confirmed that the residual waste from the animal manure management system of the project activity will be used to produce organic fertilizer, which is handled aerobically and will not result in methane emissions.. Therefore, condition (a) is applicable. By checking EIA Report /13/, FSR /11/ and EIA Approval /14/, as well as site inspection, it is confirmed that a biogas heating system has been installed to ensure that all biogas produced by the digester is flared during heating period and a flaring system has been installed to ensure that all biogas produced by the digester is flared during non-heating period. Furthermore, an emergency flare was installed to ensure that biogas are combusted when exigencies happened. Therefore, condition (b) is applicable. By checking EIA Report /13/, it is confirmed that the storage time of the manure after removal from the animal barns, including transportation, are 12

apply.	hours, not exceed 45 days before being fed into the anaerobic digester. Therefore, condition (c) is applicable.
Projects that recover methane from landfills shall use "AMS-III.G Landfill methane recovery" and projects for wastewater treatment shall use AMS-III.H. Projects for composting of animal manure shall use "AMS-III.F Avoidance of methane emissions through composting". Project activities involving co-digestion of animal manure and other organic matters shall use the methodology "AMS-III.AO Methane recovery through controlled anaerobic digestion".	By checking EIA Report /13/, FSR /11/and EIA Approval /14/, it is confirmed that the project recovers methane from an anaerobic animal manure management system used by Binhai Breeding Swine Farm, not from landfills, or wastewater treatment, or composting of animal manure, or co-digestion of animal manure and other organic matters. Therefore, this criteria is not applicable.
Utilization of the recovered biogas in one of the options detailed in AMS-III.H is also eligible under this methodology. The respective procedures in AMS-III.H shall be followed in this regard. If the recovered biogas is used to power auxiliary equipment of the project activity, it should be taken into account accordingly, using zero as its emission factor; however, energy used for such purposes is not eligible as an SSC CDM Type I project component.	By checking EIA Report /13/ and EIA Approval /14/, as well as through on-site interview, it is confirmed that during heating period, the heat (thermal energy) generated from recovered biogas is used by Binhai Swine farm, which is applicable under para 4 (a) of AMS-III.H, i.e. the recovered biogas are utilised for the thermal or mechanical, electrical energy generation directly instead of combustion/flaring. As per para 5 of AMS-III.H, if the recovered biogas is used for project activities covered under paragraph 4(a), that component of the project activity can use a corresponding methodology under Type I. As confirmed with PP and through on site inspection, it is confirmed that the heat (thermal energy) generated from recovered biogas is used by Binhai Swine farm, not by auxiliary equipment of the project activity and as confirmed with PP, no emission reductions will be claimed for SSC CDM Type I project component.
New facilities (Greenfield projects) and project activities involving capacity additions compared to the baseline scenario are only eligible if they comply with the related and relevant requirements in the "General guidelines for SSC CDM methodologies".	The project is a Greenfield project, which recovers methane from an anaerobic animal manure management system used by Binhai Breeding Swine Farm. The project activity meets the eligibility criteria of small scale project, i.e. "General guidelines for SSC CDM methodologies", as the estimated annual average GHG emission reductions or removal per year is 11,795 tCO_2e which is less than 60,000 tonnes of CO_2e per year. Therefore, it is confirmed that this criteria is applicable.

The requirements concerning demonstration of the remaining lifetime of the replaced equipment shall be met as described in the "General guidelines for SSC CDM methodologies".	By checking the EIA Report /13/, FSR /11/ and interviewing with PP during site visit and through site inspection, it is confirmed the project activity replaced existing anaerobic animal manure management systems (open lagoon), and no equipment was replaced by the project activity. Therefore, this criteria is not applicable.
Measures are limited to those that result in aggregate emission reductions of less than or equal to 60 kt CO_2 equivalent annually from all Type III components of the project activity.	All Type III components of the project activity recovered and destroyed an estimated annual average GHG (methane) emission of 11,795 tCO_2e which is less than 60,000 tonnes of CO_2e per year. Therefore, this criteria is applicable.

Applicability conditions of "Tool 06: Project emissions from flaring"

Applicability criteria	Justification of the project situation
The tool is applicable to enclosed or open flares and project participants should document in the CDM-PDD the type of flare used in the project activity.	By checking EIA Report /13/, FSR /11/ and EIA Approval /14/, as well as site inspection, it is confirmed that enclosed flare system will be used by the project activity for combustion of biogas generated. Therefore, this criteria is applicable.
This tool is applicable to the flaring of flammable greenhouse gases where: (a) Methane is the component with the highest concentration in the flammable residual gas; and (b) The source of the residual gas is coal mine methane or a gas from a biogenic source (e.g. biogas, landfill gas or wastewater treatment gas).	By checking EIA Report /13/, FSR /11/, as well as onsite inspection, it is confirmed that the generated biogas with high methane concentration and the source of the residue gas is a gas from biogas. Therefore, this criteria is applicable.
The tool is not applicable to the use of auxiliary fuels and therefore the residual gas must have sufficient flammable gas present to sustain combustion. For the case of an enclosed flare, there shall be operating specifications provided by the manufacturer of the flare.	By checking EIA Report /13/, FSR /11/ and on site inspection, it is confirmed that the project activity uses a new anaerobic animal manure management system to treat manure waste without utilize of auxiliary fuels. The residual gas contains high concentration methane and therefore have sufficient flammable gas present to sustain combustion. During the heating period, recovered biogas was sent to a biogas heating system for heat generation. During the non-heating period, recovered biogas was sent to an enclosed flare for combustion. The operation specifications have been provided by the manufacturer of the flare and has been validated by CTI. Therefore, this criteria is applicable.

Applicability conditions of "Tool 14: Project and leakage emissions from anaerobic digesters"

Applicability criteria	Justification of the project situation
This tool provides procedures to calculate project and leakage emissions associated with anaerobic digestion in an anaerobic digester. The tool is not applicable to other systems where waste may be decomposed anaerobically, for instances stockpiles, SWDS or unaerated lagoons.	By checking EIA Report /13/, FSR /11/, as well as onsite inspection, it is confirmed that the project activity uses an anaerobic animal manure management system to treat manure waste (Breeding swine) from Binhai Breeding Swine Farm, of which the main purpose is to use HDPE membrane enclosed anaerobic digesters to treat animal manure waste and collect the generated biogas. The biogas will be used for heat generation during the heating period (October to April next year) and will be destroyed in the biogas flaring system during the rest of the months (May to September). The residual waste from the HDPE membrane enclosed anaerobic digesters will be handled aerobically to produce organic fertilizer at the project site. The project activity does not involve in other systems where waste may be decomposed anaerobically, for instances stockpiles, SWDS or unaerated lagoons. Therefore, this criteria is applicable.
The following sources of project emissions are accounted for in this tool: (a) CO_2 emissions from consumption of electricity associated with the operation of the anaerobic digester; (b) CO_2 emissions from consumption of fossil fuels associated with the operation of the anaerobic digester; (c) CH_4 emissions from the digester (emissions during maintenance of the digester, physical leaks through the roof and side walls, and release through safety valves due to excess pressure in the digester); and (d) CH_4 emissions from flaring of biogas.	By checking EIA Report /13/, FSR /11/, and during on site inspection, it is confirmed that the project emissions include CO_2 emissions from consumption of electricity associated with the operation of the anaerobic digester (a); CH_4 emissions from the digester (c); and CH_4 emissions from flaring of biogas (d). By checking EIA Report /13/, FSR /11/, and through on site inspection, it is confirmed the project does not involve fossil fuel consumption, and therefore the CO2 emission from use of fossil fuels is not included (b).
The following sources of leakage emissions are accounted for in this tool: (a) CH_4 and N_2O emission from composting of digestate; (b) CH_4 emissions from the anaerobic decay of digestate disposed in a SWDS or subjected to	Not applicable. By checking EIA Report /13/, FSR /11/, and EIA Approval /14/, it is confirmed that the project activity does not involve composting of digestate or anaerobic decay of digestate disposed in a SWDS or subjected to anaerobic storage, such as in a stabilization pond.

anaerobic storage, such as in a stabilization pond.	
Emission sources associated with N_2O emissions from physical leakages from the digester, transportation of feed material and digestate or any other on-site transportation, piped distribution of the biogas, aerobic treatment of liquid digestate and land application of the digestate are neglected because these are minor emission sources or because they are accounted in the methodologies referring to this tool.	Applicable, as per AMSIII.D., N_2O are minor emission sources and therefore was neglected.

CTI Validation Team confirmed that the application of the baseline methodology is transparent and conservative and confirms that the chosen baseline and monitoring methodology i.e. AMS-III.D. Version 21.0 is applicable to the project activity.

The project activity is a Type III project with annual average GHG emission reductions or removal per year of the project activity is 11,795 tCO_2e, less than 60,000 tonnes of CO_2e per year, which is applicable as per small scale project activities methodology AMS-III.D. Version 21.0.

3.3.3 Project Boundary

As per AMS-III.D., the project boundary includes the physical, geographical site(s) of:

(a) The livestock;

(b) Animal manure management systems (including centralised manure treatment plant where applicable);

(c) Facilities which recover and flare/combust or use methane.

Therefore, CTI Validation Team confirmed that the project boundary of the project activity includes the physical and geographical sites of Binhai Swine Farm, the animal manure management system, biogas heating system, wastewater treatment system, biogas heating system and residual waste treatment system.

The sources and GHG gases involved for the Project activity are as below.

Source		Gas	Included?	Justification/Explanation
Baseline	Direct emissions from the manure treatment processes	CO_2	No	Excluded for simplification. This is conservative.
		CH_4	Yes	By checking EIA Report /13/ and FSR /11/, it is confirmed this is the major emission source.
		N_2O	No	Excluded for simplification. This is conservative.
Project	Physical leakage of biogas in the	CO_2	No	Excluded for simplification. This emission source is assumed to be very small.

Source		Gas	Included?	Justification/Explanation
	manure management systems	CH_4	Yes	By checking EIA Report /13/ and FSR /11/, it is confirmed this is the major emission source.
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small.
	Emissions from flaring or combustion of the gas stream	CO_2	No	Excluded for simplification. This emission source is assumed to be very small.
		CH_4	Yes	By checking EIA Report /13/ and FSR /11/, it is confirmed this is the major emission source.
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small.
	Emissions from use of fossil fuels or electricity	CO_2	Yes	CO_2 emissions from use of electricity is maybe the main emission source. By checking EIA Report /13/ and through on site inspection, it is confirmed the project does not involve fossil fuel consumption, and therefore the CO_2 emission from use of fossil fuels is not included.
		CH_4	No	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small.
	Emissions from incremental transportation distances	CO_2	No	By checking EIA Report /13/, it is confirmed this is the major emission source.
		CH_4	No	Through onsite inspection, it is confirmed that the HDPE membrane enclosed anaerobic digesters is installed within the breeding swine farm, and therefore no incremental transportation is involved in the project activity.
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small.
	Emissions from the storage of manure	CO_2	No	Excluded for simplification. This emission source is assumed to be very small.
		CH_4	No	By checking EIA Report /13/ and interviewed with PP during site visit, it is confirmed the storage time of the manure after removal from the animal barns is 12 hours, which is within 24 hours before being fed into the anaerobic digester, therefore emissions from the storage of manure is excluded.
		N_2O	No	Excluded for simplification. This emission source

Source		Gas	Included?	Justification/Explanation
				is assumed to be very small.

3.3.4 Baseline Scenario

By checking Environmental Impact Assessment (EIA) approval /14/ and Project Approval /12/, CTI Validation Team confirms that the Project has been approved by Chinese government. By checking laws and regulations, i.e. Environmental Protection Law of People's Republic of China, Law of the People's Republic of China on the Prevention and Control of Solid Waste Pollution, Regulations on prevention and control of pollution from large scale livestock and poultry breeding, Regulations on Environmental Protection in Shandong Province, it is confirmed that the project activity is in complicate with all laws and regulations in China.

As per AMS-III.D., the baseline scenario is the situation where, in the absence of the project activity, animal manure is left to decay anaerobically within the project boundary and methane is emitted to the atmosphere.

As per CDM Validation and Verification Standard for project activities version 03.0, "where the baseline scenario is not prescribed in the approved methodology, the DOE shall assess the list of identified credible alternatives to the project activity in the VCS PD selected to determine the most realistic baseline scenario." As the selected small scale methodology clearly mention the baseline scenario and the same has been opted in this project, therefore, no further analysis on baseline is required.

CTI Validation Team confirms that the VCS PD conforms to the guidance given by EB via CDM Validation and Verification Standard for project activities version 03.0 and VCS via VCS standard version 4.3.

Therefore, CTI Validation Team confirms that the baseline scenario of the project activity is:

The animal manure waste was left to decay in anaerobic manure management system (lagoon) at the livestock farms and methane is emitted to the atmosphere directly without any methane recovery and destruction facility.

3.3.5 Additionality

As per AMS-III.D, Project activities may demonstrate the additionality by showing that there is no regulation in the host country, applicable to the project site, that requires the collection and destruction of methane from livestock manure. If so, it is not required to apply the "Guidelines on the demonstration of additionality of small-scale project activities". This additionality condition also applies to Greenfield project activities.

CTI confirmed that there is no regulation in China, applicable to the project site, that requires the collection and destruction of methane from livestock manure through checking relevant laws and regulations, i.e.:

a) Law of the People's Republic of China on Environment Protection;

b) Law of the People's Republic of China on the Prevention and Control of Solid Waste Pollution;

c) Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution;

d) Regulations on prevention and control of pollution from large scale livestock and poultry breeding;

e) Discharge standard of pollutants for livestock and poultry breeding (GB/T 18596);

f) Technical standard of pollution prevention for livestock and poultry breeding (HJ/T 81).

Therefore, the project activity is deemed automatically additional, which is in line with AMS-III.D.

3.3.6 Quantification of GHG Emission Reductions and Removals

CTI Validation Team checked the baseline, project and leakage calculation and confirm that the evaluation of baseline, project and leakage is as per the approved methodology and formula used to calculate the same is correct. The detail analysis is as below:

Baseline emissions

As per AMS-III.D., the baseline scenario is the situation where, in the absence of the project activity, animal manure is left to decay anaerobically within the project boundary and methane is emitted to the atmosphere. Baseline emissions (BE_y) are calculated by using one of the following two options:

(a) Using the amount of the waste or raw material that would decay anaerobically in the absence of the project activity, with the most recent IPCC Tier 2 approach (please refer to the chapter 'Emissions from Livestock and Manure Management' under the volume 'Agriculture, Forestry and other Land use' of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories). For this calculation, information about the characteristics of the manure and of the management systems in the baseline is required. Manure characteristics include the amount of volatile solids (VS) produced by the livestock and the maximum amount of methane that can be potentially produced from that manure (B_o);

(b) Using the amount of manure that would decay anaerobically in the absence of the project activity based on direct measurement of the quantity of manure treated together with its specific volatile solids (SVS) content.

PP selected option (a) to calculate baseline emissions for the project activity. As per AMS-III.D., the baseline emissions are calculated as:

$$BE_y = GWP_{CH4} \times D_{CH4} \times UF_b \times \sum_{j,LT} MCF_j \times B_{0,LT} \times N_{LT,y} \times VS_{LT,y} \times MS\%_{Bl,j} \qquad \text{Equation (1)}$$

Where:

BE_y = Baseline emissions in year *y* (t CO_2e)

GWP_{CH4} = Global Warming Potential (GWP) of CH_4 applicable to the crediting period (t CO2e/t

		CH_4)
D_{CH4}	=	CH_4 density (0.00067 t/m^3 at room temperature (20 ºC) and 1 atm pressure)
LT	=	Index for all types of livestock
j	=	Index for animal manure management system
MCF_j	=	Annual methane conversion factor (*MCF*) for the baseline animal manure management system j
$B_{0,\,LT}$	=	Maximum methane producing potential of the volatile solid generated for animal type *LT* (m^3 CH_4/kg-dm)
$N_{LT,y}$	=	Annual average number of animals of type *LT* in year *y* (numbers)
$VS_{LT,y}$	=	Volatile solids production/excretion per animal of livestock *LT* in year *y* (on a dry matter weight basis, kg-dm/animal/year)
$MS\%_{Bl,j}$	=	Fraction of manure handled in baseline animal manure management system *j*
UF_b	=	Model correction factor to account for model uncertainties (0.94)[1]

(a) The maximum methane-producing capacity of the manure (Bo) varies by species and diet. The preferred method to obtain Bo measurement values is to use data from country-specific published sources, measured with a standardised method (Bo shall be based on total as-excreted VS). These values shall be compared to IPCC default values and any significant differences shall be explained. If country specific Bo values are not available, default values from tables 10 A-4 to 10 A-9 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories volume 4 Chapter 10 can be used, provided that the project participants assess the suitability of those data to the specific situation of the treatment site;

(b) VS are the organic material in livestock manure and consist of both biodegradable and non-biodegradable fractions. For the calculations the total VS excreted by each animal species is required.

Since the Chinese specific VS value are not available, as per para 18 (b) (iii) of AMS-III.D., if country specific VS values are not available, IPCC default values from 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 chapter 10 table 10 A- 4 to 10 A- 9 can be used provided that the project participants assess the suitability of those data to the specific situation of the treatment site particularly with reference to feed intake levels.

By checking Breeding Swine Purchase Contract /29/ and Breeding Swine Acceptance Confirmation /15/, it is confirmed that the genetic source of breeding swine originates from UK and Denmark and the average mass of breeding swine at the project site is 200kg. PP adopts the default value (198kg) of Region "Western Europe" from 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 chapter 10 table 10 A-8, which is 0.46kg/hd/day and the assessment team considers this value is conservative.

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

(c) B_o or VS values applicable to developed countries can be used provided the following four conditions are satisfied:

(i)The genetic source of the livestock originates from an Annex I Party;

(ii)The farm uses formulated feed rations (FFR) which are optimized for the various animal(s), stage of growth, category, weight gain/productivity and/or genetics;

(iii)The use of FFR can be validated (through on-farm record keeping, feed supplier, etc.);

(iv)The project specific animal weights are more similar to developed country IPCC default values.

(d) Methane Conversion Factors (MCF) values are determined for a specific manure management system and represent the degree to which Bo is achieved. Where available country-specific MCF values that reflect the specific management systems used in particular countries or regions shall be used. Alternatively, the IPCC default values provided in table 10.17 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 10 can be used. The site annual average temperature is taken from official data at the nearest meteorological station, or from data available from historical on site observations;

(e) The annual average number of animals ($N_{LT,y}$) is determined as follows:

$$N_{LT,y} = N_{da,y} \times \left(\frac{N_{p,y}}{365}\right) \quad \text{Equation (2)}$$

Where:

$N_{da,y}$ = Number of days animal is alive in the farm in the year *y* (numbers)

$N_{p,y}$ = Number of animals produced annually of type *LT* for the year *y* (numbers)

The parameters used to calculate BE_y ex-ante is determined and justified as below:

Parameter	Value	Data sources
GWP_{CH4}	28 tCO_2e/tCH_4	IPCC Fifth Assessment Report (AR5)
D_{CH4}	0.67 kg/m^3	As per AMS-III.D, CH_4 density is 0.00067 t/m^3 at room temperature (20 °C) and 1 atm pressure.
UF_b	0.94	As per AMS-III.D, the value of this parameter is 0.94, which is sourced from FCCC/SBSTA/2003/10/Add.2, page 25.
MCF_j	71%	Table 10.17 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 10
$B_{o,LT}$	Breeding Swine:0.45	Table 10A-8 of 2006 IPCC Guidelines for National Greenhouse

	m^3CH_4/kg-VS	Gas Inventories Volume 4 Chapter 10.
$VS_{default}$	Breeding Swine: 0.46 kg/hd/day	Table 10A-8 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 10.
$MS\%_{BI,j}$	100%	As per EIA Report /13/ and FSR /11/, as well as interview with PP and stakeholders during site visit, it is confirmed all manure were handled in baseline scenario, therefore, value of this parameter is 100%.
nd_y	365 days	As per EIA Report /13/ and FSR /11/, as well as interview with PP during site visit, it is confirmed that treatment plant was operational the whole year, which is 365 days.
$N_{da,y}$	Adult breeding Swine: 365 days	As per EIA Report /13/ and FSR /11/, as well as interview with PP during site visit, it is confirmed that animal is alive in the farm the whole year, which is 365 days.
$N_{p,y}$	Adult breeding Swine: 15.150	By checking EIA Report /13/, FSR /11/ and EIA Approval /14/, it is confirmed that the number of animals produced annually is 15.150.
$N_{LT,y}$	Adult breeding Swine: 15.150	By checking EIA Report /13/, FSR /11/ and EIA Approval /14/, it is confirmed that The annual average number of animals is 15.150. $N_{p,y} = N_{LT,y}$
$VS_{LT,y}$	167.90 kg-dm/animal/year	Calculated via equation: $VS_{LT,y} = VS_{default} * nd_y$ = 167.90 kg-dm/animal/year.
BE_y	**14,331 tCO_2e**	**Calculated via equation: (1).**

Project emissions

Project activity emissions consist of:

(a) Physical leakage of biogas in the manure management systems which includes production, collection and transport of biogas to the point of flaring/combustion or gainful use ($PE_{PL,y}$);

(b) Emissions from flaring or combustion of the gas stream ($PE_{flare,y}$);

(c) CO_2 emissions from use of fossil fuels or electricity for the operation of all the installed facilities ($PE_{power,y}$);

(d) CO_2 emissions from incremental transportation distances;

(e) Emissions from the storage of manure before being fed into the anaerobic digester ($PE_{storage,y}$).

$$PE_y = PE_{PL,y} + PE_{flare,y} + PE_{power,y} + PE_{transp,y} + PE_{storage,y}$$ Equation (3)

Where:

PE_y = Project emissions in year *y* (t CO_2e)

$PE_{PL,y}$ = Emissions due to physical leakage of biogas in year *y* (t CO_2e)

$PE_{flare,y}$ = Emissions from flaring or combustion of the biogas stream in the year *y* (t CO_2e)

$PE_{power,y}$ = Emissions from the use of fossil fuel or electricity for the operation of the installed facilities in the year *y* (t CO_2e)

$PE_{transp,y}$ = Emissions from incremental transportation in the year *y* (t CO_2e), as per relevant paragraph in AMS-III.AO

$PE_{storage,y}$ = Emissions from the storage of manure (t CO_2e)

✓ **Emissions due to physical leakage of biogas in year y ($PE_{PL,y}$)**

Project emissions due to physical leakage of biogas from the animal manure management systems used to produce, collect and transport the biogas to the point of flaring or gainful use are estimated as:

(a) 10% of the maximum methane producing potential of the manure fed into the management systems implemented by the project activity:[2]

PP selected para 17(a) from AMS-III.D., as per AMS-III.D., if the option in paragraph 17(a) is chosen, it is determined as:

$$PE_{PL,y} = 0.10 \times GWP_{CH4} \times D_{CH4} \times \sum_{i,LT} B_{0,LT} \times N_{LT,y} \times VS_{LT,y} \times MS\%_{i,y} \quad \text{Equation (4)}$$

Where:

$MS\%_{i,y}$ = Fraction of manure handled in system i in year y

If the project activity involves sequential manure management systems, the procedure specified in paragraph 18(e) shall be used to estimate the project emissions due to physical leakage of biogas in each stage

[2] 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 10 guidelines specify a default value of 10% of the maximum methane producing potential (Bo) for the physical leakages from anaerobic digesters.

The parameters used to calculate $PE_{PL,y}$ ex-ante is determined and justified as below:

Parameter	Value	Data sources
GWP_{CH4}	28 tCO_{2e}/tCH_4	IPCC Fifth Assessment Report (AR5)
D_{CH4}	0.67 kg/m^3	As per AMS-III.D, CH_4 density is 0.00067 t/m^3 at room temperature (20 ° C) and 1 atm pressure.
$B_{o,LT}$	Breeding Swine:0.45 $m^3CH_4/kg\text{-}VS$	Table 10A-8 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 10.
$VS_{default}$	Breeding Swine: 0.46 kg/hd/day	Table 10A-8 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 10.
$MS\%_{i,y}$	100%	As per EIA Report /13/ and FSR /11/, as well as interview with PP and stakeholders during site visit, it is confirmed all manure were handled in project scenario, therefore, value of this parameter is 100%.
nd_y	365 days	As per EIA Report /13/ and FSR /11/, as well as interview with PP during site visit, it is confirmed that treatment plant was operational the whole year, which is 365 days.
$N_{da,y}$	Adult breeding Swine: 365 days	As per EIA Report /13/ and FSR /11/, as well as interview with PP during site visit, it is confirmed that animal is alive in the farm the whole year, which is 365 days.
$N_{p,y}$	Adult breeding Swine: 15,150	By checking EIA Report /13/, FSR /11/ and EIA Approval /14/, it is confirmed that the number of animals produced annually is 15.150.
$N_{LT,y}$	Adult breeding Swine: 15.150	By checking EIA Report /13/, FSR /11/ and EIA Approval /14/, it is confirmed that The annual average number of animals is 15.150. $N_{p,y} = N_{LT,y}$
$VS_{LT,y}$	167.90 kg-dm/animal/year	Calculated via equation: $VS_{LT,y} = VS_{default} * nd_y$ = 167.90 kg-dm/animal/year.
$PE_{PL,y}$	**2,147 tCO_2e**	**Calculated via equation (4).**

✓ **Emissions from flaring or combustion of the biogas stream in the year y ($PE_{flare,y}$)**

In the case of flaring of the recovered biogas, project emissions are estimated using the procedures described in the methodological tool "Project emissions from flaring" (version 04.0). As per this tool, project emissions from flaring ($PE_{flare,y}$) are calculated as the sum of emissions for each minute m in year y, based on the methane mass flow in the residual gas ($F_{CH4,RG,m}$) and the flare efficiency ($\eta_{flare,m}$), as follows:

$$PE_{flare,y} = GWP_{CH4} \times \sum_{m=1}^{525600} F_{CH4,RG,m} \times (1 - \eta_{flare,m}) \times 10^{-3}$$ Equation (5)

Where:

GWP_{CH4} = Global warming potential of methane valid for the commitment period (tCO_2e/tCH_4)

$F_{CH4,RG,m}$ = Mass flow of methane in the residual gas in the minute m (kg)

$\eta_{flare,m}$ = Flare efficiency in minute m

$F_{CH4,RG,m}$ is mass flow of methane in the residual gas in the minute m (kg), which is calculated as follows:

$$\sum_{m=1}^{525600} F_{CH4,RG,m} = Q_{CH4,y} = Q_{biogas,y} \times f_{CH4,default} \times \rho_{CH4}$$ Equation (6)

The parameters used to calculate $PE_{flare,y}$ ex-ante is determined and justified as below:

Parameter	Value	Data sources
GWP_{CH4}	28 tCO_{2e}/tCH_4	IPCC Fifth Assessment Report (AR5)
D_{CH4} (ρCH_4)	0.67 kg/m^3	As per AMS-III.D., CH_4 density (0.00067 t/m^3 at room temperature (20°C) and 1 atm pressure).
Q_{biogas}	345,064m^3 (for non-heating period from May to September)	By checking EIA Report /13/, FSR /11/ and EIA Approval /14/, it is confirmed that the amount of biogas collected at the anaerobic digester system outlet is 828,154 m^3 biogas per year (483,090 m^3 for heating period from October to April next year, and 345,064m^3 for non-heating period from May to September).
$f_{CH4,default}$	0.6	As per "Tool to Project and leakage emissions from anaerobic digesters", a default value is applied, which is based on reported values from registered projects and research papers (Davidsson, 2007).
$\eta_{flare,m}$	90%	By checking EIA Report /13/ and through on site inspection, it is confirmed the project activity utilized an enclosed flare. As per "Project emissions from flaring (version 03.0)", in the case of enclosed flares, PP may choose between the following two options to determine the flare efficiency for minute m ($\eta_{flare,m}$): (a) Option A: Apply a default value for flare efficiency; (b) Option B: Measure the flare efficiency. PP selected option A and a default value was applied for the project activity. For this option, the flare efficiency for the minute m ($\eta_{flare,m}$) is 90% when the following two conditions are met to demonstrate that the flare is operating: (a) The temperature of the flare ($T_{EG.m}$) and the flow rate of the

		residual gas to the flare ($F_{RG,m}$) is within the manufacturer's operating specification for the flare ($SPEC_{flare}$) in the minute m; and (b) The flame is detected in the minute m ($Flame_m$). By checking Technical Specification of enclosed flaring system /18/, it is confirmed the above two conditions are met and therefore the default value for flare efficiency 90% can be applied. Furthermore, this parameter will be monitored ex post.
$Q_{CH4,y}$	tCH_4	Calculated via equation (6).
$PE_{flare,y}$	**388 tCO_2e**	**Calculated via equation (5).**

✓ **Emissions from the use of fossil fuel or electricity for the operation of the installed facilities in the year y ($PE_{power,y}$)**

Project emissions from electricity and fossil fuel consumption are determined by following the methodological tool "Project and leakage emissions from anaerobic digesters", where $PE_{Power,y}$ is the sum of $PE_{EC,y}$ and $PE_{FC,y}$ in the tool.

$$PE_{power} = PE_{EC,y} + PE_{FC,y}$$ Equation (7)

Where:

$PE_{EC,y}$ = Project emissions from electricity consumption associated with the anaerobic digester in year y (tCO_2)

$PE_{FC,y}$ = Project emissions from fossil fuel consumption associated with the anaerobic digester in year y (tCO_2)

By checking EIA Report /13/, FSR /11/ and through site inspection, it is confirmed that the project use no electricity or fossil fuel for operation of the installed facilities, therefore, the emissions from the use of electricity and fossil fuel are not considered. Therefore, PE_{power} = 0.

✓ **Emissions from incremental transportation in the year y ($PE_{transp,y}$)**

By checking EIA Report /13/, EIA Approval /14/, as well as through site inspection, it is confirmed that the HDPE membrane enclosed anaerobic digesters is installed within the geographic boundary of the breeding swine farm (project site), therefore, the project activity does not involve incremental transportation and emissions from incremental transportation is 0.

✓ **Emissions from the storage of manure ($PE_{storage,y}$)**

As per para 24 of AMS-III.D., project emissions on account of storage of manure before being fed into the anaerobic digester shall be accounted for **if both condition (a) and condition (b) below are satisfied**:

(a) The storage time of the manure after removal from the animal barns, including transportation, exceeds 24 hours before being fed into the anaerobic digester;

(b) The dry matter content of the manure when removed from the animal barns is less than 20%.

By checking EIA Report /13/ of the project activity and interview with PP during site visit, it is confirmed that the storage of manure before being fed into the anaerobic digester is 12 hours. Therefore, condition(a) is not satisfied. Hence, project emissions on account of storage of manure before being fed into the anaerobic digester are not accounted for, i.e. $PE_{storage,y} = 0$.

In conclusion, $PE_y = 2,147\ tCO_2e + 388\ tCO_2e + 0 + 0 = 2,536\ tCO_2e$

Leakage

As per Tool 14 "Project and leakage emissions from anaerobic digesters" (version 02.0), the leakage emissions associated with the anaerobic digester depend on how the digestate is managed. They include emissions associated with storage and composting of the digestate.

As justified above, the digestate generated from anaerobic digesters of the project (HDPE membrane enclosed anaerobic digesters) will be handled aerobically to produce organic fertilizer at the project site. During site investigation, it is confirmed that the digestate will not be stored under anaerobic conditions. Instead, the digested liquid is collected and transported to an on-site workshop for aerobic fermentation. During this process, the forklift is used every day to turn the pile over, so that the material is fully oxygenated. After sufficient fermentation, the digestate is dried and sold. This process complies with the requirements of "Sanitary Requirements for Harmless Excrement" (GB 7959-2012) and does not involve storage or anaerobic composting.

Furthermore, the project activity does not involve the anaerobic decay of digestate disposed in a SWDS or subjected to anaerobic storage, such as in a stabilization pond.

Therefore, leakage emissions of the project associated with the anaerobic digester is not accounted for.

Emission Reductions

For **ex ante estimation** of emission reductions, according to AMS-III.D., Version 21.0, emission reductions are calculated as follows:

$ER_y = BE_y - PE_y - LE_y$

Where:

ER_y	=	Emission reductions in year y (t CO_2e/yr)
BE_y	=	Baseline emissions in year y (t CO_2e/yr)
PE_y	=	Project emissions in year y (t CO_2e/yr)
LE_y	=	Leakage emissions in year y (t CO_2e/yr)

For **ex post determination** of emission reductions, according to AMS-III.D., Version 21.0, the emission reductions achieved by the project activity will be determined ex post through direct measurement of the amount of methane fuelled, flared or gainfully used. It is likely that the project activity involves manure treatment steps with higher methane conversion factors (MCF) than the MCF for the manure

treatment systems used in the baseline situation, therefore the emission reductions achieved by the project activity are limited to the ex post calculated baseline emissions minus the project emissions using the actual monitored data for the project activity (i.e. $N_{LT,y}$, $MS\%_{i,y}$, $MS\%_{l}$, AI_l, as well as $VS_{LT,y}$ in cases where adjusted values for animal weight are used). The emission reductions achieved in any year are the lowest value of the following:

$$ER_{y,ex\ post} = min\left[\left(BE_{y,ex\ post} - PE_{y,ex\ post}\right), \left(MD_y - PE_{power,y,ex\ post}\right)\right] \quad \text{Equation (8)}$$

Where:

$ER_{y,ex\ post}$ = Emission reductions achieved by the project activity based on monitored values for year y (t CO_2e)

$BE_{y,ex\ post}$ = Baseline emissions calculated using equation 1 (for projects using option in paragraph 17(a)) using ex post monitored values of $N_{LT,y}$ and if applicable $VS_{LT,y}$. For projects using option in paragraph 17(b), the ex post monitored values for $Q_{manure,j,LT,y}$ and $SVS_{j,LT,y}$ are used

$PE_{y,ex\ post}$ = Project emissions calculated using equation 6 using ex post monitored values of $N_{LT,y}$, $MS\%_{i,y}$, $MS\%_{l}$, AI_l, $Q_{res\ waste,y}$ and if applicable $VS_{LT,y}$

MD_y = Methane captured and destroyed or used gainfully by the project activity in year y (t CO_2e)

$PE_{power,y,ex\ post}$ = Emissions from the use of fossil fuel or electricity for the operation of the installed facilities based on monitored values in the year y (t CO_2e)

Biogas flared or combusted, (MD_y) shall be determined using the flare efficiency and methane content of biogas.

$$MD_y = BG_{burnt,y} \times w_{CH4,y} \times D_{CH4} \times FE \times GWP_{CH4} \quad \text{Equation (9)}$$

Where:

$BG_{burnt,y}$ = Biogas flared or combusted in year y (m^3)

$w_{CH4,y}$ = Methane content in biogas in the year y (volume fraction)

FE = Flare efficiency in the year y (fraction)

Hence for the project activity, the estimated amount of GHG emission reductions (ER_y) ex ante is 82,563 tCO_2e during the crediting period from 05/08/2020 to 04/08/2027, resulting in estimated average annual emission reductions of 11,795 tCO_2e.

Year	BE_y (tCO_2e)	PE_y (tCO_2e)	LE_y (tCO_2e)	ER_y (tCO_2e)
05/08/2020 to 31/12/2020	5,850	1,036	0	4,814
01/01/2021 to 31/12/2021	14,331	2,536	0	11,795
01/01/2022 to 31/12/2022	14,331	2,536	0	11,795
01/01/2023 to 31/12/2023	14,331	2,536	0	11,795
01/01/2024 to 31/12/2024	14,331	2,536	0	11,795
01/01/2025 to 31/12/2025	14,331	2,536	0	11,795
01/01/2026 to 31/12/2026	14,331	2,536	0	11,795
01/01/2027 to 04/08/2027	8,480	1,501	0	6,979
Total	100,316	17,753	0	82,563

CTI Validation Team confirms that all data sources and assumptions are appropriate and calculations are correct, applicable to the project activity and will result in a conservative estimate of the emission reductions. In general, CTI Validation Team is able to confirm the following:

- All assumptions and data used by the project participants are listed in the VCS PD (version 3.0 dated 06/12/2020) and/or supporting documents, including their references and sources;

- All documentation used by the project participants as the basis for assumptions and source of data is correctly quoted and interpreted in the VCS PD (version 3.0 dated 06/12/2020);

- All values used in VCS PD (version 3.0 dated 06/12/2020) are considered reasonable in the context of the project activity;

- The baseline methodology has been applied correctly to calculate project emissions, baseline emissions, and leakage emissions;

- All estimates of the baseline, project and leakage emissions can be replicated using the data and parameter values provided in VCS PD (version 3.0 dated 06/12/2020).

3.3.7 Methodology Deviations

No methodology deviation is applied in the project.

3.3.8 Monitoring Plan

The project applies the approved monitoring methodology AMS-III.D.: Methane recovery in animal manure management systems, Version 21.0. The selected monitoring methodology is applicable for the project. The monitoring plan is in accordance with the monitoring methodologies. The monitoring plan will give opportunity for real measurements of achieved emission reductions and contains principles and concepts on which it is based, operational and monitoring obligations of the project owner like resources involved in the monitoring process, training, support activities, calibration and data collection, quality assurance procedures, data management, electronic support tools.

Parameters determined ex-ante

Data / Parameter:	**GWP_{CH4}**
Data unit:	tCO_2e/tCH_4
Description:	Global warming potential of CH_4
Source of data used:	Default value from IPCC Fifth Assessment Report (AR5)
Value applied:	28

Data / Parameter:	**D_{CH4}**
Data unit:	kg/m^3
Description:	CH_4 density
Source of data used:	AMS-III.D
Value applied:	0.67 (at 20 °C and 1 atm pressure)

Data / Parameter:	**UF_b**
Data unit:	/
Description:	Model correction factor to account for model uncertainties
Source of data used:	AMS-III.D
Value applied:	0.94

Data / Parameter:	**MCF_j**
Data unit:	/

Description:	Annual methane conversion factor (MCF) for the baseline animal manure management system j
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	71% By checking public information, it is confirmed that the annual average temperature of baseline site where anaerobic manure treatment facility is located is around 13°C /28/, as per IPCC default values provided in table 10.17 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 10, a value of 71% is applied.

Data / Parameter:	$B_{0,LT}$
Data unit:	m^3 CH_4/kg-VS
Description:	Maximum methane producing potential of the volatile solid generated for animal type LT
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	0.45, for market (adult) breeding swine in Western Europe. Since no country specific B_o values are not available, default values from tables 10 A-4 to 10 A-9 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories volume 4 Chapter 10 are used. Para 18 (d) of AMS-III.D can be met and B_o values applicable to developed countries are used for the project activity because: (i) As per Breeding Swine Purchase Contract /29/ and Breeding Swine Acceptance Confirmation /15/, the genetic source of the livestock originates from UK and Denmark, which are Annex I Party; (ii) by checking Feed Processing Contract /31/ during site visit, it is confirmed that the farm uses formulated feed rations (FFR) which are optimized for the various animal(s), stage of growth, category, weight gain/productivity and/or genetics; (iii) The use of FFR can be validated through Feed Processing Contract; (iv) The project specific animal weights are more similar to developed country IPCC default values through checking Livestock Statistic Table /33/.

Data / Parameter:	$VS_{default}$

Data unit:	kg/hd/day
Description:	Default value for the volatile solid excretion rate per day on a dry-matter basis for a defined livestock population
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	0.46, for market (adult) breeding swine in Western Europe Since the Chinese specific VS value are not available, as per para 18 (b) (iii) of AMS-III.D., if country specific VS values are not available, IPCC default values from 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 chapter 10 table 10 A- 4 to 10 A- 9 can be used provided that the project participants assess the suitability of those data to the specific situation of the treatment site particularly with reference to feed intake levels. Besides, para 18 (d) of AMS-III.D can be met and VS values applicable to developed countries are used for the project activity because: (i) As per Breeding Swine Purchase Contract /29/ and Breeding Swine Acceptance Confirmation /15/, the genetic source of the livestock originates from UK and Denmark, which are Annex I Party; (ii) by checking Feed Processing Contract /31/ during site visit, it is confirmed that the farm uses formulated feed rations (FFR) which are optimized for the various animal(s), stage of growth, category, weight gain/productivity and/or genetics; (iii) The use of FFR can be validated through Feed Processing Contract; (iv) The project specific animal weights are more similar to developed country IPCC default values through checking Livestock Statistic Table /33/. By checking Breeding Swine Purchase Contract /29/ and Breeding Swine Acceptance Confirmation /15/, it is confirmed that the genetic source of breeding swine originates from UK and Denmark and the average mass of breeding swine at the project site is 200kg. PP adopts the default value (198kg) of Region "Western Europe" from 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 chapter 10 table 10 A-8, which is 0.46kg/hd/day and the

	assessment team considers this value is conservative.

Data / Parameter:	$MS\%_{BL,j}$
Data unit:	-
Description:	Fraction of manure handled in baseline animal manure management system j
Source of data used:	EIA Report /13/ and FSR /11/
Value applied:	100% By checking EIA Report /13/, it is confirmed that 100% of manure are handled in baseline animal manure management system, i.e. the anaerobic treatment system (open lagoon).

Data / Parameter:	$f_{CH4,default}$
Data unit:	-
Description:	Default value for the fraction of methane in the biogas
Source of data used:	Tool 14: Project and leakage emissions from anaerobic digesters
Value applied:	0.6 As per Tool 14, use this value for Option 2 (Procedure using a default value) of the step "Determination of the quantity of methane produced in the digester".

Parameters determined ex-post

Parameter	Description	Monitoring procedure
$MS\%_{i,y}$	Fraction of manure handled in system i in year y	By checking EIA Report /13/, FSR /11/ and as confirmed during on site inspection, it is confirmed that the project activity does not involve sequential manure management systems and all manure are handled in system i. therefore, 100% is applied for $MS\%_{i,y}$ for ex-ante estimation. This parameter will be monitored during verification.
$N_{p,y}$	Number of animals produced annually of type	The number of swine produced by the project activity will be recorded monthly recorded in operation records.

	LT for the year y	
$N_{da,y}$	Number of days animal is alive in the farm in the year y	The number of days that swine is alive on the farm will be recorded monthly recorded in operation records.
nd_y	The number of days the treatment plant was operational in year y.	The number of days the treatment plant was operational will be monitored and recorded by the project owner. nd_y will be daily recorded.
FE ($\eta_{flare,m}$)	The flare efficiency	The project activity utilized an enclosed flare. As per "Project emissions from flaring (version 03.0)", in the case of enclosed flares, PP may choose between the following two options to determine the flare efficiency for minute m ($\eta_{flare,m}$) and shall document which option is selected: (a) Option A: Apply a default value for flare efficiency; (b) Option B: Measure the flare efficiency. PP selected option A and a default value was applied for the project activity. For this option, the flare efficiency for the minute m ($\eta_{flare,m}$) is 90% when the following two conditions are met to demonstrate that the flare is operating: (a) The temperature of the flare ($T_{EG.m}$) and the flow rate of the residual gas to the flare ($F_{RG,m}$) is within the manufacturer's operating specification for the flare ($SPEC_{flare}$) in the minute m; and (b) The flame is detected in the minute m ($Flame_m$). The parameter will be monitored annually during verification. Although the emission reductions generated by displacing fossil-fuel based heat supply during heating period will not be claimed by PP, the use of the recovered biogas will be included in the project boundary and its hot water output will be monitored to ensure that the recovered biogas is actually destroyed. As per para 22 of AMS-III.D, if the recovered biogas is combusted for electrical/thermal energy production or for other gainful use, the methane destruction efficiency can be considered as 100%. During heating period, the recovered biogas will be combusted for heating, thereby the methane destruction efficiency is considered as 100%.
$BG_{burnt,y}$	Biogas flared in year y	$BG_{burnt,y}$ will be monitored continuously by flow meter with temperature sensor and pressure sensor installed at the inlet of the flare system. The monitoring values

		will be aggregated in the monthly operation records based on accumulative daily records. The flow meter will be calibrated periodically.
$T_{EG.m}$	Temperature in the exhaust gas of the enclosed flare in the minute m	Monitoring of this parameter is applicable in case of enclosed flares. Measurements are required to determine if manufacturer's flare specifications for operating temperature are met. The temperature of the exhaust gas in the flare will be measured by an appropriate temperature measurement equipment. Suitable monitoring port will be used the monitoring of the temperature of the flare. Temperature measurement equipment will be replaced or calibrated in accordance with their maintenance schedule.
$F_{RG,m}$	Flow rate of the residual gas on a dry basis at reference conditions in the minute m	Monitoring of this parameter is applicable in case of enclosed flares. Measurements are required to determine if manufacturer's flare specifications for operating temperature are met. This parameter is continuously measured by flow meter with temperature sensor and pressure sensor at the inlet of the flare system. The meter readings will be automatically converted to value at room temperature (20 °C) and 1 atm pressure. The flow meter will be replaced or calibrated in accordance with their maintenance schedule.
$Flame_m$	Flame detection of flare in the minute m	This parameter is measured once per minute using a fixed installation optical flame detector. Detection of flame recorded as a minute that the flame was on, otherwise recorded as a minute that the flame was off. Equipment will be maintained and calibrated in accordance with manufacturer's recommendations.
Soil application	Soil application of residual waste	Monitoring of this parameter is to ensure that the residual waste from the animal manure management system is handled aerobically. This parameter will be monitored annually. PP will refer refer to the original design of the soil application to ensure that the residual waste from the animal manure management system is handled aerobically. Any change in the soil application of residual waste after the implementation of the project activity should be justified.
Genetic	Genetic source of the	As per Breeding Swine Purchase Contract /29/ and

source of swine	production operations swine	Breeding Swine Acceptance Confirmation /15/, the genetic source of the livestock originates from UK and Denmark, which are Annex I Party. This parameter will be monitored annually. PP should ensure that genetic source of production operations swine originates from Annex I Party.
FFR	Formulated feed rations	This parameter is monitored monthly. Project participants should use formulated feed rations (FFR) for the production operations swine, stage of growth, category, weight gain/productivity and/or genetics.
Swine Weight	The project specific animal weights at project site	This parameter is monitored monthly. Project participants should record the project specific animal weights to ensure that they are similar to developed country IPCC default values.

Based on the on-site visit and interviewed with staff from Binzhou Topigs Norsvin Breeding Swine Co., Ltd. Binhai Branch., CTI validation team confirmed that monitoring parameter has been correctly descried in the updated PD and in compliance with the methodology AMS-III.D. Version 21.0, CDM Validation and Verification Standard for project activities version 03.0, and VCS standard version 4.3.

3.4 Non-Permanence Risk Analysis

Not applicable for the present project activity.

4 VALIDATION CONCLUSION

Climate Bridge (Shanghai) Ltd. has commissioned the CTI to carry out the Verified Carbon Standard (VCS) validation of the project activity "Binzhou Topigs Norsvin Breeding Swine Co., Ltd. Binhai Swine Farm Biogas Recovery and Utilization Project" (VCS 2880), with regard to the relevant requirements for VCS version 4.

The review of the project design documentation and the subsequent follow-up interviews have provided CTI with sufficient evidence to determine the fulfilment of stated criteria.

In the course of the validation, 2 Clarification Requests (CLs), 1 Corrective Action requests (CARs) and no Forward action request (FARs) was raised.

The review of the project design documentation and additional documents related to baseline and monitoring methodology and subsequent background investigation have provided the CTI with sufficient evidence to validate the fulfilment of the stated criteria.

In detail the conclusions can be summarized as follows:

- the baseline scenario is correctly defined as per the applied methodology and relate tools;
- the project is additional;
- all data and information used for ex-ante calculation of emission reductions is of projected and/or hypothetical nature;
- a reasonable level of assurance has been applied.
- the monitoring plan in the validated PD is as per the applied methodology AMS-III.D. Version 21.0;
- the project has been implemented and operated as per the VCS PD;
- the project complies with the validation criteria for projects set out in VCS Version 4;
- The calculation of the ex ante emission reductions is carried out in a transparent and conservative manner, so that the calculated emission reductions of 82,563 tCO_2e are most likely to be achieved within the 3*7 renewable crediting period started from 05/08/2020.

The conclusions of this report show, that the project, as it was described in the project description, is in line with all criteria applicable for the validation against the VCS standard version 4.3 without any qualifications or limitations.

Du wenjun

Mr. Du Wenjun
Team Leader
09/12/2022

Wu Lin

Mr. Lin Wu
Technical Reviewer
09/12/2022

APPENDIX 1: ABBREVIATIONS

Abbreviations	Full texts
AFOLU	Agriculture, Forestry, and Other Land Use
BM	Build Margin
CDM	Clean Development Mechanism
CME	Coordinating/managing entity
CER	Certified Emission Reduction
CM	Combined Margin
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
DNA	Designated National Authority
EB	Executive Board
GHG	Greenhouse gas(es)
GS	Gold Standard
EIA	Environmental Impact Assessement
ER	Emission Reduction
ETS	Emission Trading Scheme
FAR	Forward Action Request
GHG	Greenhouse gas(es)
IPCC	Intergovernmental Panel on Climate Change
MP	Monitoring Plan
PA	Project Activity
PD	Project Description
PP	Project Participant

QA/QC	Quality Assurance / Quality Control
UNFCCC	United Nations Framework Convention on Climate Change
VVS	Validation and Verification Standard
VCS	Verified Carbon Standard
VCSA	Verified Carbon Standard Association
VCU	Verified Carbon Unit
VVB	Validation/Verification Body
XLS	Emission Reduction Calculation Spread Sheet
PP	Project Participant
UNFCCC	United Nations Framework Convention on Climate Change

APPENDIX 2: COMPETENCE OF TEAM MEMBERS AND TECHNICAL REVIEWERS

Mr. Wenjun DU

Satisfies the requirements of competence management system of CTI Certification, and is hereby appointed as:

Qualification						
Status	GHG Auditor	Validator	Verifier	Team Leader	Technical Reviewer	Technical Expert
Date	√	√	√	√	-	√

Scope	Technical Area
SS 1: Energy industries (renewable/non-renewable sources)	TA 1.2: Energy generation from renewable energy sources
SS 13: Waste handling and disposal	TA 13.1: Solid waste and wastewater
	TA 13.2: Manure

This appointment is valid for 3 years from its date of approval below and is bound by internal requirements of management system of the Certification Body of CTI.

Approved by: Wu Lin

Wu LIN

Technical Competent Manager

Shenzhen, 01/01/2021

Mr. Wu LIN

Satisfies the requirements of competence management system of CTI Certification, and is hereby appointed as:

Qualification						
Status	GHG Auditor	Validator	Verifier	Team Leader	Technical Reviewer	Technical Expert
Date	√	√	√	√	√	√

Scope	Technical Area
SS 1: Energy industries (renewable/non-renewable sources)	TA 1.1: Thermal energy generation
	TA 1.2: Energy generation from renewable energy sources
SS 2: Energy distribution	TA 2.1: Electricity distribution
SS 3: Energy demand	TA 3.1: Energy demand
SS 4: Manufacturing industries	TA 4.1: Cement and lime production
SS 5: Chemical industry	TA 5.1: Chemical industry
	TA 5.2: Caprolactam, nitric and adipic acid
SS 10: Fugitive emissions from fuels (solid, oil and gas)	TA 10.1: Fugitive emissions from oil and gas
SS 11: Fugitive emissions from production and consumption of halocarbons and sulphur hexafluoride	TA 11.1: Emissions of fluorinated gases
	TA 11.2: Refrigerant gas production
SS 12: Solvents use	TA 12.1: Chemical industry
SS 13: Waste handling and disposal	TA 13.1: Solid waste and wastewater
	TA 13.2: Manure

This appointment is valid for 3 years from its date of approval below and is bound by internal requirements of management system of the Certification Body of CTI.

Approved by:

Lu ZHOU

General Manager

Shenzhen, 01/01/2021

APPENDIX 3: <REFERENCE LIST>

1. VCS project design version 1.0 dated 27/12/2021, version 1.1 dated 06/04/2021, version 2.0 dated 20/06/2022, version 3.0 dated 06/12/2020

2. Estimated ER calculation spreadsheet

3 VCS Standard v4.3, issued on 19/09/2019, updated on 22/06/2022

4 VCS Program Guide v4.2, issued on 19/09/2019, updated on 22/06/2022

5. CDM Validation and Verification Standard for project activities version 03

6. CDM Project Standard for project activities version 03

7. CDM project cycle procedure for project activities version 03

8. Approved methodology AMS-III.D.: Methane recovery in animal manure management systems, Version 21.0

9. Tool 06: Project emissions from flaring, Version 03.0

10. Tool 14: Project and leakage emissions from anaerobic digesters, version 02.0

11. Feasibility Study Report, compiled by Weihai Huanshan Agriculture and Animal Husbandry Investment Co., Ltd. in December 2017.

12. Project Approval issued by Development and Reform Bureau of Zhanhua District, Binzhou City on 27/12/2017.

13. Environmental Impact Assessment (EIA) Report of the project activity

14. EIA Approval issued by Environmental Protection Bureau of Zhanhua District on 29/11/2018

15. Breeding Swine Acceptance Confirmation, issued by Binzhou Topigs Norsvin Breeding Swine Co., Ltd. Binhai Branch

16. Business License of Binzhou Topigs Norsvin Breeding Swine Co., Ltd. Binhai Branch

17. Environmental Impact Assessment (EIA) approval issued by Environmental Protection Bureau of Zhanhua District on 29/11/2018

18. Technical Specification of enclosed flaring system

19. Nameplate of the equipment

20. Construction contract signed between the project owner and Binzhou Hongda Construction and Installation Engineering Co., Ltd.

21. "Notice on Strengthening Enterprise Greenhouse Gas Emission Report Management" issued by National Development and Reform Committee of P. R. China

22. Questionnaires for stakeholder meeting

23. Attendance List of CTI auditing meeting

24. "List of key emissions in the national carbon emissions transaction quota management in 2019-2020" issued by Ministry of Ecology and Environment of P.R.China

25. Technical specifications of the enclosed flaring system

26. Acceptance Certificate issued by Anshan Power Industry Co., Ltd. (evidence of the operation start date)

27. Attendance list of Stakeholder Consultation Meeting on 06/05/2019

28. Local temperature:

    http://www.weather.com.cn/cityintro/101121101.shtml

29. Breeding Swine Purchase Contract signed between the project owner and Tielijin Xinnong Ecological Agriculture and Animal Husbandry Co., Ltd.

30. Technical Specifications of HDPE membrane enclosed anaerobic digesters

31. Feed Processing Contract of Binhai Breeding Swine Farm

32. Staff roster of the project activity

33. Livestock Statistic Table

34. Operation Log

APPENDIX 4: <CLARIFICATION REQUESTS, CORRECTIVE ACTION REQUESTS, FORWARD ACTION REQUESTS (CAR/CL/FAR)>

CL ID	01	**Section no.**	3.1	**Date:** 26/05/2022
Description of CL				
Please supplement construction start date and operation start date in section 1.1 of the PD.				
Project proponent response				**Date:** 06/07/2022
The project started construction on 16/10/2019 and started operation on 05/08/2020.				
Documentation provided by project proponent				
PD (version 3.0 dated 06/12/2020)				
DOE assessment				**Date:** 09/12/2022
The construction start date and operation start date has been supplemented in section 1.1 of the PD and validated CTI to be correct. Therefore, CL 01 was closed.				

CL ID	02	**Section no.**	3.3.8	**Date:** 26/05/2022
Description of CL				
As per Tool 14 "Project and leakage emissions from anaerobic digesters" (version 02.0), the leakage emissions associated with the anaerobic digester depend on how the digestate is managed. They include emissions associated with storage and composting of the digestate. The residual waste from the digesters will be handled aerobically to produce organic fertilizer at the project site. Please clarify the detailed process of producing organic fertilizer, whether this process involves storage and composting of the digestate.				
Project proponent response				**Date:** 06/07/2022

The residual waste is collected and transported to the certain on-site workshop for aerobic fermentation. During this process, the forklift is used every day to turn the pile over, so that the material is fully oxygenated. After fully fermenting, the residual waste is dried out and sold. This process meets the requirement of "Sanitary Requirements for The Harmlessness of Manure" (GB 7959-2012). Therefore, the process of handling the residual waste doesn't involve storage or anaerobic compost.
Documentation provided by project proponent
PD (version 3.0 dated 06/12/2020)

DOE assessment	**Date:** 09/12/2022
By checking EIA Report and via on site inspection, it is confirmed that the digested liquid is collected and transported to an on-site workshop for aerobic fermentation. During this process, the forklift is used every day to turn the pile over, so that the material is fully oxygenated. After sufficient fermentation, the digestate is dried and sold. This process complies with the requirements of "Sanitary Requirements for Harmless Excrement" (GB 7959-2012). The process of disposing of residual waste does not involve storage or anaerobic composting. Therefore, CL 02 was closed.	

CAR ID	01	**Section no.**	3.1	**Date:** 26/05/2022
Description of CAR				
Please update PD as per "Project Description, v4.1" that issued by VERRA on 20/01/2022 and describe how the project contributes to achieving any nationally stated sustainable development priorities.				
Project proponent response				**Date:** 06/07/2022
It has been added in the revised PD.				
Documentation provided by project proponent				
PD (version 3.0 dated 06/12/2020)				
DOE assessment				**Date:** 09/12/2022
By checking VCS PD (version 3.0 dated 06/12/2020), it is confirmed that"Project Description, v4.1" that issued by VERRA on 20/01/2022 has been applied. Furthermore, the detailed SD contributions of the project activity have been supplemented and confirmed by the validation team to be correct. Therefore, CAR 01 was closed.				

FAR ID	NA	Section no.	NA	Date: NA
Description of FAR				
NA				
Project proponent response				**Date:** NA
NA				
Documentation provided by project proponent				
NA				
DOE assessment				**Date:** NA
NA				