



**Verification report for
GS4GG project activities**

(Gold Standard for the Global Goals)

VERIFICATION AND CERTIFICATION REPORT

Title of the project activity	Swine Farm Animal Manure Management System GHG Mitigation Project in Hubei Province	
Reference number of the project activity	GS11333	
Version number of the verification and certification report	03	
Completion date of the verification and certification report	08/03/2023	
Monitoring period number and duration of this monitoring period	MP number: first MP dates: 01/01/2021 to 30/06/2022 (both days included)	
Version number of monitoring report to which this report applies	05	
Crediting period of the project activity corresponding to this monitoring period	01/01/2021 to 31/12/2025 (both days included)	
Project Representative	The official focal point and project developer: Profit Carbon Environmental Energy Technology (Shanghai) Co., Ltd. The project owner: Jiangxi Zhengbang Breeding Co. Ltd.	
Host Party	People's Republic of China	
Activity Requirements applied	<input checked="" type="checkbox"/> Community Services Activities <input type="checkbox"/> Renewable Energy Activities <input type="checkbox"/> Land Use and Forestry Activities/Risks & Capacities <input type="checkbox"/> N/A	
Methodology (ies) applied and version number	ACM0010 "GHG emission reductions from manure management systems" (Version 08.0)	
Product Requirements applied	<input checked="" type="checkbox"/> GHG Emissions Reduction & Sequestration <input type="checkbox"/> Renewable Energy Label <input type="checkbox"/> N/A	
SDG Contributions targeted (as per approved PDD)	Goal 7: Affordable and Clean Energy Goal 8: Decent work and economic growth Goal 13: Climate Action	
Estimated annual amount of SDG impact (as per approved PDD)	Affordable and Clean Energy (SDG 7)- 7.2.1 Renewable energy share in the total final energy consumption	The amount of electricity generation by capturing biogas: 60,036 MWh

	<p>Decent Work and Economic Growth (SDG 8)-</p> <p>8.5.1 Average hourly earnings of employees, by sex, age, occupation and persons with disabilities</p>	<p>Number of full-time jobs created: 18 full-time jobs created including 9 males and 9 females</p>
	<p>Climate Action (SDG 13)-</p> <p>13.2.1 - Number of countries with nationally determined contributions, long-term strategies, national adaptation plans, strategies as reported in adaptation communications and national communications.</p>	<p>Amount of GHGs emission avoided or sequestered: 294,669 tCO₂e</p>
<p>Total amount of certified SDG impact (as per approved methodology) achieved in this monitoring period</p>	<p>SDG 7 -</p> <p>From 01/01/2021 to 31/12/2021, The amount of electricity generation by capturing biogas: 35,300.25 MWh</p> <p>From 01/01/2022 to 30/06/2022, The amount of electricity generation by capturing biogas: 17,481.82 MWh</p> <p>In the 1st monitoring period, The amount of electricity generation by capturing biogas: 52,782.06 MWh</p> <p>SDG 8 –</p> <p>From 01/01/2021 to 31/12/2021, 18 full-time jobs created including 9 males and 9 females.</p> <p>From 01/01/2022 to 30/06/2022, 18 full-time jobs created including 9 males and 9 females.</p> <p>In the 1st monitoring period, 18 full-time jobs created including 9 males and 9 females.</p> <p>SDG 13 –</p> <p>GHG emission Reductions (GS VERs)</p> <p>01/01/2021-31/12/2021 : 196,945 tCO₂e</p> <p>01/01/2022-30/06/2022 : 97,724 tCO₂e</p> <p>01/01/2021-30/06/2022 : 294,669 tCO₂e</p>	
<p>Name of VVB</p>	<p>VVB Name: Shenzhen CTI International Certification Co., Ltd (CTI)</p>	
<p>Name, position and signature of the approver of the verification and certification report</p>	<p style="text-align: center;"><i>Li Ziqi</i></p> <p>Li Ziqi Technical Reviewer/Approver</p>	

SECTION A. Executive summary

The project activity installs new animal waste management systems by replace the current open anaerobic lagoons with 9 new closed anaerobic digesters to a group of 9 swine farms in Hubei Province, which treat the manure and wastewater from the 9 swine farms to avoid methane emissions generated in the baseline uncovered anaerobic lagoons. An Animal Manure Management System (AMMS) has been installed in each swine farm respectively which treat the manure and wastewater from the 9 swine farms. The raw materials such as pig manure, urine and washing water are collected, and by Upflow Anaerobic Sludge Bed Reactor (UASB), the biogas generated. The project is expected to produce about 31,354,493 m³ biogas annually. The biogas produced is captured and then sent to the biogas generator for power generation, one biogas generator is installed in each subsidiary swine farm with total installed capacity of 6MW and the annual electricity production is estimated to be 40,134MWh, the electricity is used by the AWMSs and swine farms and surplus biogas will be destroyed through the flaring system (if any). The fermented sludge from the aerobic composting system is used to produce organic fertilizer, which partly distributed to the surrounding farmers freely and others will be sold out to the market, and wastewater will be treated aerobically and then supplied to the farmers living around free for agriculture irrigation which has been confirmed by site inspection.

The project activity enables 9 swine farms to use new animal waste management systems instead of the open anaerobic lagoons in baseline scenario to achieve the harmlessness and ecological utilization of the swine manure, finally generate the power to swine farms.

The estimated emission reduction from the project is 282,734 tCO₂e per year during the renewable 5-year crediting period and the Certified emissions reduction for the current monitoring period from 01/01/2021 to 30/06/2022 is 294,669 tCO₂e.

Scope of Verification

This verification is an independent and objective review and ex-post determination of the monitored reductions in GHG emissions by the VVB. The verification addresses the implementation and operation of the GS PA and tests the data and assertions set out in the monitoring report based on the following:

- (i) The GS PDD of the project/3/
- (ii) The approved methodology mentioned in the PDD, ACM0010 “GHG emission reductions from manure management systems” (Version 08.0)/32/
- (iii) The registered SDG monitoring parameters in the PDD
- (iv) the Gold Standard for the Global Goals Principles and Requirements/43/,
- (v) the Gold Standard for the Global Goals Safeguarding Principles & Requirements/44/,
- (vi) the Gold Standard for the Global Goals Community Services Activity Requirements/45/,
- (vii) the Gold Standard for the Global Goals Stakeholder Consultation and Engagement Requirements/46/,
- (viii) Validation and Verification Body requirements, Product requirements and references relevant to the project activity's reported emission reductions

The verification has considered both quantitative and qualitative aspects on stated/reported emission reductions. The monitoring report (all versions) and corresponding supporting documentation was assessed in accordance with the rules defined by GS4GG, as appropriate to the PA. The verification is not meant to provide any consulting or recommendations to the PP/others. However, stated requests for clarifications and/or corrective actions may provide input for improvement of the monitoring activities.

Verification process

The verification has been performed as described in the Gold Standard for the Global Goals Principles and Requirements/43/ as below process,

- a. Desk review of the GS MR (version 01 dated 06/08/2022)/1/, ER sheet/2/ and the relevant documents
- b. On-site assessment (15/08/2022~18/08/2022)
- c. Issuance of draft verification report & verification protocol
- d. Desk review of the revised MR and related documents
- e. Resolution of the raised CAR
- f. Issuance of the final verification report
- g. Independent technical review of the draft verification report and final/revised documentation (e.g., Monitoring Report, corresponding ER sheet and evidences)
- h. Reporting and closure of TR comments/findings and final approval for the decision made

- i. Issuance of final verification report to contracted PP (or authorized representatives) and submission of request for issuance, as appropriate.

Conclusion

CTI has performed the verification of the GS PA “Swine Farm Animal Manure Management System GHG Mitigation Project in Hubei Province” having GS Ref. Number GS11333 for the 1st monitoring period from 01/01/2021 to 30/06/2022. The verified emission reductions amount to 294,669 tCO_{2e} in the aforesaid monitoring period.

The technical parameters of the main equipment are consistent with the PDD, and not changed since validation/4/.

In CTI’s opinion, the GHG emission reductions reported for the project in the GS4GG 1st monitoring report are fairly stated. CTI confirmed that each SDG Impacts were calculated correctly on the basis of the approved CDM monitoring methodologies ACM0010. ver. 08.0/32/ and the monitoring plan contained in the PDD/3/.

CTI confirms that each SDG Impacts are calculated without material misstatements. Based on the evidence and information that are considered necessary to guarantee that each SDG Impacts are appropriately calculated, CTI is able to certify that each SDG Impacts from the project “Swine Farm Animal Manure Management System GHG Mitigation Project in Hubei Province” during the indicated monitoring period. Therefore, this is being submitted for request for issuance, as per GS procedures as applicable.

SECTION B. Verification team, technical reviewer and approver**B.1. Verification team member**

No.	Role	Type of resource	Last name	First name	Affiliation (e.g. name of central or other office of VVB or outsourced entity)	Involvement in			
						Desk/document review	On-site inspection	Interviews	Validation findings
1.	Team Leader & Verifier	IR	Du	Wenjun	CTI	√	√	√	√

B.2. Technical reviewer and approver of the verification and certification report

No.	Role	Type of resource	Last name	First name	Affiliation (e.g. name of central or other office of VVB or outsourced entity)
1.	Technical reviewer/Approver	IR	Li	Ziqi	CTI

SECTION C. Application of materiality

C.1. Consideration of materiality in planning the verification

No.	Risk that could lead to material errors, omissions or misstatements	Assessment of the risk		Response to the risk in the verification plan and/or sampling plan
		Risk level	Justification	
1.	Human error in the quantification of emissions	Low	Human error is likely to occur if personnel are unfamiliar with, or not well trained regarding, emissions processes or data recording	Depending on the monitoring period being verified, conduct increased verifying during the months when there is a greater likelihood of errors and issues with data quality control due to project participants' leave schedules
2.	Undue reliance on a poorly designed information system, which may have few effective quality controls	Low	Use of spreadsheets without adequate controls related to data changes/updates, version tracking, traceability, security	Depending on how data is generated, processed, and reported, place greater emphasis on verifying data captured and processed manually and/or in spreadsheets versus those that are generated from an automated system
3.	Omissions and misstatements in data transfer from hand written notes into digital Excel ER spreadsheet	Medium	Ineffective quality control of data transfer due to unclear QA/QC procedure	Check QM procedure/manual. PP may demonstrate how to transfer data and how this is crosschecked. Conduct interview with related personnel whether procedure is actually conducted but not adequately described.

On the basis of the risk analysis the verification has been planned. A detailed audit/verification plan has been prepared and submitted to the project participant(s) in due time before the site visit.

C.2. Consideration of materiality in conducting the verification

The errors identified in the project are below the threshold limit of materiality and hence not material. The GHG emission reductions are calculated without material misstatements.

SECTION D. Means of verification

D.1. Desk review

Desk review of all documents provided by PP and publicly available documents relevant for the verification including monitoring plan, monitoring report, monitoring methodology, project design document, applicable tools in particular attention to the frequency of measurements, QA/QC procedures and other relevant documents was conducted by CTI.

The main documents are listed below:

- (i) the GS4GG Monitoring Report Version 01 dated 06/08/2022/1/
- (ii) the emission reduction calculation spreadsheet related to this monitoring period/2/.
- (iii) the last revision of the PDD including the monitoring plan/3/,
- (iv) the last revision of the GS validation report/4/,

Other supporting documents, such as publicly available information and background information were also reviewed.

The list of documents reviewed during the verification is provided under Appendix 3 of this report.

D.2. On-site inspection

Duration of on-site inspection: 15/08/2022~18/08/2022				
No.	Activity performed on-site	Site location	Date	Team member
1.	Opening meeting Interview with Representatives of PD, Project Owner, Swine farms, local residents and officers	Office of Jiangxi Zhengbang Breeding Co. Ltd in Wuhan City, Hubei Province, China	15/08/2022	Du Wenjun
2.	On-site inspection of the 9 swine farms with their AWMSs and Interview with chief and operation staffs of farms and animal manure management systems	9 swine farms and their AWMSs in Hubei Province, P.R. China	15/08/2022~18/08/2022	Du Wenjun
3.	Documents check as per the list in Appendix 3 of this report	Office of Jiangxi Zhengbang Breeding Co. Ltd in Hubei Province, China	18/08/2022	Du Wenjun
4.	Findings Summary and discussion with PD	Office of Jiangxi Zhengbang Breeding Co. Ltd in Jingzhou City, Hubei Province, China	18/08/2022	Du Wenjun
5.	Close Meeting and issuance of findings/draft report	Office of Jiangxi Zhengbang Breeding Co. Ltd in Jingzhou City, Hubei Province, China	18/08/2022	Du Wenjun

D.3. Interviews

D.3.1. Interviews with PD, Project Owner, Staffs, Chief from each swine farm, local officers and local residents

No.	Interviewee			Date	Subject, Reference Number/ID	Team member
	Last name	First name	Affiliation			
1.	Shen	Min	Jiangxi Zhengbang Breeding Co. Ltd - Project Owner/ Vice General Manager	15/08/2022	Discussion on project financials, project design and implementation, Main equipment, Technical parameters, Baseline,	Du Wenjun

					Additionality, Project boundary, Monitoring plan, Monitoring devices, SDG impacts, ER calculation, Local legislation to biogas	
2.	Tu	Shulan	Profit Carbon Environmental Energy Technology (Shanghai) Co., Ltd./ Project Manager	15/08/2022~ 18/08/2022	Ex-ante and monitoring parameters and SDG parameters, PDD and ER, IRR, NPV editable issues	Du Wenjun
3.	Chan	Yuxue	Yongjiahe Swine Farm /Farm Staff	15/08/2022	Scenario before the project started, Swine genetic source on-farm record keeping Feed supplier Swine weight Sale of Swine Living dates of Swine Daily stock of animals in the farm, discounting dead and discarded animals	Du Wenjun
4.	Song	Aimei	Zhoujiachong Swine Farm / Farm Staff			
5.	Yu	Guang	Jiucaiyuan Swine Farm/ Farm Staff	16/08/2022		
6.	Jia	Yanqing	Gaoshanmiao Swine Farm/ Farm Staff			
7.	Guo	Weidong	Shayang 1st phase Swine Farm/ Farm Staff			
8.	Ma	Fuping	Shayang 2nd phase Swine Farm/ Farm Staff	17/08/2022		
9.	Cui	Jingwei	Ezhou Swine Farm/ Farm Staff			
10.	Xie	Zhiwei	Tuchong Swine Farm/ Farm Staff	18/08/2022		
11.	Han	Yunqing	Sangzihu Swine Farm / Farm Staff			
12.	Si	Mawan	Yongjiahe Swine Farm /AWMS operation staff	15/08/2022		
13.	Wang	Zhifang	Zhoujiachong Swine Farm / AWMS operation staff			
14.	Jia	Juanxian	Jiucaiyuan Swine Farm/ AWMS operation staff	16/08/2022		
15.	Liu	Zhenjie	Gaoshanmiao Swine Farm/ AWMS operation staff			
16.	Cui	Hongyu	Shayang 1st phase Swine Farm/ AWMS operation staff			
17.	Feng	Hong	Shayang 2nd phase Swine Farm/ AWMS operation staff	17/08/2022		
18.	Mu	Zengzhi	Ezhou Swine Farm/ AWMS operation staff			
19.	LV	Jinqi	Tuchong Swine Farm/ AWMS operation staff	18/08/2022		
20.	Lu	Quanfu	Sangzihu Swine Farm / AWMS			

			operation staff			
21.	Liu	Xiaolan	Local Stakeholders/ Residents	15/08/2022	Local Stakeholder Consultation issues, SDG impacts Local environment impact	Du Wenjun
22.	Chen	Baian				
23.	Xu	Zhiruo				
24.	Pu	Zhenwen				
25.	Lu	Mengqi		16/08/2022		
26.	Ma	Qinglan				
27.	Ye	Lingli				
28.	Jiang	Yazhi				
29.	Ou	Xiangwen				
30.	Gong	Zhengwen				
31.	Ding	Ningzhen		17/08/2022		
32.	Zhu	Xiuyan				
33.	Gu	Yanyu				
34.	Hao	Shulan				
35.	Li	Tiangong		18/08/2022		
36.	Li	Wenshu				
37.	Lv	Hongjun				
38.	Li	Wenyan				
39.	Li	Hongfei	Bureau of Ecology and Environment in Hubei Province / Section Staff	15/08/2022	Baseline Scenario Local Stakeholder Consultation issues, SDG impacts, Inputs, Grievances mechanism, Local legislation to swine and biogas	Du Wenjun
40.	Wang	Zhen	Bureau of Agriculture and Rural Affairs in Hubei Province / Section Staff			

D.3.2. Type of Questions asked by the team members:

During the site visit, the verifier has interviewed representatives from project owner, chief of swine farms, staffs, local officers and residents as above table to confirm that the correctness of the project designed data and information and results reported in the MR.

The questions asked were basically based on requirements of the GS4GG and MR description.

1. The representatives from project owner were asked the following questions

- a. General aspects of the project
- b. Animal Manure treatment system operation situation
- c. Biogas production
- d. Main equipment and monitoring devices
- e. Project implementation

- f. Involved personnel and responsibilities
- g. Implementation of the monitoring system
- h. Monitoring devices
- i. Sampling method
- j. Monitoring data collection and data management
- k. QA/QC
- l. Emergency procedure

All the related information has been provided by project owner interviewees which is confirmed as consistent with the MR description and project implementation and also verified by site inspection. Refer the main contents in the report for detail assessment of the related information.

2. The chief from each swine farm were asked the following questions;

- a. Swine genetic source
- b. on-farm record keeping
- c. Feed supplier
- d. Swine weight
- e. Sale of Swine
- f. Living dates of Swine
- g. Daily stock of animals in the farm, discounting dead and discarded animals

All the related information has been provided by chief from each swine farm which is confirmed as consistent with the MR description and project implementation and also verified by site inspection. Refer the main contents in the report for detail assessment of the related information.

3. The staff representatives were asked the following questions:

- a. General info of interviewee, name, gender, Age, Education, Location
- b. When joined the company?
- c. How to obtain this job?
- d. What is the main work?
- e. What about the working condition?
- f. Training provided

The feedbacks from staffs are listed as below:

All the staffs including females provided the general information, position including accounting, recording and monitoring, join time, join method, main work, all the staffs agreed that the working condition is well and some trainings were provided.

4. The local officers were asked the following questions:

- a. National and local legislation of the project type
- b. Local government's attitude to the project
- c. Environmental impacts of the project
- d. Environmental protection Measurements of the project
- e. Stakeholder comments

The feedbacks from local officers are listed as below:

All the local officers provided the information which is confirmed as consistent with the MR description and project implementation and also verified by checking the approval/8/. Refer the main contents in the report for detail assessment of the related information.

5. The local residents were asked the following questions:

- a. Continuous input / grievance
- b. Stakeholder comments

The feedbacks from local residents are listed as below:

All the local residents provided the information which is confirmed as consistent with the MR description. All of them know how to raise input / grievance to the project and they all confirmed that no negative comments to the project implementation. Refer the main contents in the report for detail assessment of the related information.

D.4. Sampling approach

Refer to section E.5 and E.6.4 of this report for detail assessment of sampling approach.

D.5. Clarification requests, corrective action requests and forward action requests raised

Areas of verification findings	No. of CL	No. of CAR	No. of FAR
General Description of Project	CL 01	-	-
Remaining forward action requests from validation and/or previous verification	-	-	-
Compliance of the project implementation with the registered project design document	CL 02	-	-
Post-registration changes	-	-	-
Compliance of the monitoring system applied by the project with the registered monitoring plan	-	CAR 01	-
Compliance of monitoring activities with the registered monitoring plan			
SDG Data and parameters fixed ex ante or at renewal of crediting period	-	CAR 02	-
SDG Data and parameters monitored	-	CAR 03 CAR 04 CAR 05 CAR 06 CAR 07 CAR 08 CAR 09 CAR 10 CAR 11 CAR 12	-
Comparison of monitored parameters with last monitoring period	-	-	-
Compliance of the sampling implementation with the registered sampling plan	CL 03	-	-
Assessment of data and calculation of SDG Impacts			
Calculation of baseline value or estimation of baseline situation of each SDG Impact	CL 04	-	-
Calculation of project value or estimation of project situation of each SDG Impact	-	-	-
Calculation of leakage	-	-	-
Calculation of net benefits or direct calculation for each SDG Impact	-	-	-
Comparison of actual SDG Impacts with estimates in approved PDD	-	-	-
Remarks on increase in achieved SDG Impacts from estimated value in approved PDD	-	-	-
Safeguards reporting	-	-	-
Stakeholder inputs and legal disputes	-	-	-
Others (please specify)	-	-	-
Total	4	12	-

SECTION E. Verification findings

E.1. General Description of Project

<p>Means of verification</p>	<p>A draft monitoring report was submitted to the verification team by the project participants prior to the start of the verification activities.</p> <p>It is checked that the appropriate form has been used for compiling the MR as per the Gold Standard for Global Goals Monitoring Report Template version 1.1 in October 2020/42/.</p> <p>Further every section has been checked against the GS4GG Principles& Requirements/43/.</p> <p>Via on-site investigation, CTI confirmed that the project installs new animal waste management systems by replace the current open anaerobic lagoons with 9 new closed anaerobic digesters to a group of 9 swine farms in Hubei Province, which will treat the manure and wastewater from the 9 swine farms to avoid methane emissions generated in the baseline uncovered anaerobic lagoons. An Animal Manure Management System (AMMS) has been installed in each swine farm respectively which treat the manure and wastewater from the 9 swine farms. The raw materials such as pig manure, urine and washing water are collected, and by Upflow Anaerobic Sludge Bed Reactor (UASB), the biogas generated. The project is expected to produce about 31,354,493 m³ biogas annually. The biogas produced is captured and then sent to the biogas generator for power generation, one biogas generator is installed in each subsidiary swine farm with total installed capacity of 6MW and the annual electricity production is estimated to be 40,134MWh, the electricity is used by the AWMSs and swine farms and surplus biogas will be destroyed through the flaring system (if any). The fermented sludge from the aerobic composting system is used to produce organic fertilizer, which partly distributed to the surrounding farmers freely and others will be sold out to the market, and wastewater will be treated aerobically and then supplied to the farmers living around free for agriculture irrigation which has been confirmed by site inspection. Hence, it is confirmed that the project is implemented in line with the PDD.</p> <p>The project built 9 new animal waste management systems in 9 existing swine farms, replacing the current open anaerobic lagoons with 9 new closed anaerobic digesters. An Animal Manure Management System (AMMS) has been constructed and installed in each swine farm respectively which treat the manure and wastewater from the 9 swine farms to avoid methane emissions generated in the baseline uncovered anaerobic lagoons which is confirmed by site inspection.</p> <p>The raw materials such as manure and wastewater are collected into waste collecting tanks and then be separated first by Solid-liquid separator, and by a Upflow Anaerobic Sludge Bed Reactor (UASB) as its anaerobic digester technologies, then the biogas generated. It is estimated that 9 swine farms involve 130,976 heads of marketing swine, 226,952 heads of breeding swine which has been confirmed during the validation process. Live pigs are kept for 180 days in the farms before shipment and are estimated to produce 522,575 tons of manure every year.</p> <p>The biogas produced is recovered and combusted for power generation and used by the AWMSs and swine farms. At the same time, and the residual biogas was flared if there is any surplus biogas. The fermented sludge from the aerobic composting system is used to produce organic fertilizer, part of the organic fertilizers are supplied to the farmers living around for free. And wastewater has been treated aerobically and then used for agriculture irrigation which has been confirmed by site inspection.</p> <p>Via checking the MR, CTI confirmed that the technical description and technical flow chart are described clearly and actual by site inspection of all the swine farms and 9 new animal waste management systems.</p> <p>All the closed anaerobic digesters, waste collecting tanks, solid-liquid separators, Upflow Anaerobic Sludge Bed Reactors (UASB), desulfurization and dehydration</p>
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	<p>system, turnover machines, biogas generators, flares and related auxiliary facilities were all normally implemented which has been confirmed by site inspection and confirmed as in line with the description in the PDD/3/.</p> <p>The project activity enables 9 swine farms to use new animal waste management systems instead of the open anaerobic lagoons in baseline scenario to achieve the harmlessness and ecological utilization of the swine manure, finally generate the power to swine farms, thus avoid GHG emission of methane from anaerobic treatment of swine manure and wastewater through recovery and destruction of biogas.</p> <p>The project applied CDM Methodology ACM0010 “GHG emission reductions from manure management systems” (Version 08.0)/32/.</p> <p>The location of the project activity is in Hubei Province, P.R. China.</p> <p>The detailed geographic coordinates of the project included in this monitoring period is listed as below:</p> <table border="1" data-bbox="454 649 1441 1142"> <thead> <tr> <th>Item</th> <th colspan="2">Project Location</th> </tr> </thead> <tbody> <tr> <td>Host Country</td> <td colspan="2">China</td> </tr> <tr> <td>Region:</td> <td colspan="2">Hubei Province</td> </tr> <tr> <td colspan="3">Geographical Coordinates</td> </tr> <tr> <th>Swine farm</th> <th>East longitude</th> <th>North latitude</th> </tr> <tr> <td>Yongjiahe swine farm</td> <td>114°39'41.8"</td> <td>31°08'39.5"</td> </tr> <tr> <td>Zhoujiachong swine farm</td> <td>114°32'08.5"</td> <td>31°17'02.0"</td> </tr> <tr> <td>Jiucaiyuan swine farm</td> <td>114°25'22.3"</td> <td>31°21'37.1"</td> </tr> <tr> <td>Gaoshanmiao swine farm</td> <td>114°26'56.9"</td> <td>31°21'00.0"</td> </tr> <tr> <td>Shayang 1st phase swine farm</td> <td>112°13'55.0"</td> <td>30°36'29.0"</td> </tr> <tr> <td>Shayang 2nd phase swine farm</td> <td>112°13'39.0"</td> <td>30°37'26.0"</td> </tr> <tr> <td>Ezhou swine farm</td> <td>114°46'46.4"</td> <td>30°23'41.2"</td> </tr> <tr> <td>Tuchong swine farm</td> <td>114°15'08.3"</td> <td>31°32'22.0"</td> </tr> <tr> <td>Sangzihu swine farm</td> <td>112°30'25.6"</td> <td>30°16'38.5"</td> </tr> </tbody> </table> <p>The project location has been clearly provided in section A.2 of the MR, which has been verified by site inspection with GPS device and the detailed coordinates of the 9 swine farms have been provided respectively which have also been verified by site inspection with GPS device and the information is correct.</p> <p>The project start date is 09/09/2020 which has been confirmed by checking the equipment purchase contracts/9/, and was put into operation on 01/01/2021 which has been confirmed by checking the operation log of the project/12/ and record of operation started of each AWMS/24/.</p> <p>The project was applied as a GS-VER project with the GS Reference number of GS11333. According to the PDD and validation report/3/,/4/, the project participant has adopted for the renewable crediting period of 15 years with the start date of 1st crediting period of 01/01/2021. The first monitoring period is from 01/01/2021 to 30/06/2022 (first and last days included) belongs to the first crediting period.</p> <p>As part of the site visit the Verification Team was able to confirm that the project description in MR is in accordance with the project description contained in the PDD/3/.</p>	Item	Project Location		Host Country	China		Region:	Hubei Province		Geographical Coordinates			Swine farm	East longitude	North latitude	Yongjiahe swine farm	114°39'41.8"	31°08'39.5"	Zhoujiachong swine farm	114°32'08.5"	31°17'02.0"	Jiucaiyuan swine farm	114°25'22.3"	31°21'37.1"	Gaoshanmiao swine farm	114°26'56.9"	31°21'00.0"	Shayang 1 st phase swine farm	112°13'55.0"	30°36'29.0"	Shayang 2 nd phase swine farm	112°13'39.0"	30°37'26.0"	Ezhou swine farm	114°46'46.4"	30°23'41.2"	Tuchong swine farm	114°15'08.3"	31°32'22.0"	Sangzihu swine farm	112°30'25.6"	30°16'38.5"
Item	Project Location																																										
Host Country	China																																										
Region:	Hubei Province																																										
Geographical Coordinates																																											
Swine farm	East longitude	North latitude																																									
Yongjiahe swine farm	114°39'41.8"	31°08'39.5"																																									
Zhoujiachong swine farm	114°32'08.5"	31°17'02.0"																																									
Jiucaiyuan swine farm	114°25'22.3"	31°21'37.1"																																									
Gaoshanmiao swine farm	114°26'56.9"	31°21'00.0"																																									
Shayang 1 st phase swine farm	112°13'55.0"	30°36'29.0"																																									
Shayang 2 nd phase swine farm	112°13'39.0"	30°37'26.0"																																									
Ezhou swine farm	114°46'46.4"	30°23'41.2"																																									
Tuchong swine farm	114°15'08.3"	31°32'22.0"																																									
Sangzihu swine farm	112°30'25.6"	30°16'38.5"																																									
Findings	CL 01 was raised and resolved. Refer to Appendix 4 in this report for detail assessment.																																										
Conclusion	It can be confirmed that the final version Monitoring report/1/ is complete and transparent and in accordance with the PDD/3/ and Global Goals Monitoring Report Template version 1.1 in October 2020/42/. Refer to the below sections for details.																																										

E.2. Remaining forward action requests from validation and/or previous verification

This is the 1st verification of the project activity. Via checking the validation report/4/, CTI verified that there is no FAR was raised.

E.3. Compliance of the project implementation with the registered project design document

Means of verification	<p>By means of an in-depth review of the PDD and the inspections carried out during the on-site visit, an assessment has been carried out whether the project has been implemented and operated in line with the PDD and whether all physical features of the project are in place. The following has been checked: implemented technology, project equipment as well as monitoring equipment.</p> <p>The verifier has performed a site visit to check the swine farms, project equipment, monitoring equipment and interview with end users and staffs, in addition by all the provided evidence, it is found that the project started first construction on 17/09/2020 which has been confirmed by checking the General contract of engineering construction/10/, and started first commissioning on 13/12/2020 and was put into operation on 01/01/2021 which has been confirmed by checking the operation log of the project/12/ and record of operation started of each AWMS/24/ and has been confirmed in the PDD and validation report/3/,/4/.</p> <p>The factors and parameters used during this monitoring period to arrive at the emission reduction calculations are transparently described in the Monitoring Report/1/ and the emission reductions achieved during this monitoring period are 294,669 tCO₂e/2/.</p> <p>This is the 1st monitoring period of 1st crediting period and the verification team herewith confirms that the project implementation is consistent since the validation as mentioned in the PDD. There are no major obstructions or gaps noted and no special event such as overhaul and downtimes of biogas digesters and power generators occurred during this monitoring period.</p> <p>The actual implementation and operation of the project are found in accordance with the descriptions provided in the PDD. There is no deviation / change evidenced during this monitoring period and there were no delays compared to information in approved project.</p>
Findings	<p>CL 02 was raised and resolved. Refer to Appendix 4 in this report for detail assessment.</p>
Conclusion	<p>Assessment concludes the following:</p> <ul style="list-style-type: none"> - The implementation status of project activity was found to be in compliance with PDD/3/. - CTI has conducted the on-site visit to confirm the implementation status of the project w.r.t. the realized technology. - The actual operation of project activity was found to be in compliance with PDD/3/. - There were no delays compared to information in approved project.

E.4. Post-registration changes

E.4.1. Temporary deviations from Certified Key Project Information, Project Design Document, Monitoring & Reporting Plan, applied methodology or applied standardized baseline

Not Applicable

E.4.2. Corrections

Not Applicable

E.4.3. Changes to start date of crediting period

Not Applicable

E.4.4. Permanent changes from registered monitoring plan, applied methodology or applied standardized baseline

Not Applicable

E.4.5. Changes to project design of approved project

Not Applicable

E.5. Compliance of the monitoring system applied by the project with the registered monitoring plan

<p>Means of verification</p>	<p>By means of comparison of the MR with the applied CDM methodology and all applicable GS4GG guidelines, the verification team has checked whether the monitoring system is in compliance with the monitoring plan in the PDD/3/ and related requirements of the applied methodology/32/ whether the sample plan conducted accordingly, the source and the applied value of the SDG monitored parameter is acceptable; whether the parameters monitored explain the operational and management structure, responsibilities and institutional arrangement for data collection/archiving, QA/QC procedures.</p> <p>The monitoring system applied by the project compliance with the registered monitoring plan is demonstrated as below:</p> <p>Monitoring for SDG parameters</p> <p>For Mitigation Measure for Safeguarding Principles Employee Training of biogas safety operation</p> <p>SDG 8 Number of full-time jobs created</p> <p>SDG 7 The amount of electricity generation by capturing biogas, $EG_{d,y}$</p> <p>SDG 13</p> <ol style="list-style-type: none"> Number of animals of type LT produced annually for the year y, $N_{p,LT}$ Number of days animal of type LT is alive in the farm in the year y, $N_{da,LT}$ Daily stock of animals in the farm, discounting dead and discarded animals, $N_{AA,LT}$ Average animal weight of a defined livestock population at the project site, W_{site} Number of days treatment plant was operational in year y, n_{dy} Quantity of electricity consumed by the proposed project in year y, $EC_{PJ,i,y}$ Average technical transmission and distribution losses for providing electricity to source j in year y, $TDL_{j,y}$ Biogas flow, V_f Volumetric flow of the gaseous stream in time interval t on a dry basis, $V_{t,db}$ Volumetric fraction of greenhouse gas i in a time interval t on a dry basis, m^3 gas i/m^3 dry gas, $V_{i,t,db}$ Temperature of the gaseous stream in time interval t, T_i Pressure of the gaseous stream in time interval t, P_i Density of greenhouse gas i in the gaseous stream in time interval t, $\rho_{i,i}$ Fraction of volatile solids directed to aerobic treatment $F_{Aer,i}$ Fraction of manure handled in system j in project activity $MS\%_j$ Maximum methane producing potential of the volatile solid generated by animal type LT, $B_{o,LT}$ Type of barn and AWMS, $Type$
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- r) Annual average ambient temperature at project site, T
- s) Annual average nitrogen excretion per head of a defined livestock population estimated as described in Appendix 2, $NEX_{L,T,y}$

CTI confirmed that all the monitoring parameters listed in the PDD have been provided in the MR corresponding to each SDG impact.

Refer to below section E.6.2 for detail assessment of the monitoring parameters.

Monitoring framework

The MR contains a diagram illustrating the Organization Structure of the Monitoring Team implemented by the project owner to implement the project activity which is confirmed consistent with the PDD. The GS monitoring team are responsible for the monitoring of all the parameters monitored for this monitoring period. And all the data was reviewed by the project developer. The organizational structure is considered sufficient to fulfil the monitoring requirements of the methodology and ensure that emission reductions verified for this monitoring period.

Monitoring equipment and installation:

Measurement instruments are described in the MR as subject to appropriate national standards with respect to installation, accuracy and calibration interval. Main instruments weight measurers, flow meters, gas analyzers, and electricity meters are used to monitor the related SDG parameters, refer to E.6.2 of this report for detail assessment of the installed monitoring devices.

The flow chart of monitoring system has been provided in the MR and checked by verifier, and via site inspection of the monitoring equipment, CTI verified that all the measuring equipment have been installed as per the location in flow chart of monitoring system of MR and monitoring plan in the PDD, thus is considered sufficient to carry out the monitoring requirements as planned in the PDD and requested in the methodology, and the appropriate national standards have been followed.

Sampling Method and Process

Sampling plan is designed by PD in PDD for monitoring the parameter W_{site} which is confirmed in line with the requirement for this parameter monitoring in the applied methodology. The sampling plan is designed according to the Standard of "Sampling and surveys for CDM project activities and programmes of activities (Version 09.0)" /33/.

For this monitoring period, as per the sampling plan in the PDD, below methods have been taken by PP to carry out the sampling,

- a. To determine the total population - Calculate the overall sample size based on the actual population of pigs in stock firstly– *the Production record of Market swine/15/ have been checked and the total population of pigs determined are verified as correct and actual;*
- b. To determine the sample size for each farm - The project involved 9 swine farms (all the swine farms including market swine and breeding swine), then the sample size in each swine farm is adjusted based on the proportion of the number of each farm in the total number of 9 swine farms– *the calculation sheet of sample size/28/ is checked as correct and actual;*
- c. To determine the sample size of each age group - The sample size of each age group of Market swine and Breeding swine in a farm is also calculated based on the proportion of the number of each age group of Market swine and Breeding swine to the total number of swine in two kinds of farms– *the calculation sheet of sample size/28/ is checked as correct and actual;*
- d. To ensure representativeness, each defined livestock population has been classified into a minimum of three age categories including Nursery phase,

Growing phase and Mature phase – *the monthly records of animal weight of a defined livestock population of three age categories/16/ have been checked and the three age categories determined are verified as in line with the PDD and applied methodology*

- e. After the sample size in each age group of Market swine and Breeding swine of each swine farm determined, the sample is conducted in every swine farm. Since swine in different age are kept in the different pig houses, samples can be randomly selected from pig houses of this age group – *the samples choosing method is checked as correct and actual;*
- f. For each defined livestock population, a minimum of one monthly sample per age category has been taken - *the monthly records of animal weight of a defined livestock population of three age categories/16/ have been checked and one monthly sample per age category determined for each defined livestock population are verified as in line with the PDD and applied methodology*
- g. If the same samples are taken the following month, then new samples will be taken, this will be done every month until the end of the monitoring period - *the monthly records of animal weight of a defined livestock population of three age categories/16/ have been checked and confirmed that the samples are not same for each month.*

PP uses 95/10 confidence/precision as the criteria for the reliability of sampling efforts - *verified as in line with the standard of “Sampling and surveys for CDM project activities and programmes of activities (Version 09.0)” and applied methodology*

Via site inspection and interview with chiefs of farms and PD, CTI confirmed that the monitoring activities of the W_{site} have been conducted in the three age groups of Nursery phase, Growing phase and Mature phase in each swine farm at least one monthly which is verified as in line with the above requirements and the 95/10 confidence/precision is confirmed as used by PP as the criteria for the reliability of sampling efforts.

The method of calculation of sample size is checked by CTI by checking the calculation sheet of sample size/28/, it is confirmed that the calculation process is in compliance with the Appendix 6 of the Guideline of the “Sampling and surveys for CDM project activities and programmes of activities (Version 04.0)”/34/ and PP has used 95/10 confidence/precision as the criteria for the reliability of sampling efforts which is confirmed in line with Standard of “Sampling and surveys for CDM project activities and programmes of activities (Version 09.0)”/33/ and is verified consistent with PDD.

The one monthly monitoring activity of the samples have been completed in the 9 swine farms during this monitoring period. The monitoring forms have been filled out by the Breeders in the 9 swine farms to record the animal weight of the samples/16/.

The implementation of sampling method and process including monitoring, data recording and collection, QA/QC procedure, emergency procedure is stated by PP which is confirmed as actual and reasonable by site inspection and interview with the chief of farms and monitoring team.

Corrective actions:

In case of non-conformities would be observed, the corrective action plan will be referred and the whole GS monitoring team will follow recognized standard data evaluation methods to guarantee that the data is reliable and accurate. Via site inspection of the log of the project operation/12/ and interview with the staffs, CTI confirmed that there was no correction of nonconformities occurred in implementation of the project or the monitoring plan during the 1st monitoring period.

Quality Assurance and Quality Control

The related QA/QC procedure has been conducted by PP for the monitoring process including data verification and cross check by monitoring team and project owner which has been verified by site interview with staffs and checking the training notices/25/.

CTI confirmed that the QA/QC procedure has been implemented by PP properly during this monitoring period and the data management is confirmed as effective. Refer to below section E.6.2 for detail assessment of each

Training:

Trainings related to monitoring have been provided to relevant personnel of monitoring team yearly so that all the staffs are competent for the monitoring work which is verified by checking the training notices/25/.

Data management:

The data management and archiving procedure has been provided in the MR which is confirmed as actual and reasonable by checking the PDD, during the on-site inspection, CTI confirmed that all the data has been recorded, collected, managed and archived accordingly for this monitoring period and all data collected as part of monitoring plan will be archived electronically on hard disks and be kept at least 2 years after the end of the last crediting period.

Emergency Procedure

Project proponents will take actions to deal with malfunction and/or damage if any damage to the operation of the system, and the most conservative approach are used for emission calculations during the emergency period.

Via checking the operation log/12/ and all the data collected for biogas flow and electricity, it is verified that there was no emergency happened during this monitoring period.

Non-Double counting assessment

The VVB has checked for double counting by reviewing all relevant registries including CDM/53/, VCS/54/, China CER/52/ and other GHGs programs such as EU ETS, IREC or subnational, various regional schemes and provincial/state-based schemes. Besides, due to all swine farms involved in this project has unique identified GPS coordinates, hence, it can't be counted in any other voluntary market or emission reduction mechanism. CTI confirmed that there is no potential exists for Double Counting of emissions reductions due to issuance of Gold Standard VERs/CO₂-certificates from the considered project activity for this monitoring period.

Furthermore, via on-site inspection, it is confirmed that the project is located in China which is an eligible host country as defined in section 2.1.6 of GS4GG GHG Emissions Reduction & Sequestration Product Requirements (Version 1.2)/47/.

Besides, based on validation team's local expertise, China has a cap & trade scheme only cover the high-emission industries, such as power generation sector that emitted at least 26,000 tons of CO₂e/year which has been verified in the public website/55/, and it is confirmed that the project activity is not included the mandatory emission control scheme and there is no emission cap enforced for the project owner by checking the enforced company list in public information/56/.

Finally, via checking the Declaration of No Double Counting Statement/27/, it is confirmed that the emission reductions were not double counted for this monitoring period.

In conclusion, CTI verified that Project Developer has provided Gold Standard with satisfactory justification that no double counting of emission reductions occurred for this monitoring period.

	In conclusion, the MP is completely in accordance with the approved methodology applied by the GS project and PDD.
Findings	CAR 01 was raised and resolved. Refer to Appendix 4 in this report for detail assessment.
Conclusion	The monitoring plan complies with the applied methodology and the monitoring system and all applied procedures are completely in compliance to the latest approved monitoring plan and the methodology.

E.6. Compliance of monitoring activities with the registered monitoring plan

E.6.1. SDG Data and parameters fixed ex ante or at renewal of crediting period

Means of verification	The values of ex-ante parameter assessed in the table given below:			
	Ex Ante Data and Parameters			
	Parameters	Value	Reference	Assessment by VT
	GWP_{CH_4} - SDG 13 Global Warming Potential of CH_4	28 tCO _{2e} /tCH ₄ after 2021	IPCC Fifth Assessment Report (AR5)	Confirmed as per the GS requirement and IPCC Fifth Assessment Report/58/ and consistent with the PDD
	GWP_{N_2O} - SDG 13 Global Warming Potential of N ₂ O	265 tCO _{2e} /tCH ₄ after 2021	IPCC Fifth Assessment Report (AR5)	Confirmed as per the GS requirement and IPCC Fifth Assessment Report/58/ and consistent with the PDD
	D_{CH_4} - SDG 13 Density of CH_4	0.00067 t/m ³	ACM0010 Version 08.0	Confirmed as per the applied methodology/32/ and consistent with the PDD
MCF_j - SDG 13 Methane conversion factor for the baseline AWMS _j	70.5%	IPCC 2006 table 10.17, chapter 10, volume 4	A conservativeness factor has been applied by multiplying MCF_j value (i.e., 75%) with a value of 0.94, to account for the 20 per cent uncertainty in the MCF_j values which is Confirmed as reported by IPCC 2006/59/ and consistent with the PDD. For this monitoring period, the monthly average temperature in 2021 is 17.4°C and the MCF_j value of 2022 applied the value of 2021 due to not whole year ended till verification finished.	
$MS\%_{BI,j}$ - SDG 13 Fraction of manure handled in system j in the baseline	100%	In this project, the baseline manure management system is uncovered anaerobic lagoon only. The amount of manure handled by the anaerobic lagoon is 100%.	Confirmed as per FSR/7/, baseline evidence/21/ and consistent with the PDD.	

	<p>W_{default} – SDG 13 Default average animal weight of a defined population</p>	<p>W_{default} (Market swine) =28kg W_{default} (Breeding swine) =28kg</p>	<p>IPCC 2006 table 10A-7 and 10A-8, chapter 10, volume 4</p>	<p>Confirmed as reported by IPCC 2006/59/ and consistent with the PDD.</p>
	<p>VS_{default} – SDG 13 Default value for the volatile solid excretion per day on a dry-matter basis for a defined livestock population</p>	<p>VS_{default} (Market swine) =0.3 kg-dm/animal/day VS_{default} (Breeding swine) =0.3 kg-dm/animal/day</p>	<p>IPCC 2006 table 10A-7 and 10A-8, chapter 10, volume 4</p>	<p>Confirmed as reported by IPCC 2006/59/ and consistent with the PDD.</p>
	<p>N_{rate(T)} – SDG 13 Default N excretion rate</p>	<p>N_{rate(T)} (Market swine) =0.42 kg N (1000 kg animal mass)⁻¹ day⁻¹ N_{rate(T)} (Breeding swine) =0.24 kg N (1000 kg animal mass)⁻¹ day⁻¹</p>	<p>IPCC 2006 table 10.19, chapter 10, volume 4 used for NEX_{IPCC default} calculations as above equation</p>	<p>Confirmed as reported by IPCC 2006/59/ and consistent with the PDD.</p>
	<p>NEX_{IPCC default} – SDG 13 Default value for the nitrogen excretion per head of a defined livestock population</p>	<p>Refer to MR for monthly data</p>	<p>Calculated by the equation: NEX_{IPCC default} = N_{rate(T)}* TAM/1000*365</p>	<p>Confirmed as according to the calculation equation. Via checking the formular, it is confirmed that 365 represents 365 days per year, which corresponds to the unit of this parameter: kg N / animal / year and N_{rate(T)} means the default N excretion rate with the unit of kg N/ (1000 kg animal mass)/ day. While this monitoring period is 01/01/2021-30/06/2022, more than one year. Therefore, this parameter should be calculated according to the actual number of days.</p>

	TAM – SDG 13 Typical animal mass for livestock category	TAM (Market swine) =28 kg animal ⁻¹ TAM (Breeding swine) =28 kg animal ⁻¹	IPCC 2006 table 10A-7 and 10A-8, chapter 10, volume 4 used for NEX _{IPCC default} calculations as above equation	Confirmed as reported by IPCC 2006/59/ and consistent with the PDD.
	F_{gas MS,j,LT} – SDG 13 Default values for nitrogen loss due to volatilisation of NH ₃ and NO _x from manure management	F _{gasMS,j,LT} , (anaerobic lagoon) : 40% F _{gasMS,j,LT} , (solid storage) : 45%	IPCC 2006 table 10.22, chapter 10, volume 4 due to site specific data is unavailable	Confirmed as reported by IPCC 2006/59/ and consistent with the PDD.
	EF_{N2O,D,j} – SDG 13 Direct N ₂ O emission factor for the treatment system <i>j</i> of the manure management system (kg N ₂ O-N/kg N)	0 Kg N ₂ O-N/kg N for anaerobic lagoon and digester 0.01 Kg N ₂ O-N/kg N for aerobic lagoon	IPCC 2006 table 10.21, chapter 10, volume 4 due to site specific data is unavailable	Confirmed as reported by IPCC 2006/59/ and consistent with the PDD.
	EF_{N2O,ID,j} – SDG 13 Indirect N ₂ O emission factor for the treatment system <i>j</i> of the manure management system	0.01 kgN ₂ O-N/kg NH ₃ -N and NO _x -N	IPCC 2006 table 11.3, chapter 11, volume 4 due to site specific data is unavailable	Confirmed as reported by IPCC 2006/59/ and consistent with the PDD.
	EF_{CH4,default} – SDG 13 Default emission factor for the fraction of CH ₄ produced that leaks from the anaerobic digester (fraction)	0.05 t CH ₄ leaked / t CH ₄ produced	Tool 14: “Project and leakage emissions from anaerobic digesters (version 02.0)” for UASB (Upflow Anaerobic Sludge Blanket) type digesters	Confirmed as correct for ex ante determination as per the tool/39/. Via checking the Digester equipment purchase contract/9/, CTI confirmed that the Digester type in the PDD is correct and actual which is identified by manufacturer information.
	R_{vs,n} – SDG 13 Default emission factor for the	R _{vs,n} , aerobic treatment and anaerobic digester:	Appendix 1 of methodology ACM0010	Confirmed as per the Appendix 1 of methodology ACM0010/32/ and consistent with the PDD.

	fraction of CH ₄ produced that leaks from the anaerobic digester (fraction)	2%, 45% and 35% for leakage N ₂ O emission released during project activity R _{vs,n} , one cell lagoon :85 % for leakage N ₂ O emission released during baseline scenario		
	R_{N,n}- SDG 13 Nitrogen reduction factor	R _{N,n} , project activity(aerobic treatment and anaerobic digester): 25% R _{N,n} ,baseline (uncovered anaerobic lagoon) : 80%	Appendix 1 of methodology ACM0010	Confirmed as per the Appendix 1 of methodology ACM0010/32/ and consistent with the PDD.
	EF₁, EF₄, EF₅- SDG 13 Emission factor for N ₂ O from N inputs; from N leaching and runoff; from atmospheric deposition of N on soils and water surfaces	EF ₁ = 0.010 kg N ₂ O-N/kg N EF ₄ =0.010 kg N ₂ O-N/(kg NH ₃ -N and NO _x -N EF ₅ = 0.0075 kg N ₂ O-N/kg N	IPCC 2006 Guidelines default values are be used, since country specific or region specific data are not available. EF ₁ from table 11.1, chapter 11, volume 4. EF ₄ and EF ₅ from table 11.3, chapter 11, volume 4 due to site specific data is unavailable	Confirmed as reported by IPCC 2006/59/ and consistent with the PDD.
	F_{gasm}- SDG 13 Fraction of N lost due to volatilization	0.2	Default values from table 11.3, chapter 11, volume 4 of IPCC 2006 guidelines due to site specific data is unavailable	Confirmed as reported by IPCC 2006/59/ and consistent with the PDD.
	F_{leach}- SDG 13 Fraction of all N added	0.3	Default values from table 11.3, chapter 11, volume 4 of IPCC 2006 guidelines due to site specific data is	Confirmed as reported by IPCC 2006/59/ and consistent with the PDD.

	to/mineralised in managed soils in regions where leaching/runoff occurs that is lost through leaching and runoff		unavailable	
	MCF_d – SDG 13 Methane conversion factor for leakage calculation	1	Methodology ACM0010 (version 08.0)	Confirmed as per the applied methodology/32/ and consistent with the PDD
	EF_{EF,i,y} – SDG 13 Emission factor for electricity generation	0.57205 tCO ₂ /MWh	China DNA	Confirmed as correct for ex ante determination as per the DNA data/60/ and consistent with the PDD
	R_u – SDG 13 Universal ideal gases constant	8,314 Pa.m ³ /kmol .K	Tool to determine the mass flow of a greenhouse gas in a gaseous stream (version 03.0)	Confirmed as per the applied Tool to determine the mass flow of a greenhouse gas in a gaseous stream (version 03.0)/38/ and consistent with the PDD
	MM_i – SDG 13 Molecular mass of greenhouse gas i	16.04 kg/kmol	Tool to determine the mass flow of a greenhouse gas in a gaseous stream (version 03.0)	Confirmed as per the applied Tool to determine the mass flow of a greenhouse gas in a gaseous stream (version 03.0)/38/ and consistent with the PDD
	η_{flare,m} – SDG 13 Flare efficiency in minute m	0%	Tool 06 “Project emissions from flaring (Version 03.0)”	Confirmed as correct open flare as per the applied Project emissions from flaring (Version 03.0)/37/
	The assessment team has checked that all the ex-ante parameters were fixed at the level of PA and were verified from the validated PDD/3/. Also, the ex-ante parameter values have been consistently applied for the ER calculation which is evident from the ER calculation sheet/2/.			
Findings	CAR 02 was raised and resolved. Refer to Appendix 4 in this report for detail assessment.			
Conclusion	The values mentioned in the Monitoring Report/1/ and Emission Reduction Spreadsheet/2/ are consistent with the PDD/3/. The applied values are correct and justified.			

E.6.2. SDG Data and parameters monitored

Means of verification	1. $N_{p,LT}$	
	Relevant SDG indicator:	SDG13

	Data/Parameter	$N_{p,LT}$
	Unit	Number
	Description	Number of animals of type LT produced annually for the year y
	Value applied for this monitoring period	340,959 heads of marketing swine
	Measuring /Reading /Recording frequency	Monitored monthly
	Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes, the measuring and reporting frequency are in line with the registered PDD/3/ and applied methodology/32/.
	Monitoring equipment with accuracy	N/A
	Is the installed monitoring equipment has been duly calibrated for this entire monitoring period?	N/A
	How were the values in the monitoring report verified?	<p>Values of Monitoring parameter of $N_{p,LT}$ were derived from Production record of Market swine issued by PP/15/ for this monitoring period.</p> <p>Data were recorded by technicians in farms each month and sourced from the data logged in each swine farm which has been confirmed by site inspection and checking the Production record of Market swine issued by PP/15/.</p> <p>Via site inspection, it is confirmed that each pig involved in this project has a unique electronic ear tag when was born, which is an electronic device dedicated to the identification and electronic management of animals, can track automatically. This electronic ear tag can be connected to the Data Collection System (DCS), which can store and read information. Through this method, the number of swine produced in the farm can be monitored through the auto tracking devices of electronic ear tag once pig slaughter monthly and obtained by the DCS which has been verified as effective by site inspection of the electronic ear tag and Data Collection System (DCS).</p> <p>Each farm control and record the numbers strictly due to the pigs production and sale are the commercial sources of farms. Hence, the recorded data are confirmed as reasonable and reliable.</p> <p>Via checking the measuring method by reviewing the Production record of Market swine issued by PP/15/ and interview with technicians as stated in the MR, CTI verified that the method is in line with the PDD monitoring plan/3/ and applied methodology/32/.</p> <p>Above mentioned evidences were provided to the verification team during site verification. Via comparing</p>

	the data in MR with the evidence, CTI verified that the data in MR is correct.
If applicable, has the reported data been cross-checked with other available data?	<p>Yes. The Production record of Market swine/15/ is cross-checked with the monthly Sale Records of Marketing swine/17/ of each farm. Via comparing with both sources, it is verified that values are consistent and hence the value of $N_{p,LT}$ determined for this monitoring period is verified as correct and reasonable.</p> <p>According to the Equation 4 in this MR, it is verified that the calculated N_{LT} is 112,096 heads (340,959 heads *180days/365days/18 months*12 months). However, according to the number of market pigs produced annually of each farm, the N_{LT} calculated is rounded to an integer as 112,096 heads.</p> <p>While via checking the monthly Sale Records of Market swine/20/ of each farm, CTI confirmed that total 340,959 head of marketing swine is produced and sold into the market which is consistent with the value from Monthly production record of market swine.</p> <p>According to the conservative principle, the 112,096 heads was applied in the calculations of emission reductions in MR, therefore, $N_{p,LT}$ is reasonable and credible.</p>
Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Yes, QA/QC procedures were found to be appropriate and reliable.
2. $N_{da,LT}$	
Relevant SDG indicator:	SDG13
Data/Parameter	$N_{da,LT}$
Unit	days
Description	Number of days animal of type LT is alive in the farm in the year y
Value applied for this monitoring period	180
Measuring /Reading /Recording frequency	Monitored monthly
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes, the measuring and reporting frequency are in line with the registered PDD/3/ and applied methodology/32/.
Monitoring equipment with accuracy	N/A
Is the installed monitoring equipment has been duly	N/A

	<p>calibrated for this entire monitoring period?</p>	
<p>How were the values in the monitoring report verified?</p>	<p>Values of Monitoring parameter of $N_{da,LT}$ were derived from Production record of Market swine issued by PP/15/ for this monitoring period.</p> <p>Data were recorded by technicians in farms each month and sourced from the data logged in each swine farm which has been confirmed by site inspection and checking the Production record of Market swine issued by PP/15/.</p> <p>Via site inspection, it is confirmed that each pig involved in this project has a unique electronic ear tag when was born, which is an electronic device dedicated to the identification and electronic management of animals, can track automatically. This electronic ear tag can be connected to the Data Collection System (DCS), which can store and read information. Through this method, the days of swine alive can be traced by the technical staffs using DCS in each farm, so it is confirmed that the recorded dates are reasonable and reliable.</p> <p>Via checking the measuring method by reviewing the Production record of Market swine issued by PP/15/ and interview with technicians as stated in the MR, CTI verified that the method is in line with the PDD monitoring plan/3/ and applied methodology/32/.</p> <p>Above mentioned evidences were provided to the verification team during site verification. Via comparing the data in MR with the evidence, CTI verified that the data in MR is correct.</p>	
<p>If applicable, has the reported data been cross-checked with other available data?</p>	<p>Yes. The Production record of Market swine/15/ is cross-checked with the sale records of Marketing swine/17/. Via comparing with both sources, it is verified that the days of swine alive in the farm is 180 days then for sale. Hence it is verified that the days in MR is correct and actual.</p>	
<p>Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?</p>	<p>Yes, QA/QC procedures were found to be appropriate and reliable.</p>	
<p>3. $N_{AA,LT}$</p>		
<p>Relevant SDG indicator:</p>	<p>SDG13</p>	
<p>Data/Parameter</p>	<p>$N_{AA,LT}$</p>	
<p>Unit</p>	<p>Number</p>	
<p>Description</p>	<p>Daily stock of animals in the farm, discounting dead and discarded animals</p>	
<p>Value applied for this monitoring period</p>	<p>Average of 191,825 heads of breeding swine</p>	

	Measuring /Reading /Recording frequency	Monitored daily
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes, the measuring and reporting frequency are in line with the registered PDD/3/ and applied methodology/32/.	
Monitoring equipment with accuracy	N/A	
Is the installed monitoring equipment has been duly calibrated for this entire monitoring period?	N/A	
How were the values in the monitoring report verified?	<p>Values of Monitoring parameter of $N_{AA,LT}$ were derived from Breeding Pig stock record issued by PP/18/ for this monitoring period.</p> <p>Data were recorded by technicians in farms each day and sourced from the data logged in each swine farm which has been confirmed by site inspection and checking the Breeding Pig stock record issued by PP/18/ of each farm.</p> <p>Via site inspection, it is confirmed that each pig involved in this project has a unique electronic ear tag when was born, which is an electronic device dedicated to the identification and electronic management of animals, can track automatically. This electronic ear tag can be connected to the Data Collection System (DCS), which can store and read information. Through this method, the daily stock number of animals from the first day of monitoring period can be recorded, and this record data including the new imported animal and discounting dead and discharge animals which can be traced and recorded by the technical staffs using DCS in each farm, so it is confirmed that the recorded dates are reasonable and reliable.</p> <p>The annual average number of animals ($N_{AA,LT}$) was calculated as an average of the daily stock of breeding swine in the farms without considering dead animals and discarded animals.</p> <p>Via checking the measuring method by reviewing the Breeding Pig stock record issued by PP/18/ and interview with technicians as stated in the MR, CTI verified that the method is in line with the PDD monitoring plan/3/ and applied methodology/32/.</p> <p>Above mentioned evidences were provided to the verification team during site verification. Via comparing the data in MR with the evidence, CTI verified that the data in MR is correct.</p>	
If applicable, has the reported data been cross-checked with other available data?	N/A as the data from DCS	

	Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Yes, QA/QC procedures were found to be appropriate and reliable.																								
4. W_{site}																										
Relevant SDG indicator:	SDG13																									
Data/Parameter	W_{site}																									
Unit	kg																									
Description	Average animal weight of a defined livestock population at the project site																									
Value applied for this monitoring period	Refer to values provided in MR																									
Measuring /Reading /Recording frequency	Monitored monthly																									
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes, the measuring and reporting frequency are in line with the registered PDD/3/ and applied methodology/32/.																									
Monitoring equipment accuracy	with	<p>The weight was measured by weight measures. For each Weight measurer, Accuracy: III level Type: SCS The calibration information and validity is listed as below table</p> <table border="1" data-bbox="742 1467 1428 2027"> <thead> <tr> <th>Farm</th> <th>Serial No.</th> <th>Calibrated Date</th> <th>Validity</th> </tr> </thead> <tbody> <tr> <td>Yongjiahe swine farm</td> <td>19121121</td> <td rowspan="10">22/12/2020 21/12/2021</td> <td rowspan="10">21/12/2021 20/12/2022</td> </tr> <tr> <td>Zhoujiachong swine farm</td> <td>19121122</td> </tr> <tr> <td>Jiucaiyuan swine farm</td> <td>19121123</td> </tr> <tr> <td>Gaoshanmiao swine farm</td> <td>19121124</td> </tr> <tr> <td>Shayang 1st phase swine farm</td> <td>19121125</td> </tr> <tr> <td>Shayang 2nd phase swine farm</td> <td>19121126</td> </tr> <tr> <td>Ezhou swine farm</td> <td>19121127</td> </tr> <tr> <td>Tuchong swine farm</td> <td>19121128</td> </tr> <tr> <td>Sangzihu swine farm</td> <td>19121129</td> </tr> </tbody> </table>	Farm	Serial No.	Calibrated Date	Validity	Yongjiahe swine farm	19121121	22/12/2020 21/12/2021	21/12/2021 20/12/2022	Zhoujiachong swine farm	19121122	Jiucaiyuan swine farm	19121123	Gaoshanmiao swine farm	19121124	Shayang 1 st phase swine farm	19121125	Shayang 2 nd phase swine farm	19121126	Ezhou swine farm	19121127	Tuchong swine farm	19121128	Sangzihu swine farm	19121129
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Tuchong swine farm	19121128																									
Sangzihu swine farm	19121129																									
Is the installed	The above calibration information has been confirmed by																									

	<p>monitoring equipment has been duly calibrated for this entire monitoring period?</p>	<p>checking the calibration reports/13/ which has been conducted by qualified parties/14/.</p>
	<p>How were the values in the monitoring report verified?</p>	<p>Values of Monitoring parameter of W_{site} were derived from Weight records issued by PP/16/ for this monitoring period.</p> <p>For monitoring this parameter, a sampling method has been used by PP following the applied methodology and PDD.</p> <p>Refer to section E.5 for detail assessment of the sampling method.</p> <p>Via checking the sampling method by reviewing the Weight records issued by PP/16/ and interview with technicians as stated in the MR, CTI verified that the sampling and recording method is in line with the PDD monitoring plan/3/ and applied methodology/32/.</p> <p>Above mentioned evidences were provided to the verification team during site verification. Via comparing the data in MR with the evidence, CTI verified that the data in MR is correct.</p>
	<p>If applicable, has the reported data been cross-checked with other available data?</p>	<p>N/A</p>
	<p>Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?</p>	<p>Yes, QA/QC procedures were found to be appropriate and reliable.</p>
	<p>5. n_{dy}</p>	
<p>Relevant SDG:</p>	<p>SDG13</p>	
<p>Data/Parameter</p>	<p>n_{dy}</p>	
<p>Unit</p>	<p>number</p>	
<p>Description</p>	<p>Number of days treatment plant was operational in year y</p>	
<p>Value applied for this monitoring period</p>	<p>546 days</p>	
<p>Measuring /Reading /Recording frequency</p>	<p>Measured Daily</p>	
<p>Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)</p>	<p>Yes, the measuring and reporting frequency are in line with the registered PDD/3/ and applied methodology/32/.</p>	
<p>Monitoring equipment</p>	<p>N/A</p>	

	with accuracy	
	Is the installed monitoring equipment has been duly calibrated for this entire monitoring period? (Yes / No)	N/A
	How were the values in the monitoring report verified?	Monitoring parameter of n_{dy} was derived from Daily operation record of each treatment plant/19/. PP record the actual number of days of each treatment plant that was operational daily. Finally, the Daily operation record of each treatment plant during this monitoring period were summarized by all the daily record. Via checking the Daily operation record of each treatment plant/19/ and interview with monitoring staff and PP, CTI verified that the method is in line with the PDD monitoring plan/3/ and applied methodology/32/. Above mentioned evidences were provided to the verification team during site verification. Via comparing the data in MR with the evidence, CTI verified that the data in MR is correct.
	If applicable, has the reported data been cross-checked with other available data? (Yes / No)	Yes. Daily operation record of each treatment plant/19/ is cross-checked with the rated flow of the biogas which has been provided in the MR and assessed as below, CTI verified that each treatment plant was operational in 546 days and all the 9 swine farms. i.e each farm was operational for 546 days and there was no breakdown/ non-operational day at any of the farms during this monitoring period.
	Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Yes, QA/QC procedures were found to be appropriate and reliable.
6. F_{Aer}		
Relevant SDG:	SDG13	
Data/Parameter	F_{Aer}	
Unit	Fraction	
Description	Fraction of volatile solids directed to aerobic treatment	
Value applied for this monitoring period	100%	
Measuring /Reading /Recording frequency	Annually	
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring	Yes, the measuring and reporting frequency are in line with the registered PDD/3/ and applied methodology/32/.	

	methodology? (Yes / No)	
	Monitoring equipment with accuracy	N/A
	Is the installed monitoring equipment has been duly calibrated for this entire monitoring period? (Yes / No)	N/A
	How were the values in the monitoring report verified?	As no monitoring equipment was installed in the project activity to monitor the influent into anaerobic digestion and aerobic system, hence using 100% as conservative.
	If applicable, has the reported data been cross-checked with other available data? (Yes / No)	N/A
	Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	N/A
	7. V_f	
Relevant SDG:	SDG13	
Data/Parameter	V_f	
Unit	m ³	
Description	Biogas flow	
Value applied for this monitoring period	Refer to values provided in the MR	
Measuring /Reading /Recording frequency	Continuously by flow meters and reported cumulatively on weekly basis	
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes, the measuring and reporting frequency are in line with the registered PDD/3/ and applied methodology/32/.	
Monitoring equipment with accuracy	3 flow meters 1,2,3 installed at each treatment plant Total 27 flow meters Type: LUGB Accuracy: 1.5	
Is the installed monitoring equipment has been	For each flow meter, the calibration information and validity is listed as below table	

	duly calibrated for this entire monitoring period? (Yes / No)	<p>Flow meter 1</p> <table border="1"> <thead> <tr> <th>Farm</th> <th>Serial No.</th> <th>Calibrated Date</th> <th>Validity</th> </tr> </thead> <tbody> <tr> <td>Yongjiahe swine farm</td> <td>1907812</td> <td rowspan="9">20/12/2020</td> <td rowspan="9">19/12/2022</td> </tr> <tr> <td>Zhoujiachong swine farm</td> <td>1907815</td> </tr> <tr> <td>Jiucaiyuan swine farm</td> <td>1907818</td> </tr> <tr> <td>Gaoshanmiao swine farm</td> <td>1907821</td> </tr> <tr> <td>Shayang 1st phase swine farm</td> <td>1907824</td> </tr> <tr> <td>Shayang 2nd phase swine farm</td> <td>1907827</td> </tr> <tr> <td>Ezhou swine farm</td> <td>1907830</td> </tr> <tr> <td>Tuchong swine farm</td> <td>1907833</td> </tr> <tr> <td>Sangzihu swine farm</td> <td>1907836</td> </tr> </tbody> </table> <p>Flow meter 2</p> <table border="1"> <thead> <tr> <th>Farm</th> <th>Serial No.</th> <th>Calibrated Date</th> <th>Validity</th> </tr> </thead> <tbody> <tr> <td>Yongjiahe swine farm</td> <td>1907813</td> <td rowspan="9">20/12/2020</td> <td rowspan="9">19/12/2022</td> </tr> <tr> <td>Zhoujiachong swine farm</td> <td>1907816</td> </tr> <tr> <td>Jiucaiyuan swine farm</td> <td>1907819</td> </tr> <tr> <td>Gaoshanmiao swine farm</td> <td>1907822</td> </tr> <tr> <td>Shayang 1st phase swine farm</td> <td>1907825</td> </tr> <tr> <td>Shayang 2nd phase swine farm</td> <td>1907828</td> </tr> <tr> <td>Ezhou swine farm</td> <td>1907831</td> </tr> <tr> <td>Tuchong swine farm</td> <td>1907834</td> </tr> <tr> <td>Sangzihu swine farm</td> <td>1907837</td> </tr> </tbody> </table> <p>Flow meter 3</p> <table border="1"> <thead> <tr> <th>Farm</th> <th>Serial No.</th> <th>Calibrated Date</th> <th>Validity</th> </tr> </thead> <tbody> <tr> <td>Yongjiahe swine farm</td> <td>1907814</td> <td rowspan="9">20/12/2020</td> <td rowspan="9">19/12/2022</td> </tr> <tr> <td>Zhoujiachong swine farm</td> <td>1907817</td> </tr> <tr> <td>Jiucaiyuan swine farm</td> <td>1907820</td> </tr> <tr> <td>Gaoshanmiao swine farm</td> <td>1907823</td> </tr> <tr> <td>Shayang 1st phase swine farm</td> <td>1907826</td> </tr> <tr> <td>Shayang 2nd phase swine farm</td> <td>1907829</td> </tr> <tr> <td>Ezhou swine farm</td> <td>1907832</td> </tr> <tr> <td>Tuchong swine farm</td> <td>1907835</td> </tr> <tr> <td>Sangzihu swine farm</td> <td>1907838</td> </tr> </tbody> </table> <p>The above calibration information has been confirmed by checking the calibration reports/13/ which has been conducted by qualified parties/14/.</p> <p>Via checking the calibration reports/13/, CTI confirmed that all the flow meters are calibrated based on JJG1029-2007-Verification Regulation of Vortex-shedding Flowmeter/49/. And based on this regulation, the validity is two years.</p> <p>And based on the validity as above table, CTI confirmed that the installed monitoring equipment has been duly calibrated for this entire monitoring period.</p>	Farm	Serial No.	Calibrated Date	Validity	Yongjiahe swine farm	1907812	20/12/2020	19/12/2022	Zhoujiachong swine farm	1907815	Jiucaiyuan swine farm	1907818	Gaoshanmiao swine farm	1907821	Shayang 1 st phase swine farm	1907824	Shayang 2 nd phase swine farm	1907827	Ezhou swine farm	1907830	Tuchong swine farm	1907833	Sangzihu swine farm	1907836	Farm	Serial No.	Calibrated Date	Validity	Yongjiahe swine farm	1907813	20/12/2020	19/12/2022	Zhoujiachong swine farm	1907816	Jiucaiyuan swine farm	1907819	Gaoshanmiao swine farm	1907822	Shayang 1 st phase swine farm	1907825	Shayang 2 nd phase swine farm	1907828	Ezhou swine farm	1907831	Tuchong swine farm	1907834	Sangzihu swine farm	1907837	Farm	Serial No.	Calibrated Date	Validity	Yongjiahe swine farm	1907814	20/12/2020	19/12/2022	Zhoujiachong swine farm	1907817	Jiucaiyuan swine farm	1907820	Gaoshanmiao swine farm	1907823	Shayang 1 st phase swine farm	1907826	Shayang 2 nd phase swine farm	1907829	Ezhou swine farm	1907832	Tuchong swine farm	1907835	Sangzihu swine farm	1907838
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	How were the values in the monitoring report verified?	<p>Monitoring parameter of v_f was derived from Daily operation record/19/.</p> <p>The biogas flow data were measured by the flow meters installed at each treatment plant (total 27 flow meters 1,2,3), flow meters 1 are installed at outlet of the anaerobic digestion, flow meters 2 are installed at the inlet of biogas generator and flow meters 3 are</p>																																																																								

	<p>installed at the inlet of flare system which have been verified as correct and actual by site inspection.</p> <p>The flowmeters monitored data continuously, record hourly and saved automatically in the Data Collection System (DCS).</p> <p>The data can be obtained from Data Collection System (DCS) and the monthly data was exported by the staff at the beginning of next month and then recorded in daily operation record, then summarized as the monthly biogas production, biogas flow to the power generator and biogas flow to flare system is the sum of the daily output.</p> <p>Via checking the measuring method by reviewing the Daily operation record/19/ as stated in the MR and interview with monitoring staff, CTI verified that the method is in line with the PDD and applied methodology.</p> <p>Above mentioned evidences were provided to the verification team during site verification. Via comparing the data in MR with the evidence, CTI verified that the data in MR is correct.</p>	<p>installed at the inlet of flare system which have been verified as correct and actual by site inspection.</p> <p>The flowmeters monitored data continuously, record hourly and saved automatically in the Data Collection System (DCS).</p> <p>The data can be obtained from Data Collection System (DCS) and the monthly data was exported by the staff at the beginning of next month and then recorded in daily operation record, then summarized as the monthly biogas production, biogas flow to the power generator and biogas flow to flare system is the sum of the daily output.</p> <p>Via checking the measuring method by reviewing the Daily operation record/19/ as stated in the MR and interview with monitoring staff, CTI verified that the method is in line with the PDD and applied methodology.</p> <p>Above mentioned evidences were provided to the verification team during site verification. Via comparing the data in MR with the evidence, CTI verified that the data in MR is correct.</p>
<p>If applicable, has the reported data been cross-checked with other available data? (Yes / No)</p>	<p>Via comparing with the data of v_i at outlet of the anaerobic digestion and at the inlet of biogas generator, it is confirmed that the values are similar by considering the gas loss, thus it is confirmed that no surplus biogas for the flaring system is correct and actual due to all the biogas produced has been used for power generation.</p>	
<p>Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?</p>	<p>Yes, QA/QC procedures were found to be appropriate and reliable.</p>	
<p>8. $EC_{PJ,j,y}$</p>		
<p>Relevant SDG:</p>	<p>SDG13</p>	
<p>Data/Parameter</p>	<p>$EC_{PJ,j,y}$</p>	
<p>Unit</p>	<p>MWh</p>	
<p>Description</p>	<p>Quantity of electricity consumed by the project in year y</p>	
<p>Value applied for this monitoring period</p>	<p>1,705.0968</p>	
<p>Measuring /Reading /Recording frequency</p>	<p>Continuous measurement and daily recording</p>	
<p>Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)</p>	<p>Yes, the measuring and reporting frequency are in line with the registered PDD/3/ and applied methodology/32/.</p>	
<p>Monitoring</p>	<p>9 Electricity meters 1 installed at each treatment plant</p>	

	equipment with accuracy	Accuracy: 0.5s Type: DSSD331																								
	Is the installed monitoring equipment has been duly calibrated for this entire monitoring period? (Yes / No)	<p>For each electricity meter 1, the calibration information and validity is listed as below table</p> <table border="1" data-bbox="742 347 1428 907"> <thead> <tr> <th>Farm</th> <th>Serial No.</th> <th>Calibrated Date</th> <th>Validity</th> </tr> </thead> <tbody> <tr> <td>Yongjiahe swine farm</td> <td>190501489Q0213</td> <td rowspan="10">27/12/2020</td> <td rowspan="10">26/12/2025</td> </tr> <tr> <td>Zhoujiachong swine farm</td> <td>190501489Q0215</td> </tr> <tr> <td>Jiucaiyuan swine farm</td> <td>190501489Q0217</td> </tr> <tr> <td>Gaoshanmiao swine farm</td> <td>190501489Q0219</td> </tr> <tr> <td>Shayang 1st phase swine farm</td> <td>190501489Q0221</td> </tr> <tr> <td>Shayang 2nd phase swine farm</td> <td>190501489Q0223</td> </tr> <tr> <td>Ezhou swine farm</td> <td>190501489Q0225</td> </tr> <tr> <td>Tuchong swine farm</td> <td>190501489Q0227</td> </tr> <tr> <td>Sangzihu swine farm</td> <td>190501489Q0229</td> </tr> </tbody> </table> <p>The above calibration information has been confirmed by checking the calibration reports/13/ which has been conducted by qualified parties/14/.</p> <p>Via checking the calibration reports/13/, CTI confirmed that all the electricity meters are calibrated based on JJG 596-2012 Electrical Meters for Measuring Alternating-current Electrical Energy/48/. And based on this regulation, if the electricity meters can be used normally, recalibration is not required. The validity is five years.</p> <p>And based on the validity as above table, CTI confirmed that the installed monitoring equipment has been duly calibrated for this entire monitoring period.</p>	Farm	Serial No.	Calibrated Date	Validity	Yongjiahe swine farm	190501489Q0213	27/12/2020	26/12/2025	Zhoujiachong swine farm	190501489Q0215	Jiucaiyuan swine farm	190501489Q0217	Gaoshanmiao swine farm	190501489Q0219	Shayang 1 st phase swine farm	190501489Q0221	Shayang 2 nd phase swine farm	190501489Q0223	Ezhou swine farm	190501489Q0225	Tuchong swine farm	190501489Q0227	Sangzihu swine farm	190501489Q0229
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Tuchong swine farm	190501489Q0227																									
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	How were the values in the monitoring report verified?			<p>Monitoring parameter of $EC_{PJ,j,y}$ was derived from Daily report of electricity/30/ and cross-checked with electricity notes issued by grid company/29/.</p> <p>The electricity consumptions were measured by the electricity meter installed at each treatment plant (total 9 Electricity meters).</p> <p>Monitoring staff read the readings of electricity daily at 24:00 and recorded meter reading data into Daily report of electricity/30/ which includes the electricity consumption of the treatment plant daily, and then the electricity consumption is calculated for each month.</p> <p>Via checking the measuring method by reviewing the Daily operation record/19/ and electricity notes issued by grid company/29/ as stated in the MR and interview with monitoring staff, CTI verified that the method is in line with the PDD monitoring plan/3/ and applied tool/36/.</p> <p>Via site inspection and checking Daily report of electricity/30/ and electricity notes issued by grid company/29/, it is confirmed that during this monitoring period, the values from both sources are consistent.</p> <p>Above mentioned evidences were provided to the verification team during site verification. Via comparing the data in MR with the evidence, CTI verified that the</p>																						

	data in MR is correct.
If applicable, has the reported data been cross-checked with other available data? (Yes / No)	N/A
Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Yes, QA/QC procedures were found to be appropriate and reliable.
9. $TDL_{j,y}$	
Relevant SDG:	SDG13
Data/Parameter	$TDL_{j,y}$
Unit	%
Description	Average technical transmission and distribution losses for providing electricity to source j in year y .
Value applied for this monitoring period	20
Measuring /Reading /Recording frequency	Changed once the tool is updated.
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes
Monitoring equipment with accuracy	N/A
Is the installed monitoring equipment has been duly calibrated for this entire monitoring period? (Yes / No)	N/A
How were the values in the monitoring report verified?	As per the tool of Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation (Version 03.0)/36/, CTI confirmed that different values applied to different scenarios. For the project, the electricity consumption was derived from the power grid. Hence, scenario A: Electricity consumption from the grid is applied to this situation. For this situation, a default value of 20% is used for $TDL_{j,y}$ in line with the tool/36/ and it is confirmed that this value is the maximum value as per Methodology tool 05 Version 03.0 and conservative.

	Via checking the Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation (Version 03.0)/36/, CTI confirmed that the data in MR is correct.
If applicable, has the reported data been cross-checked with other available data? (Yes / No)	N/A, as the value is derived from tool.
Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	N/A
10. $V_{t,db}$	
Relevant SDG:	SDG13
Data/Parameter	$V_{t,db}$
Unit	m ³ dry gas/h
Description	Volumetric flow of the gaseous stream in time interval t on a dry basis
Value applied for this monitoring period	Refer to values provided in the MR
Measuring /Reading /Recording frequency	Continuously measurement
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes, the measuring and reporting frequency are in line with the registered PDD/3/ and applied methodology/32/.
Monitoring equipment with accuracy	3 flow meters 1,2,3 installed at each treatment plant Total 27 flow meters
Is the installed monitoring equipment has been duly calibrated for this entire monitoring period? (Yes / No)	Refer to information for 27 flow meters above
How were the values in the monitoring report verified?	Monitoring parameter of $V_{t,db}$ was derived from Daily operation record/19/. The volumetric flow of the gaseous stream data was measured by the flow meters installed at each treatment plant (total 27 flow meters 1,2,3), flow meters 1 are installed at outlet of the anaerobic digestion, flow meters 2 are installed at the inlet of biogas generator and flow

	<p>meters 3 are installed at the inlet of flare system which have been verified as correct and actual by site inspection.</p> <p>The flowmeters monitored data continuously, record hourly and saved automatically in the Data Collection System (DCS).</p> <p>CTI confirmed that the measurement method is actual and the gaseous stream is defined as dry according to the Tool 8: "Tool to determine the mass flow of a greenhouse gas in a gaseous stream (version 03.0)"/38/. Hence the monitoring parameter $V_{t,db}$ does not need to be calculated based on the wet basis flow plus water concentration.</p> <p>The data can be obtained from Data Collection System (DCS) and the monthly data was exported by the staff at the beginning of next month and then recorded in daily operation record. Daily biogas flow is equal to the cumulative value of 24 hours, and monthly biogas flow can be accumulated on daily basis.</p> <p>Via checking the measuring method by reviewing the Daily operation record/19/ as stated in the MR and interview with monitoring staff, CTI verified that the method is in line with the PDD and applied methodology.</p> <p>Above mentioned evidences were provided to the verification team during site verification. Via comparing the data in MR with the evidence, CTI verified that the data in MR is correct.</p>	<p>meters 3 are installed at the inlet of flare system which have been verified as correct and actual by site inspection.</p> <p>The flowmeters monitored data continuously, record hourly and saved automatically in the Data Collection System (DCS).</p> <p>CTI confirmed that the measurement method is actual and the gaseous stream is defined as dry according to the Tool 8: "Tool to determine the mass flow of a greenhouse gas in a gaseous stream (version 03.0)"/38/. Hence the monitoring parameter $V_{t,db}$ does not need to be calculated based on the wet basis flow plus water concentration.</p> <p>The data can be obtained from Data Collection System (DCS) and the monthly data was exported by the staff at the beginning of next month and then recorded in daily operation record. Daily biogas flow is equal to the cumulative value of 24 hours, and monthly biogas flow can be accumulated on daily basis.</p> <p>Via checking the measuring method by reviewing the Daily operation record/19/ as stated in the MR and interview with monitoring staff, CTI verified that the method is in line with the PDD and applied methodology.</p> <p>Above mentioned evidences were provided to the verification team during site verification. Via comparing the data in MR with the evidence, CTI verified that the data in MR is correct.</p>
<p>If applicable, has the reported data been cross-checked with other available data? (Yes / No)</p>	<p>N/A</p>	
<p>Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?</p>	<p>Yes, QA/QC procedures were found to be appropriate and reliable.</p>	
<p>11. $V_{i,t,db}$</p>		
<p>Relevant SDG:</p>	<p>SDG13</p>	
<p>Data/Parameter</p>	<p>$V_{i,t,db}$</p>	
<p>Unit</p>	<p>m³ gas i/m³ dry gas</p>	
<p>Description</p>	<p>Volumetric fraction of greenhouse gas i in a time interval t on a dry basis</p>	
<p>Value applied for this monitoring period</p>	<p>Refer to values provided in the MR</p>	
<p>Measuring /Reading /Recording frequency</p>	<p>Continuous measurement</p>	
<p>Is measuring and reporting frequency</p>	<p>Yes, the measuring and reporting frequency are in line with the registered PDD/3/ and applied methodology/32/.</p>	

	<p>in accordance with the monitoring plan and monitoring methodology? (Yes / No)</p>																								
<p>Monitoring equipment accuracy with</p>	<p>Gas analyzers installed at each treatment plant Total 9 gas analyzers Type: ADOS Biogas 401 Accuracy: ±1%</p>																								
<p>Is the installed monitoring equipment has been duly calibrated for this entire monitoring period? (Yes / No)</p>	<p>For each gas analyzer, the calibration information and validity is listed as below table</p> <table border="1" data-bbox="742 593 1428 985"> <thead> <tr> <th>Farm</th> <th>Serial No.</th> <th>Calibrated Date</th> <th>Validity</th> </tr> </thead> <tbody> <tr> <td>Yongjiahe swine farm</td> <td>56801</td> <td rowspan="9">25/12/2020 24/12/2021</td> <td rowspan="9">24/12/2021 23/12/2022</td> </tr> <tr> <td>Zhoujiachong swine farm</td> <td>56802</td> </tr> <tr> <td>Jiucaiyuan swine farm</td> <td>56803</td> </tr> <tr> <td>Gaoshanmiao swine farm</td> <td>56804</td> </tr> <tr> <td>Shayang 1st phase swine farm</td> <td>56805</td> </tr> <tr> <td>Shayang 2nd phase swine farm</td> <td>56806</td> </tr> <tr> <td>Ezhou swine farm</td> <td>56807</td> </tr> <tr> <td>Tuchong swine farm</td> <td>56808</td> </tr> <tr> <td>Sangzihu swine farm</td> <td>56809</td> </tr> </tbody> </table> <p>The above calibration information has been confirmed by checking the calibration reports/13/ which has been conducted by qualified parties/14/.</p> <p>Via checking the calibration reports/13/, CTI confirmed that all the gas analyzers are calibrated based on JJG693-2011(Verification Regulation of Alarmer Detectors of Combustible Gas)/50/. And based on this regulation, the validity is one year.</p> <p>Calibration should include zero verification with an inert gas (e.g. N₂) and at least one reading verification with a standard gas (single calibration gas or mixture calibration gas). And the zero verification with an inert gas (N₂) and one reading verification with a standard gas (single calibration gas) are implemented in the process of calibration, which is confirmed as in accordance with JJG693-2011.</p> <p>All calibration gases are confirmed as from Guangzhou Yigas Gases Co.Ltd., which is a qualified reference materials manufacturer issued by the General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China on 16/01/2020/14/.</p> <p>And based on the validity as above table, CTI confirmed that the installed monitoring equipment has been duly calibrated for this entire monitoring period.</p>	Farm	Serial No.	Calibrated Date	Validity	Yongjiahe swine farm	56801	25/12/2020 24/12/2021	24/12/2021 23/12/2022	Zhoujiachong swine farm	56802	Jiucaiyuan swine farm	56803	Gaoshanmiao swine farm	56804	Shayang 1 st phase swine farm	56805	Shayang 2 nd phase swine farm	56806	Ezhou swine farm	56807	Tuchong swine farm	56808	Sangzihu swine farm	56809
Farm	Serial No.	Calibrated Date	Validity																						
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Ezhou swine farm	56807																								
Tuchong swine farm	56808																								
Sangzihu swine farm	56809																								
<p>How were the values in the monitoring report verified?</p>	<p>Monitoring parameter of $V_{i,t,db}$ was derived from Daily operation record/19/.</p> <p>The data are measured continuously and record hourly by online gas analysers installed at the outlet of the anaerobic digesters and saved automatically in the DCS. The data can be obtained from DCS and the monthly data was exported by the staff at the beginning of next month. Daily and Monthly CH₄ concentration was calculated based on the 24-hour average and daily</p>																								

	<p>average CH₄ concentration and recorded finally in the Daily operation record/19/.</p> <p>Via checking the measuring method by reviewing the Daily operation record/19/ as stated in the MR and interview with monitoring staff, CTI verified that the method is in line with the PDD and applied methodology.</p> <p>Above mentioned evidences were provided to the verification team during site verification. Via comparing the data in MR with the evidence, CTI verified that the data in MR is correct.</p>
If applicable, has the reported data been cross-checked with other available data? (Yes / No)	N/A
Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Yes, QA/QC procedures were found to be appropriate and reliable.
12. T_t	
Relevant SDG:	SDG13
Data/Parameter	T _t
Unit	K
Description	Temperature of the gaseous stream in time interval t
Value applied for this monitoring period	Refer to values provided in the MR
Measuring /Reading /Recording frequency	Continuously measurement
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes, the measuring and reporting frequency are in line with the registered PDD/3/ and applied methodology/32/.
Monitoring equipment with accuracy	3 flow meters 1,2,3 installed at each treatment plant Total 27 flow meters
Is the installed monitoring equipment has been duly calibrated for this entire monitoring period? (Yes / No)	Refer to information for 27 flow meters above
How were the values in the	Monitoring parameter of T _t was derived from Daily operation record/19/.

	<p>monitoring report verified?</p>	<p>The temperature of the gaseous stream data was measured by the flow meters installed at each treatment plant (total 27 flow meters 1,2,3), flow meters 1 are installed at outlet of the anaerobic digestion, flow meters 2 are installed at the inlet of biogas generator and flow meters 3 are installed at the inlet of flare system, and record hourly and saved automatically in the DCS system. which have been verified as correct and actual by site inspection.</p> <p>Via site inspection and checking the manufacture specification of the flow meter/20/, it is confirmed that the flow meter has the function to measure the temperature with recordable electronic signal (digital).</p> <p>The data are monitored continuously, record hourly and saved automatically in the DCS. The data for this monitoring period have been obtained from DCS and the monthly data was exported by the staff at the beginning of next month. Daily and Monthly temperature was calculated based on the 24-hour average and daily average temperature.</p> <p>The readout of flowmeter was indicated degrees Celsius(°C). Therefore, the temperature $T_t(K)$ is calculated as the equation $T(K)=t(^{\circ}C)+273.15$</p> <p>Via checking the measuring method by reviewing the Daily operation record/19/ as stated in the MR and interview with monitoring staff, CTI verified that the method is in line with the PDD and applied methodology.</p> <p>Above mentioned evidences were provided to the verification team during site verification. Via comparing the data in MR with the evidence, CTI verified that the data in MR is correct.</p>									
	<p>If applicable, has the reported data been cross-checked with other available data? (Yes / No)</p>	<p>N/A</p>									
	<p>Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?</p>	<p>Yes, QA/QC procedures were found to be appropriate and reliable.</p>									
	<p>13. P_t</p>										
	<p>Value applied for this monitoring period</p>	<table border="1"> <tr> <td data-bbox="438 1668 730 1736">Relevant SDG:</td> <td data-bbox="730 1668 1444 1736">SDG13</td> </tr> <tr> <td data-bbox="438 1736 730 1792">Data/Parameter</td> <td data-bbox="730 1736 1444 1792">P_t</td> </tr> <tr> <td data-bbox="438 1792 730 1848">Unit</td> <td data-bbox="730 1792 1444 1848">Pa</td> </tr> <tr> <td data-bbox="438 1848 730 1915">Description</td> <td data-bbox="730 1848 1444 1915">Pressure of the gaseous stream in time interval t</td> </tr> <tr> <td data-bbox="438 1915 730 2016">Value applied for this monitoring period</td> <td data-bbox="730 1915 1444 2016">Refer to values provided in the MR</td> </tr> </table>	Relevant SDG:	SDG13	Data/Parameter	P_t	Unit	Pa	Description	Pressure of the gaseous stream in time interval t	Value applied for this monitoring period
Relevant SDG:	SDG13										
Data/Parameter	P_t										
Unit	Pa										
Description	Pressure of the gaseous stream in time interval t										
Value applied for this monitoring period	Refer to values provided in the MR										

	Measuring /Reading /Recording frequency	Continuously measurement
	Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes, the measuring and reporting frequency are in line with the registered PDD/3/ and applied methodology/32/.
	Monitoring equipment with accuracy	3 flow meters 1,2,3 installed at each treatment plant Total 27 flow meters
	Is the installed monitoring equipment has been duly calibrated for this entire monitoring period? (Yes / No)	Refer to information for 27 flow meters above
	How were the values in the monitoring report verified?	<p>Monitoring parameter of P_t was derived from Daily operation record/19/.</p> <p>The pressure of the gaseous stream data was measured by the flow meters installed at each treatment plant (total 27 flow meters 1,2,3), flow meters 1 are installed at outlet of the anaerobic digestion, flow meters 2 are installed at the inlet of biogas generator and flow meters 3 are installed at the inlet of flare system, and record hourly and saved automatically in the DCS system which have been verified as correct and actual by site inspection.</p> <p>Via site inspection and checking the manufacture specification of the flow meter/20/, it is confirmed that the flow meter has the function to measure the pressure with recordable electronic signal (digital).</p> <p>The data are monitored continuously, record hourly and saved automatically in the DCS. The data for this monitoring period have been obtained from DCS and the monthly data was exported by the staff at the beginning of next month. Daily and Monthly pressure was calculated based on the 24-hour average and daily average pressure.</p> <p>Via checking the measuring method by reviewing the Daily operation record/19/ as stated in the MR and interview with monitoring staff, CTI verified that the method is in line with the PDD and applied methodology.</p> <p>Above mentioned evidences were provided to the verification team during site verification. Via comparing the data in MR with the evidence, CTI verified that the data in MR is correct.</p>
	If applicable, has the reported data been cross-checked with other available data? (Yes / No)	N/A

	Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Yes, QA/QC procedures were found to be appropriate and reliable.
14. $\rho_{i,t}$		
Relevant SDG: SDG13		
Data/Parameter $\rho_{i,t}$		
Unit kg gas i/m ³ gas i		
Description Density of greenhouse gas i in the gaseous stream in time interval t		
Value applied for this monitoring period Refer to values provided in the MR		
Measuring /Reading /Recording frequency N/A		
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No) Yes, calculated in line with the registered PDD/3/ and applied methodology/32/.		
Monitoring equipment with accuracy N/A		
Is the installed monitoring equipment has been duly calibrated for this entire monitoring period? (Yes / No) N/A		
How were the values in the monitoring report verified? Calculated based on temperature of the gaseous stream in time interval t and pressure of the gaseous stream in time interval t.		
If applicable, has the reported data been cross-checked with other available data? (Yes / No) N/A		
Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place? N/A		

15. $MS\%_j$	
Relevant SDG:	SDG13
Data/Parameter	$MS\%_j$
Unit	Fraction
Description	Fraction of manure handled in system j in project activity
Value applied for this monitoring period	100%
Measuring /Reading /Recording frequency	Annually
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes, the measuring and reporting frequency are in line with the registered PDD/3/ and applied methodology/32/.
Monitoring equipment with accuracy	N/A
Is the installed monitoring equipment has been duly calibrated for this entire monitoring period? (Yes / No)	N/A
How were the values in the monitoring report verified?	As no monitoring was conducted in the project activity to monitor the fraction of manure handled, hence using 100% as conservative.
If applicable, has the reported data been cross-checked with other available data? (Yes / No)	N/A
Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	N/A
16. $B_{0,LT}$	
Relevant SDG:	SDG13
Data/Parameter	$B_{0,LT}$
Unit	m^3CH_4/kg -dm
Description	Maximum methane producing potential of the volatile solid generated by animal type <i>LT</i>
Value applied for this monitoring period	$B_{0,LT}$ (Market swine) =0.29 $B_{0,LT}$ (Breeding swine) =0.29

	Measuring /Reading /Recording frequency	Annually
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes, the measuring and reporting frequency are in line with the registered PDD/3/ and applied methodology/32/.	
Monitoring equipment with accuracy	N/A	
Is the installed monitoring equipment has been duly calibrated for this entire monitoring period? (Yes / No)	N/A	
How were the values in the monitoring report verified?	As no monitoring was conducted in the project activity to monitor the value, so, 0.29 m ³ CH ₄ /kg -dm is still applied. The actual methane producing potential of the volatile solid generated by swine manure is 479.4ml/g VS according to the public literature which is higher than PDD value, therefore 0.29 m ³ CH ₄ /kg -dm applied in monitoring period is conservative.	
If applicable, has the reported data been cross-checked with other available data? (Yes / No)	N/A	
Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Yes. The value is taken from published sources. The parameter value should be updated on latest available public data source.	
17. NEX_{LT,y}		
Relevant SDG:	SDG13	
Data/Parameter	NEX_{LT,y}	
Unit	kg N/animal/year	
Description	Annual average nitrogen excretion per head of a defined livestock population estimated as described in Appendix 2	
Value applied for this monitoring period	Refer to values provided in the MR	
Measuring /Reading /Recording frequency	Annually	
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes, the measuring and reporting frequency are in line with the registered PDD/3/ and applied methodology/32/.	

	methodology? (Yes / No)	
	Monitoring equipment with accuracy	N/A
	Is the installed monitoring equipment has been duly calibrated for this entire monitoring period? (Yes / No)	N/A
	How were the values in the monitoring report verified?	The value is calculated as the equation of option 2 in Appendix 2 as listed below and $NEX_{LT,y} = \frac{W_{site}}{W_{default}} * NEX_{IPCC\ default}$ While, $NEX_{IPCC\ default}$ calculated as equation 30 of the IPCC 2006, volume 4, chapter 10/59/ $NEX_{IPCC\ default} = N_{rate(T)} * TAM / 1000 * 365$ The value of $N_{rate(T)}$ and TAM applied in the equation is taken from published sources (2006 IPCC)/59/.
	If applicable, has the reported data been cross-checked with other available data? (Yes / No)	N/A
	Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Yes. This parameter will be monitored annually by checking if the data updated on latest available public data source. The parameter value should be updated upon the changes occur in the monitoring period.
	18. Type	
	Relevant SDG:	SDG13
	Data/Parameter	Type
	Unit	/
Description	Type of barn and AWMS	
Value applied for this monitoring period	N/A	
Measuring /Reading /Recording frequency	N/A	
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes, the measuring and reporting frequency are in line with the registered PDD/3/ and applied methodology/32/.	
Monitoring equipment with accuracy	N/A	
Is the installed monitoring equipment	N/A	

	has been duly calibrated for this entire monitoring period? (Yes / No)	
	How were the values in the monitoring report verified?	The swine barn and AWMS layout and configuration are collected to confirm whether the implementation of project as design.
	If applicable, has the reported data been cross-checked with other available data? (Yes / No)	N/A
	Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Yes. Due to the project has been approved by government, it will not be changed during the implementation periods, hence the Type of barn and AWMS will not be changed, hence type will not be monitored due to all the other parameters monitored can-determine if the project type has been changed or not
19. T		
	Relevant SDG:	SDG13
	Data/Parameter	<i>T</i>
	Unit	°C
	Description	Annual average ambient temperature at project site
	Value applied for this monitoring period	2021: 17.4 2022: N/A
	Measuring /Reading /Recording frequency	Monthly
	Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes, the measuring and reporting frequency are in line with the registered PDD/3/ and applied methodology/32/.
	Monitoring equipment with accuracy	N/A
	Is the installed monitoring equipment has been duly calibrated for this entire monitoring period? (Yes / No)	N/A
	How were the values in the monitoring report verified?	The value is derived from Official public information /57/.
	If applicable, has the reported data been cross-checked with other available data? (Yes / No)	N/A

<p>Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?</p>	<p>Yes. This parameter is monitored monthly by checking the annual average ambient temperature at project site derived from Official public information. Temperature in 2021 is 17.4°C. MCF value is 75% with the lower temperature of ex ante 16°C (comparing with the actual for 2021) as per Appendix 3 of ACM0010 (Version 08.0). Then multiplying MCF values with a value of 0.94, so 70.5% of MCF_j is used for calculation during in this monitoring period. For year 2022, due to the year not ended and the temperature in first 6 months cannot represent the annual average temperature of the whole year, hence MCF_j of 70.5% is still applied for the period from 01/01/2022 to 30/06/2022, which is the same with the value in 2021.</p>
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20. Number of full-time jobs created

Relevant SDG:	SDG8
Data/Parameter	Number of full-time jobs created
Unit	Number
Description	Full-time Jobs created for both men and women
Value applied for this monitoring period	18 full-time jobs created including 9 males and 9 females
Measuring /Reading /Recording frequency	Once for each monitoring period
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes, the measuring and reporting frequency are in line with the PDD/3/.
Monitoring equipment with accuracy	N/A The value is derived from Record keeping books/22/ and labor contracts/23/
Is the installed monitoring equipment has been duly calibrated for this entire monitoring period? (Yes / No)	N/A
How were the values in the monitoring report verified?	Monitoring parameter of Number of full-time jobs created was determined by checking the record keeping books/22/ and labor contracts/23/, CTI verified that the number of jobs created during this monitoring period is 18 full-time including 9 female and 9 male employees. CTI verified that the data in MR is correct.
If applicable, has the reported data been cross-checked with other available data? (Yes / No)	Yes. The record keeping books/22/ is cross checked with labor contracts/23/, training notices of employees/25/ and on-site interview with staffs.

	Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Yes, QA/QC procedures were found to be appropriate and reliable.																								
21. The amount of electricity generation by capturing biogas																										
Relevant SDG:	SDG7																									
Data/Parameter	<i>EG_{d,y}</i>																									
Unit	MWh																									
Description	The amount of electricity generation by capturing biogas																									
Value applied for this monitoring period	52,782.064																									
Measuring /Reading /Recording frequency	Continuous measurement and daily recording																									
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes, the measuring and reporting frequency are in line with the registered PDD/3/ and applied methodology/32/.																									
Monitoring equipment with accuracy	9 Electricity meters 2 installed at outlet of biogas generator Accuracy: 0.5s Type: DSSD331																									
Is the installed monitoring equipment has been duly calibrated for this entire monitoring period? (Yes / No)	<p>For each electricity meter, the calibration information and validity is listed as below table</p> <table border="1" data-bbox="734 1422 1420 1926"> <thead> <tr> <th>Farm</th> <th>Serial No.</th> <th>Calibrated Date</th> <th>Validity</th> </tr> </thead> <tbody> <tr> <td>Yongjiahe swine farm</td> <td>190501489Q0212</td> <td rowspan="10">27/12/2020</td> <td rowspan="10">26/12/2025</td> </tr> <tr> <td>Zhoujiachong swine farm</td> <td>190501489Q0214</td> </tr> <tr> <td>Jiucaiyuan swine farm</td> <td>190501489Q0216</td> </tr> <tr> <td>Gaoshanmiao swine farm</td> <td>190501489Q0218</td> </tr> <tr> <td>Shayang 1st phase swine farm</td> <td>190501489Q0220</td> </tr> <tr> <td>Shayang 2nd phase swine farm</td> <td>190501489Q0222</td> </tr> <tr> <td>Ezhou swine farm</td> <td>190501489Q0224</td> </tr> <tr> <td>Tuchong swine farm</td> <td>190501489Q0226</td> </tr> <tr> <td>Sangzihu swine farm</td> <td>190501489Q0228</td> </tr> </tbody> </table> <p>The above calibration information has been confirmed by checking the calibration reports/13/ which has been conducted by qualified parties/14/.</p> <p>Via checking the calibration reports/13/, CTI confirmed</p>		Farm	Serial No.	Calibrated Date	Validity	Yongjiahe swine farm	190501489Q0212	27/12/2020	26/12/2025	Zhoujiachong swine farm	190501489Q0214	Jiucaiyuan swine farm	190501489Q0216	Gaoshanmiao swine farm	190501489Q0218	Shayang 1 st phase swine farm	190501489Q0220	Shayang 2 nd phase swine farm	190501489Q0222	Ezhou swine farm	190501489Q0224	Tuchong swine farm	190501489Q0226	Sangzihu swine farm	190501489Q0228
Farm	Serial No.	Calibrated Date	Validity																							
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Zhoujiachong swine farm	190501489Q0214																									
Jiucaiyuan swine farm	190501489Q0216																									
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Ezhou swine farm	190501489Q0224																									
Tuchong swine farm	190501489Q0226																									
Sangzihu swine farm	190501489Q0228																									

		<p>that all the electricity meters are calibrated based on JIG 596-2012 Electrical Meters for Measuring Alternating-current Electrical Energy/48/. And based on this regulation, if the electricity meters can be used normally, recalibration is not required. The validity is five years.</p> <p>And based on the validity as above table, CTI confirmed that the installed monitoring equipment has been duly calibrated for this entire monitoring period.</p>
	<p>How were the values in the monitoring report verified?</p>	<p>Monitoring parameter of $EG_{d,y}$ was derived from Daily report of electricity/30/.</p> <p>The electricity consumptions were measured by the electricity meter installed at outlet of biogas generator (total 9 Electricity meters).</p> <p>Monitoring staff read the readings of electricity daily at 24:00 and recorded meter reading data into Daily report of electricity/30/ which includes the electricity generated from the biogas generator daily, and then the electricity generation is calculated for each month.</p> <p>Via checking the measuring method by reviewing the Daily operation record/19/ as stated in the MR and interview with monitoring staff, CTI verified that the method is in line with the PDD monitoring plan/3/ and applied tool/36/.</p> <p>Via site inspection and checking Daily report of electricity/30/, it is confirmed that during this monitoring period, the values from both sources are consistent.</p> <p>Above mentioned evidences were provided to the verification team during site verification. Via comparing the data in MR with the evidence, CTI verified that the data in MR is correct.</p>
	<p>If applicable, has the reported data been cross-checked with other available data? (Yes / No)</p>	<p>N/A</p>
	<p>Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?</p>	<p>Yes, QA/QC procedures were found to be appropriate and reliable.</p>
<p>22. Employee Training of biogas safety operation</p>		
<p>Relevant SDG:</p>	<p>Mitigation Measure for Safeguarding Principles</p>	
<p>Data/Parameter</p>	<p>Employee Training of biogas safety operation</p>	
<p>Unit</p>	<p>/</p>	
<p>Description</p>	<p>Employees was trained on the safety operation of the biogas</p>	
<p>Value applied for this monitoring period</p>	<p>Trainings of safety operation of the biogas carried out on 20/11/2020 and 26/10/2021</p>	

	Measuring /Reading /Recording frequency	Once a year
	Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes, the measuring and reporting frequency are in line with the PDD/3/.
	Monitoring equipment with accuracy	N/A
	Is the installed monitoring equipment has been duly calibrated for this entire monitoring period? (Yes / No)	N/A
	How were the values in the monitoring report verified?	Trainings of safety operation of the biogas carried out on 20/11/2020 and 26/10/2021 is confirmed by checking the training notices/25/ and cross checked with the Meeting attendance record/26/. And via checking all the operation records of the treatment plants and by site inspection, it is verified that there was no safety accident occurred during this monitoring period. CTI verified that the data in MR is correct.
	If applicable, has the reported data been cross-checked with other available data? (Yes / No)	N/A
	Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	N/A
Findings	CAR 03, CAR 04, CAR 05, CAR 06, CAR 07, CAR 08, CAR 09, CAR 10, CAR 11 and CAR 12 were raised and resolved. Refer to Appendix 4 in this report for detail assessment.	
Conclusion	The parameters have been monitored appropriately, in accordance with the validated monitoring plan/3/ (as per measurement methods and procedures to be applied) and applied methodology/32/. The monitoring results were recorded consistently as per the approved frequency in the monitoring plan/3/.	

E.6.3. Comparison of monitored parameters with last monitoring period

Means of verification	This is the 1 st monitoring period. PP has provided the values from this monitoring period for each monitoring parameters in the MR. Due to this is the 1 st monitoring period, hence no comparison results are needed.
Findings	N/A
Conclusion	Due to this is the 1 st monitoring period, hence no comparison results are needed.

E.6.4. Compliance of the sampling implementation with the registered sampling plan

Means of verification	The sampling implementation has been carried out in accordance with the sampling
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plan contained in the PDD/3/.

Sampling Design/Size/Target Population:

Sampling plan was provided by PP and has demonstrated in the PDD. The average animal weight of a defined livestock population at the project site (W_{site}) is monitored by sampling method as per the PDD and applied methodology.

The project activity applies stratified sampling method and simple random sampling for monitoring animal weight of a defined livestock population at the project site (W_{site}), and the sample size is calculated as 423 as per the PDD. Via checking the calculation sheet of sample size/28/, the sample size is confirmed as correct which has been verified according to “Guidelines for Sampling and Surveys for CDM Project Activities and Programme of Activities”/34/.

The sample size of each farm was decided on the proportion of the number of each farm in the total number of 9 swine farms. To be conservative, both the samples number of the ten subsidiary farms is adjusted to be integer value. As a result, total 453 samples of swine population were selected within the project boundary using Excel to ensure conservation.

Furthermore, as per the applied methodology, to ensure representativeness, each defined livestock population has been classified into a minimum of three age categories including Nursery phase, Growing phase and Mature phase, hence to be conservative, both the samples number of the three age categories is adjusted to be integer value.

Finally, the PP has selected total 453 samples of swine population and the distribution of the samples for three age categories in each swine farm have been clearly and correctly determined as listed in the MR.

The sampling plan is confirmed as in line with the GS requirement, CDM sampling standard and guideline and applied methodology.

Sampling Frame:

All the swine population in ten farms are considered as the sampling frame.

Sampling Selection:

The PP has applied Stratified Sampling Method and Simple Random Sampling for all over the swine population with three age categories.

Implementation of Sampling Method:

Refer to section E.5 of this report for detail assessment of the Sampling Method used for this monitoring period.

Reliability and precision calculation:

According to Guidelines for Sampling and surveys of CDM project activities and programmes of activities (Version 04.0)/34/, confidence/precision have been checked as follows:

a. The stratified estimated overall mean:

The sample estimated of the overall mean operation hours is confirmed to be calculated with the equation below as per “Guidelines for Sampling and Surveys for CDM Project Activities and Programme of Activities”/34/:

$$m_{strat} = \sum_{i=a}^k \frac{g_i}{N} \times m_i$$

Where:

- m_{stra} is the stratified estimated overall mean;
- g_i is the size of the i^{th} district where $i=a, \dots, k$;
- N is the population total (357,928);
- m_i is the mean of the i^{th} district where $i=a, \dots, k$.

b. The standard error of the stratified estimated overall mean:

The standard error of the stratified estimated overall mean is confirmed to be

calculated as per “Guidelines for Sampling and Surveys for CDM Project Activities and Programme of Activities”/34/:

$$s.e.(m_{strat}) = \sqrt{\sum_{i=a}^k \left(\frac{g_i}{N}\right)^2 \times \left(1 - \frac{n_i}{g_i}\right) \times \frac{SD_i^2}{n_i}}$$

Where:

- s.e.(m_{strat}) is the standard error of the stratified estimated overall mean;
- g_i is the size of the ith district where i=a,...,k;
- N is the population total (357,928);
- n_i is the number of sampled units the ith district where i=a,...,k;
- SD_i² is the variance of the ith district where i=a,...,k.

c. t-value:

T-value depends on (i) the level of confidence and (ii) the size of the sample. The t-value associated with 95% confidence and the sample size of 453 is confirmed to be 1.9652 as derived in Microsoft Excel using the TINV function following “Guidelines for Sampling and Surveys for CDM Project Activities and Programme of Activities”/34/.

d. Precision:

The precision associated with an estimate is confirmed to be: t-value x standard error of the mean as per “Guidelines for Sampling and Surveys for CDM Project Activities and Programme of Activities”/34/.

e. Calculation results

According to “Standard for Sampling and surveys for CDM project activities and programmes of activities (Version 09.0)”/33/, the desired confidence level is 95% and the desired precision is 10%. Hence, calculation results is therefore confirmed to be:

Period	t-value	m _{strat}	s.e. (m _{strat})	Precision	Relative Precision
01/01/2021-31/01/2021	1.9652	69.93	1.3437	2.6408	3.78%
01/02/1021-28/02/2021	1.9652	69.71	1.3188	2.5916	3.72%
01/03/2021-31/03/3021	1.9652	70.20	1.3209	2.5958	3.70%
01/04/2021-30/04/2021	1.9652	69.60	1.3408	2.6349	3.79%
01/05/2021-31/05/2021	1.9652	69.33	1.3148	2.5839	3.73%
01/06/2021-30/06/2021	1.9652	70.04	1.3242	2.6024	3.72%
01/07/2021-31/07/2021	1.9652	69.93	1.3038	2.5622	3.66%
01/08/2021-31/08/2021	1.9652	69.40	1.3300	2.6138	3.77%
01/09/2021-30/09/2021	1.9652	69.82	1.3161	2.5864	3.70%
01/10/2021-31/10/2021	1.9652	69.64	1.3417	2.6367	3.79%
01/11/2021-30/11/2021	1.9652	69.96	1.3084	2.5713	3.68%
01/12/2021-31/12/2021	1.9652	69.84	1.3403	2.6339	3.77%
01/01/2022-31/01/2022	1.9652	69.13	1.3316	2.6168	3.79%
01/02/2022-28/02/2022	1.9652	69.24	1.3408	2.6350	3.81%
01/03/2022-31/03/2022	1.9652	69.58	1.3324	2.6184	3.76%
01/04/2022-30/04/2022	1.9652	70.09	1.2980	2.5509	3.64%
01/05/2022-31/05/2022	1.9652	69.33	1.3156	2.5855	3.73%
01/06/2022-30/06/2022	1.9652	69.47	1.3513	2.6556	3.82%

The relative precision is less than 10%. The data are within the required specification. Therefore, CTI verified that the required confidence/precision has been met.

Findings	CL 03 was raised and resolved. Refer to Appendix 4 in this report for detail assessment.
Conclusion	The verification team has found out that the sampling plan applied is found to be in-

	line with the monitoring plan mentioned in the PDD/3/ and Sampling and survey standards/33/ and guideline/34/.
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E.7. Assessment of data and calculation of SDG impacts

E.7.1. Calculation of baseline value or estimation of baseline situation of each SDG Impact

Means of verification	<p>SDG 7 Baseline Impact:</p> <p>Via checking the MR and through interview with local residents, CTI confirmed that the electricity can be generated by capturing biogas in project activity.</p> <p>In the baseline situation, as per the interview with end users, CTI verified that 0 MWh of electricity generation by capturing biogas without the project activity. Therefore, Baseline Impact is zero.</p> <p>SDG 8 Baseline Impact:</p> <p>Via checking the MR and through interview with representative of staffs, CTI confirmed that the project created jobs</p> <p>In the baseline situation, as per interview with representative of staffs, CTI verified that no new full-time job created without this project. Therefore, Baseline Impact is zero.</p> <p>SDG 13 Baseline Impact:</p> <p>Via checking the MR/1/ and through checking the emission reduction calculation sheet/2/, CTI confirmed that the amount of GHGs emission avoided or sequestered in baseline is 0 tCO₂e. Therefore, Baseline Impact is zero.</p>
Findings	CL 04 was raised and resolved. Refer to Appendix 4 in this report for detail assessment.
Conclusion	<p>The verification team confirms that</p> <ol style="list-style-type: none"> The complete data was available and is duly reported; As indicated above, the description with regard to cross-check of reported data is included under respective parameter (refer Section E.6.2 of this report); Appropriate methods and formulae are used for calculating baseline SDG impact; Appropriate emission factors and other reference values were correctly applied. The calculation of baseline situation of each SDG impact is correct.

E.7.2. Calculation of project value or estimation of project situation of each SDG Impact

Means of verification	<p>SDG 7 Project Impact:</p> <p>For SDG 7, the project installs new animal waste management systems by replace the current open anaerobic lagoons and utilized biogas for power generation, as assessed in E.6.2, CTI verified that the</p> <p>From 01/01/2021 to 31/12/2021, 35,300.25 MWh of electricity generation by capturing biogas,</p> <p>From 01/01/2022 to 30/06/2022, 17,481.82 MWh of electricity generation by capturing biogas,</p> <p>Therefore, the SDG 7 Project Impact for this monitoring period from 01/01/2021 to 30/06/2022 is total 52,782.06 MWh of electricity generation by capturing biogas.</p> <p>SDG 8 Project Impact:</p> <p>For SDG Indicator 8,</p> <p>From 01/01/2021 to 31/12/2021, 18 full-time jobs created (including 9 females and 9 males) which is verified in section E.6.2.</p> <p>From 01/01/2022 to 30/06/2022, 18 full-time jobs created (including 9 females and 9 males) which is verified in section E.6.2.</p> <p>For this monitoring period from 01/01/2021 to 30/06/2022, 18 full-time jobs created</p>
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(including 9 females and 9 males) which is verified in section E.6.2.

Hence CTI confirmed the project is beneficial to local stakeholders.

SDG 13 Project Impact:

As per section B.6.1 of the PDD, the amount of GHGs emissions avoided or sequestered is calculated equal to baseline emission – project emissions – leakage emissions, and the baseline emission, project emissions, leakage emissions are determined by ACM0010” GHG emission reductions from manure management systems (Version 08.0)”, the specific calculation method and calculation result in this monitoring period are described as follows:

Baseline Emissions BE_y Calculation Assessment:

Via checking the PDD and the applied methodology, the baseline emissions BE_y in a year y are calculated as:

$$BE_y = BE_{CH_4,y} + BE_{N_2O,y} + BE_{elec/heat,y} \quad (1)$$

Where:

BE_y	=	Baseline emissions in year y (t CO ₂ /yr)
$BE_{CH_4,y}$	=	Baseline CH ₄ emissions in year y (t CO ₂ /yr)
$BE_{N_2O,y}$	=	Baseline N ₂ O emissions in year y (t CO ₂ /yr)
$BE_{elec/heat,y}$	=	Baseline CO ₂ emissions from electricity and/or heat used in the baseline (t CO ₂ /yr)

1. Baseline CH₄ emissions ($BE_{CH_4,y}$)

$$BE_{CH_4,y} = GWP_{CH_4} * D_{CH_4} * \sum_{j,LT} (MCF_j * B_{0,LT} * N_{LT} * VS_{LT,y} * MS\%_{Bl,j}) \quad (2)$$

Where:

$BE_{CH_4,y}$	=	Baseline CH ₄ emissions in year y (t CO ₂ /yr)
GWP_{CH_4}	=	Global Warming Potential (GWP) of CH ₄ (t CO ₂ e/t CH ₄)
D_{CH_4}	=	Density of CH ₄ (t/m ³). 0.00067t/m ³ at room temperature(20°C)and 1am pressure.
MCF_j	=	Annual methane conversion factor (MCF) for the baseline $AWMS_j$. IPCC 2006, table 10.17, chapter 10, volume 4.
$B_{0,LT}$	=	Maximum methane producing potential of the volatile solid generated by animal type LT (m ³ CH ₄ /kg -dm)
N_{LT}	=	Annual average number of animals of type LT for the year y (number)
$VS_{LT,y}$	=	Annual volatile solid excretions for livestock LT entering all $AWMS$ on a dry matter weight basis (kg -dm/animal/yr)
$MS\%_{Bl,j}$	=	Fraction of manure handled in system j in the baseline. In this project, the baseline manure management system is uncovered anaerobic lagoon only. The amount of manure handled by the anaerobic lagoon is 100%. $MS\%_{Bl,j}=100\%$
LT	=	Type of livestock
j	=	Type of treatment system

Estimation of various variables and parameters for above equation:

(A) $VS_{LT,y}$

As per the methodology, there are four options to determine this value, via checking the options provided, CTI confirmed there is no published country specific data available based on the local expertise of validation team. The energy intake of the swine is not available, Option 2 can't be used. Option 3 utilizes the average weight of the swine, this data is available and therefore Option 3 is adopted by PD to calculate $VS_{LT,y}$.

Scaling default IPCC values $VS_{default}$ to adjust for a site-specific average animal weight as shown in equation below:

$$VS_{LT,y} = \left(\frac{W_{site}}{W_{default}} \right) * VS_{default} * nd_y \quad (3)$$

Where:

- $VS_{LT,y}$ = Annual volatile solid excretions for livestock LT entering all AWMS on a dry matter weight basis (kg -dm/animal/yr)
- W_{site} = Average animal weight of a defined livestock population at the project site (kg)
- $W_{default}$ = Default average animal weight of a defined population (kg)
- $VS_{default}$ = Default value for the volatile solid excretion per day on a dry-matter basis for a defined livestock population (kg-dm/animal/day)
- nd_y = Number of days treatment plant was operational in year y

(B) N_{LT}

As per the methodology, there are four options to determine this value, via checking the options provided, via site inspection, CTI confirmed that there are two types of swine in this project, i.e., Market swine and Breeding swine. For Market swine, since there is no way to trace the daily stock, so the Option 1 is adopted to calculate N_{LT} for Market swine. For Breeding swine, the PP can monitor the daily stock of breeding swine in a reliable way, discounting dead breeding swine and discarded them from the productive process from the daily stock. So, the Option 2 is adopted to calculate N_{LT} for Breeding swine.

Option 1:

$$N_{LT} = N_{da,LT} * \left(\frac{N_{p,LT}}{365} \right) \quad (4)$$

Where:

- N_{LT} = Annual average number of animals of type LT for the year y (number)
- $N_{da,LT}$ = Number of days animal of type LT is alive in the farm in the year y (number)
- $N_{p,LT}$ = Number of animals of type LT produced annually for the year y (number)

Option 2:

If the project developer can monitor in a reliable and traceable way the daily stock of animals in the farm, discounting dead animals and animals discarded from the productive process from the daily stock, then the annual average number of animals (N_{LT}) may be calculated as follows:

$$N_{LT} = \frac{\sum_1^{365} N_{AA,LT}}{365} \quad (5)$$

Where:

- N_{LT} = Annual average number of animals of type LT for the year y (number)
- $N_{AA,LT}$ = Daily stock of animals of type LT in the farm, discounting dead and discarded animals (number)

(C) $B_{0,LT}$

CTI verified that the maximum methane producing potential ($B_{0,LT}$) for Market swine and Breeding swine in Asia region is 0.29 m³ CH₄/kg VS is applicable to the project due to project is located in Hubei Province, China, Asia which is verified by checking the Table 10A-7 and 10A-8 of IPCC 2006 Guidelines for National Greenhouse Gas Inventories volume 4, chapter 10/59/.

CTI verified that the $B_{0,LT}$ values applicable for the project which has been assessed in the validation process/4/.

(D) MCF_j

As per the applied methodology, the MCF values given in table 10.17, chapter 10,

volume 4, IPCC 2006 Guidelines/59/ should be used. MCF values depend on the annual average temperature where the anaerobic manure treatment facility in the baseline existed.

i. For this monitoring period, the annual average temperature is confirmed as 17.4°C in 2021 and value from 2021 was also used in 2022 due to not ended in whole 2022, the value of 75% applied is verified as consistent with IPCC/59/.

ii. A conservativeness factor should be applied by multiplying MCF values (estimated as per above bullet) with a value of 0.94, to account for the 20% uncertainty in the MCF values as reported by IPCC 2006/59/.

2. Baseline NO₂ emissions (BE_{NO₂,y})

$$BE_{N_2O,y} = GWP_{N_2O} * CF_{N_2O-N,N} * \frac{1}{1000} * (E_{N_2O,D,y} + E_{N_2O,ID,y}) \quad (6)$$

Where:

- BE_{N₂O,y} = Annual baseline N₂O emissions in (t CO₂e/yr)
 GWP_{N₂O} = Global Warming Potential (GWP) for N₂O (t CO₂e/tN₂O)
 CF_{N₂O-N,N} = Conversion factor N₂O-N to N₂O (44/28)
 E_{N₂O,D,y} = Direct N₂O emission in year y (kg N₂O-N/year)
 E_{N₂O,ID,y} = Indirect N₂O emission in year y (kg N₂O-N/year)

$$E_{N_2O,D,y} = \sum_{j,LT} EF_{N_2O,D,j} * NEX_{LT,y} * N_{LT} * MS\%_{Bl,j} \quad (7)$$

Where:

- E_{N₂O,D,y} = Direct N₂O emission in year y (kg N₂O-N/yr)
 EF_{N₂O,D,j} = Direct N₂O emission factor for the treatment system j of the manure management system (kg N₂O-N/kg N). (Estimated with site-specific, regional or national data if such data is available, otherwise use default EF₃ from table 10.21, chapter 10, volume 4, in the IPCC 2006 Guidelines for National Greenhouse Gas Inventories). The site-specific, regional or national data are not available, so this project activity adopts default EF₃.
 NEX_{LT,y} = Annual average nitrogen excretion per head of a defined livestock population (kg N/animal/yr) estimated as described in Appendix 2
 MS%_{Bl,j} = Fraction of manure handled in system j (fraction)
 N_{LT} = Annual Average number of animals of type LT for the year y estimated as per equation 4 and 5 (number)

$$E_{N_2O,ID,y} = \sum_{j,LT} EF_{N_2O,ID} * F_{gasMS,j,LT} * NEX_{LT,y} * N_{LT} * MS\%_{Bl,j} \quad (8)$$

Where:

- E_{N₂O,ID,y} = Indirect N₂O emission in year y (kg N₂O-N/year)
 EF_{N₂O,ID} = Indirect N₂O emission factor for N₂O emissions from atmospheric deposition of nitrogen on soils and water surfaces (kgN₂O-N/kg NH₃-N and NO_x-N). (Estimated with site-specific, regional or national data if such data is available. Otherwise, default values for EF₄ from table 11.3, chapter 11, volume 4 of IPCC 2006 Guidelines for National Greenhouse Gas Inventories can be used). The site-specific, regional or national data are not available, so this project activity adopts default EF₄.
 NEX_{LT,y} = Annual average nitrogen excretion per head of a defined livestock population (kg N/animal/yr) estimated as described in Appendix 2
 MS%_{Bl,j} = Fraction of manure handled in system j (fraction)

$F_{\text{gasMS},j,LT}$ = Default values for nitrogen loss due to volatilisation of NH_3 and NO_x from manure management (fraction)
 N_{LT} Annual Average number of animals of type LT for the year y estimated as per equation (5) or (6) (number)

Estimation of various variables and parameters for above equations:

(A) Procedure for estimating $NEX_{LT,y}$

As per the Appendix 2 of the applied methodology, two options provided, for this project, neither specific information on Portion of that N intake nor site-specific national or regional data is available. So, the Option 2 is adopted to calculate $NEX_{LT,y}$.

Option 2:

In the absence of availability of project specific information on protein intake, which should be justified in the CDM-PDD, national or regional data should be used for the nitrogen excretion $NEX_{LT,y}$, if available. In the absence of such data, default values from table 10.19 of the IPCC 2006, volume 4, chapter 10) may be used and should be corrected for the animal weight at the project site in the following way:

$$NEX_{LT,y} = \frac{W_{\text{site}}}{W_{\text{default}}} * NEX_{\text{IPCC default}} \quad (9)$$

Where:

$NEX_{LT,y}$ = Annual average nitrogen excretion per head of a defined livestock population (kg N/animal/yr)
 W_{site} = Average animal weight of a defined livestock population at the project site (kg)
 W_{default} = Default average animal weight of a defined population (kg)
 $NEX_{\text{IPCC default}}$ = Default value for the nitrogen excretion per head of a defined livestock population (kg N/animal/year)

Via checking the IPCC, it is confirmed that below equation is used for calculate $NEX_{\text{IPCC default}}$

$$NEX_{\text{IPCC default}} = N_{\text{rate}(T)} * \frac{TAM}{1000} * 365 \quad (10)$$

Where:

$N_{\text{rate}(T)}$ = the default N excretion rate, kg N/ (1,000 kg animal mass)/ day, table 10.19, chapter 10, volume 4 of IPCC 2006 Guidelines
 TAM = Typical animal mass for livestock in kg/animal

3. Baseline CO_2 emission from electricity and/or heat used in the baseline

$$BE_{\text{elec/heat},y} = BE_{\text{EC},y} + BE_{\text{HG},y} \quad (11)$$

Where:

$BE_{\text{elec/heat},y}$ = Baseline CO_2 emissions from electricity and/or heat used in the baseline (t CO_2 /yr)
 $BE_{\text{EC},y}$ = Baseline emissions associated with electricity generation in year y (t CO_2 /yr)
 $BE_{\text{HG},y}$ = Baseline emissions associated with heat generation in year y (t CO_2 /yr)

Via site inspection and checking the baseline scenario evidence/21/, CTI confirmed that baseline scenario of this project is uncovered anaerobic lagoon, and no heat used in the baseline, only minor electricity will be used, so the emission can be excluded for simplification. In addition, the biogas generated during the treatment process in this project will be captured for heat generation and used by the 9 swine farms. So, the baseline CO_2 emission from electricity and/or heat used in the baseline is 0, which is conservative.

The values monitored during monitoring survey are transparently shown in the

Monitoring Report Section D.2. During onsite, the verification team cross-checked these values in detail using various supporting records and documents. Refer to the section E.6.1 and E.6.2 of this report for ex-ante and ex-post parameters' assessment.

The **SDG 13 Baseline Impact** (Baseline emission calculation) is provided in the Emission reduction calculation spreadsheet/2/ in a transparent manner and the calculation found correct. There is no material error noted in the accounting and application of various data against monitored parameters.

The Baseline Impact for SDG 13 during this monitoring period is summarized as below,

Date	$BE_{CH_4,y}$ (tCO ₂ e/yr)	$BE_{N_2O,y}$ (tCO ₂ e/yr)	BE_y (tCO ₂ e/yr)
01/01/2021-31/12/2021	322,483	3,759	326,242
01/01/2022-30/06/2022	159,869	1,862	161,731
01/01/2021-30/06/2022	482,352	5,621	487,973

Total Baseline Impact for SDG 13 (baseline emissions) of the 1st monitoring period (01/01/2021-30/06/2022) is thus verified as **487,973** tCO₂e. Among this, baseline emissions were 326,242 tCO₂e from 01/01/2021 to 31/12/2021 and 161,731 tCO₂e from 01/01/2022 to 30/06/2022.

Project Emission Calculation Assessment:

Based on the applied methodology, and via site inspection checking the project implementation, CTI confirmed that there are two stages involved in the manure treatment for the project activity: (1) anaerobic digester; (2) aerobic treatment of biogas liquid in lagoon.

The Project emissions are estimated as follows:

$$PE_y = PE_{AD,y} + PE_{Aer,y} + PE_{N_2O,y} + PE_{EC/FC,y} \tag{12}$$

Where:

- PE_y = Project emissions in year y
- $PE_{AD,y}$ = Project emissions associated with the anaerobic digester in year y (t CO₂e/yr)
- $PE_{Aer,y}$ = Project CH₄ emissions from aerobic AWMS treatment (t CO₂e/yr)
- $PE_{N_2O,y}$ = Project N₂O emissions in year y (t CO₂/yr)
- $PE_{EC/FC,y}$ = Project emissions from electricity consumption and fossil fuel combustion (t CO₂e/yr)

i) $PE_{AD,y}$

$PE_{AD,y}$ is determined using the methodological tool “Project and leakage emissions from anaerobic digesters” (Version 02.0) as defined in the applied methodology, as per the tool

$$PE_{AD,y} = PE_{EC,y} + PE_{FC,y} + PE_{CH_4,y} + PE_{flare,y} \tag{13}$$

Where:

- $PE_{AD,y}$ = Project emissions associated with the anaerobic digester in year y (t CO₂e)
- $PE_{EC,y}$ = Project emissions from electricity consumption associated with the anaerobic digester in year y (t CO₂e)
- $PE_{FC,y}$ = Project emissions from fossil fuel consumption associated with the anaerobic digester in year y (t CO₂e)
- $PE_{CH_4,y}$ = Project emissions of methane from the anaerobic digester in year y (t CO₂e)
- $PE_{flare,y}$ = Project emissions from flaring of biogas in year y (t CO₂e)

a. PE_{EC,y}

The project emissions from electricity consumption is calculated according to the “Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation” (version 03.0).

$$PE_{EC,y} = \sum_{j,LT} EC_{PJ,j,y} * EF_{EF,j,y} * (1 + TDL_{j,y}) \quad (14)$$

Where:

- PE_{EC,y} = Project emissions from electricity consumption in year y (t CO₂e)
 EC_{PJ,j,y} = Quantity of electricity consumed by the project electricity consumption source j in year y (MWh/yr)
 EF_{EF,j,y} = Emission factor for electricity generation for source j in year y (t CO₂/MWh)
 TDL_{j,y} = Average technical transmission and distribution losses for providing electricity to source j in year y

During this monitoring period, via site inspection and checking the electricity data record as assessed in section E.6.2, it is confirmed that the electricity consumed by the project came from the grid company.

b. PE_{FC,y}

Via site inspection, CTI confirmed that there are no fossil fuels involved in the project for anaerobic digestion process, hence PE_{FC,y}=0.

c. PE_{flare,y}

Via site inspection and checking the flow meter records as assessed in section E.6.2 for parameter v_f , it is confirmed that for this monitoring period, there was no residual gas stream flared by flaring, hence PE_{flare,y}=0.

d. PE_{CH₄,y}

The project emissions from methane from the anaerobic digester is calculated according to the tool “Project and leakage emissions from anaerobic digesters (Version 02.0)"/39/. According to the tool, Project emissions of methane from the anaerobic digester include 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.

These emissions are calculated using a default emission factor ($EF_{CH_4,default}$), as follows:

$$PE_{CH_4,y} = Q_{CH_4,y} * EF_{CH_4,default} * GWP_{CH_4} \quad (15)$$

Where:

- PE_{CH₄,y} = Project emissions of methane from the anaerobic digester in year y (t CO₂e)
 Q_{CH₄,y} = Quantity of methane produced in the anaerobic digester in year y (t CH₄)
 EF_{CH₄,default} = Default emission factor for the fraction of CH₄ produced that leaks from the anaerobic digester (fraction)
 GWP_{CH₄} = Global warming potential of CH₄ (t CO₂ / t CH₄)

Q_{CH₄,y}

As per PDD, the biogas is produced and collected from anaerobic digestion process. The flowmeters are installed at the outlet of the biogas digesters and the measured on an hourly basis time interval. So the quantity of methane produced in the digester in year y ($Q_{CH_4,y}$) is the accumulation of the mass flow of methane in the gaseous stream in an hourly basis time interval. i.e., $Q_{CH_4,y} = \sum_{i=1}^{8760} F_{i,t}$

Hence the mass flow of greenhouse gas i ($F_{i,t}$) is determined as follows:

$$F_{i,t} = V_{t,db} * v_{i,t,db} * \rho_{i,t} \quad (16)$$

$$\rho_{i,t} = \frac{P_t * MM_i}{R_u * T_t} \quad (17)$$

Where:

- $F_{i,t}$ = Mass flow of greenhouse gas i in the gaseous stream in time interval t (kg gas/h)
 $V_{t,db}$ = Volumetric flow of the gaseous stream in time interval t on a dry basis (m³ dry gas/h)
 $v_{i,t,db}$ = Volumetric fraction of greenhouse gas i in the gaseous stream in a time interval t on a dry basis (m³ gas i /m³ dry gas)
 $\rho_{i,t}$ = Density of greenhouse gas i in the gaseous stream in time interval t (kg gas i /m³ gas i)
 P_t = Absolute pressure of the gaseous stream in time interval t (Pa)
 MM_i = Molecular mass of greenhouse gas i (kg/kmol)
 R_u = Universal ideal gases constant (Pa.m³/kmol.K)
 T_t = Temperature of the gaseous stream in time interval t (K)

In summary, for this monitoring period, the final determined Project emission of $PE_{AD,y}$ is calculated as

$$PE_{AD,y} = PE_{EC,y} + PE_{flare,y} + PE_{CH_4,y}$$

ii). $PE_{Aer,y}$

IPCC guidelines specify emissions from aerobic lagoons as 0.1 per cent of total methane generating potential of the waste processed, which can be used as a default for all types of aerobic AWMS treatment.

$$PE_{Aer,y} = GWP_{CH_4} * D_{CH_4} * 0.001 * F_{Aer} * \left[\prod_{n=1}^N (1 - R_{VS,n}) \right] * \sum_{j,LT} (B_{0,LT} * N_{LT} * VS_{LT,y} * MS\%_j) + PE_{sl,y} \quad (18)$$

No sludge will be produced in the process of the manure treatment system in this project. So the $PE_{sl,y}=0$.

So,

$$PE_{Aer,y} = GWP_{CH_4} * D_{CH_4} * 0.001 * F_{Aer} * \left[\prod_{n=1}^N (1 - R_{VS,n}) \right] * \sum_{j,LT} (B_{0,LT} * N_{LT} * VS_{LT,y} * MS\%_j) \quad (19)$$

Where:

- GWP_{CH_4} = Global Warming Potential (GWP) of CH₄ (t CO₂e/tCH₄)
 $R_{VS,n}$ = Fraction of volatile solid degraded in AWMS treatment method n of the N treatment steps prior to waste being treated (fraction)
 D_{CH_4} = Density of CH₄ (t/m³)
 F_{Aer} = Fraction of volatile solid directed to aerobic system (fraction)
 LT = Type of livestock
 $B_{0,LT}$ = Maximum methane producing potential of the volatile solid generated by animal type LT (m³CH₄/kg dm)
 $VS_{LT,y}$ = Annual volatile solid excretion livestock type LT entering all AWMS on a dry matter weight basis in (kg -dm/animal/yr)
 N_{LT} = Annual average number of animals of type LT for the year y (number) as estimated in equation above
 $PE_{sl,y}$ = Project CH₄ emissions from sludge disposed of in storage pit prior to disposal during the year y (t CO₂e/yr)
 $MS\%_j$ = Fraction of manure handled in system j in the project activity (fraction)

iii). $PE_{N_2O,y}$

$$PE_{N_2O,y} = GWP_{N_2O} * CF_{N_2O-N,N} * \frac{1}{1000} * (E_{N_2O,D,y} + E_{N_2O,ID,y}) \quad (20)$$

Where:

- $PE_{N_2O,y}$ = Project N₂O emissions in year y (t CO₂/yr)
 GWP_{N_2O} = Global Warming Potential (GWP) for N₂O (t CO₂e/tN₂O)
 $CF_{N_2O-N,N}$ = Conversion factor N₂O-N to N₂O (44/28)
 $E_{N_2O,D,y}$ = Direct N₂O emission in year y (kg N₂O-N/year)
 $E_{N_2O,ID,y}$ = Indirect N₂O emission in year y (kg N₂O-N/year)

The same method used to estimate the emissions in the baseline should be used to estimate the project emissions of nitrous oxide, so the Option 1 is used to calculate the Project N₂O emissions $PE_{N_2O,y}$.

Option 1:

$$E_{N_2O,D,y} = \sum_{j,LT} EF_{N_2O,D,j} * NEX_{LT,y} * N_{LT} * MS\%_j \quad (21)$$

Where:

- $E_{N_2O,D,y}$ = Direct N₂O emission in year y (kg N₂O-N/yr)
 $EF_{N_2O,D,j}$ = Direct N₂O emission factor for the treatment system *j* of the manure management system (kg N₂O-N/kg N)
 $NEX_{LT,y}$ = Annual average nitrogen excretion per head of a defined livestock population (kg N/animal/yr) estimated as described in appendix 2
 $MS\%_j$ = Fraction of manure handled in system *j* (fraction)
 N_{LT} = Annual Average number of animals of type LT for the year y estimated as per equation 4 and 5 (number)

$$E_{N_2O,ID,y} = \sum_{j,LT} EF_{N_2O,ID} * F_{gasMS,j,LT} * NEX_{LT,y} * N_{LT} * MS\%_j \quad (22)$$

Where:

- $E_{N_2O,ID,y}$ = Indirect N₂O emission in year y (kg N₂O-N/year)
 $EF_{N_2O,ID}$ = Indirect N₂O emission factor for N₂O emissions from atmospheric deposition of nitrogen on soils and water surfaces (kgN₂O-N/kg NH₃-N and NO_x-N)
 $NEX_{LT,y}$ = Annual average nitrogen excretion per head of a defined livestock population (kg N/animal/yr) estimated as described in appendix 2
 $MS\%_j$ = Fraction of manure handled in system *j* (fraction)
 $F_{gasMS,j,LT}$ = Default values for nitrogen loss due to volatilisation of NH₃ and NO_x from manure management (fraction)
 N_{LT} = Annual Average number of animals of type LT for the year y estimated as per equation 4 and 5 (number)

iv) $PE_{elec/heat}$

$$PE_{EC/FC,y} = PE_{EC,y} + \sum_j PE_{FC,j,y} \quad (23)$$

Where:

- $PE_{EC,y}$ = Project emissions from electricity consumption in year y. The project emissions from electricity consumption will be calculated following the latest version of the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption”. In

	<p>case, the electricity consumption is not measured then the electricity consumption shall be estimated as follows $EC_{PJ,y} = \sum_i CP_{i,y} * 8760$, where $CP_{i,y}$ is the rated capacity (in MW) of electrical equipment i used for the project activity.</p> <p>$PE_{FC,y}$ = Project emissions from fossil fuel combustion in process j during the year y. The project emissions from fossil fuel combustion will be calculated following the latest version of the “Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion”. For this purpose, the processes j in the tool corresponds to all fossil fuel combustion in the AWMS (not including fossil fuels consumed for transportation of feed material and sludge or any other on-site transportation).</p> <p>Via site inspection, CTI confirmed there is no consumption of electricity or heat related to the anaerobic digester. Hence, these emissions should not be considered.</p> <p>Besides, as described in above, since the electricity consumption that is not related to the anaerobic digester cannot be separated from the total electricity consumption, therefore the emission for consumption of electricity is calculated in $PE_{EC,y}$.</p> <p>The same for the $PE_{EC,y}$, please refer to $PE_{EC,y}$ calculation in above. Therefore, $PE_{elec/heat}=0$.</p> <p>The values monitored during monitoring survey are transparently shown in the Monitoring Report Section D.2. During onsite, the verification team cross-checked these values in detail using various supporting records and documents. Refer to the section E.6.1 and E.6.2 of this report for ex-ante and ex-post parameters’ assessment.</p> <p>The SDG 13 Project Impact (Project emission calculation) is provided in the Emission reduction calculation spreadsheet/2/ in a transparent manner and the calculation found correct. There is no material error noted in the accounting and application of various data against monitored parameters.</p> <p>The Project Impact for SDG 13 during this monitoring period is summarized as below,</p> <table border="1" data-bbox="448 1339 1445 1547"> <thead> <tr> <th rowspan="2">Date</th> <th>$PE_{AD,y}$</th> <th>$PE_{Aer,y}$</th> <th>$PE_{N2O,y}$</th> <th>PE_y</th> </tr> <tr> <th>(tCO₂e/yr)</th> <th>(tCO₂e/yr)</th> <th>(tCO₂e/yr)</th> <th>(tCO₂e/yr)</th> </tr> </thead> <tbody> <tr> <td>01/01/2021-31/12/2021</td> <td>16,306</td> <td>258</td> <td>13,655</td> <td>30,219</td> </tr> <tr> <td>01/01/2022-30/06/2022</td> <td>8004</td> <td>127</td> <td>6,764</td> <td>14,895</td> </tr> <tr> <td>01/01/2021-30/06/2022</td> <td>24,310</td> <td>385</td> <td>20,419</td> <td>45,114</td> </tr> </tbody> </table> <p>Total Project Impact for SDG 13 (project emissions) of the 1st monitoring period (01/01/2021-30/06/2022) is thus verified as 45,114 tCO₂e. Among this, project emissions were 30,219 tCO₂e from 01/01/2021 to 31/12/2021 and 14,895 tCO₂e from 01/01/2022 to 30/06/2022.</p>	Date	$PE_{AD,y}$	$PE_{Aer,y}$	$PE_{N2O,y}$	PE_y	(tCO ₂ e/yr)	(tCO ₂ e/yr)	(tCO ₂ e/yr)	(tCO ₂ e/yr)	01/01/2021-31/12/2021	16,306	258	13,655	30,219	01/01/2022-30/06/2022	8004	127	6,764	14,895	01/01/2021-30/06/2022	24,310	385	20,419	45,114
Date	$PE_{AD,y}$		$PE_{Aer,y}$	$PE_{N2O,y}$	PE_y																				
	(tCO ₂ e/yr)	(tCO ₂ e/yr)	(tCO ₂ e/yr)	(tCO ₂ e/yr)																					
01/01/2021-31/12/2021	16,306	258	13,655	30,219																					
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Findings	N/A																								
Conclusion	<p>The verification team confirms that</p> <ol style="list-style-type: none"> The complete data was available and is duly reported; As indicated above, the description with regard to cross-check of reported data is included under respective parameter (refer Section E.6.2. of this report); Appropriate methods and formulae for calculating project SDG impact were followed; <p>The calculation of project situation of each SDG impact is correct.</p>																								

E.7.3. Calculation of leakage

Means of verification	As per the applied methodology, Leakage covers the emissions from land application of treated manure as well as the emissions related to anaerobic
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digestion in a digester, occurring outside the project boundary. These emissions are estimated as net of those released under project activity and those released in the baseline scenario. Net leakage is only considered if they are positive.

$$LE_y = (LE_{PJ,N_2O,y} - LE_{BL,N_2O,y}) + (LE_{PJ,CH_4,y} - LE_{BL,CH_4,y}) + LE_{AD,y} \quad (24)$$

Where:

- $LE_{PJ, N_2O, y}$ = Leakage N₂O emissions released during project activity from land application of the treated manure in year y (t CO₂e/yr)
- $LE_{BL, N_2O, y}$ = Leakage N₂O emissions released during baseline scenario from land application of the treated manure in year y (t CO₂e/yr)
- $LE_{PJ, CH_4, y}$ = Leakage CH₄ emissions released during project activity from land application of the treated manure in year y (t CO₂e/yr)
- $LE_{BL, CH_4, y}$ = Leakage CH₄ emissions released during baseline scenario from land application of the treated manure in year y (t CO₂e/yr)
- $LE_{AD, y}$ = Leakage emissions associated with the anaerobic digester in year y (t CO₂e)

i) Estimation of leakage N₂O emissions released during baseline scenario from land application of the treated manure in year y, $LE_{BL, N_2O, y}$

$$LE_{BL,N_2O,y} = GWP_{N_2O} * CF_{N_2O-N,N} * \frac{1}{1000} * (LE_{N_2O,land,y} + LE_{N_2O,runoff,y} + LE_{N_2O,vol,y}) \quad (25)$$

$$LE_{N_2O,land,y} = EF_1 * \prod_{n=1}^N (1 - R_{N,n}) * \sum_{LT} NEX_{LT,y} * N_{LT} \quad (26)$$

$$LE_{N_2O,runoff,y} = EF_5 * F_{leach} * \prod_{n=1}^N (1 - R_{N,n}) * \sum_{LT} NEX_{LT,y} * N_{LT} \quad (27)$$

$$LE_{N_2O,vol,y} = EF_4 * \prod_{n=1}^N (1 - R_{N,n}) * F_{gasm} * \sum_{LT} NEX_{LT,y} * N_{LT} \quad (28)$$

Where:

- GWP_{N_2O} = Global Warming Potential (GWP) for N₂O (t CO₂e/tN₂O)
- $CF_{N_2O-N,N}$ = Conversion factor N₂O-N to N₂O (44/28)
- $LE_{N_2O,land,y}$ = Leakage N₂O emissions from application of manure waste in year y (kg N₂O-N/year)
- $LE_{N_2O,runoff,y}$ = Leakage N₂O emissions due to leaching and run-off in year y (kg N₂O-N/year)
- $LE_{N_2O,vol,y}$ = Leakage N₂O emissions due to volatilisation in year y (kg N₂O-N/year)
- F_{gasm} = Fraction of N lost due to volatilization (fraction)
- N_{LT} = Annual average number of animals of type LT estimated as per equation 4 and 5 (number)
- $NEX_{LT,y}$ = Annual average nitrogen excretion per head of a defined livestock population (kg N/animal/year) estimated as described in appendix 2
- EF_1 = Emission factor for N₂O emissions from N inputs (kg N₂O-N/kg N input)
- EF_5 = Emission factor for N₂O emissions from N leaching and runoff in (kg N₂O-N/kg N leached and runoff)
- EF_4 = Emission factor for N₂O emissions from atmospheric deposition of N on soils and water surfaces, [kg N- N₂O/ (kg NH₃-N + NO_x-N volatilized)]
- F_{leach} = Fraction of all N added to/mineralised in managed soils in regions where leaching/runoff occurs that is lost through leaching and runoff (fraction)
- $R_{N,n}$ = Nitrogen reduction factor (fraction)

ii) Estimation of leakage N₂O emissions released during project activity from land application of the treated manure in year y, LE_{PJ, N₂O}

$$LE_{PJ,N_2O} = GWP_{N_2O} * CF_{N_2O-N,N} * \frac{1}{1000} * (LE_{N_2O,land,y} + LE_{N_2O,runoff,y} + LE_{N_2O,vol,y}) \quad (29)$$

$$LE_{N_2O,land,y} = EF_1 * \prod_{n=1}^N (1 - R_{N,n}) * \sum_{LT} NEX_{LT,y} * N_{LT} \quad (30)$$

$$LE_{N_2O,runoff,y} = EF_5 * F_{leach} * \prod_{n=1}^N (1 - R_{N,n}) * \sum_{LT} NEX_{LT,y} * N_{LT} \quad (31)$$

$$LE_{N_2O,vol,y} = EF_4 * \prod_{n=1}^N (1 - R_{N,n}) * F_{gasm} * \sum_{LT} NEX_{LT,y} * N_{LT} \quad (32)$$

Where:

GWP_{N₂O} = Global Warming Potential (GWP) for N₂O (t CO₂e/tN₂O)

CF_{N₂O-N,N} = Conversion factor N₂O-N to N₂O (44/28)

LE_{N₂O,land,y} = Leakage N₂O emissions from application of manure waste in year y (kg N₂O-N/year)

LE_{N₂O,runoff,y} = Leakage N₂O emissions due to leaching and run-off in year y (kg N₂O-N/year)

LE_{N₂O,vol,y} = Leakage N₂O emissions due to volatilisation in year y (kg N₂O-N/year)

F_{gasm} = Fraction of N lost due to volatilization (fraction)

N_{LT} = Annual average number of animals of type LT estimated as per equation 4 and 5 (number)

NEX_{LT,y} = Annual average nitrogen excretion per head of a defined livestock population (kg N/animal/year) estimated as described in appendix 2

EF₁ = Emission factor for N₂O emissions from N inputs (kg N₂O-N/kg N input)

EF₅ = Emission factor for N₂O emissions from N leaching and runoff in (kg N₂O-N/kg N leached and runoff)

EF₄ = Emission factor for N₂O emissions from atmospheric deposition of N on soils and water surfaces, [kg N- N₂O/ (kg NH₃-N + NO_x-N volatilized)]

F_{leach} = Fraction of all N added to/mineralised in managed soils in regions where leaching/runoff occurs that is lost through leaching and runoff (fraction)

R_{N,n} = Nitrogen reduction factor (fraction)

It is not possible to measure the quantity of manure applied to land in kg manure/yr (Q_{DM}) and the nitrogen concentration in kg N/kg manure (N_{DM}) in the manure to estimate the total quantity of nitrogen applied to land. In this case, $\prod_{n=1}^N (1 - R_{N,n}) * \sum_{LT} NEX_{LT,y} * N_{LT}$ should be substituted by $Q_{DM} * N_{DM}$.

iii) Estimation of leakage CH₄ emissions from land application of the treated manure

The calculation of methane emissions from land application of manure in the baseline and project cases are estimated as below:

$$LE_{BL,CH_4,y} = GWP_{CH_4} * D_{CH_4} * MCF_d * \left[\prod_{n=1}^N (1 - R_{VS,n}) \right] * \sum_{j,LT} (B_{0,LT} * N_{LT} * VS_{LT,y} * MS\%_j) \quad (33)$$

$$LE_{PJ,CH_4,y} = GWP_{CH_4} * D_{CH_4} * MCF_d * \left[\prod_{n=1}^N (1 - R_{VS,n}) \right] * \sum_{j,LT} (B_{0,LT} * N_{LT} * VS_{LT,y} * MS\%_j) \quad (34)$$

Where:

LE_{BL,CH₄,y} = Leakage CH₄ emissions released during baseline scenario from land application of the treated manure in year y (t CO₂e/yr)

LE_{PJ,CH₄,y} = Leakage CH₄ emissions released during project activity from land application of the treated manure in year y (t CO₂e/yr)

$R_{VS,n}$	= Fraction of volatile solid degraded in AWMS treatment method n of the N treatment steps prior to sludge being treated
GWP_{CH_4}	= Global Warming Potential (GWP) of CH_4 (t CO_2e/tCH_4)
D_{CH_4}	= Density of CH_4 (t/ m^3)
$B_{0,LT}$	= Maximum methane producing potential of the volatile solid generated by animal type LT (m^3CH_4/kg dm)
N_{LT}	= Annual average number of animals of type LT estimated as per equation 4 and 5, expressed (number)
$VS_{LT,y}$	= Annual volatile solid excretions for livestock LT entering all AWMS on a dry matter weight basis (kg -dm/animal/yr)
$MS\%_j$	= Fraction of manure handled in system j in the project activity (fraction)
MCF_d	= Methane conversion factor (MCF) assumed to be equal to 1

iv) Estimation of leakage emissions associated with the anaerobic digester

$LE_{AD,y}$ is determined using the methodological tool "Project and leakage emissions from anaerobic digesters (Version 02.0)/39/.

The leakage emissions associated with the anaerobic digester ($LE_{AD,y}$) depend on how the digestate is managed. They include emissions associated with storage and composting of the digestate and are determined as follows:

$$LE_{AD,y} = LE_{storage,y} + LE_{comp,y} \quad (35)$$

Where:

$LE_{AD,y}$	= Leakage emissions associated with the anaerobic digester in year y (t CO_2e)
$LE_{storage,y}$	= Leakage emissions associated with storage of digestate in year y (t CO_2e)
$LE_{comp,y}$	= Leakage emissions associated with composting digestate in year y (t CO_2e)

For subsequent treatment stages, the reduction of the nitrogen during a treatment stage is estimated based on referenced data for different treatment types. Emissions from the next treatment stage are then calculated following the approach outlined above, but with nitrogen adjusted for the reduction from the previous treatment stages by multiplying by $(1-R_N)$, where R_N is the relative reduction of nitrogen from the previous stage. The relative reduction (R_N) of nitrogen depends on the treatment technology and should be estimated in a conservative manner. Default values for different treatment technologies can be found in appendix 1 (values for TN).

The anaerobic digestion process of this project is carried out in a fully enclosed system, the flaring will be not taken into account as the equipment will only be used when there will be surplus biogas, normally there will be no surplus biogas during the operational period of the project. After anaerobic digestion, the fermented sludge will be treated in aerobic composting system, which will be used as fertilizer. Wastewater from the new animal waste management systems will be treated aerobically and then used for agriculture irrigation. so, the Estimation of leakage emissions associated with the anaerobic digester is 0. i.e., $LE_{AD,y}=0$.

The values monitored during monitoring survey are transparently shown in the Monitoring Report Section D.2. During onsite, the verification team cross-checked these values in detail using various supporting records and documents. Refer to the section E.6.1 and E.6.2 of this report for ex-ante and ex-post parameters' assessment.

The leakage emission calculation is provided in the Emission reduction calculation spreadsheet/2/ in a transparent manner and the calculation found correct. There is no material error noted in the accounting and application of various data against monitored parameters.

	The leakage calculation during this monitoring period is summarized as below,					
	Date	LE _{p,CH4} (tCO _{2e})	LE _{B,CH4} (tCO _{2e})	LE _{B,N2O} (tCO _{2e})	LE _{p,N2O} (tCO _{2e})	LE _y (tCO _{2e})
	01/01/2021-31/12/2021	160,276	68,603	2,670	10,075	99,078
	01/01/2022-30/06/2022	79,456	34,010	1,323	4,989	49,112
	01/01/2021-30/06/2022	239,732	102,613	3,993	15,064	148,190
	Total leakage emissions of the 1 st monitoring period (01/01/2021-30/06/2022) is thus verified as 148,190 tCO_{2e} . Among this, leakage emissions were 99,078 tCO _{2e} from 01/01/2021 to 31/12/2021 and 49,112 tCO _{2e} from 01/01/2022 to 30/06/2022.					
Findings	N/A					
Conclusion	<p>The verification team confirms that</p> <ol style="list-style-type: none"> The complete data was available and is duly reported; As indicated above, the description with regard to cross-check of reported data is included under respective parameter (refer Section E.6.2. of this report); Appropriate methods and formulae for calculating leakage were followed; <p>The calculation of project leakage emissions is correct.</p>					

E.7.4. Calculation of net benefits or direct calculation for each SDG Impact

Means of verification	<p>Calculation of net benefits as difference of baseline and project values or direct calculation for each SDG impact is as following,</p> <p>SDG 7 impact net benefit</p> <p>Net Benefit SDG 7 for 01/01/2021 to 31/12/2021 = Project Impact of SDG7 (35,300.25 MWh of electricity generation by capturing biogas) – Baseline Impact of SDG7 (0) =35,300.25 MWh of electricity generation by capturing biogas</p> <p>Net Benefit SDG 7 for 01/01/2022 to 30/06/2022 = Project Impact of SDG7 (17,481.82 MWh of electricity generation by capturing biogas) – Baseline Impact of SDG7 (0) = 17,481.82 MWh of electricity generation by capturing biogas</p> <p>Net Benefit SDG 7 for 01/01/2021 to 30/06/2022 = Project Impact of SDG7 (52,782.06 MWh of electricity generation by capturing biogas) – Baseline Impact of SDG7 (0) = 52,782.06 MWh of electricity generation by capturing biogas</p> <p>SDG 8 impact net benefit</p> <p>From 01/01/2021 to 31/12/2021, Net Benefit SDG 8 (Number of full-time jobs created) = Project Impact of SDG8 (18 full-time jobs created (9 females and 9 males)) – Baseline Impact of SDG8 (0) =18 full-time jobs created (9 females and 9 males)</p> <p>From 01/01/2022 to 30/06/2022, Net Benefit SDG 8 (Number of full-time jobs created) = Project Impact of SDG8 (18 full-time jobs created (9 females and 9 males)) – Baseline Impact of SDG8 (0) =18 full-time jobs created (9 females and 9 males)</p> <p>From 01/01/2021 to 30/06/2022, Net Benefit SDG 8 (Number of full-time jobs created) = Project Impact of SDG8 (18 full-time jobs created (9 females and 9 males)) – Baseline Impact of SDG8 (0) =18 full-time jobs created (9 females and 9 males)</p> <p>SDG 13 impact net benefit</p> <p>In accordance with applied methodology, registered PDD and validation report,</p> <p>Net Benefit SDG 13 (Amount of GHGs emission avoided or sequestered) = baseline emission – project emission – leakage emission = 487,973 tCO_{2e} -45,114 tCO_{2e} -148,190 tCO_{2e} = 294,669 tCO_{2e}</p> <p>Furthermore, as per the applied methodology and PDD, if the actual methane</p>
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	<p>captured from anaerobic digesters in project activity is lower than $(BE_{CH_4,y} - PE_{AD,y})$, then $(BE_{CH_4,y} - PE_{AD,y})$ is replaced by actual methane captured $Q_{CH_4,y}$.</p> <p>Biogas captured during monitoring period is 42,676,479.88 m³, which is verified as equals to 462,781 tCO₂e emission by calculated based on the amount of biogas, the density of biogas and the content of methane in this monitoring period. Baseline methane emission ($BE_{CH_4,y}$) is 482,352 tCO₂e. Project emissions associated with anaerobic digester is ($PE_{AD,y}$) is 24,310 tCO₂e. Actual methane captured from anaerobic digesters is higher than the difference of $BE_{CH_4,y}$ and $PE_{AD,y}$. Therefore, the equation $(BE_{CH_4,y} - PE_{AD,y})$ can be used to calculate emission reduction.</p> <p style="text-align: center;">Emission Reductions Calculation</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Parameters</th> <th style="text-align: center;">Baseline Emissions BE_y</th> <th style="text-align: center;">Project Emissions PE_y</th> <th style="text-align: center;">Leakage Emissions LE_y</th> <th style="text-align: center;">Emission Reductions ER_y</th> </tr> <tr> <th style="text-align: center;">Period</th> <th style="text-align: center;">(tCO₂e)</th> <th style="text-align: center;">(tCO₂e)</th> <th style="text-align: center;">(tCO₂e)</th> <th style="text-align: center;">(tCO₂e)</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">01/01/2021-31/12/2021</td> <td style="text-align: center;">326,242</td> <td style="text-align: center;">30,219</td> <td style="text-align: center;">99,078</td> <td style="text-align: center;">196,945</td> </tr> <tr> <td style="text-align: center;">01/01/2022-30/06/2022</td> <td style="text-align: center;">161,731</td> <td style="text-align: center;">14,895</td> <td style="text-align: center;">49,112</td> <td style="text-align: center;">97,724</td> </tr> <tr> <td style="text-align: center;">01/01/2021-30/06/2022</td> <td style="text-align: center;">487,973</td> <td style="text-align: center;">45,114</td> <td style="text-align: center;">148,190</td> <td style="text-align: center;">294,669</td> </tr> </tbody> </table> <p>All the figures as per the monitoring report were cross-checked by the verification team against basic monitored data. Refer to section E.6.2 for detail assessments.</p>	Parameters	Baseline Emissions BE_y	Project Emissions PE_y	Leakage Emissions LE_y	Emission Reductions ER_y	Period	(tCO ₂ e)	(tCO ₂ e)	(tCO ₂ e)	(tCO ₂ e)	01/01/2021-31/12/2021	326,242	30,219	99,078	196,945	01/01/2022-30/06/2022	161,731	14,895	49,112	97,724	01/01/2021-30/06/2022	487,973	45,114	148,190	294,669
Parameters	Baseline Emissions BE_y	Project Emissions PE_y	Leakage Emissions LE_y	Emission Reductions ER_y																						
Period	(tCO ₂ e)	(tCO ₂ e)	(tCO ₂ e)	(tCO ₂ e)																						
01/01/2021-31/12/2021	326,242	30,219	99,078	196,945																						
01/01/2022-30/06/2022	161,731	14,895	49,112	97,724																						
01/01/2021-30/06/2022	487,973	45,114	148,190	294,669																						
Findings	N/A																									
Conclusion	<p>The verification team confirms that</p> <ul style="list-style-type: none"> a) The complete data was available and is duly reported; b) As indicated above, the description with regard to cross-check of reported data is included under respective parameter (refer Section E.6.2 of this report); c) Appropriate methods and formulae for calculating net benefits for each SDG impact were followed; <p>The calculation of net benefits for each SDG impact is correct.</p>																									

E.7.5. Comparison of actual value of impacts with estimates in approved PDD

Means of verification	<p>The verification team has checked if the MR includes a comparison of actual values of the monitoring period with the estimations in the PDD for each SDG impact. Conclusion is as below table</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Item</th> <th style="text-align: center;">Values estimated in ex ante calculation of approved PDD</th> <th style="text-align: center;">Actual values achieved during this monitoring period</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">SDG 7</td> <td style="text-align: center;">60,036 MWh of electricity generation by capturing biogas</td> <td style="text-align: center;">52,782.06 MWh of electricity generation by capturing biogas</td> </tr> <tr> <td style="text-align: center;">SDG 8</td> <td style="text-align: center;">18 full-time jobs created (9 females and 9 males)</td> <td style="text-align: center;">18 full-time jobs created (9 females and 9 males)</td> </tr> <tr> <td style="text-align: center;">SDG 13</td> <td style="text-align: center;">422,939 tCO₂e</td> <td style="text-align: center;">294,669 tCO₂e</td> </tr> </tbody> </table>	Item	Values estimated in ex ante calculation of approved PDD	Actual values achieved during this monitoring period	SDG 7	60,036 MWh of electricity generation by capturing biogas	52,782.06 MWh of electricity generation by capturing biogas	SDG 8	18 full-time jobs created (9 females and 9 males)	18 full-time jobs created (9 females and 9 males)	SDG 13	422,939 tCO ₂ e	294,669 tCO ₂ e
Item	Values estimated in ex ante calculation of approved PDD	Actual values achieved during this monitoring period											
SDG 7	60,036 MWh of electricity generation by capturing biogas	52,782.06 MWh of electricity generation by capturing biogas											
SDG 8	18 full-time jobs created (9 females and 9 males)	18 full-time jobs created (9 females and 9 males)											
SDG 13	422,939 tCO ₂ e	294,669 tCO ₂ e											
Findings	N/A												
Conclusion	The MR includes a summary table of comparison of actual values of the monitoring period with the estimations in the approved PDD for each SDG impact and the comparison results are confirmed as correct.												

E.7.6. Remarks on increase in achieved SDG Impacts from estimated value in approved PDD

Means of verification	<p>For SDG 7, the actual outcome was 52,782.06 MWh electricity produced, which is lower than the estimated value, due to the estimated value in the PDD is the theoretical value estimated basing on amount of manure produced from the number of animals theoretically as value provided in FSR/7/, while the actual value is monitored by electricity meters. It is acceptable that the actual value is slightly lower than estimated in PDD.</p> <p>For SDG 8, Number of full-time jobs created is 18 full-time (including 9 females and 9 males) by the project during the 1st monitoring period is same to the PDD.</p>
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	For SDG 13, CTI confirmed that the actual value during this monitoring period was found to be 30% lower than ex-ante estimated value the for this project during this monitoring period, via comparing with the PDD estimated value, CTI verified that the change of three parameters, i.e. the number of animals in the swine farm (N_{LT}), the average animal weight (W_{site}) and the actual biogas captured from anaerobic digester impact the actual emission reduction calculation, however these parameters depend on the actual implementation of farms and growth of the swine which changes over time and can't be controlled by PP. Hence CTI verified that the actual value lower than estimated in PDD is reasonable and acceptable.
Findings	N/A
Conclusion	The actual SDG impacts for 7 and 13 are lower than the estimated values given in the validated PDD/3/, which is assessed as appropriate and accepted.

E.8. Safeguards reporting

Means of verification	<p>Via checking the Section D.1 and Appendix 1 in PDD, CTI confirmed that there is one Safeguarding principle need to be monitored with assessment question answered 'Potentially' i.e. in case of biogas is not handled properly during the operation period of the project, methane explosion may be caused.</p> <p>This parameter has been monitored and assessed in section E.6.2. hence, it is confirmed that during this monitoring period, no biogas explosion or leakage was occurred.</p> <p>And via site visit and interview with local stakeholders, CTI verified that the project was implemented normally and in line with the design in the PDD, there was no information on any assessment questions answered 'Potentially' related to Safeguarding principles.</p> <p>All the Information on any assessment questions answered as "No", so there is no need to re-assessment the Safeguarding principles.</p>
Findings	N/A
Conclusion	Except one 'Potentially' assessment question has been monitored, all the Information on any assessment questions answered as "No", so there is no need to re-assessment the Safeguarding principles during this monitoring period.

E.9. Stakeholder inputs and legal disputes

Means of verification	<p>As confirmed through the onsite visit and interview with the local stakeholders, CTI verified that the inputs/grievances mechanism has been in place. As per onsite checking the Grievance Book/31/ put at each swine farm and internet/email address which has been provided during the validation process and interview with PP and local stakeholders, CTI verified that they have access to provide issues or comments through given methods.</p> <p>And via checking the different approach, CTI verified that there were no inputs/grievances received during this monitoring period.</p>
Findings	N/A
Conclusion	<p>All the methods of continuous input /grievance mechanism are confirmed during on-site investigation and interviews.</p> <p>CTI verified that there were no comments/complaints received from the stakeholders during this monitoring period of the project activity.</p>

SECTION F. Internal quality control

The final verification report was undergone a technical review by a qualified independent reviewer before requesting issuance of the project activity. The technical review was performed by a technical reviewer qualified in accordance with CTI's qualification scheme for GS validation and verification that meets the criteria of GS guidelines for qualification.

SECTION G. Verification opinion

The verification team assigned by the VVB (CTI) concludes that the 1st periodic verification of GS programme of activities “Swine Farm Animal Manure Management System GHG Mitigation Project in Hubei Province” in Hubei Province, China, as described in the validated PDD and final version of monitoring report, meets all relevant requirements set by the Gold Standard for the Global Goals Principles and Requirements.

The project activity was correctly implemented according to selected monitoring methodology and monitoring plan. The collected monitoring data allowed to verify the amount of achieved SDG impacts. And the project is contributed to sustainability development. Thus, the VVB is pleased to issue a positive verification opinion.

SECTION H. Certification statement

Shenzhen CTI International Certification Co., Ltd (CTI) has performed the 1st periodic verification of the SDG outcomes that have been reported for the GS project activity “Swine Farm Animal Manure Management System GHG Mitigation Project in Hubei Province” in Hubei Province, P. R. China for the monitoring period from 01/01/2021 to 30/06/2022.

The verification is based on the baseline and monitoring methodology ACM0010 “GHG emission reductions from manure management systems” (Version 08.0), the PDD, and the final version of monitoring report. The verification consisted of the following three phases: i) desk review of the project design and the baseline and monitoring plan; ii) follow-up on-site visit and interviews with project participants; iii) resolution of outstanding issues and the issuance of the final verification and certification report.

The PPs are responsible for the collection, calculation and determination of the SDG impacts data in accordance with the monitoring plan and the reporting of SDG impacts on the basis set out within the project monitoring report.

It is CTI's responsibility to provide an independent verification statement on the reported SDG impacts for the project. Based on an understanding of the risks associated with reporting of SDG impacts data and the controls in place to mitigate these, CTI planned and performed our work to obtain the information and explanations that we considered necessary to provide reasonable assurance that reported SDG impacts are fairly stated.

CTI confirms that the SDG impacts are calculated without material misstatements. Based on the evidence and information that are considered necessary to guarantee that SDG impacts are appropriately calculated, CTI confirms that the SDG impacts from the “Swine Farm Animal Manure Management System GHG Mitigation Project in Hubei Province” in Hubei Province, P. R. China during the monitoring period from 01/01/2021 to 30/06/2022 as follows:

Monitoring period Number: 1st

Monitoring period: 01/01/2021 to 30/06/2022

The verified amount of impact for each SDG in the PA as per commitment period is stated below;

SDG No.	Contribution for Vintage year		Total for this MP
	01/01/2021 to 31/12/2021	01/01/2022 to 30/06/2022	01/01/2021 to 30/06/2022
SDG 7	35,300.25 MWh of electricity generation by capturing biogas	17,481.82 MWh of electricity generation by capturing biogas	52,782.06 MWh of electricity generation by capturing biogas
SDG 8	18 full-time jobs created (9 females and 9 males)	18 full-time jobs created (9 females and 9 males)	18 full-time jobs created (9 females and 9 males)
SDG 13	196,945 tCO ₂ e of GHGs emission avoided or sequestered	97,724 tCO ₂ e of GHGs emission avoided or sequestered	294,669 tCO ₂ e of GHGs emission avoided or sequestered

Appendix 1. Abbreviations

Abbreviations	Full texts
AMS	Approved Methodology for SSC Projects
AWMS	Animal Waste Management System
BE	Baseline Emission
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CL	Clarification Request
CO ₂	Carbon dioxide
CP	Crediting Period
DNA	Designated National Authority
EB	Executive Board
EIA	Environmental Impact Assessment
FAR	Forward Action Request
GHG	Green House Gas
GSC/GSP	Global Stakeholder Consultation Process
GS4GG	Gold Standard for the Global Goals
ILO	International Labour Organization
IPCC	Intergovernmental Panel on Climate Change
KP	Kyoto Protocol
LSC	Local Stakeholder Consultation
MoV	Means of Validation
MP	Monitoring Plan
ODA	Official Development Assistance
PDD	Project Design Document
PE	Project Emission
PP	Project Participant
PS	Project Standard
QC/QA	Quality control/Quality assurance
SCR	Stakeholder Consultation Report
SD	Sustainable Development
SDG	Sustainable Development Goals
SFR	Stakeholder Feedback Round
tCO _{2e}	Tonnes of Carbon dioxide equivalent
UNFCCC	United Nations Framework Convention on Climate Change
V	Version
VER	Voluntary Emission Reduction
VVB	Validation and Verification Body
VVS	Validation and Verification Standard

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. Li Ziqi

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 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 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:

Wu LIN

Wu Lin

Technical Competent Manager

Shenzhen, 01/01/2021

Appendix 3. Documents reviewed or referenced

No	Author	Title	References to the document	Provider
1.	PP	1 st periodic Monitoring Report of “Swine Farm Animal Manure Management System GHG Mitigation Project in Hubei Province”	- Version No. 01, dated 06/08/2022 - Version No. 04, dated 08/02/2023 - Version No. 05, dated 06/03/2023	PP
2.	PP	1 st periodic Emission Reduction Calculation spreadsheet of “Swine Farm Animal Manure Management System GHG Mitigation Project in Hubei Province”	- Version No. 01, dated 06/08/2022 - Version No. 02, dated 09/10/2022	PP
3.	PP	GS4GG Project Design document of “Swine Farm Animal Manure Management System GHG Mitigation Project in Hubei Province”	- Version No. 06, dated 06/03/2023	PP
4.	CTI	Validation report of “Swine Farm Animal Manure Management System GHG Mitigation Project in Hubei Province”	- Version No. 3.0, dated 08/03/2023	N/A
5.	PP	Stakeholder Consultation Report of “Swine Farm Animal Manure Management System GHG Mitigation Project in Hubei Province”	- Version No. 02, dated 09/10/2022	PP
6.	Local Market Supervision and Administration Bureau	Business License of PP	Business License of Jiangxi Zhengbang Breeding Co. Ltd. and Profit Carbon Environmental Energy Technology (Shanghai) Co., Ltd.	PP
7.	Jiangxi Huisen Environmental Technology Engineering Co., Ltd.	Feasibility Study Report	Issued on 16/03/2020	PP
8.	Department of Ecology and Environment of Hubei Province	EIA approval	Issued on 26/05/2020	PP
9.	PP and manufacturers	Equipment purchase contracts	Equipment purchase contracts of all the involved main equipment, a. biogas generator, signed on 09/09/2020 b. flare system, signed on 10/09/2020 c. anaerobic tanks signed on 10/09/2020 d. turnover machines signed on 11/09/2020	PP
10.	PP and Nanchang Tiangao Environmental Protection	General contract of engineering construction	General contract of engineering construction of the project signed on 13/09/2020	PP

	Technology Co., Ltd.			
11.	Manufacturers	Technical agreement	Technical agreement of main equipment	PP
12.	PP	Operation log of the project	Operation log of the project	PP
13.	Hubei Institute of Metrology and testing technology	Calibration Reports	Calibration Reports to all the electricity meters with validity covering this monitoring period Calibration Reports to all the Weight measurers with validity covering this monitoring period Calibration Reports to all the biogas analysers with validity covering this monitoring period Calibration Reports to all the flow meters with validity covering this monitoring period	PP
14.	General Administration of Quality Supervision, Inspection and Quarantine	Certificate of Metrological Authorization	The State Certificate for the Gradation of the Certified Reference Materials of Guangzhou Yigas Gases Co. Ltd. issued on 16/01/2020	PP
	General Administration of Quality Supervision, Inspection and Quarantine		Certificate of Metrological Authorization of Hubei Institute of Metrology and testing technology issued on 06/11/2017 valid to 10/05/2023	PP
15.	PP	Production record of Market swine	Production record of Market swine of each farm covering this monitoring period	PP
16.	PP	Records of animal weight	Monthly records of animal weight of a defined livestock population of three age categories	PP
17.	PP	Sale Records of Marketing swine	Monthly Sale Records of Marketing swine of each farm covering this monitoring period	PP
18.	PP	Breeding Pig stock record	Breeding Pig stock record of each farm covering this monitoring period	PP
19.	PP	Daily operation record	Daily operation record of each treatment plant covering this monitoring period	PP
20.	Jiangsu Hengda Instrument Co., Ltd.	Manufacture specification	Manufacture specification of the flow meter	PP
21.	PP	Photo of baseline lagoon	Photo of baseline lagoons of 9 swine farms	PP
22.	PP	Record keeping book	Record keeping book including employment	PP
23.	PP and employees	Labor contracts	Labor contracts signed with employees for implementation of this project	PP
24.	PP	Record of operation started date of each swine farm	Record of operation started date of each swine farm	PP
25.	PP	Technical Notice	Training notices dated on 20/11/2020 and 26/10/2021 for biogas safety operation	PP
26.	PP	Meeting attendance record	Meeting attendance records dated	PP

			on 20/11/2020 and 26/10/2021	
27.	PP	Declaration of no double counting and not involved in other GHG scheme	Issued on 12/03/2021	PP
28.	PP	Calculation sheet of sample size	Calculation sheet of sample size for determine the samples of monitoring W_{site}	PP
29.	Grid companies	Electricity notes	Electricity notes issued by local grid companies corresponding to 9 AWMS for this monitoring period	PP
30.	PP	Monthly report of electricity	Monthly report of electricity issued by PP for this monitoring period	PP
31.	VVB	Site Visit Photo	Photo taken by verifier during site visit including main equipment, monitoring devices, DCS system, swine farms, ear tags, Grievance Book etc.	N/A
32.	UNFCCC	CDM Approved Small Scale Methodology ACM0010	"ACM0010 GHG emission reductions from manure management systems" (Version 08.0.0)	UNFCCC website
33.	UNFCCC	Standard of Sampling and surveys	Standard of "Sampling and surveys for CDM project activities and programmes of activities (Version 09.0)"	UNFCCC website
34.	UNFCCC	Guideline of Sampling and surveys	Guideline of the "Sampling and surveys for CDM project activities and programmes of activities (Version 04.0)"	UNFCCC website
35.	UNFCCC	Methodological tool	Combined tool to identify the baseline scenario and demonstrate additionality (Version 07.0)	UNFCCC website
36.	UNFCCC	Methodological tool	Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation (Version 3.0)	UNFCCC website
37.	UNFCCC	Methodological tool	Project emissions from flaring (Version 04.0)	UNFCCC website
38.	UNFCCC	Methodological tool	Tool to determine the mass flow of a greenhouse gas in a gaseous stream (Version 07.0)	UNFCCC website
39.	UNFCCC	Methodological tool	Project and leakage emissions from anaerobic digesters (Version 02.0)	UNFCCC website
40.	UNFCCC	Methodological tool	Common practice (Version 03.1)	UNFCCC website
41.	UNFCCC	Methodological tool	Investment analysis (version 11.0)	UNFCCC website
42.	GS	GS4GG MR template	Gold Standard for the Global Goals Monitoring Report (MR) Template, version 1.1 in October 2020	GS Website
43.	GS	Gold Standard for the Global Goals Principles and Requirements	Version 1.2	GS Website
44.	GS	Gold Standard for the Global Goals Safeguarding Principles & Requirements	Version 1.2	GS Website
45.	GS	Gold Standard for the Global Goals Community Services Activity Requirements	Version 1.2	GS Website
46.	GS	Gold Standard for the Global Goals Stakeholder Consultation	Version 1.2	GS Website

		and Engagement Requirements		
47.	GS	GS4GG GHG Emissions Reduction & Sequestration Product Requirements	Version 2.1	GS Website
48.	National Standard	JJG 596-2012	Electrical Meters for Measuring Alternating-current Electrical Energy	Public website
49.	National Standard	JJG1029-2007	Verification Regulation of Vortex-shedding Flowmeter	Public website
50.	National Standard	JJG693-2011	Verification Regulation of Alarmer Detectors of Combustible Gas	Public Website
51.	National Standard	JJG539-2016	Digital Indicator Scale Verification Regulations	Public Website
52.	China CER platform	CCER	http://cdm.ccchina.org.cn/ccer.aspx	Public Website
53.	UNFCCC	UNFCCC website	https://cdm.unfccc.int	UNFCCC website
54.	VERRA	VCS	https://verra.org/project/vcs-program/	VCS website
55.	Ministry of Ecology and Environment of China	China cap & trade scheme	http://www.mee.gov.cn/xxgk2018/xxgk/xxgk02/202101/t20210105_816131.html	Public Website
56.	Ministry of Ecology and Environment of China	Enforced company list	http://mee.gov.cn/xxgk2018/xxgk/xxgk03/202012/W020201230736907682380.pdf	Public Website
57.	Hubei government	Temperature in Guangxi of year 2021	http://www.hubei.gov.cn/jmct/hbgk/202203/t20220325_4055939.shtml	PP
58.	IPCC	IPCC Fifth Assessment Report	IPCC Fifth Assessment Report	Public Website
59.	IPCC	IPCC	2006 IPCC Guidelines for National Greenhouse Gas Inventories	Public Website
60.	Ministry of Ecology and Environment of the People's Republic of China	Baseline emission factor of China	2019 China regional power grid carbon dioxide baseline emission factor OM calculation instructions http://www.mee.gov.cn/ywgz/ydqhbh/wsqtzk/202012/t20201229_815386.shtml	Public Website

Appendix 4. Clarification requests, corrective action requests and forward action requests

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

FAR ID	N/A	Section no.		Date: DD/MM/YYYY
Description of FAR				
No FAR from the validation.				
Project participant response				Date: DD/MM/YYYY
Documentation provided by project participant				
VVB assessment				
Date: DD/MM/YYYY				

Table 2. CL from this verification

CL ID	01	Section no.	A	Date: 26/08/2022
Description of CL				
<ol style="list-style-type: none"> In the section A.1 of MR, the description of the implementation of the project activity is not accurate. In the section A.2 of MR, the host party name is missing. In the section A.2 of MR, the county and district name where the farms located are not provided. In the section A.2 of MR, the Chinese name of each swine farm is missing. In the section A.2 of MR, the geographical coordinates of each farm are not accurate. 				
Project participant response				Date: 09/09/2022
<ol style="list-style-type: none"> The description of the implementation of the project activity has been corrected by PP, the details see section A of MR. The host party name is China, which has been added in section A.2. The county and district name where the farms located has been added to section A.2 of MR. The Chinese name of each swine farm has been added. The geographical coordinates of each farm have been updated in section A.2. 				
Documentation provided by project participant				
/1/ version 02 /7/				
VVB assessment				Date: 19/09/2022
<ol style="list-style-type: none"> The revised MR is checked, CTI confirmed that the description of the implementation of the project activity is accurate which is verified in line with the PDD. The revised MR is checked, CTI confirmed that the host party name is added which is correct. The revised MR is checked, CTI confirmed that county and district name where the farms located are provided which is verified as correct by site visit. The revised MR is checked, CTI confirmed that the Chinese name of each swine farm is added and verified as correct by site visit and checking the FSR/7/ The revised MR is checked, CTI confirmed that the geographical coordinates of each farm is updated to be accurate which is verified as correct by site visit using the GPS device. 				
CL 01 is closed.				

CL ID	02	Section no.	B.1	Date: 26/08/2022
Description of CL				
<p>In the section B.1,</p> <ol style="list-style-type: none"> PD is requested to provide the main equipment and their technical parameters in this section. Actual time of construction, commissioning, start of operation of 9 biogas treatment plant is not clarified as per the request of MR TGuide. Process flow of biogas project in figure 2 is not in line with the actual project implementation and PDD. 				
Project participant response				Date: 09/09/2022
<ol style="list-style-type: none"> The main equipment and their technical parameters have been included in table 4. Actual time of construction, commissioning, start of operation of 9 biogas treatment plant has been added to section B.1. The Process flow of biogas project has been modified. 				
Documentation provided by project participant				

/1/ version 02 /10/ /12/ /24/	
VVB assessment	Date: 19/09/2022
<ol style="list-style-type: none"> 1. The revised MR is checked, CTI confirmed that the main equipment and their technical parameters have been provided in this section which is verified in line with the PDD. 2. The revised MR is checked, CTI confirmed that the actual time of construction, commissioning, start of operation of 15 biogas treatment plant have been clarified as per the request of MR TGuide. The project started first construction on 17/09/2020 which has been confirmed by checking the General contract of engineering construction/10/, and started first commissioning on 13/12/2020 and was put into operation on 01/01/2021 which has been confirmed by checking the operation log of the project/12/ and record of operation started of each AWMS/24/ and has been confirmed in the PDD and validation report/3/,/4/. 3. The revised MR is checked, CTI confirmed that Process flow of biogas project in figure 2 is updated with the validated PDD and confirmed as in line with the actual implementation of the project through site inspection. <p>CL 02 is closed.</p>	

CL ID	03	Section no.	D.4	Date: 26/08/2022
Description of CL				
<p>In the D.4, for sampling plan,</p> <ol style="list-style-type: none"> 1. The stratified sampling method is not clarified clearly. 2. PP stated that the samples number has been selected based on the three age categories, however, it is not clarified how to divide two swine types (commercial and breeding). 3. The actual sampling method used for monitoring the weight of animal swine is not specified. 				
Project participant response				Date: 09/09/2022
<ol style="list-style-type: none"> 1. The stratified sampling method has been added to section D.4 of MR, the details as follows: (1) The overall sample size based on the design population of swine firstly is calculated. (2) As the project involved 9 swine farms, then the sample size in each swine farm is adjusted based on the proportion of the number of each farm in the total number of 9 farms. (3) Similarly, the sample size of each age group of Market swine and Breeding swine in each farm is also calculated based on the proportion of the number of each age group of Market swine and Breeding swine to the total number of swine in the farm. (4) After the sample size in each age group of Market swine and Breeding swine of each swine farm determined, the sample is conducted in every swine farm. Since swine in different age are kept in the different swine houses, samples can be randomly selected from swine houses of this age group. (5) After the samples are selected, the weight is measured in each farm monthly by weight measurers and recorded in the weight record table. (6) The sample will be marked after weighting and if the sample swine is still drawn next month, then this sample swine needs to be discarded and a new sample swine is drawn, this will be done every month until the end of the monitoring period. 2. For market swine, the three-age category is divided to Nursery phase with 30-60days, Growing phase with 60-130days, Mature phase with 130-180days. For breeding swine, the three-age category is divided to Nursery phase with 30-70days, Growing phase with 70-220days, Mature phase with 220-310days. 3. The actual sampling method used for monitoring the weight of animal swine is added to section D.4 and the details as follows: After the sample size in each age group of Market swine and Breeding swine of each swine farm determined, the sample and measure are conducted in every swine farm. Since swine in different age are kept in the different swine houses, samples can be randomly selected from swine houses of this age group. After the samples are selected, the weight is measured in each farm monthly by weight measurers and recorded in the weight record table. If the same sample is taken the following month, then a new sample will be taken. This will be done every month until the end of the monitoring period. the specific sample implement is that samples are selected randomly from pig houses of this age group by the technicians in the swine farms and then be measured by weight measures in the end of each month. At the same time, the measured value is recorded in the weight record table by the technicians in the swine farms. At last, monthly average W_{site} of market swine and breeding swine was calculated based on W_{site} of all market swine sample and breeding swine sample. 				
Documentation provided by project participant				
/1/ version 02				
VVB assessment				Date: 19/09/2022

<ol style="list-style-type: none"> 1. The revised MR is checked, CTI confirmed that the stratified sampling method has been clarified clearly. 2. The revised MR is checked, CTI confirmed that the related explanation has been added which is verified as consistent with PDD. 3. The revised MR is checked, CTI confirmed that the actual sampling method used for monitoring the weight of animal swine has been specified. <p>Refer to section E.5 of this report for detail assessment of the sampling method. CL 03 is closed.</p>
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CL ID	04	Section no.	E.1	Date: 26/08/2022
Description of CL				
In the E.1, how the project can use developed countries B _{0,LT} values is not clarified.				
Project participant response				Date: 09/09/2022
According to applied methodology ACM0010(Version 08.0), this value of B _{0,LT} varies by species and diet. Default values are used, and they are taken from tables 10A-4 through 10A-9 (IPCC 2006 Guidelines for National Greenhouse Gas Inventories volume 4, chapter10). The proposed project is located in Hubei Province, China, Asia. According to Table 10A-7 and 10A-8 of IPCC 2006 Guidelines for National Greenhouse Gas Inventories volume 4, chapter10, the maximum methane producing potential(B _{0,LT}) for Market swine and Breeding swine in Asia region is 0.29 m ³ CH ₄ /kg VS.				
Documentation provided by project participant				
/1/ version 02 /2/ version 02				
VVB assessment				Date: 19/09/2022
The revised MR is checked, CTI confirmed that the clarification has been added which is confirmed as consistent with the PDD. Refer to section E.7.1 of this report for detail assessment CL 04 is closed.				

Table 3. CAR from this verification

CAR ID	01	Section no.	C	Date: 26/08/2022
Description of CAR				
In section C of MR,				
<ol style="list-style-type: none"> 1. For the monitoring parameters, not all the monitored parameters are listed in line with the PDD. 2. For the monitoring parameter for SDG 7, the name is not consistent in the whole MR. 3. The monitoring system of the project is not in line with the actual monitoring system and the monitoring plan in PDD. 4. Emergency procedure and if any emergency happened during this monitoring period is missing. 				
Project participant response				Date: 09/09/2022
<ol style="list-style-type: none"> 1. All monitored parameter involved in this project has been added, please refer to the section C of MR. 2. The name of the monitoring parameter for SDG 7 has been corrected as The amount of electricity generation by capturing biogas. 3. The monitoring system of the project has been modified to in line with the actual monitoring system and the monitoring plan in PDD. 4. The Emergency procedure and if any emergency happened during this monitoring period had been added, the details as follows: Employees need to be familiar with the process flow and emergency situations that may occur during project operation and operate in strict accordance with the technical specifications of each process treatment equipment and monitoring equipment. During the operation of the project, all equipment and related instruments shall be checked regularly according to the manufacturer's recommendations. If necessary, calibration and/or proper repair have to be carried out immediately. In case of malfunction and/or damage of any system or piece of the process, it may cause damage to the operation of the system, especially serious damage to the biogas generation system and combustion system it must be dealt with as soon as possible and reported to the responsible technician immediately. There was no emergency happened during this monitoring period. 				
Documentation provided by project participant				
/1/ version 02 /12/				
VVB assessment				Date: 19/09/2022
<ol style="list-style-type: none"> 1. The revised MR is checked, CTI confirmed that the all the monitored parameters are listed in line with the PDD. 2. The revised MR is checked, CTI confirmed that the name has been updated to be consistent in the whole 				

MR.
3. The revised MR is checked, CTI confirmed that the monitoring system of the project in figure 4 is in line with the actual monitoring system and the monitoring plan in PDD.
4. Emergency procedure and if any emergency happened during this monitoring period is missing. The revised MR is checked, CTI confirmed that the Emergency procedure and if any emergency happened during this monitoring period has been specified. Project proponents will take actions to deal with malfunction and/or damage if any damage to the operation of the system, and the most conservative approach are used for emission calculations during the emergency period. Via checking the operation log/12/ and all the data collected for biogas flow and electricity, it is verified that there was no emergency happened during this monitoring period.
CAR 01 is closed.

CAR ID	02	Section no.	D.1	Date: 26/08/2022
Description of CAR				
In the section D.1, the data and parameters fixed ex ante need to be updated according to the final version of PDD.				
Project participant response				Date: 09/09/2022
The data and parameters fixed ex ante in the section D.1 has been updated according to the final version of PDD.				
Documentation provided by project participant				
/1/ version 02				
VVB assessment				Date: 19/09/2022
The revised MR is checked, CTI confirmed that the data and parameters fixed ex ante have been updated according to the final version of PDD. Refer to section E.6.1 of this report for detail assessment for each parameter. CAR 02 is closed.				

CAR ID	03	Section no.	D.2	Date: 26/08/2022
Description of CAR				
For parameter $N_{p,LT}$, the actual cross check result is not specified.				
Project participant response				Date: 09/09/2022
The cross check result for parameter $N_{p,LT}$ is included in Section D.2.				
Documentation provided by project participant				
/1/ version 02				
VVB assessment				Date: 19/09/2022
The revised MR is checked, CTI confirmed that the actual cross check result is specified. Refer to section E.6.2 of this report for detail assessment for this parameter. CAR 03 is closed.				

CAR ID	04	Section no.	D.2	Date: 26/08/2022
Description of CAR				
For parameter $N_{da,LT}$, the actual cross check result is not specified.				
Project participant response				Date: 09/09/2022
The cross check result for parameter $N_{p,LT}$ is included in Section D.2. The number of days the animal alive in the farm sourced from the production record of Market swine and was crosschecked through the monthly sale records of 9 swine farms during this monitoring period and it can be concluded that the data is consistent.				
Documentation provided by project participant				
/1/ version 02				
VVB assessment				Date: 19/09/2022
The revised MR is checked, CTI confirmed that the actual cross check result is specified. Refer to section E.6.2 of this report for detail assessment for this parameter. CAR 04 is closed.				

CAR ID	05	Section no.	D.2	Date: 26/08/2022
Description of CAR				
For parameter $N_{AA,LT}$, the measurement methods and procedures is not in line with PDD, DCS system description is missing.				
Project participant response				Date: 09/09/2022

The measurement methods and procedures of parameter $N_{AA,LT}$ has been revised in line with the PDD, the details as follows: Monitored daily through the auto tracking devices of electronic ear tag and the data can be obtained from DCS. The technicians in farms record the daily stock number of animals in “Breeding Swine stock record”, and this record data including the new imported animal and discounting dead and discharge animals. Archive electronically during project plus 5 years. Please see the Section C of MR for details. The DCS system description was described in the PDD.

Documentation provided by project participant	
/1/ version 02	
VVB assessment	Date: 19/09/2022
The revised MR is checked, CTI confirmed that the measurement methods and procedures has been specified in line with PDD, DCS system description is provided. Refer to section E.6.2 of this report for detail assessment for this parameter. CAR 05 is closed.	

CAR ID	06	Section no.	D.2	Date: 26/08/2022
Description of CAR				
For parameter W_{site} , the actual QA/QC procedure for the sampling is not specified, just list the requirement of the methodology is not acceptable.				
Project participant response				Date: 09/09/2022
The actual QA/QC procedure parameter W_{site} has been modified as follows: As this project involved 9 swine farms and two types of swine i.e., Market swine and Breeding swine, and as per applied methodology, each defined livestock population should be classified into a minimum of three age categories (The three age categories of marketing swine are classified according to the age in days, i.e. Nursery phase with 30-60days, Growing phase with 60-130days and Mature phase with 130-180days. The three age categories of breeding swine are classified according to the age in days, i.e. Nursery phase with 30-70days, Growing phase with 70-220days and Mature phase with 220-310days.), so the sampling method is Stratified random sampling. Furthermore, Weight measurers were calibrated on 12/12/2020 and 10/12/2021 by an officially accredited entity in compliance with JJG539-2016 “Verification Regulation of Digital Indicating Weighting Instruments” in China.				
Documentation provided by project participant				
/1/ version 02				
VVB assessment				Date: 19/09/2022
The revised MR is checked, CTI confirmed that the actual QA/QC procedure for the sampling is specified. Refer to section E.5 of this report for detail assessment of the sampling method. CAR 06 is closed.				

CAR ID	07	Section no.	D.2	Date: 26/08/2022
Description of CAR				
For parameter n_{dy} ,				
<ol style="list-style-type: none"> 1. The source of data is monthly operation record but the frequency is daily. 2. The cross-check method and the actual cross-check result is missing. 3. If each farm was operational normally for 546 days is not stated. 				
Project participant response				Date: 09/09/2022
<ol style="list-style-type: none"> 1. The source of data of parameter n_{dy} has been modified to daily operation record. 2. The daily accumulated meter reading of flowmeters installed in the outlet of anaerobic digesters in each farm can be demonstrated that the AWMSs are actually running on a daily basis. The 9 treatment plants is operational every day during this monitoring period according to the actual daily reading of flowmeters installed in the outlet of anaerobic digesters in each farm. 3. n_{dy} is the number of days treatment plants was operational. As the anaerobic fermentation is the main process of the treatment process for the project, so the operating days of the anaerobic tank in each farm can be considered as the operating days of the treatment plant. as long as the anaerobic tank is running, biogas will be generated, so the period of biogas generation monitored by the flow meter is the operating days of the treatment plant. Therefore, each farm was operational for 546 days and there was no breakdown/ non –operational day at any of the farms according to the daily meter reading of flowmeter installed in the outlet of anaerobic digesters in each farm. This is revised in MR. 				
Documentation provided by project participant				
/1/ version 02				
/19/				
VVB assessment				Date: 19/09/2022

1. The revised MR is checked, CTI confirmed that the source of data is update to daily operation record/19/ which is confirmed as actual and correct.
2. The revised MR is checked, CTI confirmed that the cross-check method is specified.
3. The revised MR is checked, CTI confirmed that the statement has been added. Daily operation record of each treatment plant/19/ is cross-checked with the rated flow of the biogas which has been provided in the MR and assessed as below, CTI verified that each treatment plant was operational in 546 days and all the 9 swine farms. i.e each farm was operational for 546 days and there was no breakdown/ non –operational day at any of the farms during this monitoring period.
Refer to section E.6.2 of this report for detail assessment for this parameter.
CAR 07 is closed.

CAR ID	08	Section no.	D.2	Date: 26/08/2022
Description of CAR				
For monitoring parameter F_{Aer} , it is missing in this section which is not in line with the methodology.				
Project participant response				Date: 09/09/2022
The monitoring parameter F_{Aer} has been added to section D.2 of MR, which is in line with the applied methodology.				
Documentation provided by project participant				
/1/ version 02				
VVB assessment				Date: 19/09/2022
The revised MR is checked, CTI confirmed that the monitoring parameter F_{Aer} has been added accordingly. Refer to section E.6.2 of this report for detail assessment for this parameter.				
CAR 08 is closed.				

CAR ID	09	Section no.	D.2	Date: 26/08/2022
Description of CAR				
For monitoring parameter $V_{t,db}$, PP stated that the value is monitored continuously, record hourly and saved automatically in the system, however, which system is not specified.				
Project participant response				Date: 09/09/2022
The description of this system has been added to this parameter.				
Documentation provided by project participant				
/1/ version 02				
VVB assessment				Date: 19/09/2022
The revised MR is checked, CTI confirmed that DCS has been specified and confirmed as correct by site inspection.				
CAR 09 is closed.				

CAR ID	10	Section no.	D.2	Date: 26/08/2022
Description of CAR				
For monitoring parameter $V_{i,t,db}$,				
1. PP stated that the value is monitored continuously, record hourly and saved automatically in the system, however, which system is not specified.				
2. The calibration is not in line with PDD which state "Calibration should include zero verification with an inert gas (e.g. N_2) and at least one reading verification with a standard gas (single calibration gas or mixture calibration gas). All calibration gases must have a certificate provided by the manufacturer and must be under their validity period.". Revision is requested.				
Project participant response				Date: 09/09/2022
1. The description of this system has been added to this parameter				
2. All the gas analysers were calibrated on 08/01/2021 and 06/01/2022 by an officially accredited entity in compliance with JJG693-2011" Verification Regulation of Alarmer Detectors of Combustible Gas" in China. And the zero verification with an inert gas (N_2) and one reading verification with a standard gas (single calibration gas) are implemented in the process of calibration, which is in accordance with JJG693-2011. All calibration gases are from Guangzhou Yigas Gases Co.Ltd., which is a qualified reference materials manufacturer issued by the General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China on 16/01/2020.				
Documentation provided by project participant				
/1/ version 02				
/14/				
VVB assessment				Date: 19/09/2022
1. The revised MR is checked, CTI confirmed that DCS has been specified and confirmed as correct by site				

inspection.
2. The revised MR is checked, CTI confirmed that the calibration information has been added accordingly. Calibration should include zero verification with an inert gas (e.g. N ₂) and at least one reading verification with a standard gas (single calibration gas or mixture calibration gas). And the zero verification with an inert gas (N ₂) and one reading verification with a standard gas (single calibration gas) are implemented in the process of calibration, which is confirmed as in accordance with JJG693-2011. All calibration gases are confirmed as from Guangzhou Yigas Gases Co.Ltd., which is a qualified reference materials manufacturer issued by the General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China on 06/09/2017/14/. And based on the validity as above table, CTI confirmed that the installed monitoring equipment has been duly calibrated for this entire monitoring period.
CAR 10 is closed.

CAR ID	11	Section no.	D.2	Date: 26/08/2022
Description of CAR				
The monitoring parameter B _{0,LT} , Type, T, NEX _{LT,y} are missing in this section which is not in line with the PDD.				
Project participant response				Date: 09/09/2022
The monitoring parameter B _{0,LT} , Type, T, NEX _{LT,y} have been added to section D.2.				
Documentation provided by project participant				
/1/ version 02				
VVB assessment				Date: 19/09/2022
The revised MR is checked, CTI confirmed that the 4 parameters have been provided accordingly. Refer to section E.6.2 of this report for detail assessment for these 4 parameters.				
CAR 11 is closed.				

CAR ID	12	Section no.	D.2	Date: 26/08/2022
Description of CAR				
For parameter Employee Training of biogas safety operation,				
1. The value of this monitoring period is missing.				
2. Measurement methods and procedures is not provided.				
Project participant response				Date: 09/09/2022
1. During this monitoring period, the Employee Training of biogas safety operation was conducted on 20/11/2020 and 26/10/2021.				
2. The measurement methods and procedures are: Training once a year. The training content includes basic biogas knowledge, Operating condition control, operating procedure, patrol inspection, Operation management and failure process. All 9 staffs in manure treatment plants and 9 technicians from 9 swine farms attended this training. All staff strictly follow the operation procedures in the process of operation and there are no safety accidents occurred during this monitoring period. Therefore, the training is effective.				
Documentation provided by project participant				
/1/ version 02				
/25/				
VVB assessment				Date: 19/09/2022
1. The revised MR is checked, CTI confirmed that the value of this monitoring period has been added accordingly. Training of safety operation of the biogas carried out on 20/11/2020 and 26/10/2021 is confirmed by checking the training notices/25/ and cross checked with Meeting attendance record/26/.				
2. The revised MR is checked, CTI confirmed that the measurement methods and procedures has been specified. Via checking all the operation records of the treatment plants and by site inspection, it is verified that there was no safety accident occurred during this monitoring period. CTI verified that the data in MR is correct.				
CAR 12 is closed.				

Table 4. FAR from this verification

FAR ID	N/A	Section No.		Date: DD/MM/YYYY
Description of FAR				
No FAR from this verification				
Project participant response				Date: DD/MM/YYYY
Documentation provided by project participant				

VVB assessment	Date: DD/MM/YYYY