



**Verification report for
GS4GG project activities**

(Gold Standard for the Global Goals)

VERIFICATION AND CERTIFICATION REPORT

Title of the project activity	Shuangbaotai Animal Manure Management System GHG Mitigation Project in Guangxi Province	
Reference number of the project activity	GS11336	
Version number of the verification and certification report	02	
Completion date of the verification and certification report	08/08/2023	
Monitoring period number and duration of this monitoring period	MP number: 2 nd MP dates: 01/04/2022 to 31/03/2023 (both days included)	
Version number of monitoring report to which this report applies	03	
Crediting period of the project activity corresponding to this monitoring period	20/01/2021 to 19/01/2026 (both days included)	
Project Representative	The official focal point and project developer: Profit Carbon Environmental Energy Technology (Shanghai) Co., Ltd. The project owner: Shuangbaotai Animal Husbandry Group Co., Ltd.	
Host Party	People's Republic of China	
Activity Requirements applied	☒ Community Services Activities ☐ Renewable Energy Activities ☐ Land Use and Forestry Activities/Risks & Capacities ☐ N/A	
Methodology (ies) applied and version number	ACM0010 "GHG emission reductions from manure management systems" (Version 08.0)	
Product Requirements applied	☒ GHG Emissions Reduction & Sequestration ☐ Renewable Energy Label ☐ 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	Total electricity produced: 33,100.6 MWh

	Decent Work and Economic Growth (SDG 8)- 8.5.1 Average hourly earnings of employees, by sex, age, occupation and persons with disabilities	Total number of jobs: 18 full-time jobs created including 9 males and 9 females
	Climate Action (SDG 13)- 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.	Amount of GHGs emission avoided or sequestered: 267,474 tCO ₂ e
Total amount of certified SDG impact (as per approved methodology) achieved in this monitoring period	SDG 7 - From 01/04/2022 to 31/12/2022, Total electricity produced: 20,643.32 MWh From 01/01/2023 to 31/03/2023, Total electricity produced: 6,760.10 MWh In the 1st monitoring period, Total electricity produced: 27,403.42 MWh SDG 8 – From 01/04/2022 to 31/12/2022, 18 full-time jobs created including 9 males and 9 females. From 01/01/2023 to 31/03/2023, 18 full-time jobs created including 9 males and 9 females. In the 1st monitoring period, 18 full-time jobs created including 9 males and 9 females. SDG 13 – GHG emission Reductions (GS VERs) 01/04/2022-31/12/2022 : 160,667 tCO₂e 01/01/2023-31/03/2023 : 52,478 tCO₂e 01/04/2022-31/03/2023 : 213,145 tCO₂e	
Name of VVB	VVB Name: CTI Certification Co., Ltd (CTI)	
Name, position and signature of the approver of the verification and certification report	<i>Zhang Lei</i> Zhang Lei Technical Reviewer/Approver	

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 Guangxi Zhuang Autonomous Region, 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 25,859,844.12 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 5.2MW and the annual electricity production is estimated to be 33,100.60MWh, 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 267,474 tCO₂e per year during the renewable 5-year crediting period and the Certified emissions reduction for the current monitoring period from 01/04/2022 to 31/03/2023 is 213,145 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 17/04/2023)/1/, ER sheet/2/ and the relevant documents
- b. On-site assessment (19/05/2023~22/05/2023)
- 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 “Shuangbaotai Animal Manure Management System GHG Mitigation Project in Guangxi Province” having GS Ref. Number GS11336 for the 1st monitoring period from 01/04/2022 to 31/03/2023. The verified emission reductions amount to 213,145 tCO₂e 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 2nd 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 “Shuangbaotai Animal Manure Management System GHG Mitigation Project in Guangxi 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	Lin	Wu	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	Zhang	Lei	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 17/04/2023/1/
- (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: 19/05/2023~22/05/2023				
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 Shuangbaotai Animal Husbandry Group Co., Ltd. in Chongzuo City, Guangxi Zhuang Autonomous Region, China	19/05/2023	Lin Wu
2.	On-site inspection of the 9 swine farms and Interview with chief and operation staffs of farms and animal manure management systems	9 swine farms and their AWMSs in Guangxi Zhuang Autonomous Region, P.R. China	19/05/2023~22/05/2023	
3.	Documents check as per the list in Appendix 3 of this report	Office of Shuangbaotai Animal Husbandry Group Co., Ltd. in Guangxi Zhuang Autonomous Region, China	22/05/2023	
4.	Findings Summary and discussion with PD	Office of Shuangbaotai Animal Husbandry Group Co., Ltd. in Guangxi Zhuang Autonomous Region, China	22/05/2023	
5.	Close Meeting and issuance of findings/draft report	Office of Shuangbaotai Animal Husbandry Group Co., Ltd. in Guangxi Zhuang Autonomous Region, China	22/05/2023	

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.	Song	Hanbai	Shuangbaotai Animal Husbandry Group Co., Ltd. - Project Owner/ Project Manager	19/05/2023	Discussion on project financials, project design and implementation, Main equipment, Technical parameters, Baseline,	Lin Wu
2.	Cheng	Yuantao	Shuangbaotai Animal Husbandry Group Co., Ltd. -			

			Project Owner/ Region Director of Guangxi Branch		Additionality, Project boundary, Monitoring plan, Monitoring devices, SDG impacts, ER calculation, Local legislation to biogas	
3.	Tu	Shulan	Profit Carbon Environmental Energy Technology (Shanghai) Co., Ltd./ Project Manager	19/05/2023~ 22/05/2023	Ex-ante and monitoring parameters and SDG parameters, PDD and ER, IRR, NPV editable issues	
4.	Li	Zezhong	Chongzuo Quming Swine Farm /Farm chief	19/05/2023	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	
5.	Dai	Yanxiong	Chongzuo Zuozhou Swine Farm / Farm chief			
6.	Xing	Xu	Jingxi Swine Farm/ Farm chief	20/05/2023		
7.	Jia	Zhong	Debao Chengguan Swine Farm/ Farm chief			
8.	Kang	Lei	Tianyang Wucun Swine Farm/ Farm chief			
9.	Yu	Ming	Liucheng Mashan Swine Farm/ Farm chief	21/05/2023		
10.	Chen	Jie	Bama Yanyan Swine Farm/ Farm chief			
11.	Lin	Miao	Quanzhou Dengjiabu Swine Farm/ Farm chief	22/05/2023		
12.	Yan	Shanhua	Tengxian Tianping Swine Farm / Farm chief			
13.	Zhou	Zhou	Chongzuo Quming Swine Farm /AWMS Plant Staff	19/05/2023	Project implementation Treatment method Main equipment Biogas production Slurry General info of interviewee, name, gender, Age, Education, Location When joined the company? How to obtain this job? What is the main work? What about the working condition? Training provided, Salary level, if	
14.	Wang	Miao				
15.	Tang	Aifang	Chongzuo Zuozhou Swine Farm / AWMS Plant Staff			
16.	Lin	Zifan				
17.	Zhang	Lina	Jingxi Swine Farm/ AWMS Plant Staff	20/05/2023		
18.	Ren	Qingbin				
19.	Chen	Guobai	Debao Chengguan Swine Farm/ AWMS Plant Staff			
20.	Zhang	Yijuan				
21.	Sun	Lili	Tianyang Wucun Swine Farm/ AWMS Plant Staff			
22.	Li	Shengli				

23.	Li	Qing	Liucheng Mashan Swine Farm/ AWMS Plant Staff	21/05/2023	satisfied		
24.	Lu	Liming					
25.	Chen	Siyang					
26.	Jia	Zhen					
27.	Pan	Chen	Quanzhou Dengjiabu Swine Farm/ AWMS Plant Staff	22/05/2023			
28.	Qian	Senlin					
29.	Wang	Yuming					
30.	Liu	Yanhong					
31.	Guo	Xue	Local Stakeholders/ Residents	19/05/2023	Local Stakeholder Consultation issues, SDG impacts Local environment impact		
32.	Cheng	li		20/05/2023			
33.	Zhang	Guoqing					
34.	Dong	Tianyun					
35.	Li	Minghui					
36.	Feng	Jia					21/05/2023
37.	Li	Lehe					
38.	Duan	Jiashi					
39.	Zhou	Feihu					
40.	Wang	Jiahao	Bureau of Ecology and Environment in Chongzuo City /Vice Section Chief	19/05/2023	Baseline Scenario Local Stakeholder Consultation issues, SDG impacts, Inputs, Grievances mechanism, Local legislation to swine and biogas		
41.	Chen	Tao	Bureau of Agriculture and Rural Affairs in Chongzuo City / Section Staff				

C.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	-	CAR 01	-
Remaining forward action requests from validation and/or previous verification	-	-	-
Compliance of the project implementation with the registered project design document	-	-	-
Post-registration changes	-	-	-
Compliance of the monitoring system applied by the project with the registered monitoring plan	-	CAR 02	-
Compliance of monitoring activities with the registered monitoring plan			
SDG Data and parameters fixed ex ante or at renewal of crediting period	-		-
SDG Data and parameters monitored	CL 01 CL 02	-	-
Comparison of monitored parameters with last monitoring period	CL 03	-	-
Compliance of the sampling implementation with the registered sampling plan	-	-	-
Assessment of data and calculation of SDG Impacts			
Calculation of baseline value or estimation of baseline situation of each SDG Impact	-	-	-
Calculation of project value or estimation of project situation of each SDG Impact	-	CAR 03	-
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	3	3	-

SECTION E. Verification findings

E.1. General Description of Project

Means of verification	A draft monitoring report was submitted to the verification team by the project participants prior to the start of the verification activities. 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/. Further every section has been checked against the GS4GG Principles& Requirements/43/. 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 Guangxi Zhuang Autonomous Region, 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 25,859,844.12 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 5.2MW and the annual electricity production is estimated to be 33,100.60MWh, 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. 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. 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 164,600 heads of marketing swine, 95,110 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 417,094.26 tons of manure every year. 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. 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. All the closed anaerobic digesters, waste collecting tanks, solid-liquid separators, Upflow Anaerobic Sludge Bed Reactors (UASB), desulfurization and dehydration
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	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/. 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. The project applied CDM Methodology ACM0010 “GHG emission reductions from manure management systems” (Version 08.0)/32/. The location of the project activity is in Guangxi Zhuang Autonomous Region, P.R. China. The detailed geographic coordinates of the project included in this monitoring period is listed as below:																																												
	<table><tr><th>Item</th><th colspan="2">Project Location</th></tr><tr><td>Host Country</td><td colspan="2">China</td></tr><tr><td>Region:</td><td colspan="2">Guangxi Zhuang Autonomous Region</td></tr><tr><td colspan="3">Geographical Coordinates</td></tr><tr><td>Swine farm</td><td>East longitude</td><td>North latitude</td></tr><tr><td>Bama Yanyan swine farm</td><td>107.231670544°</td><td>23.976710754°</td></tr><tr><td>Chongzuo Zuozhou swine Farm</td><td>107.456162364°</td><td>22.648337404°</td></tr><tr><td>Tianyang Wucun swine Farm</td><td>106.800232°</td><td>23.501188°</td></tr><tr><td>Quanzhou Dengjiabu swine Farm</td><td>111.100142756°</td><td>25.891490360°</td></tr><tr><td>Chongzuo Quming swine Farm</td><td>107.456200450°</td><td>22.686794907°</td></tr><tr><td>Jingxi swine Farm</td><td>106.315845°</td><td>23.148953°</td></tr><tr><td>Liucheng Mashan swine Farm</td><td>108.054611695°</td><td>23.755085410°</td></tr><tr><td>Tengxian Tianping swine Farm</td><td>110.773228845°</td><td>23.375143765°</td></tr><tr><td>Debao Chengguan swine Farm</td><td>106.654365049°</td><td>23.301572413°</td></tr></table>			Item	Project Location		Host Country	China		Region:	Guangxi Zhuang Autonomous Region		Geographical Coordinates			Swine farm	East longitude	North latitude	Bama Yanyan swine farm	107.231670544°	23.976710754°	Chongzuo Zuozhou swine Farm	107.456162364°	22.648337404°	Tianyang Wucun swine Farm	106.800232°	23.501188°	Quanzhou Dengjiabu swine Farm	111.100142756°	25.891490360°	Chongzuo Quming swine Farm	107.456200450°	22.686794907°	Jingxi swine Farm	106.315845°	23.148953°	Liucheng Mashan swine Farm	108.054611695°	23.755085410°	Tengxian Tianping swine Farm	110.773228845°	23.375143765°	Debao Chengguan swine Farm	106.654365049°	23.301572413°
Item	Project Location																																												
Host Country	China																																												
Region:	Guangxi Zhuang Autonomous Region																																												
Geographical Coordinates																																													
Swine farm	East longitude	North latitude																																											
Bama Yanyan swine farm	107.231670544°	23.976710754°																																											
Chongzuo Zuozhou swine Farm	107.456162364°	22.648337404°																																											
Tianyang Wucun swine Farm	106.800232°	23.501188°																																											
Quanzhou Dengjiabu swine Farm	111.100142756°	25.891490360°																																											
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Tengxian Tianping swine Farm	110.773228845°	23.375143765°																																											
Debao Chengguan swine Farm	106.654365049°	23.301572413°																																											
	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. The project start date is 05/09/2020 which has been confirmed by checking the equipment purchase contracts/9/, and was put into operation on 20/01/2021 which has been confirmed by checking the operation log of the project/12/ and record of operation started of each AWMS/24/. The project was applied as a GS-VER project with the GS Reference number of GS11336. 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 20/01/2021. The 2nd monitoring period is from 01/04/2022 to 31/03/2023 (first and last days included) belongs to the first crediting period. 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/.																																												
Findings	CAR 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 2nd verification of the project activity. Via checking the 1st periodical verification report/5/, 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	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. 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 13/09/2020 which has been confirmed by checking the General contract of engineering construction/10/, and started first commissioning on 10/01/2021 and was put into operation on 20/01/2021 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/. 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 213,145 tCO₂e/2/. This is the 2nd 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. 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.
Findings	N/A
Conclusion	Assessment concludes the following: - 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

Means of verification	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. The monitoring system applied by the project compliance with the registered monitoring plan is demonstrated as below: Monitoring for SDG parameters For Mitigation Measure for Safeguarding Principles Employee Training of biogas safety operation SDG 8 Total number of jobs SDG 7 Total electricity produced, $EG_{d,y}$ SDG 13 - 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, $EC_{PJ,j,y}$ - 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, $\rho_{i,t}$ - 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, $B_{0,LT}$ - 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, $NEX_{LT,y}$

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 Commercial Pig/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 (one fattening farm that only including market swine: Debao Chengguan swine farm, the other swine farm 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.

As per the MR, for monitoring the W_{site} , according to “Standard: Sampling and surveys for CDM project activities and programmes of activities (Version 09.0)”, the desired confidence level is 95% and the desired precision is 10%. According to statistical principles and sampling survey method, 444 samples is sufficient to satisfy the desired confidence and precision. Hence PD has taken 444 samples for measuring the weight and record all the weight in the record the animal weight of the samples, due to the record only have the values of 444 samples, VVB did not have to do the sampling check of the records from 444 samples, VVB checked all the data of 444 samples and no acceptance sampling method need to be done for all the 444 samples in the records.

The sampling method conducted by PD is verified as stated in the verification report: The method of calculation of sample size is checked by CTI by checking the calculation sheet of sample size, 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)" 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)" and is verified consistent with PDD.

As per the above explanation, VVB could not weight the swine during site visit, due to the safety reason and considering the swine fever impacts, people outside the swine farms are not allowed to be inside the swine farms but can only do the AWMS plants inspection. Hence no such sample results conducted by VVB for the checking the weight of the swine during site visit. And furthermore, due to the swine which has been sampled by PD is during the monitoring period, and VVB can only do the verification after the monitoring period ended, so when the VVB does the on-site check, it is not possible for VVB to check the PP sampled swine as these swine has raised with more weight or be sold to the market with the time passed. So, actually, VVB can't do the acceptance sampling during the site visit time as the samples from PD will not have the same weight with the PD's measuring.

Therefore, to cross-check the weight data of the PD's samples, VVB has checked the public information of the weight of market swine^{1,2} and breeding swine^{3,4} in different categories including Nursery phase, Growing phase and Mature phase, it is confirmed that the average weight data for different categories are reasonable and thus the sampling results by PD are acceptable.

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 2nd 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/.

¹

<https://www.ziyunlou.com/article/2pdr12.html#:~:text=%E7%8C%AA%E7%9A%84%E7%94%9F%E9%95%BF%E5%8F%91%E8%82%B2%E9%98%B6%E6%A%E%B5,%E4%B8%8A%E5%B8%82%EF%BC%89%E5%9B%9B%E4%B8%AA%E9%98%B6%E6%AE%B5%E3%80%82>

² <https://www.jiangxigicheng.com/96258.html>

³ <https://zhuanlan.zhihu.com/p/369296668>

⁴ <https://baike.baidu.com/item/%E7%A7%8D%E7%8C%AA/7148836>

	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 02 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
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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_2O	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 AWMSj	71.44%	2019 Refinement to the 2006 IPCC Guidelines table 10.17, chapter 10, volume 4	A conservativeness factor has been applied by multiplying MCF_j value (i.e., 76%) 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 /59/ and consistent with the PDD. For this monitoring period, the annual average temperature at the project site is 17.5~23.5°C/61/, which is higher than 10°C, and the annual average evapotranspiration is obviously less than the annual average precipitation by checking the public climate information of Guangxi Province/61/. So a ratio of potential evapotranspiration to precipitation is < 1, and the climate zone of the project site can be determined to "Warm temperature Dry" as per the 2019 Refinement to the 2006 IPCC Guidelines/59/, then the MCF value of 76% applied is verified as reasonable.
$MS\%_{BI,j}$ – SDG 13 Fraction of manure handled in	100%	In this project, the baseline manure management system is uncovered anaerobic lagoon	Confirmed as per PER/7/, baseline evidence/21/ and consistent with the PDD.

	system j in the baseline		only. The amount of manure handled by the anaerobic lagoon is 100%.	
	W_{default} – SDG 13 Default average animal weight of a defined population	W _{default} (Market swine) = 28kg W _{default} (Breeding swine) = 28kg	IPCC 2006 table 10A-7 and 10A-8, chapter 10, volume 4	Confirmed as reported by IPCC 2006/59/ and consistent with the PDD.
	VS_{default} – SDG 13 Default value for the volatile solid excretion per day on a dry-matter basis for a defined livestock population	VS _{default} (Market swine) = 0.3 kg-dm/animal/day VS _{default} (Breeding swine) = 0.3 kg-dm/animal/day	IPCC 2006 table 10A-7 and 10A-8, chapter 10, volume 4	Confirmed as reported by IPCC 2006/59/ and consistent with the PDD.
	N_{rate(T)} – SDG 13 Default N excretion rate	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	IPCC 2006 table 10.19, 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.
	NEX_{IPCC default} – SDG 13 Default value for the nitrogen excretion per head of a defined livestock population	Refer to MR for monthly data	Calculated by the equation: NEX _{IPCC default} = N _{rate(T)} * TAM/1000*365	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 01/04/2022-31/03/2023, equal to one year. Therefore, this parameter is calculated according to the actual number of

			days.
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 j 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 j 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	R _{vs,n} , aerobic treatment and anaerobic	Appendix 1 of methodology ACM0010	Confirmed as per the Appendix 1 of methodology ACM0010/32/ and consistent with the PDD.

	factor for the fraction of CH ₄ produced that leaks from the anaerobic digester (fraction)	digester: 20%, 80% 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): 5%, 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 emissions 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/mineralise d in managed soils in regions where leaching/runo ff 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	0.50885 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	N/A			
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	297,172 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?	Values of Monitoring parameter of $N_{p,LT}$ were derived from Production record of Commercial Pig issued by PP/15/ for this monitoring period. 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 Commercial Pig issued by PP/15/. 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). 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. Via checking the measuring method by reviewing the Production record of Commercial Pig 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/. 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. The Production record of Commercial Pig/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. According to the Equation 4 in this MR, it is verified that the calculated N_{LT} is 146,550 heads (297,172 heads *180days/365days). However, according to the number of market pigs produced annually of each farm, the N_{LT} calculated is rounded to an integer as 146,547 heads, the detailed calculation process has been checked in ER spreadsheet "Monitoring results". While via checking the monthly Sale Records of Market swine/20/ of each farm, CTI confirmed that total 297,172 head of marketing swine is produced and sold into the market which is consistent with the value from Monthly production record of market swine. According to the conservative principle, the 146,547 heads was applied in the calculations of emission reductions in MR, therefore, $N_{p,LT}$ is reasonable and credible.
		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 calibrated for this	N/A

	entire monitoring period?	
	How were the values in the monitoring report verified?	Values of Monitoring parameter of $N_{da,LT}$ were derived from Production record of Commercial Pig issued by PP/15/ for this monitoring period. 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 Commercial Pig issued by PP/15/. 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. Via checking the measuring method by reviewing the Production record of Commercial Pig 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/. 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. The Production record of Commercial Pig/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. Furthermore, the alive days of 180 is verified as consistent with the number of days for pigs to be slaughtered by existing large-scale breeding groups in China/62/. Hence it is verified that the days in MR is correct and actual.
	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.
	3. $N_{AA,LT}$	
	Relevant SDG indicator:	SDG13
	Data/Parameter	$N_{AA,LT}$
	Unit	Number
	Description	Daily stock of animals in the farm, discounting dead and

		discarded animals
	Value applied for this monitoring period	Average of 89,736 heads of breeding swine
	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?	Values of Monitoring parameter of $N_{AA,LT}$ were derived from Breeding Pig stock record issued by PP/18/ for this monitoring period. 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. 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. Breeding swine stocks are derived from the DCS system and can be cross-checked by an artificial inventory containing the number of dead and discarded. 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. Via checking the measuring method by reviewing the Breeding Pig stock record with animals dead/discarded which is derived from the DCS system cross-checked by an artificial inventory containing the number of dead and discarded/18/ and interview with technicians as stated in the MR, also CTI checked the DCS system to confirm how the data was recorded, 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?	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	The weight was measured by weight measures. For each Weight measurer, Accuracy: III level Type: XK3190-A12+(E) The calibration information and validity is listed as below table <table border="1"> <thead> <tr> <th>Farm</th> <th>Serial No.</th> <th>Calibrated Date</th> <th>Validity</th> </tr> </thead> <tbody> <tr> <td>Bama Yanyan swine farm</td> <td>2018465447</td> <td rowspan="4">10/12/2021 08/12/2022</td> <td rowspan="4">09/12/2022 07/12/2023</td> </tr> <tr> <td>Chongzuo Zuozhou swine Farm</td> <td>2018375816</td> </tr> <tr> <td>Tianyang Wucun swine Farm</td> <td>2019139409</td> </tr> <tr> <td>Quanzhou Dengjiabu swine</td> <td>2018470848</td> </tr> </tbody> </table>			Farm	Serial No.	Calibrated Date	Validity	Bama Yanyan swine farm	2018465447	10/12/2021 08/12/2022	09/12/2022 07/12/2023	Chongzuo Zuozhou swine Farm	2018375816	Tianyang Wucun swine Farm	2019139409	Quanzhou Dengjiabu swine	2018470848
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	Is the installed monitoring equipment has been duly calibrated for this entire monitoring period?	The above calibration information has been confirmed by checking the calibration reports/13/ which has been conducted by qualified parties/14/.														
	How were the values in the monitoring report verified?	Values of Monitoring parameter of W_{site} were derived from Weight records issued by PP/16/ for this monitoring period. For monitoring this parameter, a sampling method has been used by PP following the applied methodology and PDD. Refer to section E.5 for detail assessment of the sampling method. 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/. 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?	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.															
5. n_{dy}																
Relevant SDG:	SDG13															
Data/Parameter	n_{dy}															
Unit	number															
Description	Number of days treatment plant was operational in year y															

	Value applied for this monitoring period	365 days
	Measuring /Reading /Recording frequency	Measured 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? (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 365 days and all the 9 swine farms. i.e each farm was operational for 365 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 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 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	Yes, the measuring and reporting frequency are in line

	in accordance with the monitoring plan and monitoring methodology? (Yes / No)	with the registered PDD/3/ and applied methodology/32/.																																																		
	Monitoring equipment accuracy with	3 flow meters 1,2,3 installed at each treatment plant Total 27 flow meters Type: HD-LUB Accuracy: 1.5																																																		
	Is the installed monitoring equipment has been duly calibrated for this entire monitoring period? (Yes / No)	For each flow meter, the calibration information and validity is listed as below table Flow meter 1 <table border="1"> <thead> <tr> <th>Farm</th> <th>Serial No.</th> <th>Calibrated Date</th> <th>Validity</th> </tr> </thead> <tbody> <tr> <td>Bama Yanyan swine farm</td> <td>202001002357</td> <td rowspan="10">08/01/2021 07/01/2023</td> <td rowspan="10">07/01/2023 06/01/2025</td> </tr> <tr> <td>Chongzuo Zuozhou swine Farm</td> <td>202002003518</td> </tr> <tr> <td>Tianyang Wucun swine Farm</td> <td>202001006849</td> </tr> <tr> <td>Quanzhou Dengjiabu swine Farm</td> <td>202003001748</td> </tr> <tr> <td>Chongzuo Quming swine Farm</td> <td>202002005473</td> </tr> <tr> <td>Jingxi swine Farm</td> <td>202003002189</td> </tr> <tr> <td>Liucheng Mashan swine Farm</td> <td>202002002847</td> </tr> <tr> <td>Tengxian Tianping swine Farm</td> <td>202001004638</td> </tr> <tr> <td>Debao Chengguan swine Farm</td> <td>202003000432</td> </tr> </tbody> </table> Flow meter 2 <table border="1"> <thead> <tr> <th>Farm</th> <th>Serial No.</th> <th>Calibrated Date</th> <th>Validity</th> </tr> </thead> <tbody> <tr> <td>Bama Yanyan swine farm</td> <td>202001002358</td> <td rowspan="10">08/01/2021 07/01/2023</td> <td rowspan="10">07/01/2023 06/01/2025</td> </tr> <tr> <td>Chongzuo Zuozhou swine Farm</td> <td>202002003519</td> </tr> <tr> <td>Tianyang Wucun swine Farm</td> <td>202001006850</td> </tr> <tr> <td>Quanzhou Dengjiabu swine Farm</td> <td>202003001749</td> </tr> <tr> <td>Chongzuo Quming swine Farm</td> <td>202002005444</td> </tr> <tr> <td>Jingxi swine Farm</td> <td>202003002190</td> </tr> <tr> <td>Liucheng Mashan swine Farm</td> <td>202002002848</td> </tr> <tr> <td>Tengxian Tianping swine Farm</td> <td>202001004639</td> </tr> <tr> <td>Debao Chengguan swine Farm</td> <td>202003000433</td> </tr> </tbody> </table> Flow meter 3				Farm	Serial No.	Calibrated Date	Validity	Bama Yanyan swine farm	202001002357	08/01/2021 07/01/2023	07/01/2023 06/01/2025	Chongzuo Zuozhou swine Farm	202002003518	Tianyang Wucun swine Farm	202001006849	Quanzhou Dengjiabu swine Farm	202003001748	Chongzuo Quming swine Farm	202002005473	Jingxi swine Farm	202003002189	Liucheng Mashan swine Farm	202002002847	Tengxian Tianping swine Farm	202001004638	Debao Chengguan swine Farm	202003000432	Farm	Serial No.	Calibrated Date	Validity	Bama Yanyan swine farm	202001002358	08/01/2021 07/01/2023	07/01/2023 06/01/2025	Chongzuo Zuozhou swine Farm	202002003519	Tianyang Wucun swine Farm	202001006850	Quanzhou Dengjiabu swine Farm	202003001749	Chongzuo Quming swine Farm	202002005444	Jingxi swine Farm	202003002190	Liucheng Mashan swine Farm	202002002848	Tengxian Tianping swine Farm	202001004639	Debao Chengguan swine Farm
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How were the values in the monitoring report verified?	Monitoring parameter of v_f was derived from Daily operation record/19/. 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 installed at the inlet of flare system which have been verified as correct and actual by site inspection. Via checking the applied methodology and PDD, it is confirmed that if the project participants can demonstrate that leakage in distribution pipeline is zero, it need be measured at any three points. For this project, all the biogas produced is used for electricity generation as the figure listed in monitoring result of v_f, and no leakage in distribution pipeline occurred which has been reflected in the actual monitoring process. Therefore, the biogas flow is measured at the three points. The flowmeters monitored data continuously, record hourly and saved automatically in the Data Collection System (DCS). 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. 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. 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)	Via comparing with the data of v_f 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.
	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. Based on checking the project design in the PDD, it is confirmed that the purified biogas can enter the generator system for power generation after a desulfurization purification system, while the biogas just produced by the anaerobic fermentation system is a mixed gas containing saturated steam which contains H_2S and suspended particulate impurities, and based on checking the contents of H_2S, it is confirmed that the difference between V_f (measured by flowmeter1) and V_f (measured by flowmeter3) is 1.88% which is within the range of the 0.1%-3%, so it is reasonable and the value monitored by flowmeters are verified as acceptable.
8. $EC_{PJ,j,y}$		
	Relevant SDG:	SDG13
	Data/Parameter	$EC_{PJ,j,y}$
	Unit	MWh
	Description	Quantity of electricity consumed by the project in year y
	Value applied for this monitoring period	189.08484
	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 1 installed at each treatment plant Accuracy: 0.5s Type: DSSD331
	Is the installed	For each electricity meter 1, the calibration information

	monitoring equipment has been duly calibrated for this entire monitoring period? (Yes / No)	and validity is listed as below table																						
	<table><tr><th>Farm</th><th>Serial No.</th><th>Calibrated Date</th><th>Validity</th></tr><tr><td>Bama Yanyan swine farm</td><td>120236</td><td rowspan="9">11/01/2021</td><td rowspan="9">10/01/2026</td></tr><tr><td>Chongzuo Zuozhou swine Farm</td><td>180877</td></tr><tr><td>Tianyang Wucun swine Farm</td><td>146742</td></tr><tr><td>Quanzhou Dengjiabu swine Farm</td><td>158112</td></tr><tr><td>Chongzuo Quming swine Farm</td><td>162261</td></tr><tr><td>Jingxi swine Farm</td><td>180946</td></tr><tr><td>Liucheng Mashan swine Farm</td><td>218445</td></tr><tr><td>Tengxian Tianping swine Farm</td><td>178004</td></tr><tr><td>Debao Chengguan swine Farm</td><td>207758</td></tr></table> The above calibration information has been confirmed by checking the calibration reports/13/ which has been conducted by qualified parties/14/. 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. And based on the validity as above table, CTI confirmed that the installed monitoring equipment has been duly calibrated for this entire monitoring period.	Farm	Serial No.	Calibrated Date	Validity	Bama Yanyan swine farm	120236	11/01/2021	10/01/2026	Chongzuo Zuozhou swine Farm	180877	Tianyang Wucun swine Farm	146742	Quanzhou Dengjiabu swine Farm	158112	Chongzuo Quming swine Farm	162261	Jingxi swine Farm	180946	Liucheng Mashan swine Farm	218445	Tengxian Tianping swine Farm	178004	Debao Chengguan swine Farm
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	How were the values in the monitoring report verified?	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/. Based on checking the Daily report of electricity/30/, it is confirmed 8 AWMSs imported the electricity from the grid company except AWMS in Bama Yanyan swine farm which is verified as actual by checking the electricity notes issued by grid company/29/. The electricity consumptions were measured by the electricity meter installed at each treatment plant (total 9 Electricity meters). 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. 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/. 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. 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)	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. As per the design in PDD, it is confirmed that the electricity generated by the project was used firstly for the operation of AWMSs normally, then the excess electricity was supplied to the swine farms. Unless no electricity generation for this project, the electricity consumption of the project was supplied by the grid company. The calculated value of load factor for the project in this monitoring period of 75.20% (27,403.42 MWh/ (365days*24h)/5.2MW/80%) is verified as correct and is reasonable.
	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 meters 3 are installed at the inlet of flare system which have been verified as correct and actual by site inspection. The flowmeters monitored data continuously, record hourly and saved automatically in the Data Collection System (DCS). 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. 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. 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. 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)	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.
	11. $V_{i,t,db}$	
Relevant SDG:	SDG13	
Data/Parameter	$V_{i,t,db}$	
Unit	m ³ gas i/m ³ dry gas	
Description	Volumetric fraction of greenhouse gas i in a time interval t on a dry basis	

	Value applied for this monitoring period	Refer to values provided in the MR																									
	Measuring /Reading /Recording frequency	Continuous 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	Gas analyzers installed at each treatment plant Total 9 gas analyzers Type: Gasboard-9060 Accuracy: $\pm 1\%$																									
	Is the installed monitoring equipment has been duly calibrated for this entire monitoring period? (Yes / No)	For each gas analyzer, the calibration information and validity is listed as below table <table border="1"> <thead> <tr> <th>Farm</th> <th>Serial No.</th> <th>Calibrated Date</th> <th>Validity</th> </tr> </thead> <tbody> <tr> <td>Bama Yanyan swine farm</td> <td>2021010637</td> <td rowspan="10">06/01/2022 04/01/2023</td> <td rowspan="10">05/01/2023 03/01/2024</td> </tr> <tr> <td>Chongzuo Zuozhou swine Farm</td> <td>2021010315</td> </tr> <tr> <td>Tianyang Wucun swine Farm</td> <td>2021010409</td> </tr> <tr> <td>Quanzhou Dengjiabu swine Farm</td> <td>2020122503</td> </tr> <tr> <td>Chongzuo Quming swine Farm</td> <td>2021010621</td> </tr> <tr> <td>Jingxi swine Farm</td> <td>2020122809</td> </tr> <tr> <td>Liucheng Mashan swine Farm</td> <td>2020010719</td> </tr> <tr> <td>Tengxian Tianping swine Farm</td> <td>2020010247</td> </tr> <tr> <td>Debao Chengguan swine Farm</td> <td>2021010503</td> </tr> </tbody> </table> The above calibration information has been confirmed by checking the calibration reports/13/ which has been conducted by qualified parties/14/. 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. 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. All calibration gases are confirmed as from Nanjing Changyuan Industrial Gas Co. Ltd, which is a qualified reference materials manufacturer issued by the General Administration of Quality Supervision, Inspection and			Farm	Serial No.	Calibrated Date	Validity	Bama Yanyan swine farm	2021010637	06/01/2022 04/01/2023	05/01/2023 03/01/2024	Chongzuo Zuozhou swine Farm	2021010315	Tianyang Wucun swine Farm	2021010409	Quanzhou Dengjiabu swine Farm	2020122503	Chongzuo Quming swine Farm	2021010621	Jingxi swine Farm	2020122809	Liucheng Mashan swine Farm	2020010719	Tengxian Tianping swine Farm	2020010247	Debao Chengguan swine Farm
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Tengxian Tianping swine Farm	2020010247																										
Debao Chengguan swine Farm	2021010503																										

		Quarantine of the People's Republic of China on 16/04/2007/14/. And based on the validity as above table, CTI confirmed that the installed monitoring equipment has been duly calibrated for this entire monitoring period.
	How were the values in the monitoring report verified?	Monitoring parameter of $V_{i,t,db}$ was derived from Daily operation record/19/. 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 CH ₄ concentration was calculated based on the 24-hour average and daily average CH ₄ concentration and recorded finally in the Daily operation record/19/. 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. 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)	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	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	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 T_t was derived from Daily operation record/19/. 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. 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). 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. The readout of flowmeter was indicated degrees Celsius($^{\circ}\text{C}$). Therefore, the temperature $T_t(\text{K})$ is calculated as the equation $T(\text{K})=t(^{\circ}\text{C})+273.15$ 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. 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)	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.

	13. P_t	
	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?	Monitoring parameter of P_t was derived from Daily operation record/19/. 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. 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). 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. 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. 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)	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	N/A

	other available data? (Yes / No)	
	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 LT
	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, $0.29 m^3CH_4/kg -dm$ 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 $0.29 m^3CH_4/kg -dm$ 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/.
	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 has been duly calibrated for this entire monitoring period? (Yes / No)	N/A
	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	T
	Unit	°C
	Description	Annual average ambient temperature at project site
	Value applied for this monitoring period	20.9
	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	N/A

	entire monitoring period? (Yes / No)	
	How were the values in the monitoring report verified?	The value is derived from Temperature Monitoring Report issued by local meteorological bureau to the temperature of the project site /57/.
	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 is monitored continuously by local meteorological bureau and aggregated in monthly and annual average values as per requirements of the methodology confirmed by checking the Temperature Monitoring Report issued by local meteorological bureau to the temperature of the project site /57/. The annual average temperature during this monitoring period is 20.9°C and any month at the project site is greater than 5 °C/57/. MCF value is 76% with the lower temperature of ex ante 17.5~23.5°C (comparing with the actual for this monitoring period) as per the table 10.17 and Annex 10A.2 in the 2019 Refinement to the 2006 IPCC Guidelines/IPCC/. Then multiplying MCF values with a value of 0.94, so 71.44% of MCFj is used for calculation during in this monitoring period.
	20. Total number of jobs	
	Relevant SDG:	SDG8
	Data/Parameter	Total number of jobs
	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 Total number of jobs 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. In addition, to check if the payment is fair, CTI has verified the labor contracts/23/ and verified that the both men and women have the same salary.															
	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. Total electricity produced																
	Relevant SDG:	SDG7															
	Data/Parameter	$EG_{d,y}$															
	Unit	MWh															
	Description	Total electricity produced															
	Value applied for this monitoring period	27,403.42															
	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)	For each electricity meter, the calibration information and validity is listed as below table <table border="1"> <thead> <tr> <th>Farm</th> <th>Serial No.</th> <th>Calibrated Date</th> <th>Validity</th> </tr> </thead> <tbody> <tr> <td>Bama Yanyan swine farm</td> <td>120237</td> <td rowspan="4">11/01/2021</td> <td rowspan="4">10/01/2026</td> </tr> <tr> <td>Chongzuo Zuozhou swine Farm</td> <td>180878</td> </tr> <tr> <td>Tianyang Wucun swine Farm</td> <td>146743</td> </tr> <tr> <td>Quanzhou Dengjiabu</td> <td>158113</td> </tr> </tbody> </table>			Farm	Serial No.	Calibrated Date	Validity	Bama Yanyan swine farm	120237	11/01/2021	10/01/2026	Chongzuo Zuozhou swine Farm	180878	Tianyang Wucun swine Farm	146743	Quanzhou Dengjiabu	158113
Farm	Serial No.	Calibrated Date	Validity														
Bama Yanyan swine farm	120237	11/01/2021	10/01/2026														
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Quanzhou Dengjiabu	158113																

		swine Farm			
		Chongzuo Quming swine Farm	162262		
		Jingxi swine Farm	180947		
		Liucheng Mashan swine Farm	218446		
		Tengxian Tianping swine Farm	178005		
		Debao Chengguan swine Farm	207759		
		The above calibration information has been confirmed by checking the calibration reports/13/ which has been conducted by qualified parties/14/. 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. And based on the validity as above table, CTI confirmed that the installed monitoring equipment has been duly calibrated for this entire monitoring period.			
	How were the values in the monitoring report verified?	Monitoring parameter of $EG_{d,y}$ was derived from Daily report of electricity/30/. The electricity consumptions were measured by the electricity meter installed at outlet of biogas generator (total 9 Electricity meters). 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. 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/. 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. 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)	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.			

	22. Employee Training of biogas safety operation	
	Relevant SDG:	Mitigation Measure for Safeguarding Principles
	Data/Parameter	Employee Training of biogas safety operation
	Unit	/
	Description	Employees was trained on the safety operation of the biogas
	Value applied for this monitoring period	Trainings of safety operation of the biogas carried out on 09/12/2022
	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 09/12/2022 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	CL 01 and CL 02 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 2 nd monitoring period. PD has provided the values from this monitoring period and from 1 st monitoring period for each monitoring parameters in the MR and comparing all the values with sufficient justification of the changes.
Findings	CL 03 was raised and resolved. Refer to Appendix 4 in this report for detail assessment.
Conclusion	By comparing the values of all the monitoring parameters for this monitoring period with the values of all the monitoring parameters for the 2 nd monitoring period/5/, CTI verified that all the values are not changed significantly and thus verified as reasonable for this monitoring period. Only the number of market swine and breeding swine is slightly lower, which causes the decreasing of biogas and electricity generation, however, this status is confirmed as reasonable as the number of market swine and breeding swine is fluctuant based on the market reason.

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 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 422 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 9 subsidiary farms is adjusted to be integer value. As a result, total 444 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 444 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
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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 (259,710);
- 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 i^{th} district where $i=a, \dots, k$;
- N is the population total (259,710);
- n_i is the number of sampled units the i^{th} district where $i=a, \dots, k$;
- SD_i^2 is the variance of the i^{th} district where $i=a, \dots, k$.

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 444 is confirmed to be 1.9653 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 × 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
01/04/2022-30/04/2022	1.9653	50.88	1.13	2.2238	4.37%
01/05/2022-31/05/2022	1.9653	50.30	1.14	2.2364	4.45%
01/06/2022-30/05/2023	1.9653	50.64	1.13	2.2187	4.38%
01/07/2022-31/07/2022	1.9653	50.09	1.14	2.2487	4.49%
01/08/2022-31/08/2022	1.9653	51.37	1.12	2.2098	4.30%
01/09/2022-30/09/2022	1.9653	50.81	1.09	2.1460	4.22%
01/10/2022-31/10/2022	1.9653	51.04	1.12	2.2080	4.33%
01/11/2022-30/11/2022	1.9653	51.47	1.16	2.2759	4.42%
01/12/2022-31/12/2022	1.9653	49.93	1.13	2.2282	4.46%
01/01/2023-31/01/2023	1.9653	51.50	1.15	2.2654	4.40%
01/02/2023-28/02/2023	1.9653	51.01	1.15	2.2517	4.41%

	<table><tr><td>01/03/2023-31/03/2023</td><td>1.9653</td><td>50.63</td><td>1.14</td><td>2.2331</td><td>4.41%</td></tr></table> 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. As per the MR, for monitoring the W_{site}, according to “Standard: Sampling and surveys for CDM project activities and programmes of activities (Version 09.0)”, the desired confidence level is 95% and the desired precision is 10%. According to statistical principles and sampling survey method, 444 samples is sufficient to satisfy the desired confidence and precision. Hence PD has taken 444 samples for measuring the weight and record all the weight in the record the animal weight of the samples, due to the record only have the values of 444 samples, VVB did not have to do the sampling check of the records from 444 samples, VVB checked all the data of 444 samples and no acceptance sampling method need to be done for all the 444 samples in the records. The sampling method conducted by PD is verified as stated in the verification report: The method of calculation of sample size is checked by CTI by checking the calculation sheet of sample size, 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)” 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)” and is verified consistent with PDD. As per the above explanation, VVB could not weight the swine during site visit, due to the safety reason and considering the swine fever impacts, people outside the swine farms are not allowed to be inside the swine farms but can only do the AWMS plants inspection. Hence no such sample results conducted by VVB for the checking the weight of the swine during site visit. And furthermore, due to the swine which has been sampled by PD is during the monitoring period, and VVB can only do the verification after the monitoring period ended, so when the VVB does the on-site check, it is not possible for VVB to check the PP sampled swine as these swine has raised with more weight or be sold to the market with the time passed. So, actually, VVB can't do the acceptance sampling during the site visit time as the samples from PD will not have the same weight with the PD's measuring. Therefore, to cross-check the weight data of the PD's samples, VVB has checked the public information of the weight of market swine^{5,6} and breeding swine^{7,8} in different categories including Nursery phase, Growing phase and Mature phase, it is confirmed that the average weight data for different categories are reasonable and thus the sampling results by PD are acceptable.	01/03/2023-31/03/2023	1.9653	50.63	1.14	2.2331	4.41%
01/03/2023-31/03/2023	1.9653	50.63	1.14	2.2331	4.41%		
Findings	N/A						
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/.						

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	SDG 7 Baseline Impact: Via checking the MR and through interview with local residents, CTI confirmed that the biogas can be utilized in project activity.
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<https://www.ziyunlou.com/article/2pdr12.html#:~:text=%E7%8C%AA%E7%9A%84%E7%94%9F%E9%95%BF%E5%8F%91%E8%82%B2%E9%98%B6%E6%A%E8%B5,%E4%B8%8A%E5%B8%82%E5%BC%89%E5%9B%9B%E4%B8%AA%E9%98%B6%E6%AE%B5%E3%80%82>

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<https://www.jiangxiqicheng.com/96258.html>

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<https://zhuanlan.zhihu.com/p/369296668>

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<https://baike.baidu.com/item/%E7%A7%8D%E7%8C%AA/7148836>

	In the baseline situation, as per the interview with end users, CTI verified that 0 m³ of biogas can be utilized without the project activity. Therefore, Baseline Impact is zero. SDG 8 Baseline Impact: Via checking the MR and through interview with representative of staffs, CTI confirmed that the project created jobs 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. SDG 13 Baseline Impact: 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.
Findings	N/A
Conclusion	The verification team confirms that - 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	SDG 7 Project Impact: 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 From 01/04/2022 to 31/12/2022, 20,643.32 MWh biogas were utilized, From 01/01/2023 to 31/03/2023, 6,760.10 MWh biogas were utilized, Therefore, the SDG 7 Project Impact for this monitoring period from 01/04/2022 to 31/03/2023 is total 27,403.42 MWh biogas were utilized. SDG 8 Project Impact: For SDG Indicator 8, From 01/04/2022 to 31/12/2022, 18 full-time jobs created (including 9 females and 9 males) which is verified in section E.6.2. From 01/01/2023 to 31/03/2023, 18 full-time jobs created (including 9 females and 9 males) which is verified in section E.6.2. For this monitoring period from 01/04/2022 to 31/03/2023, 18 full-time jobs created (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
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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 CO₂/yr)
- $BE_{CH_4,y}$ = Baseline CH₄ emissions in year y (t CO₂/yr)
- $BE_{N_2O,y}$ = Baseline N₂O emissions in year y (t CO₂/yr)
- $BE_{elec/heat,y}$ = Baseline CO₂ emissions from electricity and/or heat used in the baseline (t CO₂/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 CH₄ emissions in year y (t CO₂/yr)
- GWP_{CH_4} = Global Warming Potential (GWP) of CH₄ (t CO₂e/t CH₄)
- D_{CH_4} = Density of CH₄ (t/m³). 0.00067t/m³ 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 (m³CH₄/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 Guangxi Zhuang Autonomous Region, 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 20.9°C in 2022 and value from 2022 was also used in 2023 due to not ended in whole 2023, the value of 76% 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:

- $BE_{N_2O,y}$ = Annual baseline N₂O emissions in (t CO₂e/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)

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

Where:

- $E_{N_2O,D,y}$ = 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). (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:

- $E_{N_2O,ID,y}$ = 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). (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)
 $F_{gasMS,j,LT}$ = 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 (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:

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

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)
 $NEX_{IPCC\ default}$ = 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 $NEX_{IPCC\ default}$

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

Where:

- $N_{rate(T)}$ = 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 CO₂ emission from electricity and/or heat used in the baseline

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

Where:

- $BE_{elec/heat,y}$ = Baseline CO₂ emissions from electricity and/or heat used in the baseline (t CO₂/yr)
 $BE_{EC,y}$ = Baseline emissions associated with electricity generation in year y (t CO₂/yr)
 $BE_{HG,y}$ = Baseline emissions associated with heat generation in year y (t CO₂/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 CO₂ 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	$BE_{CH4,y}$ (tCO ₂ e/yr)	$BE_{N2O,y}$ (tCO ₂ e/yr)	BE_y (tCO ₂ e/yr)
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01/04/2022-31/12/2022	183,340	2,496	185,836
01/01/2023-31/03/2023	59,992	815	60,807
01/04/2022-31/03/2023	243,332	3,311	246,643

Total Baseline Impact for SDG 13 (baseline emissions) of the 2nd monitoring period (01/04/2022-31/03/2023) is thus verified as 246,643 tCO₂e. Among this, baseline emissions were 185,836 tCO₂e from 01/04/2022 to 31/12/2022 and 60,807 tCO₂e from 01/01/2023 to 31/03/2023.

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:

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

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

$$PE_{AD,y} = PE_{EC,y} + PE_{FC,y} + PE_{CH_4,y} + PE_{flare,y} \quad (13)$$

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_r , it is confirmed that for this monitoring period, there was no residual gas stream flared by flaring, hence $PE_{flare,y}=0$.

d. $PE_{CH_4,y}$

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:

$PE_{CH_4,y}$ = Project emissions of methane from the anaerobic digester in year y (t CO₂e)

$Q_{CH_4,y}$ = Quantity of methane produced in the anaerobic digester in year y (t CH₄)

$EF_{CH_4,default}$ = Default emission factor for the fraction of CH₄ produced that leaks from the anaerobic digester (fraction)

GWP_{CH_4} = Global warming potential of CH₄ (t CO₂ / t CH₄)

$Q_{CH_4,y}$

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 (m^3 gas i/m^3 dry gas)
 $\rho_{i,t}$ = Density of greenhouse gas i in the gaseous stream in time interval t (kg gas i/m^3 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 ($Pa \cdot m^3/kmol \cdot K$)
 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 CH_4 (t CO_2e/tCH_4)
 $R_{VS,n}$ = 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 CH_4 (t/m^3)
 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 (m^3CH_4/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 CH_4 emissions from sludge disposed of in storage pit prior to disposal during the year y (t CO_2e/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 N_2O emissions in year y (t CO_2/yr)
 GWP_{N_2O} = Global Warming Potential (GWP) for N_2O (t CO_2e/tN_2O)
 $CF_{N_2O-N,N}$ = Conversion factor N_2O-N to N_2O (44/28)
 $E_{N_2O,D,y}$ = Direct N_2O emission in year y (kg $N_2O-N/year$)
 $E_{N_2O,ID,y}$ = Indirect N_2O emission in year y (kg $N_2O-N/year$)

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 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.
- $PE_{FC, y}$ = 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).

	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. 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 $PE_{EC,y}$. The same for the $PE_{EC,y}$, please refer to $PE_{EC,y}$ calculation in above. Therefore, $PE_{elec/heat}=0$. 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 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. The Project Impact for SDG 13 during this monitoring period is summarized as below, <table><tr><th>Date</th><th>$PE_{AD,y}$ (tCO₂e/yr)</th><th>$PE_{Aer,y}$ (tCO₂e/yr)</th><th>$PE_{N2O,y}$ (tCO₂e/yr)</th><th>PE_y (tCO₂e/yr)</th></tr><tr><td>01/04/2022-31/12/2022</td><td>8,870</td><td>63</td><td>9,069</td><td>18,002</td></tr><tr><td>01/01/2023-31/03/2023</td><td>3,003</td><td>20</td><td>2,964</td><td>5,987</td></tr><tr><td>01/04/2022-31/03/2023</td><td>11,873</td><td>83</td><td>12,033</td><td>23,989</td></tr></table> Total Project Impact for SDG 13 (project emissions) of the 2nd monitoring period (01/04/2022-31/03/2023) is thus verified as 23,989 tCO₂e. Among this, project emissions were 18,002 tCO₂e from 01/04/2022 to 31/12/2022 and 5,987 tCO₂e from 01/01/2023 to 31/03/2023.	Date	$PE_{AD,y}$ (tCO ₂ e/yr)	$PE_{Aer,y}$ (tCO ₂ e/yr)	$PE_{N2O,y}$ (tCO ₂ e/yr)	PE_y (tCO ₂ e/yr)	01/04/2022-31/12/2022	8,870	63	9,069	18,002	01/01/2023-31/03/2023	3,003	20	2,964	5,987	01/04/2022-31/03/2023	11,873	83	12,033	23,989
Date	$PE_{AD,y}$ (tCO ₂ e/yr)	$PE_{Aer,y}$ (tCO ₂ e/yr)	$PE_{N2O,y}$ (tCO ₂ e/yr)	PE_y (tCO ₂ e/yr)																	
01/04/2022-31/12/2022	8,870	63	9,069	18,002																	
01/01/2023-31/03/2023	3,003	20	2,964	5,987																	
01/04/2022-31/03/2023	11,873	83	12,033	23,989																	
Findings	N/A																				
Conclusion	The verification team confirms that 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 project SDG impact were followed; The calculation of project situation of each SDG impact is correct.																				

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 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. $LE_y = (LE_{PJ,N2O,y} - LE_{BL,N2O,y}) + (LE_{PJ,CH4,y} - LE_{BL,CH4,y}) + LE_{AD,y} \quad (24)$ Where: $LE_{PJ, N2O, y}$ = Leakage N₂O emissions released during project activity from land application of the treated manure in year y (t CO₂e/yr) $LE_{BL, N2O, y}$ = Leakage N₂O emissions released during baseline scenario from land application of the treated manure in year y (t CO₂e/yr)
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- $LE_{PJ, CH_4, y}$ = Leakage CH_4 emissions released during project activity from land application of the treated manure in year y (t CO_2e/yr)
 $LE_{BL, CH_4, y}$ = Leakage CH_4 emissions released during baseline scenario from land application of the treated manure in year y (t CO_2e/yr)
 $LE_{AD, y}$ = Leakage emissions associated with the anaerobic digester in year y (t CO_2e)

i) Estimation of leakage N_2O 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 N_2O (t CO_2e/tN_2O)
 $CF_{N_2O-N, N}$ = Conversion factor N_2O-N to N_2O (44/28)
 $LE_{N_2O, land, y}$ = Leakage N_2O emissions from application of manure waste in year y (kg $N_2O-N/year$)
 $LE_{N_2O, runoff, y}$ = Leakage N_2O emissions due to leaching and run-off in year y (kg $N_2O-N/year$)
 $LE_{N_2O, vol, y}$ = Leakage N_2O emissions due to volatilisation in year y (kg $N_2O-N/year$)
 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 N_2O emissions from N inputs (kg N_2O-N/kg N input)
 EF_5 = Emission factor for N_2O emissions from N leaching and runoff in (kg N_2O-N/kg N leached and runoff)
 EF_4 = Emission factor for N_2O emissions from atmospheric deposition of N on soils and water surfaces, [kg N- $N_2O/$ (kg NH_3-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 N_2O emissions released during project activity from land application of the treated manure in year y, LE_{PJ, N_2O}

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

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

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

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

Where:

GWP_{N_2O}	= Global Warming Potential (GWP) for N_2O (t CO_2e/tN_2O)
$CF_{N_2O-N,N}$	= Conversion factor N_2O-N to N_2O (44/28)
$LE_{N_2O,land,y}$	= Leakage N_2O emissions from application of manure waste in year y (kg $N_2O-N/year$)
$LE_{N_2O,runoff,y}$	= Leakage N_2O emissions due to leaching and run-off in year y (kg $N_2O-N/year$)
$LE_{N_2O,vol,y}$	= Leakage N_2O emissions due to volatilisation in year y (kg $N_2O-N/year$)
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 N_2O emissions from N inputs (kg $N_2O-N/kg N$ input)
EF_5	= Emission factor for N_2O emissions from N leaching and runoff in (kg $N_2O-N/kg N$ leached and runoff)
EF_4	= Emission factor for N_2O emissions from atmospheric deposition of N on soils and water surfaces, [kg $N-N_2O/(kg NH_3-N + NO_x-N volatilized)$]
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 CH_4 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:

$LE_{BL,CH_4,y}$	= Leakage CH_4 emissions released during baseline scenario from land application of the treated manure in year y (t CO_2e/yr)
$LE_{PJ,CH_4,y}$	= Leakage CH_4 emissions released during project activity from land application of the treated manure in year y (t CO_2e/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 CO₂e)

$LE_{storage,y}$ = Leakage emissions associated with storage of digestate in year y (t CO₂e)

$LE_{comp,y}$ = Leakage emissions associated with composting digestate in year y (t CO₂e)

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,CH_4}	LE_{B,CH_4}	LE_{B,N_2O}	LE_{P,N_2O}	LE_y
	(tCO ₂ e)	(tCO ₂ e)	(tCO ₂ e)	(tCO ₂ e)	(tCO ₂ e)
01/04/2022-31/12/2022	41,072	38,488	1,773	6,356	7,167
01/01/2023-31/03/2023	13,440	12,595	580	2,077	2,342
01/04/2022-31/03/2023	54,512	51,083	2,353	8,433	9,509

Total leakage emissions of the 2nd monitoring period (01/04/2022-31/03/2023) is thus verified as 9,509 tCO₂e. Among this, leakage emissions were 7,167 tCO₂e from 01/04/2022 to 31/12/2022 and 2,342 tCO₂e from 01/01/2023 to 31/03/2023.

Findings	N/A
Conclusion	The verification team confirms that 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 leakage were followed; The calculation of project leakage emissions is correct.

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

Means of verification	Calculation of net benefits as difference of baseline and project values or direct calculation for each SDG impact is as following,													
	SDG 7 impact net benefit													
	Net Benefit SDG 7 for 01/04/2022 to 31/12/2022 = Project Impact of SDG7 (20,643.32 MWh electricity produced) – Baseline Impact of SDG7 (0) =20,643.32 MWh electricity produced													
	Net Benefit SDG 7 for 01/01/2023 to 31/03/2023 = Project Impact of SDG7 (6,760.10 MWh electricity produced) – Baseline Impact of SDG7 (0) = 6,760.10 MWh electricity produced													
	Net Benefit SDG 7 for 01/04/2022 to 31/03/2023 = Project Impact of SDG7 (27,403.42 MWh electricity produced) – Baseline Impact of SDG7 (0) = 27,403.42 MWh electricity produced													
	SDG 8 impact net benefit													
	From 01/04/2022 to 31/12/2022, Net Benefit SDG 8 (Total number of jobs) = 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)													
	From 01/01/2023 to 31/03/2023, Net Benefit SDG 8 (Total number of jobs) = 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)													
	From 01/04/2022 to 31/03/2023, Net Benefit SDG 8 (Total number of jobs) = 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)													
	SDG 13 impact net benefit													
In accordance with applied methodology, registered PDD and validation report, Net Benefit SDG 13 (Amount of GHGs emission avoided or sequestered) = baseline emission – project emission – leakage emission = 246,643 tCO ₂ e -23,989 tCO ₂ e -9,509 tCO ₂ e = 213,145 tCO ₂ e														
Furthermore, as per the applied methodology and PDD, if the actual methane captured from anaerobic digesters in project activity is lower than (BE _{CH₄,y} - PE _{AD,y}), then (BE _{CH₄,y} - PE _{AD,y}) is replaced by actual methane captured Q _{CH₄,y} .														
Biogas captured during monitoring period is 21,675,159.11 m ³ , which is verified as equals to 235,047.07 tCO ₂ e 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 _{CH₄,y}) is 243,332 tCO ₂ e. Project emissions associated with anaerobic digester is (PE _{AD,y}) is 11,873 tCO ₂ e. So (BE _{CH₄,y} - PE _{AD,y})=231,459 tCO ₂ e. Actual methane captured from anaerobic digesters is higher than the difference of BE _{CH₄,y} and PE _{AD,y} . Therefore, the equation (BE _{CH₄,y} - PE _{AD,y}) can be used to calculate emission reduction.														
Emission Reductions Calculation														
<table><tr><th>Parameters</th><th>Baseline Emissions <i>BE_y</i></th><th>Project Emissions <i>PE_y</i></th><th>Leakage Emissions <i>LE_y</i></th><th>Emission Reductions <i>ER_y</i></th></tr><tr><th>Period</th><th>(tCO₂e)</th><th>(tCO₂e)</th><th>(tCO₂e)</th><th>(tCO₂e)</th></tr></table>					Parameters	Baseline Emissions <i>BE_y</i>	Project Emissions <i>PE_y</i>	Leakage Emissions <i>LE_y</i>	Emission Reductions <i>ER_y</i>	Period	(tCO ₂ e)	(tCO ₂ e)	(tCO ₂ e)	(tCO ₂ e)
Parameters	Baseline Emissions <i>BE_y</i>	Project Emissions <i>PE_y</i>	Leakage Emissions <i>LE_y</i>	Emission Reductions <i>ER_y</i>										
Period	(tCO ₂ e)	(tCO ₂ e)	(tCO ₂ e)	(tCO ₂ e)										

	01/04/2022-31/12/2022	185,836	18,002	7,167	160,667
	01/01/2023-31/03/2023	60,807	5,987	2,342	52,478
	01/04/2022-31/03/2023	246,643	23,989	9,509	213,145
	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.				
Findings	N/A				
Conclusion	The verification team confirms that 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; The calculation of net benefits for each SDG impact is correct.				

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

Means of verification	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		
	Item	Values estimated in ex ante calculation of approved PDD	Actual values achieved during this monitoring period
	SDG 7	33,100.6 MWh electricity produced	27,403.42 MWh electricity produced
	SDG 8	18 full-time jobs created (9 females and 9 males)	18 full-time jobs created (9 females and 9 males)
	SDG 13	267,474 tCO ₂ e	213,145 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	For SDG 7, the actual outcome was 27,403.42 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 PER/7/, while the actual value is monitored by flowmeters. It is acceptable that the actual value is slightly lower than estimated in PDD. For SDG 8, total number of jobs created is 18 full-time (including 9 females and 9 males) by the project during the 2nd monitoring period is same to the PDD. For SDG 13, CTI confirmed that the actual value during this monitoring period was found to be 20% 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 parameters including the number of animals in the swine farm (N_{LT}), the average animal weight (W_{site}) 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 slightly 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	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. 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. 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. All the Information on any assessment questions answered as "No", so there is no need to re-assessment the Safeguarding principles.
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	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. And via checking the different approach, CTI verified that there were no inputs/grievances received during this monitoring period.
Findings	N/A
Conclusion	All the methods of continuous input /grievance mechanism are confirmed during on-site investigation and interviews. CTI verified that there were no comments/complaints received from the stakeholders during this monitoring period of the project activity.

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 2nd periodic verification of GS programme of activities “Shuangbaotai Animal Manure Management System GHG Mitigation Project in Guangxi Province” in Guangxi Zhuang Autonomous Region, 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

CTI Certification Co., Ltd (CTI) has performed the 2nd periodic verification of the SDG outcomes that have been reported for the GS project activity “Shuangbaotai Animal Manure Management System GHG Mitigation Project in Guangxi Province” in Guangxi Zhuang Autonomous Region, P. R. China for the monitoring period from 01/04/2022 to 31/03/2023.

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 “Shuangbaotai Animal Manure Management System GHG Mitigation Project in Guangxi Province” in Guangxi Zhuang Autonomous Region, P. R. China during the monitoring period from 01/04/2022 to 31/03/2023 as follows:

Monitoring period Number: 2nd

Monitoring period: 01/04/2022 to 31/03/2023

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
	01/04/2022 to 31/12/2022	01/01/2023 to 31/03/2023	01/04/2022 to 31/03/2023
SDG 7	20,643.32 MWh electricity produced	6,760.10 MWh electricity produced	27,403.42 MWh electricity produced
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	160,667 tCO ₂ e of GHGs emission avoided or sequestered	52,478 tCO ₂ e of GHGs emission avoided or sequestered	213,145 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 ₂ e	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. Lei ZHANG

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

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

Scope	Technical Area
SS 1: Energy industries (renewable/non-renewable sources)	TA 1.1: Thermal energy generation
	TA 1.2: Energy generation from renewable energy sources
SS 3: Energy demand	TA 3.1: Energy demand
SS 4: Manufacturing industries	TA 4.1: Cement and lime production
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, 25/10/2022

Mr. Wu LIN

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

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

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

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

Approved by:

Lu ZHOU

General Manager

Shenzhen, 01/01/2021



Appendix 3. Documents reviewed or referenced

No	Author	Title	References to the document	Provider
1.	PP	2 nd periodic Monitoring Report of “Shuangbaotai Animal Manure Management System GHG Mitigation Project in Guangxi Province”	- Version No. 01, dated 17/04/2023 - Version No. 02, dated 30/05/2023 - Version No. 03, dated 05/08/2023	PP
2.	PP	2 nd periodic Emission Reduction Calculation spreadsheet of “Shuangbaotai Animal Manure Management System GHG Mitigation Project in Guangxi Province”	- Version No. 01, dated 17/04/2023 - Version No. 02, dated 05/08/2023	PP
3.	PP	GS4GG Project Design document of “Shuangbaotai Animal Manure Management System GHG Mitigation Project in Guangxi Province”	- Version No. 05, dated 12/10/2022	PP
4.	CTI	Validation report of “Shuangbaotai Animal Manure Management System GHG Mitigation Project in Guangxi Province”	- Version No. 3.0, dated 26/05/2023	N/A
5.	VVB	1 st Periodical verification report of “Shuangbaotai Animal Manure Management System GHG Mitigation Project in Guangxi Province”	- Version No. 02, dated 14/10/2022	PP
6.	Local Market Supervision and Administration Bureau	Business License of PP	Business License of Shuangbaotai Animal Husbandry Group Co., Ltd. and Profit Carbon Environmental Energy Technology (Shanghai) Co., Ltd.	PP
7.	Hangzhou Energy and Environmental Engineering Co., Ltd.	Project Evaluation Report	Issued on 05/05/2020	PP
8.	Department of Ecology and Environment of Guangxi Zhuang Autonomous Region	EIA approval	Issued on 07/07/2020	PP
9.	PP and manufacturers	Equipment purchase contracts	Equipment purchase contracts of all the involved main equipment, a. biogas generator, signed on 05/09/2020 b. flare system, signed on 10/10/2020 c. anaerobic tanks signed on 13/09/2020 d. turnover machines signed on 15/10/2020	PP
10.	PP and Jiangxi	General contract of engineering construction	General contract of engineering construction of the project signed	PP

	Kesheng Environmental Protection Co., Ltd.		on 08/09/2020	
11.	Manufacturers	Technical agreement	Technical agreement of main equipment	PP
12.	PP	Operation log of the project	Operation log of the project	PP
13.	Guangxi Zhuang Autonomous Region Institute of Metrology&Testing	Calibration Reports	Calibration Reports to all the electricity meters with validity covering this monitoring period	PP
			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	
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 Nanjing Changyuan Industrial Gas Co. Ltd issued on 06/09/2017	PP
	General Administration of Quality Supervision, Inspection and Quarantine		Certificate of Metrological Authorization of Guangxi Zhuang Autonomous Region Institute of Metrology&Testing issued on 06/11/2017 valid to 05/11/2022 and issued on 19/08/2022 valid to 18/08/2027	PP
15.	PP	Production record of Commercial Pig	Production record of Commercial Pig 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	PP

			01/12/2022 for biogas safety operation	
26.	PP	Meeting attendance record	Meeting attendance records dated on 09/12/2022	PP
27.	PP	Declaration of no double counting and not involved in other GHG scheme	Issued on 30/05/2021	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 8 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	Version 1.2	GS Website

		Activity Requirements		
46.	GS	Gold Standard for the Global Goals Stakeholder Consultation and Engagement Requirements	Version 1.2	GS Website
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.	Local meteorological bureau	Temperature Monitoring Report	Temperature Monitoring Report issued by local meteorological bureau	PD
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/ydqhb/hsqtkz/202012/t20201229_815386.shtml	Public Website
61.	Meteorological Bureau of Guangxi Zhuang Autonomous Region	Climate information of Guangxi Zhuang Autonomous Region	http://gx.cma.gov.cn/qxwh/mwmt/202003/t20200305_1461610_11374.html	Public Website
62.	Public Info	Days for pigs to be slaughtered	Number of days for pigs to be slaughtered by existing large-scale breeding groups in China https://zhuanlan.zhihu.com/p/38676811 http://finance.people.com.cn/n1/2017/1121/c1004-29658996.html	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.	D.2	Date: 24/05/2023
Description of CL				
In the section D.2 of MR, for monitoring parameter EC _{PJ,j,y} , it is observed that not all the AWMSs consumed electricity from grid, the related information should be clarified clearly.				
Project participant response				Date: 30/05/2023
During this monitoring period, the biogas generator in Bama Yanyan swine Farm operates continuously, so it did not need to consume electricity from the grid. The rest 8 farms need to consume electricity from the power grid when not in operation. The relevant description has been added to section D.2. Please refer to the revised MR (Version 02) for more information.				
Documentation provided by project participant				
/1/ version 02 /29/ /30/				
VVB assessment				Date: 30/05/2023
The revised MR is checked, CTI confirmed that the clarification has been added. Based on checking the Daily report of electricity/30/, it is confirmed 8 AWMSs imported the electricity from the grid company except AWMS in Bama Yanyan swine farm which is verified as actual by checking the electricity notes issued by grid company/29/. CL 01 is closed.				

CL ID	02	Section no.	D.2	Date: 24/05/2023
Description of CL				
In the section D.2 of MR, for monitoring parameter Total number of jobs, if the salary payment is fair is not clarified.				
Project participant response				Date: 30/05/2023
According to the recording keeping book, both men and women have the same salary, which can be cross checked through labor contracts. The relevant description has been added to section D.2. Please refer to the revised MR (Version 02) for more information				
Documentation provided by project participant				
/1/ version 02 /23/				
VVB assessment				Date: 30/05/2023
The revised MR is checked, to check if the payment is fair, CTI has verified the labor contracts/23/ and verified that the both men and women have the same salary. CL 02 is closed.				

CL ID	03	Section no.	D.3	Date: 24/05/2023
Description of CL				
In the section D.3 of MR, the comparison results of monitored parameters with last monitoring period is not clarified.				

Project participant response	Date: 30/05/2023
Comparing to the previous monitoring period, the number of market swine and breeding swine is slightly lower, which causes the decreasing of biogas and electricity generation. The values of other parameters were the same or remained basically stable compared to the first monitoring period. The relevant description has been added to section D.3. Please refer to the revised MR (Version 02) for more information	
Documentation provided by project participant	
/1/ version 02	
VVB assessment	Date: 30/05/2023
The revised MR is checked, CTI confirmed that the comparison results of monitored parameters with last monitoring period has been clarified. Only the number of market swine and breeding swine is slightly lower, which causes the decreasing of biogas and electricity generation, however, this status is confirmed as reasonable as the number of market swine and breeding swine is fluctuant based on the market reason. CL 03 is closed.	

Table 3. CAR from this verification

CAR ID	01	Section no.	Table 2	Date: 24/05/2023
Description of CAR				
In section Table 2 of MR, the Total electricity produced value for period from 01/01/2023 to 31/03/2023 is not correct.				
Project participant response				Date: 30/05/2023
It has been revised accordingly, Please refer to the revised MR (Version 02) for more information.				
Documentation provided by project participant				
/1/ version 02 /2/ /30/				
VVB assessment				Date: 30/05/2023
The revised MR is checked, CTI confirmed that the data has been updated to be correct and in line with the Monthly report of electricity/30/ and consistent with ER sheet. CAR 01 is closed.				

CAR ID	02	Section no.	C	Date: 24/05/2023
Description of CAR				
In the section C, for the monitoring equipment, the calibration date and validity did not covering this monitoring period, revision is requested.				
Project participant response				Date: 30/05/2023
It has been revised accordingly, Please refer to the revised MR (Version 02) for more information.				
Documentation provided by project participant				
/1/ version 02				
VVB assessment				Date: 30/05/2023
The revised MR is checked, CTI confirmed that the calibration conducted in last MP with date and validity has been supplemented which verified covering this monitoring period. CAR 02 is closed.				

CAR ID	03	Section no.	E.2	Date: 24/05/2023
Description of CAR				
For determination of the Annual methane conversion factor (MCF _i), PD did not provide the value related to this monitoring period in section E.2. Revision is requested.				
Project participant response				Date: 30/05/2023

The MCF_j values given in table 10.17, chapter 10, volume 4, 2019 Refinement to the 2006 IPCC Guidelines should be used. MCF_j values depend on the climate zone where the uncover anaerobic lagoon in the baseline. According to the registered PDD, the annual average temperature at the project site is 17.5~23.5°C, which is higher than 10°C, and the annual average evapotranspiration is obviously less than the annual average precipitation⁹. So a ratio of potential evapotranspiration to precipitation < 1. Therefore, as per Annex 10A.2, 2019 Refinement to the 2006 IPCC Guidelines, the climate zone of the project site can be determined to "Warm temperature Dry", and the MCF value of 76% is applied.

Then multiplying MCF values with a value of 0.94, so 71.44% of MCF_j is used for calculation during in this monitoring period. It has been revised accordingly, Please refer to the revised MR (Version 02) for more information.

Documentation provided by project participant	
/1/ version 02	
VVB assessment	Date: 30/05/2023
The revised MR is checked, CTI confirmed that the actual value for this monitoring period has been added. A conservativeness factor has been applied by multiplying MCF _j value (i.e., 76%) 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 /59/ and consistent with the PDD.	
For this monitoring period, the annual average temperature at the project site is 17.5~23.5°C/61/, which is higher than 10°C, and the annual average evapotranspiration is obviously less than the annual average precipitation by checking the public climate information of Guangxi Province/61/. So a ratio of potential evapotranspiration to precipitation is < 1, and the climate zone of the project site can be determined to "Warm temperature Dry" as per the 2019 Refinement to the 2006 IPCC Guidelines/59/, then the MCF value of 76% applied is verified as reasonable. CAR 03 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

⁹ http://gx.cma.gov.cn/qxwh/mwmt/202003/t20200305_1461610_11374.html