



**Verified Carbon
Standard**

GANSU GANZHOU BIOGAS RECOVERY AND UTILIZATION PROJECT



Document Prepared by Climate Bridge (Shanghai) Ltd.

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1 PROJECT DETAILS

1.1 Summary Description of the Project

Gansu Ganzhou Biogas Recovery and Utilization Project (hereinafter referred to as the Project) locates in Mingyong Town, Ganzhou District, Zhangye City, Gansu Province, P.R China. The project is owned and implemented by Gansu Founder Energy Conservation Sci&Tech Service Co., Ltd.

The project builds a centralized anaerobic animal manure treatment system which collects manure waste (dairy cow and market swine) from surrounding existing livestock farms in Ganzhou district. The project uses animal manure waste as ferment material to produce biogas in the Completely Stirred Tank Reactor (CSTR) type anaerobic digesters. The recovered biogas is used for electricity generation at the project site, or flared in case biogas generators are not available or under maintenance. The electricity generated by the project is for internal use first, the excess electricity will be delivered to Northwest China Power Grid (NWCPG). The residual waste from the CSTR digesters is used to produce organic fertilizer at the project site.

The project is designed to be implemented in two phases. Phase I is the construction of the centralized anaerobic animal manure treatment system. Three CSTR digesters with effective volume of 5,000m³ each and one dry anaerobic digester with effective volume of 5,000m³ will be installed at the project site. Phase II is the installation of the biogas power plant, whose installed capacity is 2MW.

Prior to the implementation of the project, the animal manure waste was left to decay in anaerobic manure management system (lagoon) at the livestock farms and methane is emitted to the atmosphere directly without any methane recovery and destruction facility. Equivalent amount of electricity was supplied from the NWCPG connected fossil fuel fired power plants.

The project is expected to avoid GHG emission of methane through recovery and destruction of biogas. In addition, the electricity generated from the biogas will be delivered to NWCPG to replace equivalent electricity generated by the fossil fuel fired power plants connected to the grid. The project is expected to achieve an annual emission reduction of 33,220 tCO_{2e} and a total emission reduction of 232,540 tCO_{2e} during the first 7-year crediting period. This monitoring period covers the period from 01-Aug-2021 to 31-Dec-2022, the actual emission reductions achieved during this monitoring period are 10,156 tCO_{2e}.

<u>Audit Type</u>	<u>Period</u>	<u>Program</u>	<u>VVB Name</u>	<u>Number of years</u>
Joint Validation and 1 st Verification	01-Aug-2021 to 31-Dec-2022	VCS	CTI Certification CO., LTD.	1.4 years
<u>Total</u>	01-Aug-2021 to 31-Dec-2022	-	-	1.4 years

1.2 Sectoral Scope and Project Type

Sectoral Scope 1: Energy industries (renewable - / non-renewable sources)

Sectoral Scope 13: Waste handling and disposal.

The project is not a grouped project.

1.3 Project Eligibility

The scope of the VCS Program includes:

1) The seven Kyoto Protocol greenhouse gases: The project avoids two greenhouse gases: 1) Methane (CH₄) emissions from the anaerobic animal manure management system in the baseline scenario, which is captured and destroyed in the project scenario; 2) CO₂ emissions from the production of the equivalent amount of electricity replaced by the Project that would otherwise be generated by the fossil fuel fired power plants of NWCPG. Thus, the project applicable to this scope.

2) Ozone-depleting substances: Not Applicable.

3) Project activities supported by a methodology approved under the VCS Program through the methodology approval process: Not Applicable.

4) Project activities supported by a methodology approved under a VCS approved GHG program, unless explicitly excluded under the terms of Verra approval: The applied methodology AMS-III.D (Version 21.0) and AMS-I.D (Version 18.0) of the project are methodologies approved under CDM Program, which is a VCS approved GHG program.

5) Jurisdictional REDD+ programs and nested REDD+ projects as set out in the VCS Program document Jurisdictional and Nested REDD+ (JNR) Requirements: Not Applicable.

The project is primarily designed to dispose the animal manure waste and utilize the biogas for energy usage; therefore the project does not belong to the projects that can reasonably be assumed to have generated GHG emissions primarily for the purpose of their subsequent reduction, removal, or destruction.

Furthermore, the project does not belong to the project activities excluded in Table 1 of VCS Standard 4.4.

Thus, the project is eligible under the scope of VCS program.

Also, the project meets all the high-level requirements as set out in section 3.1 of VCS standard v4.4, detailed below:

Section No.	Requirements	The project
3.1.1	Projects shall meet all applicable rules and requirements set out under the VCS Program, including this document. Projects	The project meets all applicable rules and requirements set out under the VCS Program,

	shall be guided by the principles set out in Section 2.2.1.	including VCS standard v4.4. The project is guided by the principles set out in Section 2.2.1 of VCS standard v4.4
3.1.2	Projects shall apply methodologies eligible under the VCS Program. Methodologies shall be applied in full, including the full application of any tools or modules referred to by a methodology, noting the exception set out in Section 3.14.1. The list of methodologies and their validity periods is available on the Verra website.	The project applies the CDM methodologies AMS-III.D (Version 21.0) and AMS-I.D (Version 18.0) in full, including all tools referred by the methodologies.
3.1.3	Projects shall apply the latest version of the applicable methodology in all cases unless a grace period applies to the project as set out in 3.21 below. Projects must update to the latest version of the methodology when reassessing the baseline and renewing a crediting period	The methodologies applied by the project are the latest version available.
3.1.4	Projects and the implementation of project activities shall not lead to the violation of any applicable law, regardless of whether or not the law is enforced	The project meets all applicable laws and regulations, which has been demonstrated in section 1.14 of this JPM (joint project description and monitoring report).
3.1.5	Where projects apply methodologies that permit the project proponent its own choice of model (see the VCS Program document VCS Program Definitions for the definition of model), the model shall meet the requirements set out in the VCS Program document VCS Methodology Requirements, and it shall be demonstrated at validation that the model is appropriate to the project circumstances (i.e., use of the model will lead to an appropriate quantification of GHG emission reductions or removals).	Not applicable. The project does not apply any model chosen by the project proponent.
3.1.6	Where projects apply methodologies that permit the project proponent to choose a	Not applicable. The project does not apply any third-party

	third-party default factor or standard to ascertain GHG emission data and any supporting data for establishing baseline scenarios and demonstrating additionality, such default factor or standard shall meet the requirements set out in the VCS Program document VCS Methodology Requirements.	default factor or standard to ascertain GHG emission data and any supporting data for establishing baseline scenarios and demonstrating additionality chosen by the project proponent.
3.1.7	Where the rules and requirements under an approved GHG program conflict with the rules and requirements of the VCS Program, the rules and requirements of the VCS Program shall take precedence	The project is developed under VCS program by using CDM methodologies. No conflict between CDM methodologies and VCS rules is identified.
3.1.8	Where projects apply methodologies from approved GHG programs, they shall conform with any specified capacity limits (see the VCS Program document VCS Program Definitions for the definition of capacity limit) and any other relevant requirements set out with respect to the application of the methodology and/or tools referenced by the methodology under those programs.	The project is a small scale project using small scale CDM methodologies. The annual emission reductions of the project meet the limits set out in the methodologies.
3.1.9	Where Verra issues new VCS Program rules, the effective dates of these requirements are set out in Appendix 3 Document History and Effective Dates or equivalent for other program documents, and are listed in a companion Summary of Effective Dates document which corresponds with each update.	New VCS program rules will be applied in the project according to the effective dates set out in appendix 3 document history of the new VCS standard and other VCS program rules.

1.4 Project Design

- The project includes a single location or installation only.
- The project includes multiple locations or project activity instances, but is not being developed as a grouped project.
- The project is a grouped project.

Eligibility Criteria

Not applicable, the project is not a grouped project.

1.5 Project Proponent

Organization name	Gansu Founder Energy Conservation Sci&Tech Service Co., Ltd.
Contact person	Du Tianji
Title	Manager
Address	Mingyong Town, Ganzhou District, Zhangye City, Gansu Province, P.R China
Telephone	+86-021 23019950
Email	3542346576@qq.com

1.6 Other Entities Involved in the Project

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

1.7 Ownership

The project owner of the project is Gansu Founder Energy Conservation Sci&Tech Service Co., Ltd. The project approval, approval of Environmental Impact Assessment (EIA) and the business license of the project owner are evidence for legislative right. Besides, the equipment purchasing contract, the construction contract and Grid-connection Agreement signed with the grid company are the evidence for the ownership of the plant and equipment.

1.8 Project Start Date

01-Aug-2021 (Operation start date).

As per VCS standard v4.4, the project start date of a non-AFOLU project is the date on which the project began generating GHG emission reductions or removals. The project started operation on 01-Aug-2021, thus the project start date is 01-Aug-2021.

1.9 Project Crediting Period

This project adopts a 7-year renewable crediting period, the first crediting period is from 01-Aug-2021 to 31-July-2028 (both days included).

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

Project Scale	
Project	✓
Large project	

Year	Estimated GHG emission reductions or removals (tCO _{2e})
01-Aug-2021 to 31-Dec-2021	13,925
01-Jan-2022 to 31-Dec-2022	33,220
01-Jan-2023 to 31-Dec-2023	33,220
01-Jan-2024 to 31-Dec-2024	33,220
01-Jan-2025 to 31-Dec-2025	33,220
01-Jan-2026 to 31-Dec-2026	33,220
01-Jan-2027 to 31-Dec-2027	33,220
01-Jan-2028 to 31-July-2028	19,295
Total estimated ERs	232,540
Total number of crediting years	7
Average annual ERs	33,220

1.11 Description of the Project Activity

The project involves construction of a centralized animal manure management system which collects manure waste (dairy cow and market swine) from surrounding livestock farms in Ganzhou district. The project uses animal manure waste as ferment material to produce biogas in the Completely Stirred Tank Reactor (CSTR) type anaerobic digesters. The anaerobic digesters are expected to produce 20,000 Nm³ biogas per day. The recovered biogas is used for electricity generation at the biogas power plant, or flared in case biogas generators are not available or under maintenance. Waste heat recovery boiler is installed at the biogas power plant to recover and supply heat to the auxiliary equipment of the project. The emission reductions from waste heat recovery will not be accounted for conservativeness. The installed capacity of the biogas power plant will be 2MW. The biogas power plant of the project is expected to supply 9,310 MWh of electricity to the Northwest China Power Grid annually. The project activity is expected to have a 20-year operational lifetime.

The project is expected to avoid GHG emission of methane through recovery and destruction of biogas. In addition, the electricity generated from the biogas will be delivered to NWCPG to replace equivalent electricity generated by the fossil fuel fired power plants connected to the grid.

The key system involved in the project are as follows:

Anaerobic animal manure management system:

The Completely Stirred Tank Reactor (CSTR) type anaerobic digesters are to be applied in the project activity. The CSTR digester is designed by the project proponent and Beijing University of Chemical Technology. Three CSTR digesters with effective volume of 5,000m³ each and one dry anaerobic digester with effective volume of 5,000m³ will be installed. The project is expected to produce 20,000 Nm³ biogas per day.

Biogas pre-treatment system

Before electricity generation, combustion or flaring, the biogas is pre-treated to remove impurities and moisture etc., to prevent the corrosion of the project facility. In addition, biogas should be continuously in a stable condition before it flows into gas engine or flare. The pre-treatment consists of pre-filtration, dehumidification, dewatering, cooling and fine filtration.

Organic fertilizer production plant

The digestate from the anaerobic digesters, both solid and liquid digestate, will be used as material to produce organic fertilizer at the onsite organic fertilizer production plant. Hence proper conditions and procedures (not resulting in methane emissions) for digestate is ensured.

Biogas power generation system

The biogas electricity generation plant will be installed at the project site. The total installed capacity will be 2MW. The biogas power plant of the project is expected to supply 9,310 MWh of electricity to the Northwest China Power Grid annually. Waste heat recovery boiler will also be

installed at the biogas power plant to recover and supply waste heat to the auxiliary equipment of the project.

Biogas flare system

The project adopts enclosed flare system to flare the biogas in case biogas generators are not available or under maintenance, and also for emergencies. The enclosed flare system is customized for the project, with a maximum residue gas flow rate of 1,000 m³/h. The diameter of the combustion enclosure is 600mm, while the height of the flame enclosure is 8000mm, therefore the enclosed flare system does not belong to the low height flare system.

Livestock farms involved in this project activity is shown as follows:

No.	Livestock farms	Location	Distance to project site (km)
1.	Gansu Qilianmuge Dairy Farm	No. 19 km, Zhangsu Rd. Ganzhou District	16
2.	Ganzhou Muyuan Dairy Farm	Xiliu Village, Shajing Town, Ganzhou District	25
3.	Ganzhou Wanlin Swine Farm	Siergou Village, Shajing Town, Ganzhou District	14
4.	Zhangye Shengfeng Swine Farm	Xiaya Village, Mingyong Twon, Ganzhou District	1
5.	Ganzhou Xingliang Dairy Farm	Chenguang Village, Ganjun Town, Ganzhou District	25
6.	Ganzhou Yongxing Dairy Farm	Guangming Village, Ganjun Town, Ganzhou District	17
7.	Ganzhou Zixing Swine Farm	Pujiazhuang Village, Jiantan Town, Ganzhou District	32
8.	Ganzhou Wujinquan Swine Farm	Suijiasi Village, Xindun Town, Ganzhou District	14
9.	Wanglong Dairy Swine Farm	Pingyuan Village, Wujiang Town, Ganzhou District	15

1.12 Project Location

The Project locates in Mingyong Town, Ganzhou District, Zhangye City, Gansu Province, P.R China. The geographical coordinates for the project site are east longitude 100°21'43" and north latitude 39°0'12". And the geographical coordinates for the livestock farms are as follows:

No.	Livestock farms	Geographical coordinates
10.	Gansu Qilianmuge Dairy Farm	E 100° 15'21.09", N 38° 57'19.47"
11.	Ganzhou Muyuan Dairy Farm	E 100° 11'7.53", N 39° 6'42.83"
12.	Ganzhou Wanlin Swine Farm	E 100° 14'45.60", N 39° 2'53.87"
13.	Zhangye Shengfeng Swine Farm	E 100° 21'19.73", N 39° 0'2.53"
14.	Ganzhou Xingliang Dairy Farm	E 100° 12'13.65", N 38° 54'29.55"
15.	Ganzhou Yongxing Dairy Farm	E 100° 13'57.03", N 38° 58'54.64"
16.	Ganzhou Zixing Swine Farm	E 100° 35'0.57", N 38° 51'16.19"
17.	Ganzhou Wujinquan Swine Farm	E 100° 24'52.51", N 38° 54'46.21"
18.	Wanglong Dairy Swine Farm	E 100° 23'0.89", N 39° 4'14.85"

The geographic location of the project is shown in Figure 1-1.



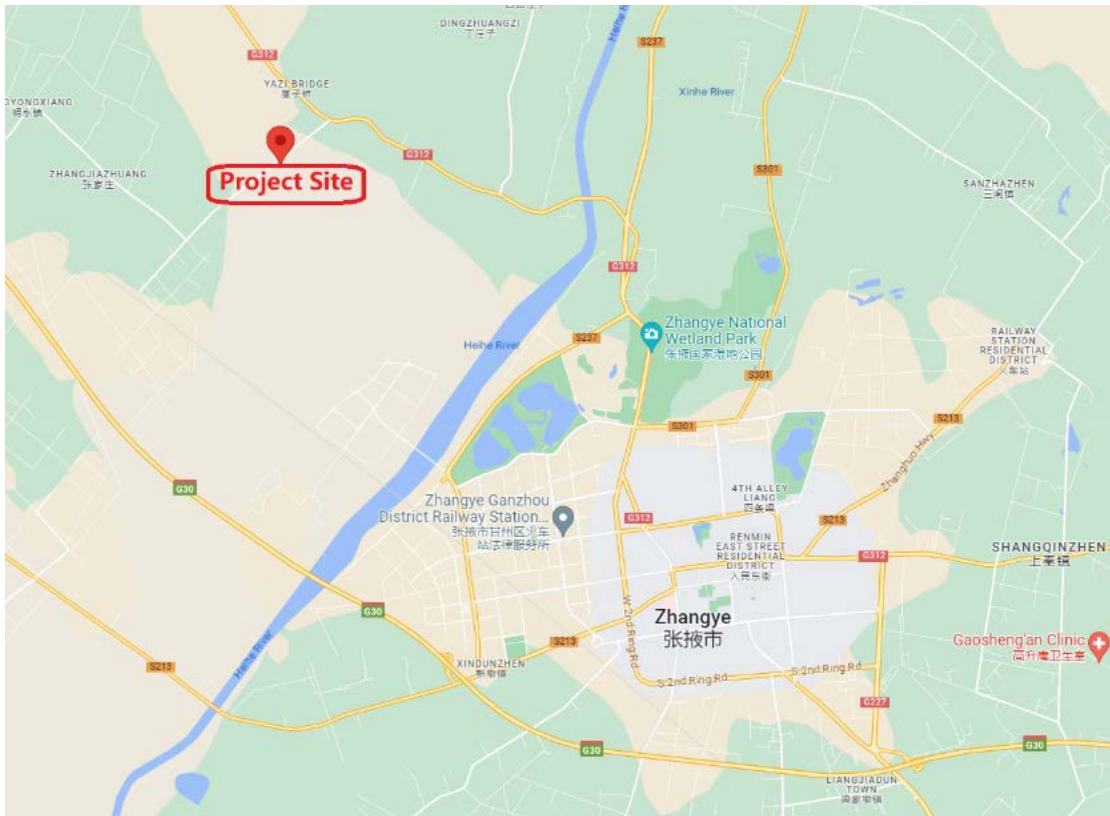


Figure 1-1 Location of the project

1.13 Conditions Prior to Project Initiation

The conditions existing prior to project initiation:

- 1) The animal manure waste was left to decay in anaerobic manure management system (lagoon) at the livestock farms and methane is emitted to the atmosphere directly without any methane recovery and destruction facility.
- 2) Equivalent amount of electricity was supplied from the NWCPG connected fossil fuel fired power plants.

The conditions existing prior to project initiation is also the baseline scenario of the project.

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

The project complies with all Chinese relevant laws and regulations. Mainly include:

1. Environmental Protection Law of People’s Republic of China;
2. Law of the People's Republic of China on the Prevention and Control of Solid Waste Pollution;

3. Regulations on prevention and control of pollution from large scale livestock and poultry breeding
4. Renewable Energy Law of the People's Republic of China;
5. Catalogue for the Guidance of Industrial Structure Adjustment (2013 revision);

The project has obtained the project approval and EIA approval from local government authorities: Development and Reform Commission of Ganzhou district and Ecology and Environment Bureau of Zhangye City. The two approvals well demonstrate that local government permits the construction of the project. Consequently, the project is compliance with laws, status and other regulatory frameworks.

1.15 Participation under Other GHG Programs

1.15.1 Projects Registered (or seeking registration) under Other GHG Program(s)

The project has neither been registered, nor is seeking registration under any other GHG programs. The project is seeking registration only under VCS program.

1.15.2 Projects Rejected by Other GHG Programs

The project has never been seeking registration under any other GHG program; hence the project has never been rejected by any other GHG programs.

1.16 Other Forms of Credit

1.16.1 Emissions Trading Programs and Other Binding Limits

The project is not included in an emissions trading program or any other mechanism that includes GHG allowance trading. The GHG emission reductions and removals generated by the project have not and will not be used for compliance under such programs or mechanisms.

China has a national emissions trading scheme only cover the high-emission industries, such as fossil fuel-fired power generation, petrochemical, chemical, building materials, iron and steel, nonferrous, paper, aviation and other key emission industries that emitted at least 26,000 tons of CO₂e/year, not including renewable project¹.

Also, the project has not been and will not be registered as a CCER (Chinese Certified Emission Reductions) project in China, thus it is not eligible for emission reductions transaction under the China's ETS. Therefore, the project does not reduce GHG emissions from activities that are included in an emissions trading program or any other mechanism that includes GHG allowance

¹ http://www.mee.gov.cn/xxgk2018/xxgk/xxgk05/202103/t20210330_826728.html

trading. The net GHG emission reductions generated during this monitoring period have not been used for compliance under such programs or mechanisms.

Furthermore, as a voluntary emission reduction project, the GHG emission reductions and removals generated by the project will not be enforced to be used for compliance in China. The credits in this monitoring period have not been counted and will not be counted under emission trading programs and other binding limits.

A no double counting declaration has been provided by the project proponent for verification.

1.16.2 Other Forms of Environmental Credit

The project is not registered under any other program; therefore, the project has not sought or received another form of GHG-related environmental credit, including renewable energy certificates.

1.16.3 Supply Chain (Scope 3) Emissions


Not applicable yet. This requirement is effective as of 01-Jan-2024 as per latest VERRA rules.

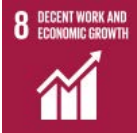


1.17 Sustainable Development Contributions

1.17.1 Sustainable Development Contributions Activity Description

The project built a centralized anaerobic animal manure treatment system which collects manure waste from surrounding livestock farms in Gansu Province, China. The project uses animal manure waste as ferment material to produce biogas in the CSTR anaerobic digesters. The recovered biogas is used for electricity generation which is then delivered to NWCPG. The residual waste from the CSTR digesters is used to produce organic fertilizer at the project site.

The Project contributes to sustainable development in the following ways:

SDG	SDG indicators	Chinese sustainable development priorities	Project activity contribution
	SDG 7.2 By 2030, increase substantially the share of renewable energy in the global energy mix	By 2030, the proportion of non-fossil energy in China's primary energy consumption will reach about 25%	The project supplies renewable electricity generated from recovered biogas to NWCPG. Therefore, the project contributes to SDG7.

	<p>SDG 8.5 By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value</p>	<p>The 14th Five-Year Plan strengthens the policy of giving priority to employment, and at the same time promotes employment by promoting entrepreneurship. Implement the policy of equal access to employment services for migrant workers in the place of employment, and help the disabled, families with zero employment and other disadvantaged groups to find employment.</p>	<p>The project provides long-term job opportunities for local residents. Therefore, the project contributes to SDG8.</p>
	<p>SDG 12.5 By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse</p>	<p>The "14th Five-Year Plan" and the 2035 Vision Outline put forward the "widespread formation of green production and lifestyle", which clearly calls for the in-depth implementation of promoting recycling-based production methods, green design and cleaner production, improvement of the recycling network of waste and used materials, and enhance the recycling capacity of renewable resources</p>	<p>The project uses animal manure waste as ferment material to produce biogas for electricity generation. The residual waste from the CSTR digesters is further used to produce organic fertilizer. Therefore, the project contributes to SDG12.</p>
	<p>SDG13 Take urgent action to combat climate change and its impacts</p>	<p>By 2030, China's carbon dioxide emissions per unit of GDP will drop by more than 65% compared with 2005</p>	<p>The project reduces methane emissions from anaerobic decay of animal manure waste without methane recovery and destruction facility in the baseline scenario. The project also supplies renewable electricity generated to NWCPG to replace electricity</p>

			supplied by fossil fuel dominated NWCPG. Therefore, the project contributes to SDG13.
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1.17.2 Sustainable Development Contributions Activity Monitoring

During this monitoring period, the centralized anaerobic animal manure treatment system has been built and operated to collect and treat animal manure waste in the CSTR anaerobic digesters to produce biogas. The recovered biogas is used for electricity generation or flared. The residual waste from the CSTR digesters is used to produce organic fertilizer at the project site. The project contributes to SDG 7, 8, 12 and 13, detailed as follows:

Table 1: Sustainable Development Contributions

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
1)	7.2	Renewable electricity generated and supplied to the power grid	Implemented activities to increase	During this monitoring period, all 736.56 MWh renewable electricity generated by the project was for internal use, no electricity was supplied to the power grid, therefore for conservative consideration, 0 MWh renewable electricity is reported for SDG 7.2 during this monitoring period.	By 31-Dec-2022, a total of 736.56 MWh renewable electricity has been generated by the project for internal use. Therefore for conservative consideration, 0 MWh renewable electricity is reported for SDG 7.2
2)	8.5	Number of jobs provided	Implemented activities to increase	During this monitoring period, 10 jobs have been provided to local residents	Since project start date, 10 jobs have been provided to local residents
3)	12.5	Amount of animal manure waste treated	Implemented activities to increase	During this monitoring period, 55,875 tonnes of animal manure waste (wet basis) have been treated by the project	Since project start date, a total of 55,875 tonnes of animal manure waste (wet basis) have been treated by the project
4)	13.0	Tonnes of greenhouse gas emissions avoided	Implemented activities to increase	During this monitoring period, 10,156 tCO ₂ e GHG emission reductions have been achieved	Since project start date, a total of 10,156 tCO ₂ e GHG emission reductions have been achieved

1.18 Additional Information Relevant to the Project

Leakage Management

Not applicable.

Commercially Sensitive Information

No commercially sensitive information has been excluded from the public version of the project description.

Further Information

Not applicable.

2 SAFEGUARDS

2.1 No Net Harm

The Environmental Impact Assessment (EIA) of the project has been conducted, and EIA report has been approved by Ecology and Environment Bureau of Zhangye City on 12-July-2019 (Approval No. “Zhanghuanpingfa [2019] No.25”). The EIA report has assessed every possible aspect of environmental impact of the project and recommended corresponding measures, where applicable. All mitigation measures have been implemented to ensure the compliance of environment protection regulations. No net harm has been detected. Meanwhile, the implementation of the project improves local socio-economic development through creating career opportunities and paying taxes. The project also contributes to the sustainable development of local community as described in section 1.17 above.

In conclusion, the project has no negative impacts on local environment and socio-economy. No net harm on local environment and social community has been detected for the project.

2.2 Local Stakeholder Consultation

The Project owner conducted Local Stakeholder Consultation as per VCS rules to collect comments from local stakeholders in November 2019. Survey questionnaires were distributed to relevant personnel of the livestock farms, local villagers and government officials by the Project owner on 17-Nov-2019. The survey questionnaire was designed to assess the project impacts on the local environment and social economic development. The structure of the survey respondents is listed in Table 2-1 below.

Table 2-1 Structure of stakeholder survey

Item		Distribution	Quantity	Percentage
Amount of stakeholders surveyed	Male		16	53%
	Female		14	47%
Age	<25		6	20%
	25-55		18	60%
	>55		6	20%
Education	Junior high school or below		10	33%
	Senior high school		12	40%
	College or above		8	27%
Occupation	Worker		16	53%
	Peasant		9	30%
	Management personnel		2	7%
	Civil servant		2	7%
	Unspecified		1	3%

Thirty questionnaires were distributed to local stakeholders, and all questionnaires have been recollected. Comments from these questionnaires are summarized in Table 2-2 below:

Table 2-2 Summary of stakeholders' comments

No.	Questions	Attitude or Opinion	Amount	Percentage
1	Do you know about the project activity?	Very much	21	70%
		Heard of	5	17%
		Nothing	4	13%

2	Do you think the project will improve the current situation of livestock farms?	Yes	27	90%
		No	0	0
		Don't know	3	10%
3	Do you think the project will improve the local employment?	Yes	20	67%
		No	0	0
		Don't know	10	33%
4	Do you think the project will improve the local social community?	Yes	19	63%
		No	0	0
		Don't know	11	37%
5	Do you think the project will promote local economic development?	Positive impact	20	67%
		No impact	10	33%
		Negative impact	0	0%
6	What is the most probable environmental impact do you think the project will cause after the construction finish? (multiple choice)	None	23	77%
		Air pollution	0	0%
		Water pollution	0	0
		Noise pollution	0	0%
		Harm to indigenous animals and plants	0	0%
		Don't know	7	23%

7	What is your attitude to the project activity?	Support	26	87%
		Against	0	0
		Indifferent	4	13%

In general, local stakeholders are supportive of the project construction. The survey shows that a majority of local stakeholders think the Project will help improve the life of local people and promote local economic development without adverse environmental impact. Most stakeholders are supportive to the project. Therefore, the implementation of the Project is regarded as beneficial by most of the local stakeholders.

Local Stakeholder Consultation during the project implementation stage:

On-going communication mechanism has been established for the project. Key implementation schedules or changes of the project will be communicated to the local authority, the neighbourhood committee and the local residents. Comments and suggestions (if any) from residents will be collected through grievance register set at the project site and considered by the project owner. Also, the local government officials (such local environmental protection bureau) conducts spot checks on the project to ensure compliance of laws and regulations.

Communications with Local stakeholders are being carried out at periodic intervals. In this monitoring period, Local Stakeholder Consultation was done in December 2021 and October 2022. During these two Local Stakeholder Consultations, local stakeholders from surrounding villages, livestock farms and government officials were invited to the LSC meetings at project site. Also, for those unable to attend the LSC meetings, the project owner visited their home and offices to collect comments. A total of 28 questionnaires have been distributed and collected in December 2021, and a total of 33 questionnaires have been distributed and collected in October 2022. No negative comments were received during these two LSC process.

In line with VCS requirements, all the processes have been implemented to receive comments from local stakeholders as well as on-going communicate.

2.3 Environmental Impact

As per the EIA report, the environmental impacts of the project are summarized as follows.

Air pollution

The air pollution during the operation mainly includes the exhaust gas of the biogas generator and the flare, and dust from organic fertilizer plant. The exhaust gas is treated through 2 stage purification equipment before being discharged through exhaust cylinders with 20m high. The dust from organic fertilizer plant is filtered by dust collector and reused in the organic fertilizer

plant. The NO_x, sulfur dioxide, H₂S, NH₃ and particulate matter in all the exhaust gas by the project meets Grade 2 emission standard of "Integrated Emission Standard of Air Pollutants" (GB16297).

Wastewater

The wastewater during operation is mainly domestic sewage and biogas slurry from anaerobic digesters. The domestic sewage of the project is pretreated in a septic tank and reused in anaerobic digesters. Most biogas slurry is recycled in anaerobic digesters; surplus biogas slurry is used as material for organic fertilizer production. No wastewater is discharged to the environment.

Noise

The noise of this project comes from noise from various mechanical operation and vibration. All production equipment is placed in the workshop or steel container, and measures are taken to reduce vibration and noise. The operating noise is effectively attenuated after being blocked by the solid wall. Besides, there're no residents within the 2 km radius of the project site, therefore no negative impact from noise.

Solid waste

The solid waste of the project is mainly domestic garbage, filtered dust. The domestic garbage and filtered dust are collected uniformly and then sent to landfill site for landfill treatment.

Hazardous waste: The hazardous waste, e.g. mineral oil, generated by the project mechanical facilities is properly collected and stored in the hazardous waste temporary deposit, and transported to the qualified entities for centralized treatment regularly.

In conclusion, the environmental impact during the project operation is minor. And appropriate mitigation measures have been implemented to minimize any adverse environmental impacts.

2.4 Public Comments

The project was published on VERRA website from 09-Feb-2023 to 11-Mar-2023, no comment was raised.

2.5 AFOLU-Specific Safeguards

Not applicable.

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

The methodologies applied to the project are small scale CDM methodologies:

AMS-III.D Methane recovery in animal manure management systems (version 21.0);

AMS-I.D Grid connected renewable electricity generation (version 18.0).

This methodology also refers to the latest approved version of the following tools:

Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation (version 03.0);

Project emissions from flaring (version 04.0);

Project and leakage emissions from anaerobic digesters (version 02.0);

Project and leakage emissions from transportation of freight (version 01.1.0);

Tool to calculate the emission factor for an electricity system (version 07.0);

For more detail information about the methodology and tools, please reference to the following link:

<https://cdm.unfccc.int/methodologies/DB/H9DVSB2407GEZQYLYNWUX23YS6G4RC>

<https://cdm.unfccc.int/methodologies/DB/W3TINZ7KKWCK7L8WTXFQQOFQOH4SBK>

3.2 Applicability of Methodology

The project satisfies all the applicability criteria of the methodology AMS-III.D (Version 21.0) and AMS-I.D (version 18.0), of which the detailed description is listed in Table 3-1 below:

Table 3-1 Applicability of AMS-III.D

No.	Applicability conditions of the methodology	The project
1	This methodology covers project activities involving the replacement or modification of anaerobic animal manure management systems in livestock farms to achieve methane recovery and destruction by flaring/combustion or gainful use of the recovered methane. It also covers treatment of manure collected from several farms in a centralized plant	Applicable. The project is a centralized plant treats animal manure waste collected from surrounding livestock farms. The project replaces existing anaerobic animal manure management systems (open lagoon) in livestock farms to achieve methane recovery and destruction by flaring or power generation of the recovered methane.
2	This methodology is only applicable under the following conditions:	Applicable.

	a) The livestock population in the farm is managed under confined conditions	All the livestock population in the farms within the project boundary is managed under confined conditions
	b) Manure or the streams obtained after treatment are not discharged into natural water resources (e.g. river or estuaries), otherwise "AMS-III.H Methane recovery in wastewater treatment" shall be applied	Applicable. As per the EIA report, manure or the streams obtained after treatment are not discharged into natural water resources (e.g. river or estuaries)
	c) The annual average temperature of baseline site where anaerobic manure treatment facility is located is higher than 5 °C	Applicable. The annual average temperature of baseline site where anaerobic manure treatment facility is located is 7 °C ² , which is higher than 5 °C.
	d) In the baseline scenario the retention time of manure waste in the anaerobic treatment system is greater than one month, and if anaerobic lagoons are used in the baseline, their depths are at least 1 m	Applicable. In the baseline scenario the retention time of manure waste in the anaerobic lagoons is 3 to 6 months ³ , which is greater than one month, and their minimum depths are 1.5 meters, which is higher than 1 m.
	e) No methane recovery and destruction by flaring or combustion for gainful use takes place in the baseline scenario	Applicable. No methane recovery and destruction by flaring or combustion for gainful use takes place in the baseline scenario.
3	The project activity shall satisfy the following conditions: (a) The residual waste from the animal manure management system shall be handled aerobically, otherwise the related emissions shall be taken into account as per relevant procedures of "AMS-III.AO Methane recovery through controlled anaerobic digestion". In the case of soil application, proper conditions and	Applicable. The residual waste from the animal manure management system of the project is used to produce organic fertilizer, which is handled aerobically and will not result in methane emissions.

² <http://www.weather.com.cn/cityintro/101160701.shtml>

³ http://jyg.gov.cn/nyncj/ztl/syjs/art/2023/art_05620dca6f2d4b61aa0520573d07f3c0.html

	procedures (not resulting in methane emissions) must be ensured;	
	(b) Technical measures shall be used (including a flare for exigencies) to ensure that all biogas produced by the digester is used or flared;	Applicable. Biogas produced by the project are used directly to produce electricity, the emergency flare ensure biogas would be destroyed while exigencies happened
	(c) The storage time of the manure after removal from the animal barns, including transportation, should not exceed 45 days before being fed into the anaerobic digester. If the project proponent can demonstrate that the dry matter content of the manure when removed from the animal barns is larger than 20%, this time constraint will not apply.	Applicable. The storage time of the manure after removal from the animal barns, including transportation does exceed 24 hours before being fed into the anaerobic digester, much less than 45 days.
4	Projects that recover methane from landfills shall use "AMS-III.G Landfill methane recovery" and projects for wastewater treatment shall use AMS-III.H. Projects for composting of animal manure shall use "AMS-III.F Avoidance of methane emissions through composting". Project activities involving co-digestion of animal manure and other organic matters shall use the methodology "AMS-III.AO Methane recovery through controlled anaerobic digestion".	Irrelevant. The project does not involve landfill methane recovery, wastewater treatment, composting animal manure, or co-digestion of animal manure and other organic matters.
5	Utilization of the recovered biogas in one of the options detailed in AMS-III.H is also eligible under this methodology. The respective procedures in AMS-III.H shall be followed in this regard. If the recovered biogas is used to power auxiliary equipment of the project activity, it should be taken into account accordingly, using zero as its emission factor; however, energy used for such purposes is not eligible as an SSC CDM Type I project component.	Applicable. The recovered biogas is either flared or used for power generation. The electricity generated by the project is for internal use first, excess electricity will be delivered to the power grid. In compliance with the methodology, the electricity for internal usage will not be taken into account for ER calculation (i.e. using zero as its emission factor).
6	New facilities (Greenfield projects) and project activities involving capacity additions compared to the baseline scenario are only eligible if they	Applicable. The project is a Greenfield project. The emission reduction sourced from methane

	comply with the related and relevant requirements in the "General guidelines for SSC CDM methodologies".	recovery is 33,220 tCO ₂ e/yr, which is lower than 60,000 tCO ₂ e/yr; the installed capacity of the project is 2.0MW, which is lower than the threshold of 15MW. Therefore, the Project is in line with "General Guidelines to SSC CDM methodologies"
7	The requirements concerning demonstration of the remaining lifetime of the replaced equipment shall be met as described in the "General guidelines for SSC CDM methodologies".	The project is a Greenfield project, does not involve the replaced equipment; therefore, this is irrelevant.
8	Measures are limited to those that result in aggregate emission reductions of less than or equal to 60 kt CO ₂ equivalent annually from all Type III components of the project activity.	Applicable. The total emission reductions from type I and type III components of the project are 33,220 tCO ₂ e/yr, which is less than 60 kt CO ₂ equivalent.

Table 3-2 Applicability of AMS-I.D

No.	Applicability conditions of the methodology	The project
1	This methodology comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass: (a) Supplying electricity to a national or a regional grid; or (b) Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	Applicable. The project uses biogas to generate electricity and supply to Northwest China Power Grid.
2	Illustration of respective situations under which each of the methodology (i.e. "AMS-I.D.: Grid connected renewable electricity generation", "AMS-I.F.: Renewable electricity generation for captive use and mini-grid" and "AMS-I.A.: Electricity generation by the user) applies is included in the appendix.	The Illustration of respective situations for AMS-I.D stated in the appendix is the same as applicability condition No. 1 above. No need for further justification.
3	This methodology is applicable to project activities that: (a) Install a Greenfield plant; (b) Involve a capacity addition in (an) existing plant(s);	Applicable. The project is a greenfield plant.

	<p>(c) Involve a retrofit of (an) existing plant(s);</p> <p>(d) Involve a rehabilitation of (an) existing plant(s)/unit(s); or</p> <p>(e) Involve a replacement of (an) existing plant(s).</p>	
4	<p>Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology:</p> <p>(a) The project activity is implemented in an existing reservoir with no change in the volume of reservoir;</p> <p>(b) The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the project emissions section, is greater than 4 W/m²;</p> <p>(c) The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the project emissions section, is greater than 4 W/m².</p>	Irrelevant. The project is not a hydro power plant.
5	<p>If the new unit has both renewable and non-renewable components (e.g. a wind/diesel unit), the eligibility limit of 15 MW for a small-scale CDM project activity applies only to the renewable component. If the new unit co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15 MW.</p>	Irrelevant. The project does not involve non-renewable components.
6	<p>Combined heat and power (co-generation) systems are not eligible under this category.</p>	Irrelevant. The project does not involve co-generation system.
7	<p>In the case of project activities that involve the capacity addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct¹ from the existing units.</p>	Irrelevant. The project does not involve capacity addition.
8	<p>In the case of retrofit, rehabilitation or replacement, to qualify as a small-scale project, the total output of the retrofitted, rehabilitated or replacement power plant/unit shall not exceed the limit of 15 MW.</p>	Irrelevant. The project does not involve retrofit, rehabilitation or replacement.

9	In the case of landfill gas, waste gas, wastewater treatment and agro-industries projects, recovered methane emissions are eligible under a relevant Type III category. If the recovered methane is used for electricity generation for supply to a grid then the baseline for the electricity component shall be in accordance with procedure prescribed under this methodology. If the recovered methane is used for heat generation or cogeneration other applicable Type-I methodologies such as “AMS-I.C.: Thermal energy production with or without electricity” shall be explored.	Irrelevant. The project does not involve landfill gas, waste gas, wastewater treatment and agro-industries projects.
10	In case biomass is sourced from dedicated plantations, the applicability criteria in the tool “Project emissions from cultivation of biomass” shall apply.	Irrelevant. The project does not involve biomass.

In addition, the project meets the applicability conditions of the applied tools applied in the JPM as follows:

Table 3-3 Applicability of applied tools

Tool	Applicability	The project
Tool to calculate the emission factor for an electricity system (version 07.0)	This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity that is where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects)	Applicable. The project utilizes biogas for power generation to supply electricity to NWCPG that dominated by fossil-fuel plants. Therefore, the tool is applied to estimate the OM, BM and/or CM when calculating baseline emissions for the project.
	Under this tool, the emission factor for the project electricity system can be calculated either for grid power plants only or, as an option, can include off-grid power plants. In the latter case, two sub-options under the step 2 of the tool are available to the project participants, i.e. option II a and option II b. If option II a is chosen, the conditions specified in “Appendix 1: Procedures related to off-grid power generation” should be met. Namely, the total capacity of off-grid power plants (in MW) should be	In the host country as off-grid power generation is not significant. Therefore, emission factor for the project electricity system is calculated only for the grid power plants. Thus, this applicability criterion is satisfied.

	<p>at least 10 per cent of the total capacity of grid power plants in the electricity system; or the total electricity generation by off-grid power plants (in MWh) should be at least 10 per cent of the total electricity generation by grid power plants in the electricity system; and that factors which negatively affect the reliability and stability of the grid are primarily due to constraints in generation and not to other aspects such as transmission capacity.</p>	
	<p>In case of CDM projects the tool is not applicable if the project electricity system is located partially or totally in an Annex I country.</p>	<p>Applicable. The project electricity system is located in a non-Annex I country.</p>
	<p>Under this tool, the value applied to the CO₂ emission factor of biofuels is zero.</p>	<p>The project is not involved in biofuels.</p>
<p>Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation (version 03.0)</p>	<p>If emissions are calculated for electricity consumption, the tool is only applicable if one out of the following three scenarios applies to the sources of electricity consumption:</p> <p>(a) Scenario A: Electricity consumption from the grid. The electricity is purchased from the grid only, and either no captive power plant(s) is/are installed at the site of electricity consumption or, if any captive power plant exists on site, it is either not operating or it is not physically able to provide electricity to the electricity consumer;</p> <p>(b) Scenario B: Electricity consumption from (an) off-grid fossil fuel fired captive power plant(s). One or more fossil fuel fired captive power plants are installed at the site of the electricity consumer and supply the consumer with electricity. The captive power plant(s) is/are not connected to the electricity grid; or</p> <p>(c) Scenario C: Electricity consumption from the grid and (a) fossil fuel fired captive power plant(s). One or more fossil fuel fired captive power plants operate at the site of the electricity consumer. The captive power plant(s) can provide electricity to the electricity consumer. The captive power plant(s) is/are also connected to the electricity grid. Hence, the electricity consumer can be provided with</p>	<p>Applicable. The source of electricity consumption of the project is Scenario A: Electricity consumption from the grid</p>

	electricity from the captive power plant(s) and the grid.	
	This tool can be referred to in methodologies to provide procedures to monitor amount of electricity generated in the project scenario, only if one out of the following three project scenarios applies to the recipient of the electricity generated: (a) Scenario I: Electricity is supplied to the grid; (b) Scenario II: Electricity is supplied to consumers/electricity consuming facilities; or (c) Scenario III: Electricity is supplied to the grid and consumers/electricity consuming facilities.	Applicable. The electricity generated by the project is supplied to the NWCPG (Scenario I).
	This tool is not applicable in cases where captive renewable power generation technologies are installed to provide electricity in the project activity, in the baseline scenario or to sources of leakage. The tool only accounts for CO ₂ emissions.	N.A. No captive renewable power generation technologies are installed to provide electricity in the project activity, in the baseline scenario or to sources of leakage.
Project emissions from flaring (version 04.0)	This tool provides procedures to calculate project emissions from flaring of a residual gas. The tool is applicable to enclosed or open flares and project participants should document in the PD the type of flare used in the project activity.	Applicable. The project uses enclosed flare system.
	This tool is applicable to the flaring of flammable greenhouse gases where: (a) Methane is the component with the highest concentration in the flammable residual gas; and (b) The source of the residual gas is coal mine methane or a gas from a biogenic source (e.g. biogas, landfill gas or wastewater treatment gas).	Applicable. Methane is the component with the highest concentration in the biogas flared in the project.
	The tool is not applicable to the use of auxiliary fuels and therefore the residual gas must have sufficient flammable gas present to sustain combustion. For the case of an enclosed flare, there shall be operating specifications provided by the manufacturer of the flare.	Applicable. The project does not use auxiliary fuels.

<p>Project and leakage emissions from anaerobic digesters (version 02.0)</p>	<p>The following sources of project emissions are accounted for in this tool:</p> <p>(a) CO₂ emissions from consumption of electricity associated with the operation of the anaerobic digester;</p> <p>(b) CO₂ emissions from consumption of fossil fuels associated with the operation of the anaerobic digester;</p> <p>(c) CH₄ emissions from the digester (emissions during maintenance of the digester, physical leaks through the roof and side walls, and release through safety valves due to excess pressure in the digester); and</p> <p>(d) CH₄ emissions from flaring of biogas.</p>	<p>Applicable.</p> <p>All sources of project emissions have been accounted.</p>
	<p>The following sources of leakage emissions are accounted for in this tool:</p> <p>(a) CH₄ and N₂O emission from composting of digestate;</p> <p>(b) CH₄ emissions from the anaerobic decay of digestate disposed in a SWDS or subjected to anaerobic storage, such as in a stabilization pond.</p>	<p>Irrelevant. The project does not involve composting or anaerobic storage.</p>
	<p>Emission sources associated with N₂O emissions from physical leakages from the digester, transportation of feed material and digestate or any other on-site transportation, piped distribution of the biogas, aerobic treatment of liquid digestate and land application of the digestate are neglected because these are minor emission sources or because they are accounted in the methodologies referring to this tool.</p>	<p>Applicable. As per the applied methodology, N₂O emissions are neglected because these are minor emission sources.</p>
<p>Project and leakage emissions from transportation of freight (version 01.1.0)</p>	<p>This tool is applicable to project activities which involve freight transportation by road and where transportation is not the main project activity. This tool is not applicable to project activities where transportation is the main source of greenhouse gases emissions. This tool does not provide</p>	<p>Applicable.</p> <p>The project involves freight transportation by road and transportation is not the main project activity.</p>

	<p>procedures to estimate baseline emissions from road transportation of freight. The tool only provides to determine CO₂ emissions. CH₄ and N₂O emissions are excluded for simplification as they are small compared to CO₂ emissions.</p>	
	<p>In addition, the tool is applicable for the determination of project or leakage emissions from freight transportation by rail in project activities where transportation is not the main project activity.</p>	<p>Irrelevant. The project does not involve rail transportation.</p>

3.3 Project Boundary

According to the methodology AMS-III.D, the project boundary includes the physical, geographical site(s) of (a) The livestock; (b) Animal manure management systems (including centralised manure treatment plant where applicable); (c) Facilities which recover and flare/combust or use methane.

According to the methodology AMS-I.D, the spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to.

Hence, the project boundary of the Project includes the physical and geographical sites of the livestock farms, the centralized animal manure management system, the biogas flare system, the biogas power plant and all the power plants connected into the NWCPG.

Figure 3-1 describes the project boundary of the Project Activity.

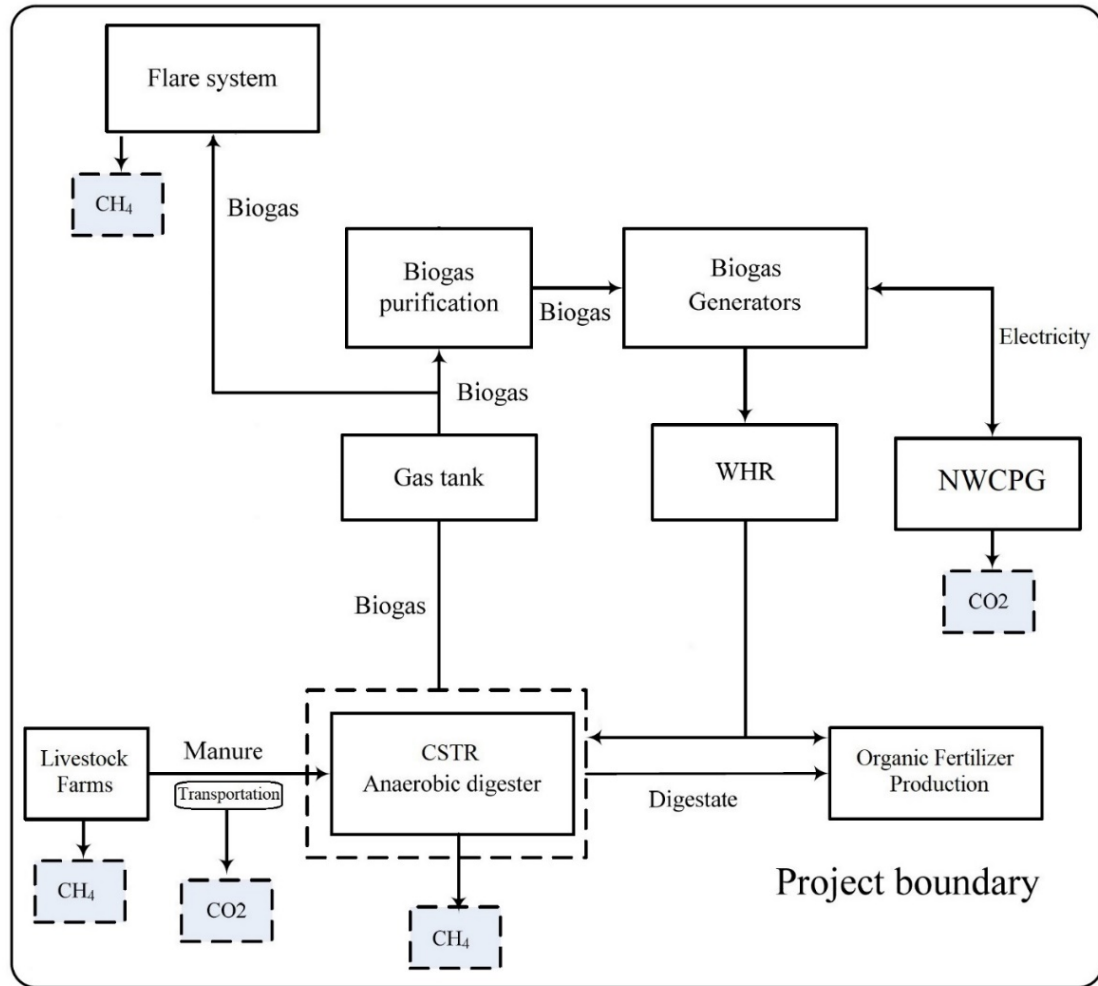


Figure 3-1 Project boundary of the project

Table 3-4 Emission sources included in or excluded from the project boundary

Source	Gas	Included?	Justification/Explanation	
Baseline	Direct emissions from the manure treatment processes	CO ₂	No	Excluded for simplification.
		CH ₄	Yes	The major source of emissions in the baseline
		N ₂ O	No	Excluded for simplification.
	Emissions from electricity consumption /generation	CO ₂	Yes	The major source of emissions in the baseline
		CH ₄	No	Excluded for simplification.
		N ₂ O	No	Excluded for simplification.
Project		CO ₂	No	Excluded for simplification.

Source		Gas	Included?	Justification/Explanation
Physical leakage of biogas in the manure management systems	CH ₄	Yes	Main emission source.	
	N ₂ O	No	Excluded for simplification.	
Emissions from flaring or combustion of the gas stream	CO ₂	No	Excluded for simplification.	
	CH ₄	Yes	The enclosed flare is installed for flaring in case of maintenance or unavailability of biogas power plant	
	N ₂ O	No	Excluded for simplification.	
Emissions from use of fossil fuels or electricity	CO ₂	Yes	The project consumes electricity during operation, so Emission from use of electricity is the main emission source. The project does not involve fossil fuel consumption, so the emission from use of fossil fuels is not included.	
	CH ₄	No	Excluded for simplification.	
	N ₂ O	No	Excluded for simplification.	
Emissions from incremental transportation distances	CO ₂	Yes	Main emission source.	
	CH ₄	No	Excluded for simplification.	
	N ₂ O	No	Excluded for simplification.	
Emissions from the storage of manure	CO ₂	No	Excluded for simplification.	
	CH ₄	No	The storage time of the manure after removal from the animal barns, including transportation, is within 24 hours before being fed into the anaerobic digester, hence Emissions from the storage of manure is not accounted.	
	N ₂ O	No	Excluded for simplification.	

3.4 Baseline Scenario

As per para. 17 of AMS-III.D, the baseline scenario is the situation where, in the absence of the project activity, animal manure is left to decay anaerobically within the project boundary and methane is emitted to the atmosphere.

As per para. 19 of AMS-I.D, the baseline scenario is that the electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources into the grid.

Hence, the baseline scenario of the project is the animal manure waste was left to decay in anaerobic manure management system (lagoon) at the livestock farms and methane is emitted

to the atmosphere directly without any methane recovery and destruction facility; equivalent amount of electricity was supplied from the NWCPG connected fossil fuel fired power plants.

3.5 Additionality

As per para. 15-16 of applied methodology AMS-III.D, project activities may demonstrate the additionality by showing that there is no regulation in the host country, applicable to the project site, that requires the collection and destruction of methane from livestock manure. If so, it is not required to apply the “Guidelines on the demonstration of additionality of small-scale project activities”. This additionality condition also applies to Greenfield project activities. Furthermore, for project activities applying this methodology in combination with a Type I methodology, that has an energy component whose installed capacity is less than 5 MW, this procedure for additionality demonstration also applies to that component.

The regulations relative to the project in China are identified as below.

- a) Law of the People's Republic of China on Environment Protection;
- b) Law of the People's Republic of China on the Prevention and Control of Solid Waste Pollution;
- c) Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution;
- d) Regulations on prevention and control of pollution from large scale livestock and poultry breeding;
- e) Discharge standard of pollutants for livestock and poultry breeding (GB/T 18596);
- f) Technical standard of pollution prevention for livestock and poultry breeding (HJ/T 81).

It has been identified that all the above laws and regulations in China **do not** require the collection and destruction of methane from livestock manure. Furthermore, the project recovers biogas to generate electricity with a total installed capacity of 2MW, which is lower than 5MW. Therefore, in line with the applied methodology AMS-III.D, the project is deemed automatically additional.

3.6 Methodology Deviations

Not applicable.

4 IMPLEMENTATION STATUS

4.1 Implementation Status of the Project Activity

In compliance with the project design, the project was implemented in two phases. Phase I was the construction of the centralized anaerobic animal manure treatment system, which started construction since 01-Dec-2019, and started commissioning on 01-Aug-2021. Three CSTR digesters with effective volume of 5,000m³ each and one dry anaerobic digester with effective volume of 5,000m³ have been installed at the project site. All the biogas recovered by the project was flared during the period from 01-Aug-2021 to 30-Apr-2022, until the commissioning date (01-May-2022) of biogas power plant.

Phase II was the installation of the biogas power plant. 6 sets of biogas generators with unit capacity of 200kW and 2 sets of biogas generators with unit capacity of 300kW have been installed at the project site and started operation since 01-May-2022. During the first monitoring period (01-Aug-2021 to 31-Dec-2022), the total installed capacity of the biogas power plant is 1.8MW. The designed installed capacity of the biogas power plant is 2MW, and the remaining 0.2MW is expected to be purchased and installed in 2024, depends on the operation level of centralized anaerobic animal manure treatment system and the availability of biogas recovered.

Since the commissioning date (01-May-2022) of biogas power plant, part of the biogas recovered was used for power generation, the rest biogas was still flared, as the grid-connection switch cabinet has not been retrofitted and upgraded to meet the technical requirements of the power grid company, therefore during this monitoring period the biogas power plant ran at low output level to supply electricity for internal usage only. No electricity was supplied to the power grid during the whole monitoring period (01-Aug-2021 to 31-Dec-2022). The upgrade of the grid-connection switch cabinet is expected to complete in late 2023.

During this monitoring period, the project operated normally without any malfunctioning or system failure, and no events or situations that may impact the applicability of the methodologies occurred. However, due to market reasons and the low availability of animal manures around the project site, the project kept operating at very low operating load. And during the period from 01-Oct-2022 to 31-Dec-2022, no animal manure waste was fed into the anaerobic digesters.

The technical specifications of key equipment are as follows:

Table 4-1 Technical specifications of key equipment

Equipment	CSTR digester	Dry anaerobic digester
Rated capacity (m ³)	5,000	5,000
Quantity	3	1
Equipment	Biogas generator	Biogas generator

Rated capacity (kW)	200	300
Quantity	6	2
Equipment	Enclosed flare system	
Maximum flow rate (m ³ /h)	1,000	
Quantity	1	

5 ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

According to the methodology AMS-III.D and AMS-I.D, baseline emissions are determined according to equation (1) and comprise the following sources:

$$BE_y = BE_{CH_4,y} + BE_{Elec,y} \quad (1)$$

Where:

- BE_y Baseline emissions in year y (t CO₂e/yr)
- $BE_{CH_4,y}$ Baseline emissions from the manure treatment processes in year y (t CO₂e/yr)
- $BE_{Elec,y}$ Baseline emissions associated with electricity generation in year y (t CO₂/yr)

1. Baseline emissions from the manure treatment processes in year y ($BE_{CH_4,y}$)

As per AMS-III.D, Baseline emissions ($BE_{CH_4,y}$) are calculated by using one of the following two options:

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

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

The project applies option (b) to calculate baseline emissions from the manure treatment processes ($BE_{CH_4,y}$).

$$BE_{CH_4,y} = GWP_{CH_4} \times D_{CH_4} \times UF_b \times \sum_{j,LT} MCF_j \times B_{0,LT} \times Q_{manure,j,LT,y} \times SVS_{j,LT,y} \quad (2)$$

Where:

GWP_{CH_4}	Global Warming Potential (GWP) of CH ₄ applicable to the crediting period (t CO ₂ e/t CH ₄)
D_{CH_4}	CH ₄ density (0.00067 t/m ³ at room temperature (20 °C) and 1 atm pressure)
UF_b	Model correction factor to account for model uncertainties (0.94)
LT	Index for all types of livestock
j	Index for animal manure management system
$Q_{manure,j,LT,y}$	Quantity of manure treated from livestock type LT at animal manure management system j (tonnes/year, dry basis)
$SVS_{j,LT,y}$	Specific volatile solids content of animal manure from livestock type LT and animal manure management system j in year y (tonnes/tonnes, dry basis)
MCF_j	Annual methane conversion factor (MCF) for the baseline animal manure management system j , as per paragraph 18 of AMS-III.D
$B_{0,LT}$	Maximum methane producing potential of the volatile solid generated for animal type LT (m ³ CH ₄ /kg-VS), as per paragraph 18 of AMS-III.D

a) The maximum methane-producing capacity of the manure ($B_{0,LT}$) varies by species and diet. The preferred method to obtain $B_{0,LT}$ measurement values is to use data from country-specific published sources, measured with a standardised method ($B_{0,LT}$ shall be based on total as-excreted VS). These values shall be compared to IPCC default values and any significant differences shall be explained. If country specific B_0 values are not available, default values from 2006 IPCC Guidelines for National Greenhouse Gas Inventories can be used, provided that the project participants assess the suitability of those data to the specific situation of the treatment site.

For the project, the country specific B_0 values are not available, therefore the default values from 2019 Refinement to 2006 IPCC guideline, volume 4, chapter 10, Table 10.16 are applied. The dairy farms and market swine farms involved in the project are all high-performance systems which are 100% market oriented with high yielding and high level of overall herd (flock) performance confinement productions system. Therefore, default values for high-performance systems in other regions are chosen for the project. The maximum methane-producing capacity of the manure ($B_{0,LT}$) for dairy cow and market swine is 0.24 m³ CH₄/kg VS and 0.45 m³ CH₄/kg VS respectively.

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

For the project, no country-specific MCF values are available, therefore default value from 2019 Refinement to 2006 IPCC guideline, volume 4, chapter 10, table 10.17 is applied. The project location has a mean annual temperature (MAT) of 7 degree Celsius and mean annual precipitation to potential evapotranspiration ratio (MAP:PET) lower than 1⁴, which falls under the Cool Temperate Dry Zone as defined in 2019 refinement to 2006 IPCC guideline, a default value of 67% is chosen for the project.

2. Baseline emissions associated with electricity generation in year y ($BE_{elec,y}$)

As per AMS-I.D, baseline emissions associated with electricity generation in year y is calculated according to equation (3) as below:

$$BE_{elec,y} = EG_{PJ,y} \times EF_{grid,y} \tag{3}$$

Where:

- $EG_{PJ,y}$ Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the project activity in year y (MWh)
- $EF_{grid,y}$ Combined margin CO₂ emission factor for grid connected power generation in year y calculated using the latest version of the “Tool to calculate the emission factor for an electricity system” (t CO₂/MWh)

Calculation of combined margin CO₂ emission factor for grid ($EF_{grid,y}$)

The baseline emission factor ($EF_{grid,y}$) equals to the combined margin CO₂ emission factor ($EF_{grid,CM,y}$) in the latest version of CDM TOOL07 “Tool to calculate the emission factor for an electricity system” (version 07.0). According to CDM TOOL07, the following six steps are applied to determine OM, BM, and CM used for calculating the project baseline emissions:

Step 1. Identify the relevant electricity systems

According to the Tool to calculate the emission factor for an electricity system, project participants may delineate the project electricity system using any of the following options:

Option 1. A delineation of the project electricity system and connected electricity systems published by the DNA or the group of the DNAs of the host country(ies), In case a delineation is

⁴ <http://www.weather.com.cn/cityintro/101160701.shtml>

provided by a group of DNAs, the same delineation should be used by all the project participants applying the tool in these countries;

Option 2. A delineation of the project electricity system defined by the dispatch area of the dispatch centre responsible for scheduling and dispatching electricity generated by the project activity. Where the dispatch area is controlled by more than one dispatch centre, i.e. layered dispatch area, the higher level area shall be used as a delineation of the project electricity system (e.g. where regional dispatch centres are required to comply with dispatch orders of the national dispatch centre then area controlled by the national dispatch centre shall be used);

Option 3. A delineation of the project electricity system defined by more than one independent dispatch areas, e.g. multi-national power pools.

The Chinese DNA has published a delineation of the project electricity system and connected electricity systems, Option 1 is applied for the project. According to the delineations, the Northwest China Power Grid (NWCPG) is identified as the relevant electric power system of the project, which includes Shaanxi, Gansu, Qinghai, Ningxia and Xinjiang Provincial Power Grids.

Step 2. Choose whether to include off-grid power plants in the project electricity system (optional)

Project participants may choose between the following two options to calculate the operating margin and build margin emission factor:

Option I: Only grid power plants are included in the calculation.

Option II: Both grid power plants and off-grid power plants are included in the calculation

Based on China's actual situation, only grid power plants are included in the calculation.

Step 3. Select a method to determine the operating margin (OM)

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods:

- (a) Simple OM, or
- (b) Simple adjusted OM, or
- (c) Dispatch data analysis OM, or
- (d) Average OM.

In China, specific data from the grid or each power plant is treated as business confidential and thus not public available. Therefore, method (b) and method (c) is not suitable for the project.

The Simple OM method (a) can only be applied when low-cost/must run resources constitute less than 50% of total grid generation in average of the five most recent years. According to the data from China Electric Power Yearbook 2014-2018, from year 2013 to year 2017, for the NWCPG the project activity connected to, the low-cost/must-run electric power resources generation

accounts for the total grid total are lower than 50%, which satisfied the applicability of the method (a), therefore, the simple OM method is chosen for the calculation of the OM emission factor $EF_{grid,OM,y}$.

As per the latest version of “Tool to calculate the emission factor for an electricity system” (version 07.0), one of the following methods should be chosen to calculate the simple OM emission factor:

- Ex ante option: If the ex ante option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required. For grid power plants, use a 3-year generation-weighted average, based on the most recent data available at the time of submission of the VCS-PD to the DOE for validation, or
- Ex post option: If the ex post option is chosen, the emission factor is determined for the year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring. If the data required calculating the emission factor for year y is usually only available later than six months after the end of year y, alternatively the emission factor of the previous year (y-1) may be used. If the data is usually only available 18 months after the end of year y, the emission factor of the year proceeding the previous year (y-2) may be used. The same data vintage (y, y-1 or y-2) should be used throughout all crediting periods.

Here the ex ante option is selected, and the $EF_{grid,OM}$ is fixed during the crediting period.

Step 4. Calculate the operating margin emission factor according to the selected method

Based on the analysis of the step 3, the simple OM method is used to calculate the NWCPG OM emission factor in this step. The simple OM emission factor is calculated as the generation-weighted average CO₂ emissions per unit net electricity generation (tCO₂/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/ units.

The simple OM may be calculated by one of the following two options:

Option A: Based on the net electricity generation and a CO₂ emission factor of each power unit; or

Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

For the project activity, the required data for the exercise of Option A is not available and those of Option B can be obtained from official sources, and off-grid power plants are not included in the calculation, therefore, Option B is chosen to calculate the operating margin emission factor:

For Option B, the Simple OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost / must-run power plants / units, and based on the fuel type(s) and total fuel consumption of the project electricity system, as follows:

$$EF_{grid,OMsimple,y} = \frac{\sum_i (FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y})}{EG_y} \tag{4}$$

Where:

$EF_{grid,OMsimple,y}$	Simple operating margin CO ₂ emission factor in year y (tCO ₂ /MWh)
$FC_{i,y}$	Amount of fuel type i consumed in the project electricity system in year y (mass or volume unit)
$NCV_{i,y}$	Net calorific value (energy content) of fuel type i in year (GJ/mass or volume unit)
$EF_{CO_2,i,y}$	CO ₂ emission factor of fuel type i in year y (tCO ₂ /GJ)
EG_y	Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost/must-run power plants/units, in year y (MWh)
i	All fuel types combusted in power sources in the project electricity system in year y
y	The three most recent years for which data is available at the time of submission of the PD to the DOE for validation.

If available, $NCV_{i,y}$ and $EF_{CO_2,i,y}$ from the fuel supplier of the power plants in invoices may be used; or, regional or national average default values may be used. In this JPM, $NCV_{i,y}$ of different fuels are obtained from China Energy Statistical Yearbook 2018. Emission factors ($EF_{CO_2,i,y}$) of each type of fossil fuel come from IPCC 2006 default values.

The Simple OM Emission Factor ($EF_{grid,OMsimple,y}$) of the project is calculated on the basis of the fuel consumption data for electricity generation of the Northwest China Power Grid, not including those of low-operating cost and must-run power plants, such as wind power, hydropower and nuclear etc. These data are obtained from the China Electric Power Yearbook (2016~2018, published annually) and China Energy Statistical Yearbook (2016~2018). Based on these data, the Simple OM Emission Factor ($EF_{grid,OMsimple,y}$) of the Northwest China Power Grid is calculated as 0.8922 tCO₂/MWh. Details of the calculations and the published data from the Chinese DNA⁵, which uses official national statistics.

Step 5. Calculate the build margin (BM) emission factor

In terms of vintage of data, project participants can choose between one of the following two options:

Option 1: For the first crediting period, calculate the build margin emission factor ex ante based on the most recent information available on units already built for sample group m at the time of PD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the

⁵ “2019 Baseline Emission Factors for Regional Power Grids in China”, http://www.mee.gov.cn/ywgz/ycqhbh/wsqtzk/202012/t20201229_815386.shtml

DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

Option 2: For the first crediting period, the build margin emission factor shall be updated annually, ex post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated ex ante, as described in Option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

The JPM chooses Option 1, which requires the project participant to calculate the Build Margin Emission Factor $EF_{grid, BM, y}$, ex-ante based on the most recent information available on units already built for sample group m at the time of JPM submission.

The sample group of power units m used to calculate the build margin should be determined as per the following procedure, consistent with the data vintage selected above:

(a) Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently ($SET_{5-units}$) and determine their annual electricity generation ($AEG_{SET-5-units}$, in MWh);

(b) Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities (AEG_{total} , in MWh). Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20 per cent of AEG_{total} (if 20 per cent falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) ($SET_{\geq 20 \text{ per cent}}$) and determine their annual electricity generation ($AEG_{SET \geq 20 \text{ per cent}}$, in MWh);

(c) From $SET_{5-units}$ and $SET_{\geq 20 \text{ per cent}}$ select the set of power units that comprises the larger annual electricity generation (SET_{sample});

Identify the date when the power units in SET_{sample} started to supply electricity to the grid. If none of the power units in SET_{sample} started to supply electricity to the grid more than 10 years ago, then use SET_{sample} to calculate the build margin. Ignore steps (d), (e) and (f).

Under the current circumstances in China, the power plants consider the Build Margin data as important business data and will not have them published. Therefore, it is difficult to obtain the data of five power plants that have been put into operation most recently or the newly installed power plant capacity additions in the electricity system that comprise 20% of the system generation.

According to the instructions of China DNA, for the determination of the set of samples, a sample merging processing in some degree has been adopted due to that the power generation data, energy consumption data or thermal efficiency data of each plant cannot be consulted in the public statistical data. In this calculation, the newly-installed power units in the past years are

classified by year, province and power generation technology, and the same type of newly-installed power units in the same province and in the same year are bundled as a "newly-installed power units".

The power generation of each “newly-installed power units” in the most recent year y is estimated based on its installed capacity and the number of power generation utilization hours in year y . The formula is as follows:

$$EG_{m,y} = CAP_m \times H_{m,y} \quad (5)$$

Where:

- $EG_{m,y}$ Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
- CAP_m Installed capacity of electricity generated and delivered to the grid by power unit m in year y (MW)
- $H_{m,y}$ The number of power utilization hours (h) of electricity generated and delivered to the grid by power unit m in year y . And it selects the average utilization hours of similar units in the province in which it is located in year y ;
- y Most recent year for which data is available.
- m The sample group of power units.

The power unit m is selected from the "newly-installed power plants" in the most recent year y (For the calculation of the grid BM in 2019, the y is equal to 2017) to the "newly-installed power plants" in the earlier year, until the cumulative power generation reaches 20% of the total power generation in the year y ($y=2017$).

Since the newly-installed power units of the same type (k) in the same province (A) and the same year (t) are bundled into the “newly-installed power units”, the CAP_m is equal to the statistical data of recent installed capacity of a given unit type(k) in a given year(t) in a given province (A).

$$CAP_m = CAP_m |_{m=(A,t,k)} = CAP_{A,t,k} \quad (6)$$

Where:

- CAP_m Installed capacity of electricity generated and delivered to the grid by power unit m in year y (MW), and m is equivalent to an established combination of (A , t , k);
- $CAP_{A,t,k}$ Capacity of newly-installed power units of a given province (A), given year (t), and given unit type (k) (MW)
- A It is the various provincial regions covered by the regional power grid
- t It is the sampling year of the "newly-installed power units".
- t For the calculation of the grid BM in 2019, t is equal to 2017, 2016, ..., until the units that comprise at least 20 percent of the system generation in 2017.
- k It is the power generation technology classification of "newly-installed power units", which is divided into: hydro-power, coal-thermal power, gas-thermal power,

oil-thermal power, Waste-thermal power plant, other thermal power⁶, nuclear power, wind power, solar power, and others⁷.

As per tool, the CO₂ emission factor of each power unit m ($EF_{EL,m,y}$) should be determined as per the tool in Step 4 section 6.4.1 for the simple OM, using Options A1, A2 or A3, using for y the most recent historical year for which electricity generation data is available, and using for m the power units included in the build margin.

Because current statistics data cannot separate each power plant, for a power unit m , only data on electricity generation and the fuel types used is available. So, the option A2 is selected, the emission factor should be determined based on the CO₂ emission factor of the fuel type used and the efficiency of the power unit, as follows:

$$EF_{EL,m,y} = \frac{EF_{CO2,m,i,y} \times 3.6}{\eta_{m,y}} \quad (7)$$

Where:

$EF_{EL,m,y}$ CO₂ emission factor of power unit m in year y (tCO₂/MWh)

$EF_{CO2,m,i,y}$ Average CO₂ emission factor of fuel type i used in power unit m in year y (tCO₂/GJ)

$\eta_{m,y}$ Average net energy conversion efficiency of power unit m in year y (ratio)

3.6 Conversion coefficient of thermal work equivalent of electricity (GJ/MWh)

According to formula (7), the unit electricity emission factor of the hydro-power, nuclear power, wind power, solar power, other thermal power⁸, and others power generation technology⁹ in the “newly-installed power units” samples are is zero. The emission factor per unit of electricity for power generation from coal, gas, oil and waste power is calculated based on formula (7). Since the average net energy conversion efficiency of each sample ($\eta_{m,y}$) cannot be obtained, the power supply thermal efficiency of the best commercialized technology of coal, gas, oil and waste power ($\eta_{Best,m,y}$) is better than $\eta_{m,y}$. It is conservative to use $\eta_{Best,m,y}$ for the calculation of $EF_{EL,m,y}$.

The Build Margin emissions factor is the generation-weighted average emission factor (tCO₂/MWh) of all power units m during the most recent year y for which power generation data is available, calculated as follows:

⁶ refers to waste heat and pressure, straw, bagasse, forest wood power generation.

⁷ refers to power generation such as geothermal energy and ocean energy.

⁸ Other thermal power mainly refers to waste heat and pressure, straw, bagasse and forest power generation.

⁹ Others power generation technology mainly refers to geothermal energy, ocean energy and other power generation.

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad (8)$$

Where,

- $EF_{grid,BM,y}$ Build Margin CO₂ emission factor in year y (tCO₂/MWh)
- $EG_{m,y}$ Net quantity of electricity generated and delivered to the grid by power unit m in year y
- $EF_{EL,m,y}$ CO₂ emission factor of power unit m in year y (tCO₂/MWh)
- m Power units included in the Build Margin
- y The most recent year for which data is available

Outcome of STEP5:

According to the latest and available data at the time of this JPM submission, $EF_{grid,BM,y}$ is calculated to be 0.4407 tCO₂/MWh.

Step 6. Calculate the combined margin (CM) emission factor

As per the “tool to calculate the emission factor for an electricity system”, the combined margin emission factor ($EF_{grid,CM,y}$) is calculated based on one of the following methods:

- (a) Weighted average CM; or
- (b) Simplified CM.

The weighted average CM method (option A) should be used as the preferred option.

The simplified CM method (option b) can only be used if:

The project activity is located in: (i) a Least Developed Country (LDC); or in (ii) a country with less than 10 registered CDM projects at the starting date of validation; or (iii) a Small Island Developing States (SIDS); and

The data requirements for the application of step 5 above cannot be met.

The JPM choose option (a).

The combined margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = \omega_{OM} \times EF_{grid,OM,y} + \omega_{BM} \times EF_{grid,BM,y} \quad (9)$$

Where,

- $EF_{grid,BM,y}$ Build margin CO₂ emission factor in year y (tCO₂/MWh)
- $EF_{grid,OM,y}$ Operating margin CO₂ emission factor in year y (tCO₂/MWh)
- ω_{OM} Weighting of operating margin emissions factor (per cent)

ω_{BM} Weighting of build margin emissions factor (per cent)

The combined margin emissions factor $EF_{grid,CM,y}$ should be calculated as the weighted average of the Operating Margin emission factor ($EF_{grid,OM,y}$) and the Build Margin emission factor ($EF_{grid,BM,y}$), where $\omega_{OM} = 0.5$ and $\omega_{BM} = 0.5$ for all other projects (owing to their intermittent and non-dispatchable nature) for the first crediting period and $\omega_{OM}=0.25$ and $\omega_{BM} =0.75$ for the second and third crediting period.

For the project, the weight ω_{OM} and ω_{BM} are both 0.5 by default for the fixed crediting period. Thus, $EF_{grid,y} = EF_{grid,CM,y} = 0.8922 \text{ tCO}_2/\text{MWh} * 0.5 + 0.4407 \text{ tCO}_2/\text{MWh} * 0.5 = 0.6665 \text{ tCO}_2/\text{MWh}$

5.2 Project Emissions

According to the methodology AMS-III.D and AMS-I.D, project emissions consist of:

- (a) Physical leakage of biogas in the manure management systems which includes production, collection and transport of biogas to the point of flaring/combustion or gainful use ($PE_{PL,y}$);
- (b) Emissions from flaring or combustion of the gas stream ($PE_{flare,y}$);
- (c) CO₂ emissions from use of fossil fuels or electricity for the operation of all the installed facilities ($PE_{power,y}$);
- (d) CO₂ emissions from incremental transportation distances ($PE_{transp,y}$);
- (e) Emissions from the storage of manure before being fed into the anaerobic digester ($PE_{storage,y}$).

$$PE_y = PE_{PL,y} + PE_{flare,y} + PE_{power,y} + PE_{transp,y} + PE_{storage,y} \quad (10)$$

Where:

PE_y	Project emissions in year y (t CO ₂ e)
$PE_{PL,y}$	Emissions due to physical leakage of biogas in year y (t CO ₂ e)
$PE_{flare,y}$	Emissions from flaring or combustion of the biogas stream in the year y (t CO ₂ e)
$PE_{power,y}$	Emissions from the use of fossil fuel or electricity for the operation of the installed facilities in the year y (t CO ₂ e)
$PE_{transp,y}$	Emissions from incremental transportation in the year y (t CO ₂ e), as per relevant paragraph in AMS-III.AO
$PE_{storage,y}$	Emissions from the storage of manure (t CO ₂ e)

1. Emissions due to physical leakage of biogas in year y

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

$$PE_{PL,y} = 0.10 \times GWP_{CH_4} \times D_{CH_4} \times \sum_{i,LT} B_{0,LT} \times Q_{manure,LT,y} \times SVS_{LT,y} \times MS\%_{i,y} \quad (11)$$

Where:

GWP_{CH_4}	Global Warming Potential (GWP) of CH ₄ applicable to the crediting period (t CO ₂ e/t CH ₄)
D_{CH_4}	CH ₄ density (0.00067 t/m ³ at room temperature (20 °C) and 1 atm pressure)
LT	Index for all types of livestock
j	Index for animal manure management system
$Q_{manure,j,LT,y}$	Quantity of manure treated from livestock type LT at animal manure management system j (tonnes/year, dry basis)
$SVS_{j,LT,y}$	Specific volatile solids content of animal manure from livestock type LT and animal manure management system j in year y (tonnes/tonnes, dry basis)
$MS\%_{i,y}$	Fraction of manure handled in system i in year y . If the project activity involves sequential manure management systems, the procedure specified in paragraph 18(e) of AMS-III.D shall be used to estimate the project emissions due to physical leakage of biogas in each stage
$B_{0,LT}$	Maximum methane producing potential of the volatile solid generated for animal type LT (m ³ CH ₄ /kg-VS), as per paragraph 18 of AMS-III.D

2. Emissions from flaring or combustion of the biogas stream in the year y

In the case of flaring of the recovered biogas, project emissions are estimated using the procedures described in the methodological tool “Project emissions from flaring” (version 04.0). If the recovered biogas is combusted for electrical/thermal energy production or for other gainful use, the methane destruction efficiency can be considered as 100%. Therefore, the biogas flared by the project will be included in this calculation, while the biogas used for electricity will not be accounted for Emissions from flaring or combustion of the biogas stream in the year y since the methane destruction efficiency is 100%.

As per Project emissions from flaring (version 04.0), Emissions from flaring ($PE_{flare,y}$) should be calculated as follows:

$$PE_{flare,y} = GWP_{CH_4} \times \sum_{m=1}^{525600} F_{CH_4,RG,m} \times (1 - \eta_{flare,m}) \times 10^{-3} \quad (12)$$

Where:

$F_{CH_4,RG,m}$ = Mass flow of methane in the residual gas in the minute m (kg)

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

For the Mass flow of methane in the residual gas ($F_{CH_4,RG,m}$), $\sum_{m=1}^{525600} F_{CH_4,RG,m}$ is determined as follows:

$$\sum_{m=1}^{525600} F_{CH_4,RG,m} = BG_{flare,y} \times f_{CH_4,default} \times \rho_{CH_4} \quad (13)$$

Where:

$BG_{flare,y}$ = Biogas flared in year y (Nm³)

$f_{CH_4,default}$ = Fraction of methane in the biogas (m³CH₄/m³biogas), equals to parameter $w_{CH_4,y}$ in equation (17) below

ρ_{CH_4} = Density of methane at normal conditions (kgCH₄/Nm³CH₄), equals to parameter D_{CH_4} in equation (2) above

Based on the FSR, all the methane generated by the project will be used for power generation. In order to ensure no biogas is released under exigencies, an emergency flare system (Enclosed flare) is installed at the project site, this emergency flare system is used the biogas power plant is under maintenance or not available. Therefore, for ex-ante calculation $PE_{flare,y}$ is considered as zero. The actual biogas flared will be monitored during project operation and used for ex-post calculation.

3. Emissions from the use of fossil fuel or electricity for the operation of the installed facilities in the year y

Project emissions from electricity and fossil fuel consumption are determined by following the methodological tool “Project and leakage emissions from anaerobic digesters” (version 02.0), where $PE_{Power,y}$ is the sum of $PE_{EC,y}$ and $PE_{FC,y}$ in the tool.

The project does not use any fossil fuel, so $PE_{FC,y}$ is not included in the project emission.

According to methodological tool “Project and leakage emissions from anaerobic digesters”, $PE_{EC,y}$ shall be calculated using the “Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation” (version 03.0) as follows:

$$PE_{EC,y} = \sum_j EC_{PJ,j,y} \times EF_{EL,j,y} \times (1 + TDL_{j,y}) \quad (14)$$

Where:

$PE_{EC,y}$ Project emissions from electricity consumption in year y (t CO₂/ yr)

$EC_{PJ,j,y}$ Quantity of electricity consumed by the project electricity consumption source j in year y (MWh/yr)

$EF_{EL,j,y}$ 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
j	Sources of electricity consumption in the project

As stated above, according to the tool “Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation”(version 03.0), for the project is in the case of Scenario A: Electricity consumption from the grid, the project participants choose Option A1: Calculate the combined margin emission factor of the applicable electricity system, using the procedures in the latest approved version of the “Tool to calculate the emission factor for an electricity system” (version 07.0) ($EF_{EL,j,y} = EF_{grid,CM,y}$).

According to the tool “Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation” (version 03.0), the project belongs to the case of Scenario A, use as default values of 20% for project emission, i.e. $TDL_{j,y} = 20\%$.

4. Emissions from incremental transportation in the year y

Emissions from incremental transportation in the year y is calculated using “Option B: Using conservative default values” of the methodological tool “Project and leakage emissions from transportation of freight” (version 01.1.0). Parameter $PE_{TR,m}$ in the tool corresponds to the parameter $PE_{transp,y}$ of the project, which is calculated as follows:

$$PE_{transp,y} = \sum_f D_{f,m} \times FR_{f,m} \times EF_{CO_2,f} \times 10^{-6} \quad (15)$$

Where:

$PE_{transp,y}$	Emissions from incremental transportation in the year y (tCO ₂)
$D_{f,m}$	Return trip distance between the origin and destination of freight transportation activity f in monitoring period m (km)
$FR_{f,m}$	Total mass of freight transported in freight transportation activity f in monitoring period m (t)
$EF_{CO_2,f}$	Default CO ₂ emission factor for freight transportation activity f (g CO ₂ /t km)
f	Freight transportation activities conducted in the project activity in monitoring period m

5. Emissions from the storage of manure

Project emissions on account of storage of manure before being fed into the anaerobic digester shall be accounted for if both condition (a) and condition (b) below are satisfied:

- (a) The storage time of the manure after removal from the animal barns, including transportation, exceeds 24 hours before being fed into the anaerobic digester;
- (b) The dry matter content of the manure when removed from the animal barns is less than 20%.

According to the project design and the actual implementation, the storage time of the manure after removal from the animal barns, including transportation, is within 24 hours before being

fed into the anaerobic digester, hence emissions from the storage of manure is not accounted for, $PE_{storage,y} = 0 \text{ tCO}_2\text{e}$.

5.3 Leakage

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

Digestate from the anaerobic digesters of the project is used to produce organic fertilizer as soon as digestate is removed from the digesters. Digestate will not be stored under anaerobic conditions. In addition, the project does not involve composting of digestate. Therefore, leakage emissions of the project associated with the anaerobic digester is not accounted for.

5.4 Estimated Net GHG Emission Reductions and Removals

The emission reductions achieved by the project activity will be determined ex post through direct measurement of the amount of methane fuelled, flared or gainfully used. It is likely that the project activity involves manure treatment steps with higher methane conversion factors (MCF) than the MCF for the manure treatment systems used in the baseline situation, therefore the emission reductions achieved by the project activity are limited to the ex post calculated baseline emissions minus the project emissions using the actual monitored data for the project activity (i.e. $N_{LT,y}$, $MS\%_{i,y}$, $MS\%_l$, AI_l , as well as $VS_{LT,y}$ in cases where adjusted values for animal weight are used). The emission reductions achieved in any year are the lowest value of the following:

$$ER_{y,ex\ post} = \min\left[(BE_{y,ex\ post} - PE_{y,ex\ post}), (MD_y - PE_{power,y,ex\ post})\right] \quad (16)$$

Where:

$ER_{y,ex\ post}$	Emission reductions achieved by the project activity based on monitored values for year y (t CO ₂ e)
$BE_{y,ex\ post}$	Baseline emissions calculated using equation 1 (for projects using option in paragraph 17(a)) using ex post monitored values of $N_{LT,y}$ and if applicable $VS_{LT,y}$. For projects using option in paragraph 17(b), the ex post monitored values for $Q_{manure,j,LT,y}$ and $SVS_{j,LT,y}$ are used
$PE_{y,ex\ post}$	Project emissions calculated using equation (10) using ex post monitored values of $N_{LT,y}$, $MS\%_{i,y}$, $MS\%_l$, AI_l , $Q_{res\ waste,y}$ and if applicable $VS_{LT,y}$
MD_y	Methane captured and destroyed or used gainfully by the project activity in year y (t CO ₂ e)
$PE_{power,y,ex\ post}$	Emissions from the use of fossil fuel or electricity for the operation of the installed facilities based on monitored values in the year y (t CO ₂ e)

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

$$MD_y = BG_{burnt,y} \times w_{CH_4,y} \times D_{CH_4} \times FE \times GWP_{CH_4} \quad (17)$$

Where:

$BG_{burnt,y}$	=	Biogas flared or combusted in year y (m ³)
$w_{CH_4,y}$	=	Methane content in biogas in the year y (volume fraction)
FE	=	Flare efficiency in the year y (fraction)

Ex-ante calculation of GHG emission reductions

1. Calculation of baseline emissions:

The baseline emissions are calculated as follows:

$$BE_y = BE_{CH_4,y} + BE_{EC,y}$$

1.1 Baseline emissions of methane from the manure treatment process

Table 4-1 Ex-ante value of parameters for $BE_{CH_4,y}$

Parameter	Value	Data sources
D_{CH_4}	0.00067 t CH ₄ /m ³ CH ₄	AMS-III.D
UF_b	0.94	AMS-III.D
MCF_j	67%	2019 Refinement to 2006 IPCC guideline, volume 4, chapter 10, table 10.17
$B_{0,LT}$	Dairy Cows: 0.24 m ³ /kg VS Market swine: 0.45 m ³ /kg VS	2019 Refinement to 2006 IPCC guideline, volume 4, chapter 10, Table 10.16
GWP_{CH_4}	28	IPCC AR5
$Q_{manure,j,LT,y}$	Dairy Cows: 7,500,000 kg dm Market swine: 6,000,000 kg dm	Feasibility Study Report
$SVS_{j,LT,y}$	Dairy Cows: 0.7 kg VS/kg dm Market swine: 0.6 kg VS/kg dm	Feasibility Study Report

Hence, the ex-ante calculated baseline emissions of methane from the manure treatment processes of the project are:

$$BE_{CH_4,y} = GWP_{CH_4} \times D_{CH_4} \times UF_b \times \sum_{j,LT} MCF_j \times B_{0,LT} \times Q_{manure,j,LT,y} \times SVS_{j,LT,y}$$

$$\begin{aligned}
 &= 28 \text{ tCO}_2\text{e/tCH}_4 \times 0.00067 \text{ t CH}_4/\text{m}^3 \text{ CH}_4 \times 0.94 \times 67\% \times 0.24 \text{ m}^3 \text{ CH}_4/\text{kg-VS} \times 7,500,000 \text{ kg-dm} \\
 &\quad \times 0.7 \text{ kg-VS/kg-dm} + 67\% \times 0.45 \text{ m}^3 \text{ CH}_4/\text{kg-VS} \times 6,000,000 \text{ kg-dm} \times 0.6 \text{ kg-VS/kg-dm} \\
 &= 34,027 \text{ tCO}_2
 \end{aligned}$$

1.2 Baseline emissions associated with electricity generation

As pre the FSR, the annual exported electricity to the NWCPG of the project is expected to be 9,310 MWh, the combined margin CO₂ emission factor for the grid is 0.6665 tCO₂/MWh, hence the expected annual baseline emissions associated with electricity generation of the project is calculated as follows:

$$BE_{elec,y} = EG_{PJ,y} \times EF_{grid,y} = 9,310 \text{ MWh} \times 0.6665 \text{ tCO}_2/\text{MWh} = 6,205 \text{ tCO}_2$$

Hence, the baseline emission of the project is: $BE_y = BE_{CH_4,y} + BE_{EC,y} = 40,232 \text{ tCO}_2$

2. Calculation of project emissions

The project emissions of the project are calculated as follows:

$$\begin{aligned}
 PE_y &= PE_{PL,y} + PE_{flare,y} + PE_{power,y} + PE_{transp,y} + PE_{storage,y} \\
 &= 5,403 \text{ tCO}_2\text{e} + 0 \text{ tCO}_2\text{e} + 480 \text{ tCO}_2\text{e} + 1,129 \text{ tCO}_2\text{e} + 0 \text{ tCO}_2\text{e} = 7,012 \text{ tCO}_2\text{e}
 \end{aligned}$$

Calculation Details as follows:

2.1 Emissions due to physical leakage of biogas in year y

Project emissions due to physical leakage of biogas is calculated as below:

$$\begin{aligned}
 PE_{PL,y} &= 0.10 \times GWP_{CH_4} \times D_{CH_4} \times \sum_{i,LT} B_{0,LT} \times Q_{manure,LT,y} \times SVS_{LT,y} \times MS\%_{i,y} \\
 &= 0.1 \times 28 \text{ tCO}_2\text{e/tCH}_4 \times 0.00067 \times (0.24 \text{ m}^3 \text{ CH}_4/\text{kg-VS} \times 7,500,000 \text{ kg-dm} \times 0.7 \text{ kg-VS/kg-dm} \\
 &\quad \times 100\% + 0.45 \text{ m}^3 \text{ CH}_4/\text{kg-VS} \times 6,000,000 \text{ kg-dm} \times 0.6 \text{ kg-VS/kg-dm} \times 100\%) \\
 &= 5,403 \text{ tCO}_2\text{e}
 \end{aligned}$$

2.2 Emissions from flaring or combustion of the biogas stream in the year y

As stated in Section 5.2 above, it is assumed that all biogas recovered will be used for power generation, the methane destruction efficiency is considered as 100%, therefore, ex-ante calculation of $PE_{flare,y}$ is zero.

2.3 Emissions from the use of fossil fuel or electricity for the operation of the installed facilities in the year y

As per the FSR, the annual electricity consumption from the power grid is expected to be 600 MWh, the CO₂ emission factor for the grid is 0.6665 tCO₂/MWh, hence the expected annual baseline emissions associated with electricity generation of the project is calculated as follows:

$$PE_{EC,y} = \sum_j EC_{PJ,j,y} \times EF_{EL,j,y} \times (1 + TDL_{j,y})$$

$$= 600\text{MWh} \times 0.6665 \text{ tCO}_2/\text{MWh} \times (1+20\%) = 480 \text{ tCO}_2$$

2.4 Emissions from incremental transportation in the year y

The project is expected to collect 87,500 tonnes of animal manure waste annually from surrounding dairy farm and market swine farm located within 50km radius and transport to the project site by heavy vehicles, therefore, $PE_{transp,y}$ is ex ante calculated as follows:

$$PE_{transp,y} = \sum_f D_{f,m} \times FR_{f,m} \times EF_{CO_2,f} \times 10^{-6}$$

$$= 87,500 \text{ t} \times 100\text{km} \times 129 \text{ g CO}_2/\text{t km} \times 10^{-6} = 1,129 \text{ tCO}_2$$

3. Calculation of emission reductions

Annual emission reductions of the project can be calculated as follows:

Year	Estimated baseline emissions or removals (tCO _{2e})	Estimated project emissions or removals (tCO _{2e})	Estimated leakage emissions (tCO _{2e})	Estimated net GHG emission reductions or removals (tCO _{2e})
01-Aug-2021 to 31-Dec-2021	16,864	2,939	0	13,925
01-Jan-2022 to 31-Dec-2022	40,232	7,012	0	33,220
01-Jan-2023 to 31-Dec-2023	40,232	7,012	0	33,220
01-Jan-2024 to 31-Dec-2024	40,232	7,012	0	33,220
01-Jan-2025 to 31-Dec-2025	40,232	7,012	0	33,220
01-Jan-2026 to 31-Dec-2026	40,232	7,012	0	33,220
01-Jan-2027 to 31-Dec-2027	40,232	7,012	0	33,220

01-Jan-2028 to 31-July-2028	23,368	4,073	0	19,295
Total	281,624	49,084	0	232,540

6 MONITORING

6.1 Data and Parameters Available at Validation

Data / Parameter	GWP_{CH_4}
Data unit	t CO ₂ e/t CH ₄
Description	Global Warming Potential (GWP) of CH ₄ applicable to the crediting period
Source of data	IPCC
Value applied	28
Justification of choice of data or description of measurement methods and procedures applied	Default value of 28 from IPCC Fifth Assessment Report (AR5). Shall be updated according to any future COP/MOP decisions
Purpose of Data	Calculation of baseline emissions and project emissions
Comments	-

Data / Parameter	$D_{CH_4} (\rho_{CH_4})$
Data unit	t/m ³
Description	CH ₄ density
Source of data	AMS-III.D
Value applied	0.00067 (at 20 °C and 1 atm pressure)
Justification of choice of data or description of measurement methods and procedures applied	-
Purpose of Data	Calculation of baseline emissions and project emissions

Comments	-
Data / Parameter	UF_b
Data unit	-
Description	Model correction factor to account for model uncertainties
Source of data	AMS-III.D
Value applied	0.94
Justification of choice of data or description of measurement methods and procedures applied	-
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	MCF_j
Data unit	-
Description	Annual methane conversion factor (MCF) for the baseline animal manure management system j
Source of data	2019 Refinement to 2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied	67%
Justification of choice of data or description of measurement methods and procedures applied	<p>No country or regional specific value is available. Default value from table 10.17 of 2019 Refinement to 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 10 is applied.</p> <p>The project location has a mean annual temperature (MAT) of 7 degree Celsius and mean annual precipitation to potential evapotranspiration ratio (MAP:PET) lower than 1¹⁰, which falls under the Cool Temperate Dry Zone, a default value of 67% is chosen for MCF_j</p>
Purpose of Data	Calculation of baseline emissions
Comments	-

¹⁰ <http://www.weather.com.cn/cityintro/101160701.shtml>

Data / Parameter	$B_{0,LT}$							
Data unit	$m^3 CH_4/kg-VS$							
Description	Maximum methane producing potential of the volatile solid generated for animal type LT							
Source of data	2019 Refinement to 2006 IPCC Guidelines for National Greenhouse Gas Inventories							
Value applied	<table border="1"> <thead> <tr> <th>Animal type</th> <th>$B_{0,LT}$</th> </tr> </thead> <tbody> <tr> <td>Dairy Cows</td> <td>0.24</td> </tr> <tr> <td>Market Swine</td> <td>0.45</td> </tr> </tbody> </table>	Animal type	$B_{0,LT}$	Dairy Cows	0.24	Market Swine	0.45	
Animal type	$B_{0,LT}$							
Dairy Cows	0.24							
Market Swine	0.45							
Justification of choice of data or description of measurement methods and procedures applied	For the project, the country specific B_0 values are not available, therefore the default values from 2019 Refinement to 2006 IPCC guideline, volume 4, chapter 10, Table 10.16 are applied. The dairy farms and market swine farms involved in the project are all high-performance systems which are 100% market oriented with high yielding and high level of overall herd (flock) performance confinement productions system. Therefore, default values for high-performance systems in other regions are chosen for the project.							
Purpose of Data	Calculation of baseline emissions and project emissions							
Comments	-							

Data / Parameter	$MS\%_{i,y}$	
Data unit	-	
Description	Fraction of manure handled in system i in year y	
Source of data	AMS-III.D	
Value applied	100%	
Justification of choice of data or description of measurement methods and procedures applied	The project does not involve sequential manure management system, hence all manure would be handled in system i, 100% is applied for $MS\%_{i,y}$	
Purpose of Data	Calculation of project emissions	
Comments	-	

Data / Parameter	$EF_{CO_2,f}$
Data unit	g CO ₂ /t km
Description	Default CO ₂ emission factor for freight transportation activity f
Source of data	CDM tool12
Value applied	129
Justification of choice of data or description of measurement methods and procedures applied	The project vehicles used for animal manure transport have a Gross vehicle mass (GVM) of 31 tonnes, which fall under the category of Heavy Vehicles. Therefore, the Default CO ₂ emission factor for heavy vehicles is chosen.
Purpose of Data	Calculation of project emissions
Comments	-

Data / Parameter	$EF_{grid,OM,y}$
Data unit	t CO ₂ /MWh
Description	Operating margin CO ₂ emission factor in year y
Source of data	Calculated based on Tool to calculate the emission factor for an electricity system (version 07.0) <i>2019 Baseline Emission Factors for Regional Power Grids in China</i> published by Ministry of Ecology and Environment of China ¹¹ for Northwest China Power Grid
Value applied	0.8922
Justification of choice of data or description of measurement methods and procedures applied	Official and authoritative statistic data.
Purpose of Data	Calculation of baseline emissions and project emissions
Comments	According to section 4.1, the ex ante option is selected to calculate $EF_{grid,OM,y}$ and fixed in the crediting period.

Data / Parameter	$EF_{grid,BM,y}$
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¹¹ https://www.mee.gov.cn/ywgz/ydqhbh/wsqtz/202012/t20201229_815386.shtml

Data unit	t CO ₂ /MWh
Description	Build margin CO ₂ emission factor in year y
Source of data	Calculated based on Tool to calculate the emission factor for an electricity system (version 07.0) <i>2019 Baseline Emission Factors for Regional Power Grids in China</i> published by Ministry of Ecology and Environment of China ¹¹ for Northwest China Power Grid
Value applied	0.4407
Justification of choice of data or description of measurement methods and procedures applied	Official and authoritative statistic data.
Purpose of Data	Calculation of baseline emissions and project emissions
Comments	According to section 4.1, the ex ante option is selected to calculate $EF_{grid,BM,y}$ and fixed in the crediting period.

Data / Parameter	$EF_{grid,CM,y} (EF_{grid,y}, EF_{EL,j,y})$
Data unit	t CO ₂ /MWh
Description	Combined margin emission factor for the grid in year y
Source of data	Calculated based on Tool to calculate the emission factor for an electricity system (version 07.0) <i>2019 Baseline Emission Factors for Regional Power Grids in China</i> published by Ministry of Ecology and Environment of China ¹¹ for Northwest China Power Grid
Value applied	0.6665
Justification of choice of data or description of measurement methods and procedures applied	$EF_{grid,CM,y}$ is calculated based on $EF_{grid,OM,y}$ and $EF_{grid,BM,y}$ as per the latest version of “Tool to calculate the emission factor for an electricity system”
Purpose of Data	Calculation of baseline emissions and project emissions
Comments	According to section 4.1, the ex ante option is selected to calculate $EF_{grid,OM,y}$ and $EF_{grid,BM,y}$ and fixed in the crediting period, thus the $EF_{grid,CM,y}$ is fixed during the crediting period.

Data / Parameter	WOM, WBM
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Data unit	-
Description	Weighting of operating margin emissions factor (w_{OM}) Weighting of build margin emissions factor (w_{BM})
Source of data	CDM TOOL07: Tool to calculate the emission factor for an electricity system (version 07.0)
Value applied	0.5 for both parameters
Justification of choice of data or description of measurement methods and procedures applied	As per CDM TOOL07, default value of 0.5 for w_{OM} and w_{BM} for all projects other than wind and solar power projects for the 1 st crediting period. The project is not a wind or solar power project, and this is the first crediting period of the project, therefore 0.5 is applied for w_{OM} and w_{BM}
Purpose of Data	Calculation of baseline emissions and project emissions
Comments	-

6.2 Data and Parameters Monitored

Data / Parameter	$Q_{manure,j,LT,y}$
Data unit	kg-dm/year
Description	Quantity of manure treated from livestock type LT at animal manure management system j (dry basis)
Source of data	Records by project participants
Description of measurement methods and procedures to be applied	Quantity of manure (wet basis) is measured by electric truck scale at the project site daily. Dry matter content of manure (wet basis) is measured by electric scale as per GB/T25169 Technical specifications for monitoring of animal manure by lab staff daily
Frequency of monitoring/recording	Annually, based on daily measurement and monthly aggregation
Value applied	Dairy Cow: 7,500,000 (Ex-ante value) Market swine: 6,000,000 (Ex-ante value)
Monitoring equipment	Electric truck scale, electric scale
QA/QC procedures to be applied	Monitoring equipment is to be calibrated annually as per national regulations. The quantity of animal manure from different farms and different animal types are recorded for crosscheck.
Purpose of data	Calculation of baseline emissions and project emissions

Calculation method	Quantity of manure (dry basis) = Quantity of manure (wet basis) × Dry matter content of manure (wet basis)
Comments	-

Data / Parameter	$SVS_{j,LT,y}$
Data unit	Kg VS/kg-dm
Description	Specific volatile solids content of animal manure from livestock type LT and animal manure management system j in year y
Source of data	Records by project participants
Description of measurement methods and procedures to be applied	<p>As per the applied methodology AMS-III.D, if animal manure is treated in a centralized plant, as the case in paragraph 17(b), testing shall be performed according to the guideline in annex 2 of AM0073. This project is a centralized animal manure waste treatment project, thus $SVS_{j,LT,y}$ is tested as per the guideline in annex 2 of AM0073.</p> <p>Method for determination of Volatile Solids in animal waste</p> <p>From: USDA. Agricultural Waste Management Field Handbook. Chapter 4 - Agricultural Waste Characteristics. Page 2.</p> <p><u>Definitions</u></p> <ul style="list-style-type: none"> • Total Solids: Residue remaining after water is removed from waste material by evaporation; dry matter; • Volatile Solids: The part of total solids driven off as volatile (combustible) gases when heated to 600°C; organic matter; • Fixed Solids: The part of total solids remaining after volatile gases driven off at 600°C; ashes. <p><u>Determination method</u></p> <p>1 - Evaporate free water on steam able and dry in oven at 103 °C for 24 hours or until constant weight to obtain the Total Solids.</p> <p>2 - Place Total Solids residue in furnace at 600°C for at least 1 hour. Volatile Solids are determined from weight difference of total and Fixed Solids.</p> $\text{Volatile matter (dry basis)} = \frac{W_2 - W_f}{W_2 - W_1}$ <p>Where W1 is the weight of sample container, W2 is combined weight of the sample container and oven dried sample, W_f is the combined constant weight of the sample container and sample after heating at 600°C</p>

Frequency of monitoring/recording	Annually, based on daily measurement and monthly aggregation
Value applied	Dairy Cow: 0.7 (Ex-ante value) Market swine: 0.6 (Ex-ante value)
Monitoring equipment	Electric scales
QA/QC procedures to be applied	Monitoring equipment will be calibrated annually as per national regulations
Purpose of data	Calculation of baseline emissions and project emissions
Calculation method	-
Comments	-

Data / Parameter	$EG_{P,y}$
Data unit	MWh
Description	Quantity of electricity generation supplied by the project to the grid in year y
Source of data	Records by project participants
Description of measurement methods and procedures to be applied	Measured by electricity meter continuously and monthly recorded
Frequency of monitoring/recording	Continuous monitoring and at least monthly recording
Value applied	9,310 (Ex-ante value)
Monitoring equipment	Electricity meter
QA/QC procedures to be applied	The accuracy class of electricity meter is in accordance with national standards. The electricity meter will be calibrated annually as per national regulations. Electricity sales receipts will be used for cross check.
Purpose of data	Calculation of baseline emissions
Calculation method	-
Comments	Electricity imported from the grid will be used to calculate project emission using equation (14), hence electricity imported from the grid

	will not be deducted from electricity supplied to the grid by the project directly
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Data / Parameter	$EC_{P,j,y}$
Data unit	MWh
Description	Quantity of electricity consumed by the project in year y
Source of data	Electricity invoice issued by the grid company
Description of measurement methods and procedures to be applied	Continuously measured by electricity meter and at least monthly recorded
Frequency of monitoring/recording	Continuously measured and monthly recorded
Value applied	600 (Ex-ante value)
Monitoring equipment	Electricity meter
QA/QC procedures to be applied	The accuracy class of electricity meter is in accordance with national standards. The electricity meter is calibrated annually as per national regulations.
Purpose of data	Calculation of project emissions
Calculation method	-
Comments	-

Data / Parameter	$TDL_{j,y}$
Data unit	-
Description	Average technical transmission and distribution losses for providing electricity to source j in year y
Source of data	Am-tool-05-v3.0 Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation (version 03.0)
Description of measurement methods and procedures to be applied	The project belongs to scenario A of am-tool-05-v3.0. There's no available annual average value of technical transmission and distribution losses in China, a default value of 20% is applied for project emission calculation

Frequency of monitoring/recording	Annually
Value applied	20%
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of data	Calculation of project emissions
Calculation method	-
Comments	-

Data / Parameter	$BG_{burnt,y}$
Data unit	m ³
Description	Biogas flared or combusted in year y
Source of data	Records by project participants
Description of measurement methods and procedures to be applied	<p>The amount of biogas recovered and flared or combusted shall be monitored ex post by flow meters.</p> <p>Continuously measured by flow meters. The meter readings are automatically converted to value at room temperature (20 °C) and 1 atm pressure.</p> <p>The biogas flared by the project ($BG_{flare,y}$) and the biogas used for power generation ($BG_{elec,y}$) will be monitored separately by different flow meters. The sum of the biogas flared by the project ($BG_{flare,y}$) and the biogas used for power generation ($BG_{elec,y}$) is the biogas flared or combusted in year y ($BG_{burnt,y}$)</p>
Frequency of monitoring/recording	Annually, based on continuous flow measurement with accumulated volume recording (e.g. daily accumulated reading)
Value applied	Ex-post monitored, no ex-ante value needed
Monitoring equipment	Flow meter(s)
QA/QC procedures to be applied	Flow meter is calibrated at periodic interval as per national regulations
Purpose of data	Calculation of emission reductions
Calculation method	-

Comments	-
Data / Parameter	$D_{f,m}$
Data unit	km
Description	Return trip distance between the origin and destination of freight transportation activity f in monitoring period m
Source of data	Records by project participants
Description of measurement methods and procedures to be applied	Determined once for each freight transportation activity f for a reference trip using the vehicle odometer or any other appropriate sources (e.g. on-line sources)
Frequency of monitoring/recording	To be updated whenever the distance changes
Value applied	100 (Ex-ante value)
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of data	Calculation of project emissions
Calculation method	-
Comments	-
Data / Parameter	$FR_{f,m}$
Data unit	Tonnes
Description	Total mass of freight transported in freight transportation activity f in monitoring period m
Source of data	Records by project participants
Description of measurement methods and procedures to be applied	Measured by Electric truck scale
Frequency of monitoring/recording	Continuously

Value applied	87,500 (Ex-ante value)
Monitoring equipment	Electric truck scale
QA/QC procedures to be applied	Monitoring equipment is to be calibrated annually as per national regulation
Purpose of data	Calculation of project emissions
Calculation method	-
Comments	-

Data / Parameter	$w_{CH_4,y} (f_{CH_4,default})$
Data unit	%
Description	Methane content in biogas in the year y
Source of data	AMS-III.D default value
Description of measurement methods and procedures to be applied	Default value of 60% is applied as per AMS-III.D
Frequency of monitoring/recording	-
Value applied	60%
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of data	Calculation of emission reductions and project emissions
Calculation method	-
Comments	-

Data / Parameter	$FE (\eta_{flare,m})$
Data unit	%
Description	The flare efficiency

Source of data	Project emissions from flaring (version 04.0)
Description of measurement methods and procedures to be applied	<p>As per para. 22 of the applied methodology, if the recovered biogas is combusted for electrical/thermal energy production or for other gainful use, the methane destruction efficiency can be considered as 100%. Therefore, the methane destruction efficiency of biogas used for power generation is 100%.</p> <p>As for flaring, the project uses enclosed flares, and the project chose option A of Project emissions from flaring (version 04.0) for the determination of flare efficiency. The flare efficiency of the project is determined as 90% since the enclosed flare applied by the project is not low height flare and the project meets the following two conditions when in operating:</p> <ul style="list-style-type: none"> • The temperature of the flare and the flow rate of the residual gas to the flare is within the manufacturer’s specification for the flare; and • The flame is detected in minute m.
Frequency of monitoring/recording	-
Value applied	90% for flaring (for FE and $\eta_{flare,m}$) 100% for power generation
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of data	Calculation of emission reductions and project emissions
Calculation method	-
Comments	-

6.3 Monitoring Plan

The monitoring plan presented in this JPM assures that real, measurable, long-term GHG emission reductions can be monitored, recorded and reported. It is a crucial procedure to identify the final VCUs of the project. This monitoring plan will be implemented by the project owner during the project operation. The details of the monitoring plan are specified as follows:

(A) Monitoring structure

The Project owner organizes a specific VCS team in project development department to be responsible for data collection, supervision and witness the whole process of data measuring and recording. A VCS manager is appointed to take full responsibility for the overall monitoring of the project. The monitoring and measurement are to be carried out by designated monitoring

officers. In addition, the Project developer appoints internal verifiers who is responsible for internal check of the measurement, collection of relevant receipts and invoices, and the calculation of the emission reductions. A monitoring and management manual of the project that identifies detailed duties and responsibilities of the relevant parties is developed and served as the basis of the project monitoring. Figure 5-1 shows the operation and management structure of the Project.

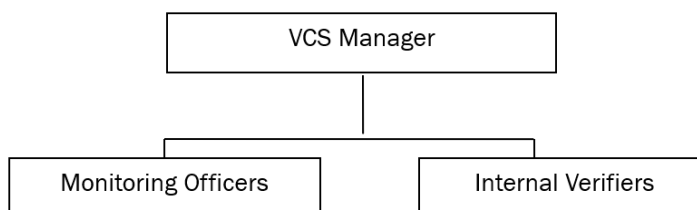


Figure 5-1 Operation and management structure of the project

(B) Data and parameters to be monitored

Data and parameters to be monitored are listed below. Figure 5-2 shows the positions of the monitoring instruments and Table 5-1 lists the corresponding parameters monitored:

Table 5-1 Data and parameters to be monitored

Monitoring point	Parameters Monitored	Description
E1	$Q_{manure,j,LT,y}$	Quantity of manure treated from livestock type LT at animal manure management system j (dry basis), calculated as follows: Quantity of manure (dry basis) = Quantity of manure (wet basis) × Dry matter content of manure (wet basis) Quantity of manure (wet basis) is measured by electric truck scale. Dry matter content of manure (wet basis) is measured by electric scale as per GB/T25169 Technical specifications for monitoring of animal manure
E2	$SVS_{j,LT,y}$	Specific volatile solids content of animal manure from livestock type LT and animal manure management system j in year y is measured as per the guideline in annex 2 of AM0073
E3	$EG_{P,j,y}$	Quantity of electricity generation supplied by the project to the grid in year y is measured by electricity meter continuously and monthly recorded
E4	$EC_{P,j,y}$	Quantity of electricity consumed by the project in year y is continuously measured by electricity meter and monthly recorded

E5	$BG_{burnt,y}$	Biogas flared or combusted in year y is monitored by flow meters continuously, which includes two parts: The biogas flared by the project ($BG_{flare,y}$) and the biogas used for power generation ($BG_{elec,y}$) will be monitored separately by different flow meters. The sum of the biogas flared by the project ($BG_{flare,y}$) and the biogas used for power generation ($BG_{elec,y}$) is the biogas flared or combusted in year y ($BG_{burnt,y}$)
E6	$FR_{f,m}$	Total mass of freight transported in freight transportation activity f in monitoring period m is measured by Electric truck scale
	$D_{f,m}$	Return trip distance between the origin and destination of freight transportation activity f in monitoring period m is determined once for each freight transportation activity f for a reference trip using the vehicle odometer or any other appropriate sources (e.g. on-line sources)
E7 (These 3 parameters do not require monitoring equipment, hence not shown in Figure 5-2 below)	$TDL_{j,y}$	Average technical transmission and distribution losses for providing electricity to source j in year y applies a default value of 20%. No monitoring equipment is required.
	$W_{CH_4,y}$ ($f_{CH_4,default}$)	Methane content in biogas in the year y applies a default value of 60%, no monitoring equipment is required.
	FE ($\eta_{flare,m}$)	The flare efficiency applies default value of 90% for biogas flared, and 100% for biogas for power generation. No monitoring equipment is required.

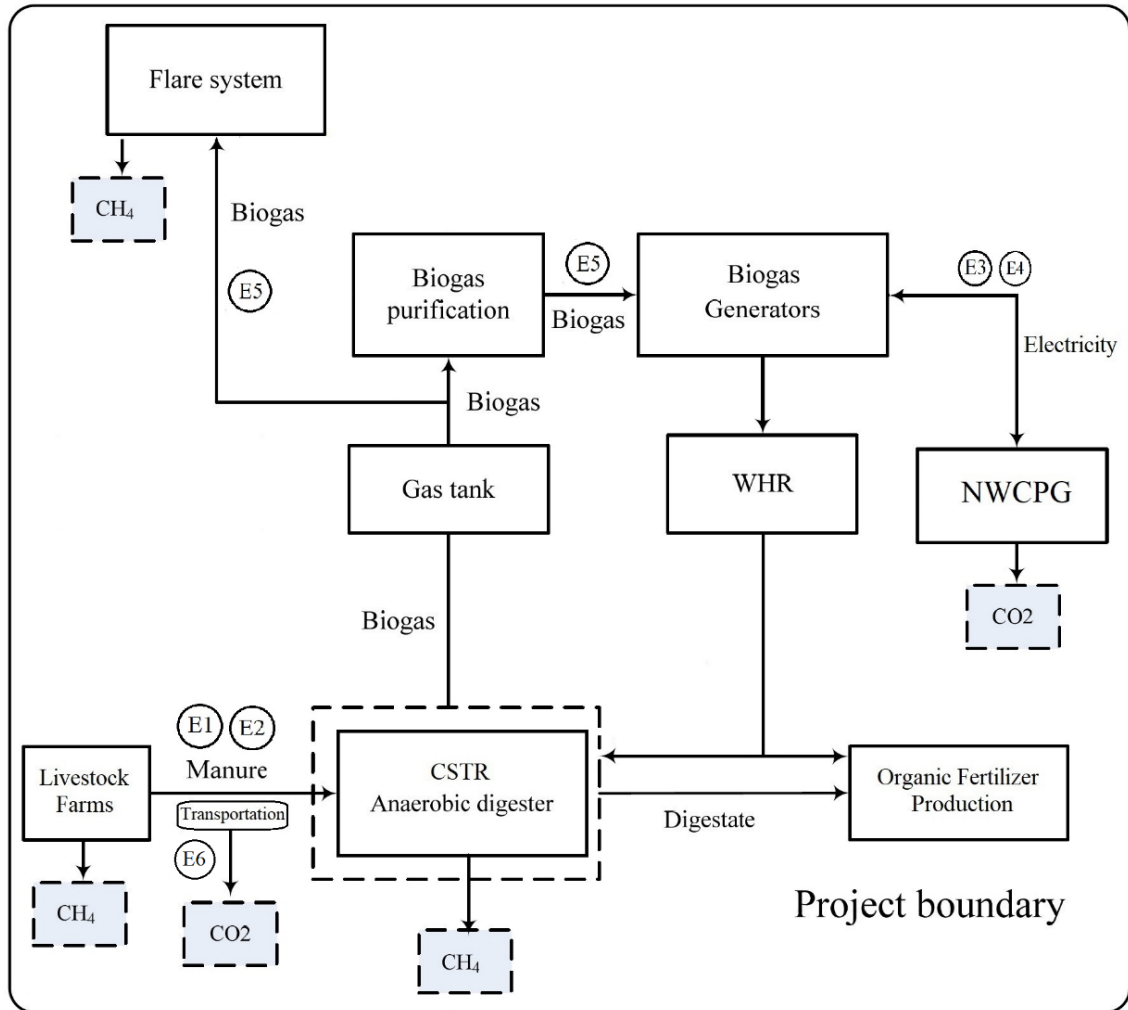


Figure 5-2 Project monitoring diagram

(C) Data collection

Monitoring officers are responsible for data collection. Designated teams read and collect the monitored data regularly. The monthly records serve as the main data source for emission reductions calculation. All data files, relevant receipts are collected by a designated monitoring officer, who prepares backup in time and archive all documents properly.

(D) Quality assurance

All metering equipment for monitoring are chosen in accordance with VCS requirements and have been calibrated regularly for accuracy by qualified party according to the national regulations. To assist in future verifications, the Project owner preserve the calibration records, along with the data files of project monitoring.

Error check routines have been established on site and at the point of data storage to detect data measuring/transmission failures as well as malfunctions. In case of malfunction of the meters,

the meter supplier will provide technical support to engage the problem promptly and emission reductions during the corresponding period will be calculated conservatively.

The installation of the electricity metering equipment fulfills the requirements of “*DL/T448-2016 Technical Administrative Code of Electric Energy Metering*”. The accuracy should not be lower than 0.5. The installation of flow meters complies the national standard (JJG1132-2017). All the meters have been checked and maintained periodically.

(E) Data file management

All monitoring data will be electronically filed by the end of each month and the electronic data files will be archived in both disk copy and printed hard copy. All data collected as part of monitoring will be archived electronically and be kept at least for 2 years after the end of the crediting period. The Project owner will provide original records and documents if necessary.

7 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

7.1 Data and Parameters Monitored

Data / Parameter	$Q_{manure,j,LT,y}$																		
Data unit	kg-dm/year																		
Description	Quantity of manure treated from livestock type LT at animal manure management system j (dry basis)																		
Value applied:	$Q_{manure,j,LT,y}$	Dairy Cow	Market swine																
	2021	591,078	1,317,343																
	2022	1,603,320	2,459,310																
	The calculation process of $Q_{manure,j,LT,y}$ from wet basis to dry basis is as follows:																		
	<table border="1"> <thead> <tr> <th>Dairy Cow</th> <th>$Q_{manure\ wet,j,LT,y}$ (t)</th> <th>Dry matter content</th> <th>$Q_{manure,j,LT,y}$ (kg-dm)</th> </tr> </thead> <tbody> <tr> <td></td> <td>A</td> <td>B</td> <td>$C=A*1000*B$</td> </tr> <tr> <td>2021</td> <td>3,745</td> <td>15.78</td> <td>591,078</td> </tr> <tr> <td>2022</td> <td>10,315</td> <td>15.54</td> <td>1,603,320</td> </tr> </tbody> </table>	Dairy Cow	$Q_{manure\ wet,j,LT,y}$ (t)	Dry matter content	$Q_{manure,j,LT,y}$ (kg-dm)		A	B	$C=A*1000*B$	2021	3,745	15.78	591,078	2022	10,315	15.54	1,603,320		
Dairy Cow	$Q_{manure\ wet,j,LT,y}$ (t)	Dry matter content	$Q_{manure,j,LT,y}$ (kg-dm)																
	A	B	$C=A*1000*B$																
2021	3,745	15.78	591,078																
2022	10,315	15.54	1,603,320																
	<table border="1"> <thead> <tr> <th>Market swine</th> <th>$Q_{manure\ wet,j,LT,y}$ (t)</th> <th>Dry matter content</th> <th>$Q_{manure,j,LT,y}$ (kg-dm)</th> </tr> </thead> <tbody> <tr> <td></td> <td>A</td> <td>B</td> <td>$C=A*1000*B$</td> </tr> <tr> <td>2021</td> <td>13,940</td> <td>9.45</td> <td>1,317,343</td> </tr> <tr> <td>2022</td> <td>27,875</td> <td>8.82</td> <td>2,459,310</td> </tr> </tbody> </table>	Market swine	$Q_{manure\ wet,j,LT,y}$ (t)	Dry matter content	$Q_{manure,j,LT,y}$ (kg-dm)		A	B	$C=A*1000*B$	2021	13,940	9.45	1,317,343	2022	27,875	8.82	2,459,310		
Market swine	$Q_{manure\ wet,j,LT,y}$ (t)	Dry matter content	$Q_{manure,j,LT,y}$ (kg-dm)																
	A	B	$C=A*1000*B$																
2021	13,940	9.45	1,317,343																
2022	27,875	8.82	2,459,310																
Comments	Quantity of manure treated from livestock type LT at animal manure management system j (dry basis) is calculated as follows: Quantity of manure (dry basis) = Quantity of manure (wet basis) × Dry matter content of manure (wet basis) Quantity of manure (wet basis) is measured by electric truck scale at the project site daily. Dry matter content of manure (wet basis) is measured by electric scale as per GB/T25169 Technical specifications for monitoring of animal manure by lab staff daily. The monitored data were recorded in the monthly operation records. All monitoring equipment have been properly calibrated annually, detailed in the table below.																		

	The quantity of manure (wet basis) has been crosschecked with transportation records of animal manure waste from livestock farms.		
	Monitoring equipment	Electric truck scale	Electric scale
	Mode	SCS-30-QC	YP-B20002
	Serial No.	100816	22165028
	Accuracy	Class III	Class I
	Calibration Date	21-Jun-2021 02-Jun-2022	31-Mar-2021 31-Mar-2022
	Calibration Validity	20-Jun-2022 01-Jun-2023	30-Mar-2022 30-Mar-2023

Data / Parameter	SVS _{j,LT,y}														
Data unit	Kg VS/kg-dm														
Description	Specific volatile solids content of animal manure from livestock type LT and animal manure management system j in year y														
Value applied:	Year	Dairy Cow	Market swine												
	2021	0.671	0.583												
	2022	0.681	0.580												
Comments	<p>This parameter was monitored separately for animal manure of dairy cow and market swine as per the guideline in annex 2 of AM0073 daily by lab staff daily and recorded in the monthly operation records.</p> <p>The monitoring equipment has been properly calibrated annually, detailed in the table below.</p> <table border="1"> <tr> <td>Monitoring equipment</td> <td>Electric scale</td> </tr> <tr> <td>Mode</td> <td>YP-B20002</td> </tr> <tr> <td>Serial No.</td> <td>22165028</td> </tr> <tr> <td>Accuracy</td> <td>Class I</td> </tr> <tr> <td>Calibration Date</td> <td>31-Mar-2021 31-Mar-2022</td> </tr> <tr> <td>Calibration Validity</td> <td>30-Mar-2022 30-Mar-2023</td> </tr> </table>			Monitoring equipment	Electric scale	Mode	YP-B20002	Serial No.	22165028	Accuracy	Class I	Calibration Date	31-Mar-2021 31-Mar-2022	Calibration Validity	30-Mar-2022 30-Mar-2023
Monitoring equipment	Electric scale														
Mode	YP-B20002														
Serial No.	22165028														
Accuracy	Class I														
Calibration Date	31-Mar-2021 31-Mar-2022														
Calibration Validity	30-Mar-2022 30-Mar-2023														

Data / Parameter	$EG_{P,j,y}$	
Data unit	MWh	
Description	Quantity of electricity generation supplied by the project to the grid in year y	
Value applied:	2021	0
	2022	0
Comments	<p>During this monitoring period, no electricity was supplied to the power grid as the grid-connection switch cabinet has not been retrofitted and upgraded to meet the technical requirements of the power grid company. Therefore, no monitoring equipment is involved in this monitoring period.</p> <p>The information of monitoring equipment will be reported in future verification, in case the monitoring equipment is available then.</p>	

Data / Parameter	$EC_{P,j,y}$											
Data unit	MWh											
Description	Quantity of electricity consumed by the project in year y											
Value applied:	2021	65.112										
	2022	169.572										
Comments	<p>This parameter is monitored continuously by electricity meter installed at the project site, and the meter readings were recorded in the electricity sales receipts monthly.</p> <p>The accuracy class of the electricity meter complies with national standard DL/T448-2016. And the electricity meter has been calibrated annually, details as follows:</p> <table border="1"> <tr> <td>Monitoring equipment</td> <td>Electricity meter</td> </tr> <tr> <td>Mode</td> <td>DSZ110</td> </tr> <tr> <td>Serial No.</td> <td>6230001000001189498426</td> </tr> <tr> <td>Accuracy</td> <td>0.5S</td> </tr> <tr> <td>Calibration Date</td> <td>11-June-2021</td> </tr> </table>		Monitoring equipment	Electricity meter	Mode	DSZ110	Serial No.	6230001000001189498426	Accuracy	0.5S	Calibration Date	11-June-2021
Monitoring equipment	Electricity meter											
Mode	DSZ110											
Serial No.	6230001000001189498426											
Accuracy	0.5S											
Calibration Date	11-June-2021											

	22-May-2022
Calibration Validity	10-June-2022 21-May-2023

Data / Parameter	$TDL_{j,y}$
Data unit	-
Description	Average technical transmission and distribution losses for providing electricity to source j in year y
Value applied:	20%
Comments	The project belongs to scenario A of am-tool-05-v3.0. There's no available annual average value of technical transmission and distribution losses in China, a default value of 20% is applied for project emission calculation

Data / Parameter	$BG_{burnt,y}$			
Data unit	m ³			
Description	Biogas flared or combusted in year y			
Value applied:	Year	$BG_{flare,y}$	$BG_{elec,y}$	$BG_{burnt,y}$
	2021	879,102	0	879,102
	2022	1,159,378	453,963	1,613,341
Comments	<p>The biogas flared or combusted in year y ($BG_{burnt,y}$) consists of two parts: the biogas flared by the project ($BG_{flare,y}$) and the biogas used for power generation ($BG_{elec,y}$), which are monitored continuously by the flow meters installed at the biogas pipeline leading to the flare and the biogas generators respectively. The meter readings are automatically converted to value at room temperature (20 °C) and 1 atm pressure. The meter readings were recorded daily in the monthly operation records.</p> <p>The two flows meters have been properly calibrated every two years as per national standard.</p>			
	Monitoring equipment	Flow meter ($BG_{flare,y}$)	Flow meter ($BG_{elec,y}$)	

	Mode	KZR/DC-1AL	KZR/DC-1AL
	Serial No.	2020072020	2020072019
	Accuracy	±1.5%	±1.5%
	Calibration Date	21-July-2021	21-July-2021
	Calibration Validity	20-July-2023	20-July-2023

Data / Parameter	$D_{f,m}$
Data unit	km
Description	Return trip distance between the origin and destination of freight transportation activity f in monitoring period m
Value applied:	100
Comments	<p>The return trip distance between the livestock farms and the project site have been determined as per online map system for each transportation activity.</p> <p>The outcome shows that the return trip distance between the farthest animal farm and the project site is within 100 km. To simplify the ER calculation and monitoring, 100km is chosen for ER calculation for all transportation activities, which is conservative.</p> <p>The distance will be updated in case the distance changes in future.</p>

Data / Parameter	$FR_{f,m}$						
Data unit	Tonnes						
Description	Total mass of freight transported in freight transportation activity f in monitoring period m						
Value applied:	<table border="1"> <thead> <tr> <th>Year</th> <th>$FR_{f,m}$</th> </tr> </thead> <tbody> <tr> <td>2021</td> <td>17,685</td> </tr> <tr> <td>2022</td> <td>38,190</td> </tr> </tbody> </table>	Year	$FR_{f,m}$	2021	17,685	2022	38,190
Year	$FR_{f,m}$						
2021	17,685						
2022	38,190						
Comments	The parameter is monitored by electric truck scale installed at the project site continuously for each truck of animal manure transported						

	into the project site and recorded in the transportation records of animal manure waste from livestock farms by project staffs.	
	The electric truck scale has been calibrated annually as per national standard.	
	Monitoring equipment	Electric truck scale
	Mode	SCS-30-QC
	Serial No.	100816
	Accuracy	Class III
	Calibration Date	21-Jun-2021 02-Jun-2022
Calibration Validity	20-Jun-2022 01-Jun-2023	

Data / Parameter	$w_{CH_4,y} (f_{CH_4,default})$
Data unit	%
Description	Methane content in biogas in the year y
Value applied:	60%
Comments	Default value of 60% is applied as per AMS-III.D

Data / Parameter	$FE (\eta_{flare,m})$
Data unit	%
Description	The flare efficiency
Value applied:	90% for flaring (for FE and $\eta_{flare,m}$) 100% for power generation
Comments	As per para. 22 of the applied methodology, if the recovered biogas is combusted for electrical/thermal energy production or for other gainful use, the methane destruction efficiency can be considered as 100%. Therefore, the methane destruction efficiency of biogas used for power generation is 100%.

As for flaring, the project uses enclosed flares, and the project chose option A of Project emissions from flaring (version 04.0) for the determination of flare efficiency. The flare efficiency of the project is determined as 90% since the enclosed flare applied by the project is not low height flare

7.2 Baseline Emissions

As per section 5.1 above, baseline emission is calculated as below:

1. Baseline emissions from the manure treatment processes in year y ($BE_{CH4,y}$)

$$BE_{CH4,y} = GWP_{CH4} \times D_{CH4} \times UF_b \times \sum_{j,LT} MCF_j \times B_{0,LT} \times Q_{manure,j,LT,y} \times SVS_{j,LT,y}$$

Year	2021		2022		Unit
	Dairy Cows	Market Swine	Dairy Cows	Market Swine	
$Q_{manure\ wet,j,LT,y}$	3,745	13,940	10,315	27,875	tonnes
Dry matter content	15.78%	9.45	15.54%	8.82	-
$Q_{manure,j,LT,y}$	591,078	1,317,343	1,603,320	2,459,310	kg-dm/year
GWP_{CH4}	28	28	28	28	-
D_{CH4}	0.00067	0.00067	0.00067	0.00067	t/m ³
Uf_b	0.94	0.94	0.94	0.94	-
MCF_j	67%	67%	67%	67%	-
$B_{0,LT}$	0.24	0.45	0.24	0.45	m ³ CH ₄ /kg_VS
$SVS_{j,LT,y}$	0.671	0.583	0.681	0.580	kg_VS/kg-dm
Baseline emission	1,124	4,081	3,094	7,588	tCO ₂ e
$BE_{y,ex\ post}$	5,205		10,682		tCO ₂ e

2. Baseline emissions associated with electricity generation in year y ($BE_{elec,y}$)

During this monitoring period, no electricity was supplied to the power grid, therefore Baseline emissions associated with electricity generation in year y ($BE_{elec,y}$) is zero.

Hence the baseline emission of the project is shown below:

$BE_{y,ex\ post}$ 2021	5,205	tCO ₂ e
$BE_{y,ex\ post}$ 2022	10,682	tCO ₂ e
Total $BE_{y,ex\ post}$	15,887	tCO ₂ e

7.3 Project Emissions

As per section 5.2 above, project emission is calculated as below:

$$PE_y = PE_{PL,y} + PE_{flare,y} + PE_{power,y} + PE_{transp,y} + PE_{storage,y}$$

Since $PE_{storage,y}$ equals to 0 tCO_{2e}, project emission is calculated as below:

$$PE_y = PE_{PL,y} + PE_{flare,y} + PE_{power,y} + PE_{transp,y}$$

1. Physical leakage of biogas is calculated as per equation (11) in section 5.2 above, details as below:

Parameter	2021		2022		Unit
	Dairy Cows	Market Swine	Dairy Cows	Market Swine	
GWP_{CH_4}	28	28	28	28	-
D_{CH_4}	0.00067	0.00067	0.00067	0.00067	t/m ³
$B_{o,LT}$	0.24	0.45	0.24	0.45	m ³ CH ₄ /kg VS
$Q_{manure,j,LT,y}$	591078	1317343	1603320	2459310	kg-dm/year
$SVS_{i,LT,y}$	0.671	0.583	0.681	0.580	Kg VS/kg-dm
$MS\%_{i,y}$	100%	100%	100%	100%	-
$PE_{PL,y}$	179	649	492	1,205	tCO _{2e}
Total $PE_{PL,y}$	828		1,697		tCO_{2e}

2. Emissions from flaring or combustion of the biogas stream in the year y is calculated as per equation (12) in section 5.2 above, details as follows:

Parameter	2021	2022	Unit
GWP_{CH_4}	28	28	tCO _{2e} /tCH ₄
ρ_{CH_4}	0.67	0.67	kg/m ³
$BG_{flare,y}$	879,102	1,159,378	m ³
$f_{CH_4,default}$	60%	60%	-
$\eta_{flare,m}$	90%	90%	-
$PE_{flare,y}$	990	1,305	tCO _{2e}

3. project emissions from use of electricity for the operation of all the installed facilities is calculated as per equation (14) in section 5.2 above, details as below:

Parameter	2021	2022	Unit
$EC_{PJ,j,y}$	65.112	169.572	MWh
$EF_{EL,j,y}$	0.6665	0.6665	tCO ₂ /MWh
$TDL_{j,y}$	20%	20%	-
$PE_{power,y}$	53	136	tCO_{2e}

4. emissions from incremental transportation distances is calculated as per equation (15) in section 5.2 above, details as below:

Parameter	2021	2022	Unit
$D_{f,m}$	100	100	km
$FR_{f,m}$	17685	38190	tonnes
$EF_{CO_2,f}$	129	129	g CO ₂ /t km
$PE_{transp,y}$	229	493	tCO₂e

Hence the project emission is as follows:

PE_{y,ex post} 2021	2,100	tCO ₂ e
PE_{y,ex post} 2022	3,631	tCO ₂ e
Total PE_{y,ex post}	5,731	tCO₂e

7.4 Leakage

As per Section 5.3 above, leakage emissions of the project are not accounted.

7.5 Net GHG Emission Reductions and Removals

As per section 5.4 above, net GHG emission reduction if calculated as:

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

MD_y is calculated as follows:

Parameter	2021	2022	Unit
$BG_{burnt,y}$	879102	1613341	m ³
$BG_{flare,y}$	879102	1159378	m ³
$BG_{elec,y}$	0	453963	m ³
$W_{CH_4,y}$	60%	60%	-
$D_{CH_4,y}$	0.00067	0.00067	t/m ³
<i>FE for flaring</i>	90%	90%	-
<i>FE for power generation</i>	100%	100%	-
GWP_{CH_4}	28	28	-
MD_y	8,905	16,854	tCO ₂ e
Total MD_y	25,759		tCO₂e

Hence emission reduction of the project is calculated as follows:

Period	$BE_{y,ex post}$ (tCO ₂ e)	$PE_{y,ex post}$ (tCO ₂ e)	$BE_{y,ex post} - PE_{y,ex post}$ (tCO ₂ e)	MD_y (tCO ₂ e)	$PE_{power,y}$ (tCO ₂ e)	$MD_y - PE_{power,y}$ (tCO ₂ e)	$ER_{y,ex post}$ (tCO ₂ e)
	A	B	C=A-B	D	E	F=D-E	G=MIN(C,F)
01-Aug-2021 to 31-Dec-2021	5,205	2,100	3,105	8,905	53	8,852	3,105

01-Jan-2022 to 31-Dec-2021	10,682	3,631	7,051	16,854	136	16,718	7,051
Total	15,887	5,731	10,156	25,759	189	25,570	10,156

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
01-Aug-2021 to 31-Dec-2021	5,205	2,100	0	3,105
01-Jan-2022 to 31-Dec-2022	10,682	3,631	0	7,051
Total	15,887	5,731	0	10,156

The comparison of actual ER and ex-ante ER is as follows:

<u>Ex-ante emissions reductions</u>	<u>Achieved emissions reductions</u>	<u>Percent difference</u>	<u>Justification for the difference</u>
13,925 (01-Aug-2021 to 31-Dec-2021)	3,105	-77.70%	The significant difference is due to the following reasons: 1. the project was phase implemented, the biogas power plant only operated for a few months during this monitoring period, at a very low output level, and there was no electricity supplied to the power grid, therefore no ER from electricity generation. 2. Due to market reasons, the availability of animal manures around the project site is much lower than expected. There was no animal manure waste fed into the anaerobic digesters during the period from 01-Oct-2022 to 31-Dec-2022. Therefore, the actual animal manures treated by the project is significantly lower than the estimated value, and the actual ER achieved is significantly lower than ex-ante ER in the JPM.
33,220 (01-Jan-2022 to 31-Dec-2022)	7,051	-78.77%	
47,145 (Total)	10,156	-78.46%	

APPENDIX 1: SUPPORTING INFORMATION FOR SDG CONTRIBUTIONS

Evidence for SDG 7.2, SDG 12.5 and SDG 13: From project operation start date, the electricity generated from renewable sources, the quantity of animal manure waste (wet) treated by the project and the emission reduction achieved in each monitoring period have been listed in below table.

Period	Renewable electricity generated*	Amount of animal manure waste treated (wet basis)	Tonnes of greenhouse gas emissions avoided
	MWh	Tonnes	tCO _{2e}
01-Aug-2021 to 31-Dec-2022	736.56	55,875	10,156
Total	736.56	55,875	10,156

Source of data: the monthly operation records from August 2021 to December 2022, please refer to the records below.

*Note: All 736.56 MWh renewable electricity generated by the project was for internal use, no electricity was supplied to the power grid, therefore for conservative consideration, 0 MWh renewable electricity is reported for SDG 7.2 during this monitoring period.

Gansu Ganzhou Biogas Recovery and Utilization Project

Operation records for 2021-2022

甘肃方正节能张掖分公司(甘州)

2021-2022 年生产情况汇总表



Month 月份	Animal Manure treated (wet tonnes) 新鲜粪便处理量 (湿基, 吨)	Biogas generation 沼气产量 (m ³)	Biogas flared 其中: 火炬焚 烧量 (m ³)	Biogas for electricity 其中: 发电消 耗量 (m ³)	Electricity generation 发电量 (kWh)
2021年8月	4000	195374	195374	0	0
2021年9月	4700	236873	236873	0	0
2021年10月	4385	211502	211502	0	0
2021年11月	3000	151238	151238	0	0
2021年12月	1600	84115	84115	0	0
2022年1月	1815	72537	72537	0	0
2022年2月	3640	96020	96020	0	0
2022年3月	3485	113706	113706	0	0
2022年4月	4310	160174	160174	0	0
2022年5月	3750	194259	98031	96228	159570
2022年6月	3900	206639	114459	92180	153850
2022年7月	4240	200060	104880	95180	159810
2022年8月	7750	193607	104372	89235	139640
2022年9月	5300	175904	94764	81140	123690
2022年10月	0	139532	139532	0	0
2022年11月	0	60903	60903	0	0
2022年12月	0	0	0	0	0
合计	55875	2492443	2038480	453963	736560

