



**Verified Carbon
Standard**

BINZHOU TOPIGS NORSVIN BREEDING SWINE CO., LTD. BINHAI SWINE FARM 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

Binzhou Topigs Norsvin Breeding Swine Co., Ltd. Binhai Swine Farm Biogas Recovery and Utilization Project is located in Zhanhua District, Binzhou City, Shandong Province, P.R China. The project is owned and implemented by Binzhou Topigs Norsvin Breeding Swine Co., Ltd. Binhai Branch.

This project is to build an anaerobic animal manure treatment system to treat manure waste of breeding swine in the Binhai Breeding Swine Farm. The project uses the HDPE membrane enclosed anaerobic digester to treat animal manure waste, and the biogas produced in this process will be recovered and utilized by the biogas heating system for heat supply of Binhai Swine Farm during the heating period (October to April next year). The GHG emission reductions generated by displacing fossil fuel-based heat supply during heating period are not claimed in this project. During the non-heating period (May to September), the biogas will be burnt through the biogas flare system. The residual waste from the digesters will be handled aerobically to produce organic fertilizer at the project site. The effective volume of each HDPE membrane enclosed anaerobic digester is 9,000m³ (60m*70m*6m), thus the total effective volume is 18,000m³. The project is expected to produce 828,154 m³ biogas per year (Heating period: 483,090 m³; Non-heating period: 345,064 m³).

This project starts construction on 16/10/2019 and starts operation on 05/08/2020.

Prior to the implementation of the project, the animal manure waste was left to decay in anaerobic manure management system (uncovered open lagoon) at the Binhai Breeding Swine Farm and methane is emitted to the atmosphere directly without any methane recovery and destruction facility.

The project is expected to avoid GHG emission of methane through recovery and destruction of biogas. For conservativeness, the GHG emission reductions generated by displacing fossil fuel-based heat supply during heating period are not claimed in this project. The project is expected to achieve an annual emission reduction of 11,795 tCO₂e and a total emission reduction of 82,563 tCO₂e during the first 7-year renewable crediting period.

1.2 Sectoral Scope and Project Type

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

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 six Kyoto Protocol greenhouse gases: The project is expected to avoid Methane (CH₄) emissions from the anaerobic animal manure management system in the baseline scenario, which will be captured and destroyed in the project scenario.
- 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) of the project is methodology approved under CDM Program, which is a VCS approved GHG program.
- 5) Jurisdictional REDD+ programs and nested REDD+ projects as set out in the VCS Program document Jurisdictional and Nested REDD+ (JNR) Requirements: Not Applicable.

Furthermore, the project does not belong to the project activities excluded in Table 1 of VCS Standard 4.3.

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

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.

1.5 Project Proponent

Organization name	Binzhou Topigs Norsvin Breeding Swine Co., Ltd. Binhai Branch
Contact person	Wang Geng
Title	Project Manager

Address	Huaquan Village, Binhai Town, Zhanhua District, Binzhou City, Shandong Province
Telephone	+86-2162462036
Email	3542346576@qq.com

1.6 Other Entities Involved in the Project

Organization name	Climate Bridge (shanghai) Ltd.
Role in the project	Consultancy
Contact person	Zhiwen Gao
Title	General Manager
Address	Block B, Level 24, Jiangong Mansion, 33 Fushan Road, Pudong New Area, Shanghai, China 200120
Telephone	+86-2162462036
Email	gao.zhiwen@climatebridge.com ; projects@climatebridge.com

1.7 Ownership

The project owner of the project is Binzhou Topigs Norsvin Breeding Swine Co., Ltd. Binhai Branch. 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 and the construction contracts are the evidence for the ownership of the plant and equipment.

1.8 Project Start Date

05/08/2020 (operation start date of anaerobic animal manure treatment system).

1.9 Project Crediting Period

This project adopts a 7-year renewable crediting period, from 05/08/2020 to 04/08/2027 (both days included).

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

The estimated annual GHG emission reductions/removals of the project are:

<20,000 tCO₂e/year

- 20,000 – 100,000 tCO₂e/year
- 100,001 – 1,000,000 tCO₂e/year
- >1,000,000 tCO₂e/year

Project Scale	
Project	✓
Large project	

Year	Estimated GHG emission reductions or removals (tCO ₂ e)
05/08/2020~31/12/2020	4,814
01/01/2021~31/12/2021	11,795
01/01/2022~31/12/2022	11,795
01/01/2023~31/12/2023	11,795
01/01/2024~31/12/2024	11,795
01/01/2025~31/12/2025	11,795
01/01/2026~31/12/2026	11,795
01/01/2027~04/08/2027	6,979
Total estimated ERs	82,563
Total number of crediting years	7
Average annual ERs	11,795

1.11 Description of the Project Activity

This project is to build an anaerobic animal manure treatment system to treat manure waste of breeding swine in the Binhai Breeding Swine Farm. The project uses the HDPE membrane enclosed anaerobic digesters to treat animal manure waste, and the biogas produced in this process will be recovered and utilized by the biogas heating system for heat supply during the heating period (October to April next year). During the non-heating period (May to September), the biogas will be burnt through the biogas flare system. The residual waste from the digesters will be handled aerobically to produce organic fertilizer at the project site. The project is expected to avoid GHG emission of methane through recovery and destruction of biogas.

The key system involved in the project are as follows:

Anaerobic animal manure management system:

There're two HDPE membrane enclosed anaerobic digesters at the project site. The effective volume of each HDPE membrane enclosed anaerobic digester is 9,000m³ (60m*70m*6m), thus the total effective volume is 18,000m³. The ferment process takes place in the HDPE membrane enclosed anaerobic digesters under the temperature between 15 and 25 °C. The project is expected to produce 828,154 m³ biogas per year (Heating period: 483,090 m³; Non-heating period: 345,064 m³).

Biogas pre-treatment system:

Before combustion or flaring, the biogas will be pre-treated to remove sulphide and moisture etc., to prevent the corrosion of the biogas pipeline. In addition, biogas should be continuously in a stable condition before it flows into gas engine or flare. The pre-treatment consists of desulfurization and dehumidification.

Biogas heating system:

The project will install a biogas heating system. During the heating period, the recovery methane will be sent to biogas heating system for combustion and supply heat for the livestock farm and the HDPE membrane enclosed anaerobic digesters instead of emitting to atmosphere.

Biogas flare system:

The project will install a flare combustion system. During the non-heating period, the recovery methane will be sent to flare instead of emitting to atmosphere.

Wastewater treatment system:

The outlet wastewater from the anaerobic digesters will be treated in an open tank. Wastewater treatment system will be handled aerobically and the treated wastewater will be used for nearby farm irrigation.

The Residual waste treatment system:

The residual waste from HDPE membrane enclosed anaerobic digesters and wastewater treatment will be handled aerobically to produce organic fertilizer at the project site.

1.12 Project Location

This project locates in Huaquan Village, Binhai Town, Zhanhua District, Binzhou City, Shandong Province, P.R.China. The geographical coordinates for the project sites are east longitude 118° 10'54" and north latitude 37° 52'43".

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

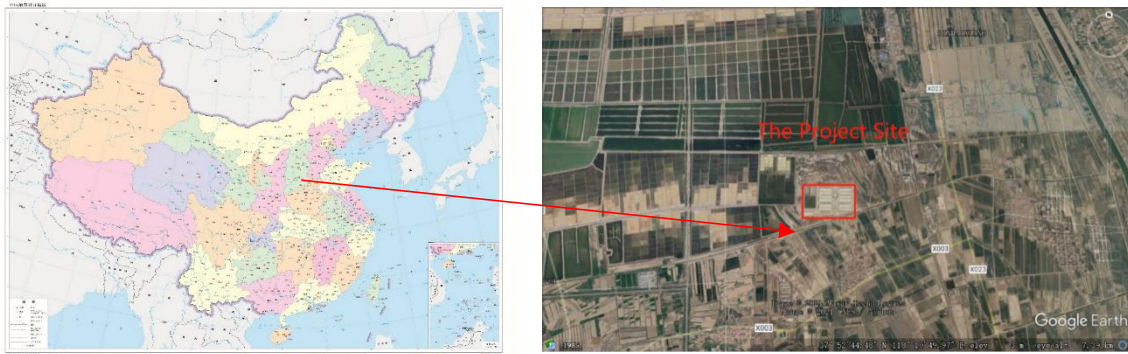


Figure 1-1 Location of the project

1.13 Conditions Prior to Project Initiation

The conditions existing prior to project initiation: the animal manure waste was left to decay in anaerobic manure management system (uncovered open lagoon) at the livestock farms and methane is emitted to the atmosphere directly without any methane recovery and destruction facility.

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

No.	Laws and Regulations	Compliance of the project
1	Environmental Protection Law of People's Republic of China	<p>Article 49 <i>"The site selection, construction and management of livestock and poultry farms, breeding zones, designated slaughtering enterprises shall be in compliance with laws and regulations. Entities and individuals engaged in livestock poultry breeding and slaughtering shall take effective measures to dispose of manure and carcasses of livestock, sewage and other wastes in a scientific manner to prevent environmental pollution."</i></p> <p>The project is to build a centralized anaerobic animal manure treatment system, which is a commonly used method to prevent methane emission. And the digestate will be handle in the onsite organic fertilizer production plant. Both the methods will prevent environmental pollution. Therefore, this project is in compliance with "take effective measures to dispose of manure and</p>

		carcasses of livestock, sewage and other wastes in a scientific manner to prevent environmental pollution”.
2	Law of the People's Republic of China on the Prevention and Control of Solid Waste Pollution	<p>Article 20 <i>“For large-scale livestock and poultry farming, livestock and poultry manure and other solid wastes produced during the farming process shall be promptly collected, stored, utilized or treated to avoid environmental pollution.”</i></p> <p>The project is to build a centralized anaerobic animal manure treatment system, which is a commonly used method to collect and utilize animal manure. And the digestate will be handle at the onsite organic fertilizer production plant. Both the methods will prevent environmental pollution. The solid waste of the project would be classified into domestic garbage, industrial solid waste and hazardous waste and collected respectively and then sent to the relevant qualified entities for centralized treatment regularly. Therefore, this project is in compliance with “take effective measures to dispose of manure and carcasses of livestock, sewage and other wastes in a scientific manner to prevent environmental pollution”.</p>
3	Action plan for the resource utilization of livestock and poultry manure	<p>Section 2 article 4 <i>“Regulations on prevention and control of pollution from large scale livestock and poultry breeding.”</i></p> <p>The Regulation requires effective measures such as scientific breeding methods and waste treatment techniques should be adopted to reduce the amount of waste generated from livestock and poultry breeding and the amount of pollutants emissions to the environment.</p> <p>The project adopts HDPE membrane enclosed anaerobic digesters to treat animal manures from livestock farms, which fully complies with the Regulation.</p>
4	Regulations on Environmental Protection in Shandong Province	Article 43 <i>“People's governments at all levels should promote green and low-carbon development, formulate policies and measures such as circular economy, clean production, comprehensive environmental management, and waste recycling, strengthen pollution control in key regions, key river basins, and key industries, and</i>

		<p><i>encourage and support pollution-free or low-pollution Industrial development, improve resource utilization efficiency, and reduce pollution emissions.”</i></p> <p>The project collects and utilize animal manure to produce methane for onsite power supply. During this process, the project improves resource utilization efficiency and reduces the pollution emissions, which is in compliance with the regulations.</p>
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The project has obtained the project approval and EIA approval from local government authorities: Dvelopment and Reform Bureau of Zhanhua District, Binzhou City and Environmental Protection Bureau of Zhanhua District, Binzhou City. The two approvals well demonstrate that local government permits the construction of the project. Consequently, the project is compliance with laws, statutes 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

Does the project reduce GHG emissions from activities that are included in an emissions trading program or any other mechanism that includes GHG allowance trading?

Yes No

If yes, provide the name of the emissions trading program or other mechanism that allows GHG allowance trading.

Not applicable.

1.16.2 Other Forms of Environmental Credit

Has the project sought or received another form of GHG-related credit, including renewable energy certificates?

Yes



 No

If yes, provide the name of the other program(s) under which the project has sought or received another form of GHG-related credit.

Not applicable.

1.17 Sustainable Development Contributions

The Project will contribute to sustainable development in the following ways:

SDG	Indicators	Chinese Sustainable Development Progress	Project activity contribution
	SDG 13 “Take urgent action to combat climate change and its impacts” ¹ .	In 2020, China's energy consumption per unit of GDP was reduced by 24.4% compared with 2012; carbon dioxide emissions per unit of GDP was reduced by 18.8% compared with 2015 and 48.4% compared with 2005, all of which have already fulfilled China's commitment to the international community in 2020 ahead of schedule.	The project will reduce CH ₄ emissions from animal wastes through biogas digesters with methane capture and flare. This contributes to achieve one of China’s stated sustainable development priorities "Actively adapt to climate change and strengthen resistance capacity to climate risks in agriculture, forestry, water resources and other key fields, as well as cities, coastal regions and ecologically vulnerable areas"
	SDG 6 “Ensure availability and sustainable management of water and sanitation for all”. ²	The Chinese government promotes water control, and promotes the conservation, protection and management of water resources. The urban and rural water supply and environmental sanitation conditions have been significantly improved, and the people feel happy. It	The project will avoid waste of animals discharging into the farm and underground water system through capturing waste of animals. The project will enhance the quality of the water and improve the working environment of the workers of the livestock farm. This contributes to one of China’s

¹ <https://sdgs.un.org/goals/goal13>

² <https://sdgs.un.org/goals/goal6>

		is of great significance to promote the comprehensive green transformation of economic and social development.	actions for promoting sustainable developing: "Continue to implement water pollution prevention and control. Coordinate the development of high-quality protection and high levels of development and continuously improve the ecological environment of the basin.
	SDG 8 “Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all” ³ .	China continuously improves the quality and efficiency of development. In-depth implementation of the innovation-driven development strategy, the rapid development of small and medium-sized enterprises. Adhering to the policy of giving priority to employment, the unemployment rate has remained at a low level. By coordinating epidemic prevention and control and economic and social development, it has become the only major economy to achieve positive growth in 2020 and has made positive contributions to the recovery of the global economy.	The project will provide new job opportunities and increase tax revenue, which will have a positive effect on the local economy. This contributes to one of China’s actions for promoting sustainable developing: "by 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value”.

1.18 Additional Information Relevant to the Project

Leakage Management

Not applicable.

³ <https://sdgs.un.org/goals/goal8>

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 Environmental Protection Bureau of Zhanhua District, Binzhou City on 29-11-2018 (Approval No. “Zhanhuanzi [2018] No.76”). The EIA report has assessed every possible aspect of environmental impact of the project and recommended corresponding measures, where applicable. Meanwhile, the implementation of the project will improve local socio-economic development through creating career opportunities and paying taxes. The project will also contribute 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

Local Stakeholder Consultation during the project preparation stage:

The project owner collected comments from local stakeholders on the project activity. Survey questionnaires were distributed to relevant personnel of the livestock farms, local villagers, and government officials by the Project owner on 06/05/2019. The survey questionnaire was designed to assess the project's 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		
	Female	15	50%
Age	<25	7	23%

	25-55	15	50%
	>55	8	27%
Education	Junior high school or below	9	30%
	Senior high school	15	50%
	College or above	6	20%
Occupation	Worker	14	47%
	Peasant	7	23%
	Management personnel	4	13%
	Civil servant	3	10%
	Unspecified	2	7%

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	24	80%
		Heard of	2	7%
		Nothing	4	13%
2	Do you think the project will improve the current situation of livestock farms?	Yes	28	93%
		No	0	0%
		Don't know	2	7%
3	Do you think the project will improve the local employment situation?	Yes	24	80%
		No	0	0%
		Don't know	6	20%
4	Do you think the project will improve the local social community?	Yes	19	63%
		No	0	0%
		Don't know	11	37%
		No impact	1	3%

		Negative impact	0	0%
5	What is the most probable environmental impact do you think the project will cause after the construction finish? (Multiple choice)	None	22	73%
		Air pollution	0	0%
		Water pollution	0	0%
		Noise pollution	0	0%
		Harm to indigenous animals and plants	0	0%
		Don't know	8	27%
6	What is your attitude to the project activity?	Support	27	90%
		Against	0	0%
		Indifferent	3	10%

In general, local stakeholders are supportive of the project construction. The survey shows that most local stakeholders think the Project will help improve the life of local people and local social community without much adverse environmental impact. The survey shows that almost all the stakeholders are supportive of the proposed project, believing that the Project will provide more employment opportunities. Therefore, the implementation of the project is regarded as beneficial by most of the local stakeholders.

Local Stakeholder Consultation during the project implementation stage:

Communications with Local stakeholders are being carried out once a year. Key implementation schedules or changes of the project will be communicated to the local authority, the neighborhood committee and the residents. The comments and suggestions from the local authority, the neighborhood committee and the residents will be collected and considered by the project owner. And the local government agencies and competent authorities will conduct spot checks on the implementation of the project from time to time and give suggestions on the involved rectification problems. There are no negative comments received for the project. In line with VCS requirements, all the processes have been implemented to receive comments from local stakeholders as well as communicate with them at periodic intervals.

2.3 Environmental Impact

As per the EIA report, the environmental impacts of the project in the construction period and operation period are summarized as follows.

1. Construction Phase

1.1 Air pollution

Construction dust and road dust during the construction has a certain effect on the surrounding areas of the construction site, these adverse effects are accidental, temporary, and partial, as long as to take effective measures and strengthen management, the scope of its influence is generally limited to the surrounding area of the construction site and will disappear along with the end of construction.

1.2 Wastewater

Wastewater during the construction period mainly includes construction wastewater and domestic sewage. The following measures are taken to prevent and control the pollution of construction wastewater: construct temporary diversion ditches on the construction site; Set up a sedimentation tank and reuse the washing water for construction machinery as much as possible after simple treatment of equipment and vehicles.

Domestic sewage is collected and pre-treatment in the on-site septic tank; then it is regularly cleared by the sanitation department.

1.3 Noise

The noise generated by the project construction has a slight impact on the surrounding sensitive points, and its pollution impact is localized and short-term. After adopting a reasonable construction organization method, its impact on the surrounding area can be reduced to the acceptable range.

1.4 Solid waste

During the construction period, a certain amount of construction waste and domestic waste from construction workers will be generated, of which part of the construction waste will be recycled, and the unusable waste will be handed over to the sanitation department for disposal. After the above measures are taken, the solid waste of the project will not cause pollution to the surrounding environment.

2. Operation Phase

2.1 Air pollution

The air pollution during the operation mainly includes the malodorous exhaust gas of the biogas flaring system and biogas heating system, which consists of NO_x, sulfur dioxide, H₂S, NH₃, and particulate matter. The malodorous exhaust gas is to be treated through biological purification equipment before being discharged into the biogas flaring system and biogas heating system. The emission of NO_x, sulfur dioxide, H₂S, NH₃, and particulate matter in all the exhaust gas by the project meets standard of " Malodorous Pollutants Emission Standards " (GB14554-93) and the standard of " Discharge standard of pollutants for livestock and poultry breeding " (DB37/534-2005).

2.2 Wastewater

The wastewater during operation is mainly biogas slurry from *anaerobic digesters*. Most biogas slurry will also be recycled in anaerobic digesters, and surplus biogas slurry will be treated in the wastewater treatment system and be used for nearby farm irrigation. No wastewater will be discharged into the environment. Therefore, the project activity has little effect on the surrounding ground water and surface water.

2.3 Noise

The source of noise pollution in this project is mainly the sound of various pumps and fans in the animal manure treatment area. The project owner will use low-noise equipment, and for high-noise equipment, noise reduction and sound insulation measures will be taken. After the above-mentioned measures are taken, with the attenuation of the distance between the plant boundaries, the noise on the field boundary can meet the requirements of the Class 2 standard in the "Environmental Noise Emission Standard for Industrial Enterprise Plant Boundaries" (GB12348-2008) and can achieve emission compliance.

2.4 Solid waste

The solid waste of the project is mainly domestic garbage and digestate. Among them, the digestate from the anaerobic digesters will be used as material to produce organic fertilizer. The domestic garbage is collected respectively and then sent to the landfill site for landfill treatment by the sanitation department.

In conclusion, the environmental impact during the project construction will be temporary and not significant, and the environmental impact during the project operation will be minor. The project activity can reduce greenhouse gas emissions and environmental pollution caused by methane release and coal-fired power generation. The Project owner takes appropriate measures to minimize adverse environmental impacts.

2.4 Public Comments

This project has listed for the public comments from 23/04/2022 to 23/05/2022, and there was no public comment received during this period.

2.5 AFOLU-Specific Safeguards

Not applicable.

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

The project applies one small scale CDM methodology and two relevant tools:

The methodology:

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

Reference:

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

The tool:

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

Project emissions from flaring (version 03.0);

Reference:

<https://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-14-v2.pdf>

<https://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-06-v3.0.pdf>

3.2 Applicability of Methodology

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

Table 3-1 Applicability of AMS-III.D

Clauses	Requirements of the AMS-III.D	Scenario of the project	Conclusion
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 the treatment of manure collected from several farms in a centralized plant.	The project uses the HDPE membrane enclosed anaerobic digesters to treat animal manure waste. The project replaces existing anaerobic animal manure management systems (open lagoon) in livestock farms to achieve methane recovery and destruction by flaring.	Applicable
2	This methodology is only applicable under the following conditions:		
	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.	Applicable
	b) Manure or the streams obtained after treatment are not discharged into natural water resources (e.g. river or estuaries), otherwise “AMS-III.H	As per the EIA report, manure or the streams obtained after treatment are not discharged into natural water resources	Applicable

Clauses	Requirements of the AMS-III.D	Scenario of the project	Conclusion
	Methane recovery in wastewater treatment" shall be applied	(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	The annual average temperature of the baseline site where the anaerobic manure treatment facility is located is around 13°C ⁴ .	Applicable
	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	In the baseline scenario, the retention time of manure waste in the anaerobic lagoons is greater than one month, and their depths are 6 m.	Applicable
	e) No methane recovery and destruction by flaring or combustion for gainful use takes place in the baseline scenario	No methane recovery and destruction by flaring or combustion for gainful use takes place in the baseline scenario.	Applicable
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 procedures (not resulting in methane emissions) must be ensured;	The residual waste from the animal manure management system of the project will be used to produce organic fertilizer, which is handled aerobically and will not result in methane emissions.	Applicable

⁴ <http://www.weather.com.cn/cityintro/101121101.shtml>

Clauses	Requirements of the AMS-III.D	Scenario of the project	Conclusion
	<p>(b) Technical measures shall be used (including a flare for exigencies) to ensure that all biogas produced by the digester is used or flared;</p>	<p>During the heating period (October to April next year), biogas produced by the project are used directly to power the biogas heating system of Binhai Swine Farm. And during the non-heating period, all biogas produced by the project is collected and flared by the biogas flare system.</p> <p>When a malfunction or emergency happens to the biogas flare system, there's a gasbag, whose capacity is 12,710 m³, temporarily storing recovered biogas for 5 to 6 days. When the gasbag is run out of capacity, the biogas heating system will be activated to flare the biogas produced during repairs on the biogas flare system. Therefore, all biogas produced by the digester is flared.</p>	<p>Applicable</p>
	<p>I 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.</p>	<p>The storage time of the manure after removal from the animal barns, including transportation is approximately 12 hours, which will not exceed 45 days before being fed into the anaerobic digester.</p>	<p>Applicable</p>
<p>4</p>	<p>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".</p>	<p>The project does not involve landfill methane recovery, wastewater treatment, composting animal manure, or co-digestion of animal manure and other organic matters.</p>	<p>Irrelevant</p>

Clauses	Requirements of the AMS-III.D	Scenario of the project	Conclusion
5	<p>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.</p>	<p>The biogas recovered is used to power the biogas heating system of Binhai Swine Farm during the heating period, which belongs to the option (a) of AMS-III.H, Thermal energy generation directly. Therefore, it is applicable to use the procedures of AMS-III.H.</p> <p>Also, the energy is not used for project activity, so zero cannot be applied as its emission factor.</p> <p>Therefore, it is applicable, but the GHG emission reduction of this process is not claimed in this project.</p>	Applicable
6	<p>New facilities (Greenfield projects) and project activities involving capacity additions compared to the baseline scenario are only eligible if they comply with the related and relevant requirements in the "General guidelines for SSC CDM methodologies".</p>	<p>The project is a Greenfield project. The emission reduction sourced from methane recovery is 11,795 tCO₂e/yr, which is lower than the threshold of 60,000 tCO₂e/yr.</p> <p>Therefore, the Project is in line with "General Guidelines to SSC CDM methodologies"</p>	Applicable.
7	<p>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".</p>	<p>The project is a Greenfield project, the project will replace the existing anaerobic animal manure management systems, and it does not involve the replaced equipment. Therefore, this is irrelevant.</p>	Irrelevant.
8	<p>Measures are limited to those that result in aggregate emission reductions of less than or equal to 60 kt CO₂ equivalent annually from all Type III components of the project activity.</p>	<p>The emission reductions from the recovery and destruction of methane (Type III components of the project) are 11,795 tCO₂e/yr, which is less than 60 kt CO₂ equivalent.</p>	Applicable.

In addition, the project meets the applicability conditions of the applied tool: Project and leakage emissions from anaerobic digesters (version 02.0) as follows:

Tool/Criteria	Applicability	Conclusion
<p>This tool provides procedures to calculate project and leakage emissions associated with anaerobic digestion in an anaerobic digester. The tool is not applicable to other systems where waste may be decomposed anaerobically, for instances stockpiles, SWDS or unaerated lagoons.</p>	<p>This project is to build an anaerobic animal manure treatment system to treat manure waste. It doesn't involve other systems where waste may be decomposed anaerobically.</p>	<p>Applicable</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>All sources of project emissions have been accounted.</p> <p>(a) According to applied methodology, CO₂ emissions from use of electricity for the operation of all the installed facilities are accounted as PE_{EC,y}. The project don't involve use of electricity, thus, PE_{EC,y} = 0.</p> <p>(b) According to applied methodology, CO₂ emissions from use of fossil fuels for the operation of all the installed facilities are accounted, the project don't involve use of fossil fuel, thus, PE_{FC,y} = 0.</p> <p>(c) According to applied methodology, 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 are accounted as PE_{PL,y}.</p> <p>(d) According to applied methodology, emissions from flaring or combustion of the gas stream are accounted as PE_{flare,y}.</p>	<p>Applicable.</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>The project does not involve composting or anaerobic storage.</p>	<p>Irrelevant.</p>
<p>Emission sources associated with N₂O emissions from physical leakages from the</p>	<p>As per the applied methodology, N₂O emissions are neglected</p>	<p>Applicable.</p>

digester, transportation of feed material and digestate or any other on-site transportation, piped distribution of the biogas, the 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.	because these are minor emission sources.	
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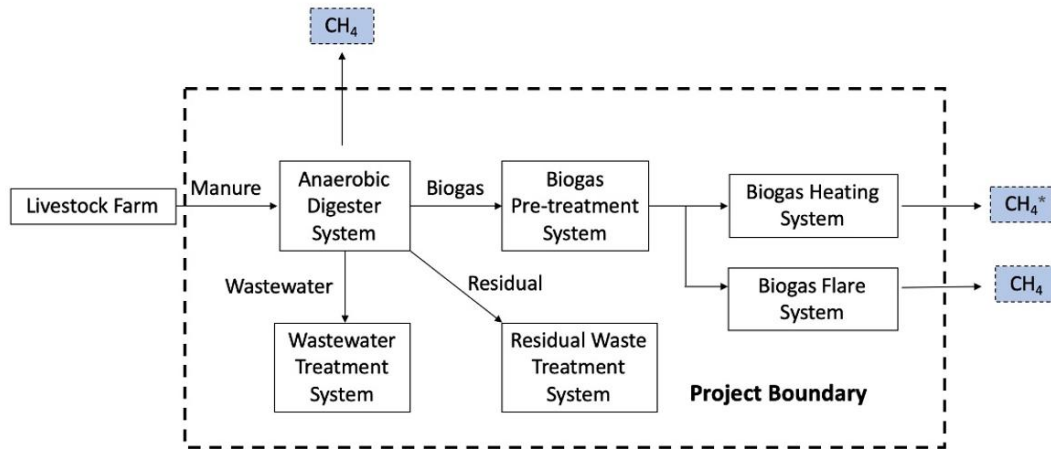
In addition, the project meets the applicability conditions of the applied tool: Project emissions from flaring (version 03.0) as follows:

Tool/Criteria	Applicability	Conclusion
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.	The project will use an enclosed flaring system.	Applicable
This tool is applicable to the flaring of flammable greenhouse gases where: (a) Methane is the component with the highest concentration in the flammable residual gas; and (b) The source of the residual gas is coal mine methane or a gas from a biogenic source (e.g. biogas, landfill gas or wastewater treatment gas).	Methane is the component with the highest concentration in the biogas flared in the project.	Applicable
The tool is not applicable to the use of auxiliary fuels and therefore the residual gas must have sufficient flammable gas present to sustain combustion. For the case of an enclosed flare, there shall be operating specifications provided by the manufacturer of the flare.	The project does not use auxiliary fuels. Methane is the component with the highest concentration in the biogas flared in the project, thus, the residual gas has sufficient flammable gas present to sustain combustion. The operating specifications was provided in the Appendix by the manufacturer of the flare.	Applicable

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.

Hence, the project boundary of the project activity includes the physical and geographical sites of Binhai Swine Farm, the anaerobic animal manure management systems, the biogas flaring systems, wastewater treatment system, biogas heating system and residual waste treatment system.



*According to AMS III-D, it won't be claimed for VCUs

Figure 3-1 Project boundary of the project

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.
Project	Physical leakage of biogas in the manure management systems	CO ₂	No	Excluded for simplification.
		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	Main emission source.
		N ₂ O	No	Excluded for simplification.
	Emissions from the use of fossil fuels or electricity	CO ₂	Yes	Maybe an important source.
		CH ₄	No	Excluded for simplification.
		N ₂ O	No	Excluded for simplification.
Emissions	CO ₂	No	The project does not involve the transportation of	

Source	Gas	Included?	Justification/Explanation
			manure.
from incremental transportation distances	CH ₄	No	Excluded for simplification.
	N ₂ O	No	Excluded for simplification.
	CO ₂	No	Excluded for simplification.
Emissions from the storage of manure	CH ₄	No	The storage time of the manure after removal from the animal barns, is within 24 hours before being fed into the anaerobic digester, hence Emissions from the storage of manure are not accounted for.
	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.

Hence, the baseline scenario of the project is the animal manure waste was left to decay in the anaerobic manure management system (open lagoon) at the livestock farms and methane was emitted to the atmosphere directly without any methane recovery and destruction facility.

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”.

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

- a) Environmental Protection Law of People’s Republic of China;
- 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/T18596);

- f) The technical standard of pollution prevention for livestock and poultry breeding (HJ/T81).

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. In line with AMS-III.D, the project is deemed automatically additional.

3.6 Methodology Deviations

Not applicable.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

According to the methodology AMS-III.D, Baseline Emissions (BE_y) are calculated by using one of the following two options:

(a) Using the amount of the waste or raw material that would decay anaerobically in the absence of the project activity, with the most recent IPCC Tier 2 approach (please refer to the chapter 'Emissions from Livestock and Manure Management' under the volume 'Agriculture, Forestry and other Land use' of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories). For this calculation, information about the characteristics of the manure and of the management systems in the baseline is required. Manure characteristics include the amount of volatile solids (VS) produced by the livestock and the maximum amount of methane that can be potentially produced from that manure (B_0);

(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 (a) to calculate baseline emissions from the manure management (BE_y), and baseline emissions are determined as follows:

$$BE_y = GWP_{CH_4} \times D_{CH_4} \times UF_b \times \sum_{j,LT} MCF_j \times B_{0,LT} \times N_{LT,y} \times VS_{LT,y} \times MS\%_{Bl,j} \quad (1)$$

Where:

BE_y = Baseline emissions in year y (t CO₂e)

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

		(tCO ₂ e/tCH ₄)
D_{CH_4}	=	CH ₄ density (0.67kg/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
MCF_j	=	Annual methane conversion factor (MCF) for the baseline animal manure management system j
$B_{0,LT}$	=	Maximum methane producing potential of the volatile solid generated for animal type LT (m ³ CH ₄ /kg-dm)
$N_{LT,y}$	=	Annual average number of animals of type LT in year y (numbers)
$VS_{LT,y}$	=	Volatile solids production/excretion per animal of livestock LT in year y (on a dry matter weight basis, kg-dm/animal/year)
$MS\%_{0,Bl,j}$	=	Fraction of manure handled in baseline animal manure management system j

- 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 tables 10 A-4 to 10 A-9 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories volume 4 Chapter 10 can be used, provided that the project participants assess the suitability of those data to the specific situation of the treatment site.
- b) VS are the organic material in livestock manure and consist of both biodegradable and non-biodegradable fractions. For the calculations the total VS excreted by each animal species is required.

If country specific VS values are not available IPCC default values from 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 10 table 10 A-4 to 10 A-9 can be used provided that the project participants assess the suitability of those data to the specific situation of the treatment site particularly with reference to feed intake levels;

- c) $B_{0,LT}$ values applicable to developed countries can be used provided the following four conditions are satisfied:

- i. The genetic source of the livestock originates from an Annex I Party;
 - ii. The farm uses formulated feed rations (FFR) which are optimized for the various animal(s), stage of growth, category, weight gain/productivity and/or genetics;
 - iii. The use of FFR can be validated (through on-farm record keeping, feed supplier, etc.);
 - iv. The project specific animal weights are more similar to developed country IPCC default values.
- d) Methane Conversion Factors (MCF) values are determined for a specific manure management system and represent the degree to which B₀ is achieved. Where available country-specific MCF values that reflect the specific management systems used in particular countries or regions shall be used. Alternatively, the IPCC default values provided in table 10.17 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 10 can be used. The site annual average temperature is taken from official data at the nearest meteorological station, or from data available from historical on site observations;
- e) The annual average number of animals (N_{LT,y}) is determined as follows:

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

Where:

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

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

4.2 Project Emissions

According to the methodology AMS-III.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}).

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

Where:

PE_y	=	Project emissions in year y (tCO ₂ e)
$PE_{PL,y}$	=	Emissions due to physical leakage of biogas in year y (tCO ₂ e)
$PE_{flare,y}$	=	Emissions from flaring or combustion of the biogas stream in the year y (tCO 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 (tCO ₂ e)
$PE_{transp,y}$	=	Emissions from incremental transportation in the year y (tCO ₂ e), as per relevant paragraph in AMS-III.AO
$PE_{storage,y}$	=	Emissions from the storage of manure (tCO 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:

$$PE_{PL,y} = 0.10 \times GWP_{CH_4} \times D_{CH_4} \times \sum_{j,LT} B_{0,LT} \times N_{LT,y} \times VS_{LT,y} \times MS\%_{i,y} \quad (4)$$

Where:

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

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 03.0)”.

As per “Project emissions from flaring” (version 03.0)”, Emissions from flaring ($PE_{flare,y}$) should be calculated as follows:

$$PE_{flare,y} = GWP_{CH_4} \times \sum_{m=1}^{525600} F_{CH_4,RG,m} \times (1 - \eta_{flare,m}) \times 10^{-3} \quad (5)$$

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 equal to the quantity of methane produced in the anaerobic digester in year y,

$$\sum_{m=1}^{525600} F_{CH_4,RG,m} = Q_{CH_4,y} \quad (6)$$

Where:

$Q_{CH_4,y}$ = Quantity of methane produced in the anaerobic digester in year y (tCH₄)

And for $Q_{CH_4,y}$ could be calculated based on the amount of biogas collected at the digester outlet in a year.

$$Q_{CH_4,y} = Q_{biogas,y} \times f_{CH_4,default} \times \rho_{CH_4} \quad (7)$$

Where:

$Q_{biogas,y}$ = Amount of biogas collected at the digester outlet in year y (Nm³biogas),

$f_{CH_4,default}$ = Default value for the fraction of methane in the biogas (m³CH₄/m³biogas)

ρ_{CH_4} = Density of methane at normal conditions (kgCH₄/Nm³CH₄)

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.

$$PE_{power} = PE_{EC,y} + PE_{FC,y} \quad (8)$$

Where:

$PE_{EC,y}$ = Project emissions from electricity consumption associated with the anaerobic digester in year y (tCO₂)

$PE_{FC,y}$ = Project emissions from fossil fuel consumption associated with the anaerobic digester in year y (tCO₂)

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

As per the methodological tool “Project and leakage emissions from anaerobic digesters” (version 02.0), project emissions from electricity consumption associated with the anaerobic digester are calculated as follows:

$$PE_{EC,y} = Q_{CH_4,y} \times F_{EC,default} \times EF_{EL,default} \quad (9)$$

Where:

$F_{EC,default}$ = Default factor for the electricity consumption associated with the anaerobic digester per ton of methane generated (MWh/tCH₄)

$EF_{EL, default}$ = Default emission factor for the electricity consumed in year y (tCO₂/MWh)

As per the methodological tool “Project and leakage emissions from anaerobic digesters” (version 02.0), $F_{EC, default}$ for covered anaerobic lagoons (gravity fed) / conventional digesters is 0. This project uses the HDPE membrane enclosed anaerobic digesters, which is a commonly used kind of covered anaerobic lagoons, so the $F_{EC, default}$ in this project is 0. Therefore, $PE_{EC, y}$ in this project is 0.

In summary, $PE_{Power, y}$ is 0 in this project.

4. Emissions from incremental transportation in the year y

The project will transfer the manure to the HDPE membrane enclosed anaerobic digester installed within the geographic boundary of the breeding swine farm (project site), and won't involve road and rail transportation. Therefore, $PE_{transp, y}$ is not included in the project emission.

5. Emissions from the storage of manure

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

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

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

As per the FSR of the project, all animal manure will be collected several times a day and delivered to the anaerobic digesters systems immediately. Therefore, the storage time of the manure before being fed into the anaerobic digester is approximately 12 hours less than 24 hours and condition (a) is not satisfied.

Hence project emissions on account of storage of manure before being fed into the anaerobic digester are not accounted for, $PE_{storage, y} = 0$ tCO₂e.

In conclusion, the project emission of the project activity is calculated as follows:

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

4.3 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 will be handled aerobically to produce organic fertilizer when digestate is removed from the digesters. The digestate is collected and transported to the certain on-site workshop for aerobic fermentation. During this process, the forklift is used every day to turn the pile over, so that the material is fully oxygenated. After fully fermenting, the digestate is dried out and sold. This process meets the requirement of "Sanitary Requirements for The Harmlessness of Manure" (GB 7959-2012). The process of handling the residual waste doesn't involve storage or anaerobic compost. Therefore, leakage emissions of the project associated with the anaerobic digester is not accounted for.

4.4 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 flared. 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. $N_{LT,y}$, $MS\%_{i,y}$, 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:

$$ER_{y,ex\ post} = \min[(BE_{y,ex\ post} - PE_{y,ex\ post}), (MD_y - PE_{power,y,ex\ post})] \quad (11)$$

Where:

- $ER_{y,ex\ post}$ = Emission reductions achieved by the project activity based on monitored values for year y (tCO₂e)
- $BE_{y,ex\ post}$ = 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 11 using ex post monitored values of $N_{LT,y}$, $MS\%_{i,y}$, and if applicable $VS_{LT,y}$
- MD_y = Methane captured and destroyed or used gainfully by the project activity in year y (tCO₂e)
- $PE_{power,y,ex\ post}$ = Emissions from the use of fossil fuel or electricity for the operation of the installed facilities based on monitored values in the year y (tCO₂e)

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

$$MD_y = BG_{burnt,y} \times w_{CH_4,y} \times D_{CH_4} \times FE \times GWP_{CH_4} \quad (12)$$

Where:

- $BG_{burnt,y}$ = Biogas flared or combusted in year y (m³)
- $w_{CH_4,y}$ = Methane content in biogas in the year y (volume fraction)
- FE = Flare efficiency in the year y (fraction), which is equal to $\eta_{flare,m}$

Ex-ante calculation of GHG emission reductions

1. Calculation of baseline emissions:

Table 4-1 Ex-ante value of parameters to calculate BE_y

Parameter	Value	Data sources
GWP_{CH_4}	28 tCO ₂ e/tCH ₄	IPCC Fifth Assessment Report (AR5)
D_{CH_4}	0.67 kg/m ³	AMS-III.D
UF_b	0.94	AMS-III.D
MCF_j	71%	Table 10.17 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 10
$B_{0,LT}$	Breeding Swine: 0.45 m ³ CH ₄ /kg-VS	Table 10A-8 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 10
$VS_{default}$	Breeding Swine: 0.46 kg/hd/day	Table 10A-8 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 10
$MS\%_{BI,j}$	100%	Feasibility Study Report of the project
nd_y	365 days	Feasibility Study Report of the project
$N_{da,y}$	Adult breeding Swine: 365 days	Feasibility Study Report of the project
$N_{p,y}$	Adult breeding Swine: 15,150	Feasibility Study Report of the project

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

Parameter	Adult Breeding Swine	Unit
GWP_{CH_4}	28	tCO ₂ e/tCH ₄
D_{CH_4}	0.67	kg/m ³
UF_b	0.94	/
MCF_j	71%	/
$B_{0,LT}$	0.45	m ³ CH ₄ /kg-dm
$N_{LT,y}$	15,150	/
$VS_{LT,y}$	167.90	kg-dm/(animal*year)
$MS\%_{BI,j}$	100%	/
$BE_{y,i}$	14,331	t CO ₂ e

So, the ex-ante calculated baseline emissions (BE_y) is 14,331 tCO₂e.

2. Calculation of project emissions

Table 4-3 Ex-ante value of parameters to calculate project emissions

Parameter	Value	Data sources
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GWP_{CH_4}	28 tCO _{2e} /tCH ₄	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
D_{CH_4}	0.67 kg/m ³	AMS-III.D
$B_{o,LT}$	Breeding Swine: 0.45 m ³ CH ₄ /kg-VS	Table 10A-8 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 10
$VS_{default}$	Breeding Swine: 0.46 kg/hd/day	Table 10A-8 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 10
$MS\%_{o_i,y}$	100%	AMS-III.D
$n_{d,y}$	365 days	Feasibility Study Report of the project
$N_{da,y}$	Adult breeding Swine: 365 days	Feasibility Study Report of the project
$N_{p,y}$	Adult breeding Swine: 15,150	Feasibility Study Report of the project
$Q_{biogas,y}$	Non-heating Period: 345,064 m ³	Feasibility Study Report of the project
$f_{CH_4,default}$	0.6	"Tool to Project and leakage emissions from anaerobic digesters"
$\eta_{flare,m}$	Non-heating Period: 0.9	<p>As per "Project emissions from flaring (version 03.0)", in the case of enclosed flares, PP may choose between the following two options to determine the flare efficiency for minute m ($\eta_{flare,m}$):</p> <p>(a) Option A: Apply a default value for flare efficiency;</p> <p>(b) Option B: Measure the flare efficiency.</p> <p>PP selected option A and a default value was applied for the project activity.</p> <p>For this option, the flare efficiency for the minute m ($\eta_{flare,m}$) is 90% when the following two conditions are met to demonstrate that the flare is operating:</p> <p>(a) The temperature of the flare ($T_{EG,m}$) and the flow rate of the residual gas to the flare ($F_{RG,m}$) is within the manufacturer's operating specification for the flare ($SPEC_{flare}$) in the minute m; and</p> <p>(b) The flame is detected in the minute m ($Flame_m$)</p> <p>Thus, 90% is chosen for the flare efficiency, and it will be monitored in verification period to ensure 90% can be chosen for flare efficiency.</p>

2.1 Emissions due to physical leakage of biogas in year y

As described in 4.2, project emissions from physical leakage of biogas are calculated as follow:

Table 4-4 Ex-ante calculate Physical leakage of biogas ($PE_{PL,y}$)

Parameter	Adult Breeding Swine	Unit
GWP_{CH_4}	28	tCO ₂ e/tCH ₄
D_{CH_4}	0.67	kg/m ³
$B_{0,LT}$	0.45	m ³ CH ₄ /kg-dm
$N_{LT,y}$	15,150	/
$VS_{LT,y}$	167.900	kg-dm/(animal*year)
$MS\%_{BI,j}$	100%	/
$PE_{PL,y}$	2,147	t CO ₂ e

So, the ex-ante calculated result of the project's Physical leakage of biogas is 2,147 tCO₂e.

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

As described in 4.2, the emissions from flaring or combustion of the biogas stream shall ex-ante calculated as follow:

Table 4-5 Ex-ante calculate emissions from flaring or combustion of the biogas stream

Parameter	Non-heating Period	Unit
GWP_{CH_4}	28	tCO ₂ e/tCH ₄
D_{CH_4}	0.67	kg/m ³
Biogas Produce Quantity	345,064	m ³
$f_{CH_4,default}$	0.6	/
Efficiency	0.9	/
$PE_{flare,y}$	388	t CO ₂ e
$PE_{flare,y}$	388	t CO ₂ e

So, the ex-ante calculated result of the project's emissions from flaring or combustion of the biogas stream is 388 tCO₂e.

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

As described in 4.2, the emissions from the use of fossil fuel or electricity for the operation of the installed facilities ($PE_{power,y}$) is 0 tCO₂e.

2.4 Emissions from incremental transportation in the year y

As described above, $PE_{transp,y}$ is excluded, hence $PE_{transp,y} = 0$ for the project.

2.5 Emissions from the storage of manure

As described above, $PE_{storage,y}$ is excluded, hence emissions from the storage of manure are not accounted for, $PE_{storage,y} = 0$ tCO₂e.

So, the ex-ante estimated project emission shall calculate as far equation (11):

$$PE_y = PE_{PL,y} + PE_{flare,y} = 2,147 \text{ tCO}_2\text{e} + 388 \text{ tCO}_2\text{e} = 2,536 \text{ tCO}_2\text{e}$$

3. Calculation of leakage

As described above, leakage is 0.

4. Calculation of emission reductions

Emission reductions of the project can be calculated as following equation (13):

$$ER_y = BE_y - PE_y - LE_y = BE_y - PE_y \quad (13)$$

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

Year	Estimated baseline emissions or removals (tCO ₂ e)	Estimated project emissions or removals (tCO ₂ e)	Estimated leakage emissions (tCO ₂ e)	Estimated net GHG emission reductions or removals (tCO ₂ e)
05/08/2020 to 31/12/2020	5,850	1,036	0	4,814
01/01/2021 to 31/12/2021	14,331	2,536	0	11,795
01/01/2022 to 31/12/2022	14,331	2,536	0	11,795
01/01/2023 to 31/12/2023	14,331	2,536	0	11,795
01/01/2024 to 31/12/2024	14,331	2,536	0	11,795
01/01/2025 to 31/12/2025	14,331	2,536	0	11,795
01/01/2026 to 31/12/2026	14,331	2,536	0	11,795
01/01/2027 to 04/08/2027	8,480	1,501	0	6,979
Total	100,316	17,753	0	82,563

5 MONITORING

5.1 Data and Parameters Available at Validation

Data / Parameter	GWP _{CH4}
Data unit	tCO ₂ e/tCH 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 revision to VCS standard by VERRA.
Purpose of Data	Calculation of baseline emissions and project emissions
Comments	-

Data / Parameter	D_{CH_4}
Data unit	kg/m ³
Description	CH4 density
Source of data	AMS-III.D
Value applied	0.67 (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 and project 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	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied	71%
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 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 10 is applied.</p> <p>The annual average temperature of baseline site where anaerobic manure treatment facility is located is around 13°C⁵, the corresponding annual methane conversion factor (MCF) is 71%.</p>
Purpose of Data	Calculation of baseline emissions and project emissions
Comments	-

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	2006 IPCC Guidelines for National Greenhouse Gas Inventories				
Value applied	<table border="1"> <tr> <td>Animal type</td> <td>B_{0,LT}</td> </tr> <tr> <td>Western European Adult Breeding Swine</td> <td>0.450</td> </tr> </table>	Animal type	B _{0,LT}	Western European Adult Breeding Swine	0.450
Animal type	B _{0,LT}				
Western European Adult Breeding Swine	0.450				
Justification of choice of data or description of measurement methods	No country or regional specific value is available. Default values from tables 10 A-4 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories volume 4 Chapter 10 are applied.				

⁵ <http://www.weather.com.cn/cityintro/101121101.shtml>

and procedures applied	<p>Bo values applicable to developed countries are used for the project as the following conditions are satisfied:</p> <p>(i) According to the animal purchase contract and breeding swine acceptance confirmation, the genetic source for all types of swine originates from UK and Denmark;</p> <p>(ii) The farm uses formulated feed rations (FFR) which are optimized for the various animal(s), stage of growth, category, weight gain/productivity and/or genetics;</p> <p>(iii) The use of FFR can be validated through on-farm record keeping;</p> <p>(iv) The project specific animal weights are similar to developed country IPCC default values as per on-farm record keeping</p>
Purpose of Data	Calculation of baseline emissions and project emissions
Comments	-

Data / Parameter	VS _{default}					
Data unit	kg/hd/day					
Description	Default value for the volatile solid excretion rate per day on a dry-matter basis for a defined livestock population					
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories					
Value applied	<table border="1"> <tr> <td>Animal type</td> <td>VS_{default}</td> </tr> <tr> <td>Western European Adult Breeding Swine</td> <td>0.46</td> </tr> </table>		Animal type	VS _{default}	Western European Adult Breeding Swine	0.46
Animal type	VS _{default}					
Western European Adult Breeding Swine	0.46					
Justification of choice of data or description of measurement methods and procedures applied	<p>No country or regional specific value is available. According to animals' genetic region" and type, default values from table 10 A-8 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories volume 4 Chapter 10 are applied.</p> <p>VS values applicable to developed countries are used for the project as the following conditions are satisfied:</p> <p>(i) According to the animal purchase contract and breeding swine acceptance confirmation, the genetic source for all types of swine originates from UK and Denmark;</p> <p>(ii) The farm uses formulated feed rations (FFR) which are optimized for the various animal(s), stage of growth, category, weight gain/productivity and/or genetics;</p> <p>(iii) The use of FFR can be validated through on-farm record keeping;</p> <p>(iv) The project specific animal weights are similar to developed</p>					

	country IPCC default values as per on-farm record keeping;
Purpose of Data	Calculation of baseline emissions and project emissions
Comments	-

Data / Parameter	$MS_{BI,j}$
Data unit	-
Description	Fraction of manure handled in baseline animal manure management system j
Source of data	FSR
Value applied	100%
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	$f_{CH4,default}$
Data unit	-
Description	Default value for the fraction of methane in the biogas
Source of data	Tool to Project and leakage emissions from anaerobic digesters
Value applied	0.6
Justification of choice of data or description of measurement methods and procedures applied	<p>There are two different procedures to determine the quantity of methane produced in the digester in year y ($Q_{CH4,y}$). For small scale projects, project participants may choose between Option 1 or Option 2.</p> <ul style="list-style-type: none"> ● Option 1: Procedure using monitored data ● Option 2: Procedure using a default value <p>Use this default value for Option 2 of the step “Determination of the quantity of methane produced in the digester”</p>
Purpose of Data	Calculate the quantity of methane produced in the digester in

	year y
Comments	-

5.2 Data and Parameters Monitored

Data / Parameter	$MS\%_{i,y}$
Data unit	-
Description	Fraction of manure handled in system i in year y
Source of data	AMS-III.D
Description of measurement methods and procedures to be applied	The project does not involve sequential manure management system, hence all manure would be handled in system i, 100% is applied for $MS\%_{i,y}$
Frequency of monitoring/recording	-
Value applied	100%
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of data	Calculation of baseline emissions and project emissions
Calculation method	-
Comments	-

Data / Parameter	$N_{p,y}$
Data unit	Number
Description	Number of animals produced annually of type LT for the year y
Source of data	Ex-ante values are sourced from the FSR of the project. Ex-post values are from the operation records.
Description of measurement methods and procedures to be applied	The number of breeding swine on the farm will be recorded monthly in the operation records.

Frequency of monitoring/recording	Monthly.
Value applied	Adult breeding Swine: 15,150
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of data	To calculate the annual average number of animals ($N_{LT,y}$)
Calculation method	-
Comments	-

Data / Parameter	$N_{da,y}$
Data unit	Day
Description	Number of days animal is alive in the farm in the year y
Source of data	Ex-ante values are sourced from the FSR of the project. Ex-post values are from the operation records.
Description of measurement methods and procedures to be applied	To collect the alive days of breeding swine in the livestock farms, the number of alive days of swine on the livestock farm will be recorded monthly in the operation records.
Frequency of monitoring/recording	Monthly
Value applied	Adult breeding Swine: 365 days
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of data	To calculate the annual average number of animals ($N_{LT,y}$)
Calculation method	-
Comments	-

Data / Parameter	nd_y
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Data unit	number
Description	The number of days the treatment plant was operational in year y.
Source of data	Ex-ante values are sourced from the FSR of the project. Ex-post values are from the operation records.
Description of measurement methods and procedures to be applied	365 days used for ex-ante estimation. The actual number of days the treatment plant was operationally used in the monitoring periods will be monitored and recorded by staff.
Frequency of monitoring/recording	Daily
Value applied	365 (Ex-ante)
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of data	To estimate the annual volatile solid excretions for livestock LT entering all animal waste management systems on a dry matter weight basis ($VS_{LT,y}$).
Calculation method	-
Comments	-

Data / Parameter	FE ($\eta_{flare,m}$)
Data unit	%
Description	The flare efficiency
Source of data	Project emissions from flaring (version 03.0)
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%. During heating period, the recovered biogas will be combusted for heating, thereby the methane destruction efficiency is considered as 100%.</p> <p>As for flaring, the project uses enclosed flares, and the project chose option A of <i>Project emissions from flaring (version 03.0)</i> for the determination of flare efficiency. The flare efficiency of the project is determined as 90% since the project meets the</p>

	<p>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. <p>The project proponent chooses 90% for non-heating period, this is conservative.</p> <p>However, this use of the recovered biogas will be included in the project boundary. Although the GHG emission reductions generated by displacing fossil fuel-based heat supply during heating period are not claimed in this project, its hot water output will be monitored to ensure that the recovered biogas is actually destroyed.</p>
Frequency of monitoring/recording	Annually
Value applied	Non-heating period: 90% Heating period: 100%
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of data	Calculation of emission reductions
Calculation method	-
Comments	-

Data / Parameter	$BG_{\text{burnt},y}$
Data unit	m^3
Description	Biogas flared 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 used gainfully shall be monitored ex post, using flow meters.</p> <p>Continuously measured by flow meter with temperature sensor and pressure sensor at the inlet of the flare system. The meter readings will be automatically converted to value at room temperature (20 °C) and 1 atm pressure.</p>
Frequency of	Monthly, based on continuous flow measurement with

monitoring/recording	accumulated daily accumulated volume recording.
Value applied	Monitored ex-post
Monitoring equipment	Flow meter
QA/QC procedures to be applied	Flow meter will be calibrated at the periodic interval as per national regulations.
Purpose of data	Calculation of emission reductions
Calculation method	-
Comments	-

Data / Parameter	$T_{EG,m}$
Data unit	°C
Description	Temperature in the exhaust gas of the enclosed flare in the minute m
Source of data	Records by project participants
Description of measurement methods and procedures to be applied	The temperature in the exhaust gas of the enclosed flare shall be monitored ex post, using monitoring port in the flare to ensure that the flare is functioning correctly.
Frequency of monitoring/recording	Once per minute
Value applied	Monitored ex-post
Monitoring equipment	Monitoring port in the flare
QA/QC procedures to be applied	Temperature measurement equipment should be replaced or calibrated in accordance with their maintenance schedule
Purpose of data	To confirm that the flare operates within the manufacturer's operating specification
Calculation method	-
Comments	Unexpected changes such as a sudden increase/drop in temperature can occur for different reasons. These events should be noted in the site records along with any corrective action that was implemented to correct the issue.

Data / Parameter	$F_{RG,m}$
Data unit	m^3
Description	Flow rate of the residual gas on a dry basis at reference conditions in the minute m
Source of data	Records by project participants
Description of measurement methods and procedures to be applied	<p>The flow rate of the residual gas to the flare shall be monitored ex post, using flow meters.</p> <p>Continuously measured by flow meter with temperature sensor and pressure sensor at the inlet of the flare system. The meter readings will be automatically converted to value at room temperature (20 °C) and 1 atm pressure.</p>
Frequency of monitoring/recording	Continuously. Values to be averaged on a minute basis
Value applied	Monitored ex-post
Monitoring equipment	Flow meter
QA/QC procedures to be applied	Flow meters are to be periodically calibrated according to the manufacturer's recommendation
Purpose of data	To confirm that the flare operates within the manufacturer's operating specification
Calculation method	-
Comments	-

Data / Parameter	$Flame_m$
Data unit	Flame on or Flame off
Description	Flame detection of flare in the minute m
Source of data	Records by project participants
Description of measurement methods and procedures to be applied	Measure using a fixed installation optical flame detector.
Frequency of monitoring/recording	Once per minute. Detection of flame recorded as a minute that the flame was on, otherwise recorded as a minute that the flame was off

Value applied	Monitored ex-post
Monitoring equipment	Optical flame detector
QA/QC procedures to be applied	Equipment shall be maintained and calibrated in accordance with manufacturer's recommendations
Purpose of data	To monitor if the flare is operating.
Calculation method	-
Comments	-

Data / Parameter	Soil application
Data unit	-
Description	Soil application of residual waste
Source of data	Records by project participants
Description of measurement methods and procedures to be applied	<p>Project participants should refer to the original design of the soil application to ensure that the residual waste from the animal manure management system is handled aerobically.</p> <p>Any change in the soil application of residual waste after the implementation of the project activity should be justified.</p>
Frequency of monitoring/recording	Annually
Value applied	Monitored ex-post
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of data	To ensure that the residual waste from the animal manure management system is handled aerobically.
Calculation method	-
Comments	-

Data / Parameter	Genetic source of swine
Data unit	-

Description	Genetic source of the production operations swine
Source of data	Records by project participants
Description of measurement methods and procedures to be applied	Project participants should ensure that genetic source of production operations swine originates from Annex I Party.
Frequency of monitoring/recording	Annually
Value applied	Monitored ex-post
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of data	To ensure that the genetic source of production operations swine should be listed in Annex I Party.
Calculation method	-
Comments	-

Data / Parameter	FFR
Data unit	-
Description	Formulated feed rations
Source of data	Records by project participants
Description of measurement methods and procedures to be applied	Project participants should use formulated feed rations (FFR) for the production operations swine, stage of growth, category, weight gain/productivity and/or genetics.
Frequency of monitoring/recording	Monthly
Value applied	Monitored ex-post
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of data	To ensure the use of FFR is validated.

Calculation method	-
Comments	-
Data / Parameter	Swine Weight
Data unit	kg
Description	The project specific animal weights at project site
Source of data	Records by project participants
Description of measurement methods and procedures to be applied	Project participants should record the project specific animal weights to ensure that they are similar to developed country IPCC default values.
Frequency of monitoring/recording	Monthly
Value applied	Monitored ex-post
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of data	To ensure the project specific animal weights are similar to developed country IPCC default values.
Calculation method	-
Comments	-

5.3 Monitoring Plan

The monitoring plan presented in this PD 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 the 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 are 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.

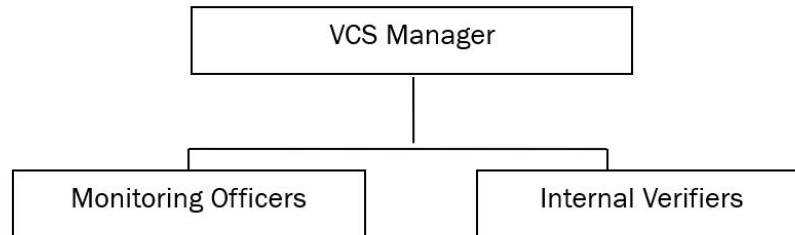


Figure 5-1 Operation and management structure of the project

(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.

Table 5-1 list the corresponding parameters monitored:

Table 5-1 Data and parameters to be monitored

Equipment No.	Parameter to be Monitored	Description
E1	$BG_{burnt,y}$	Biogas flared or combusted in year y is continuously measured by flow meter installed at the outlet of biogas purification system. The meter readings will be automatically converted to value at room temperature (20 °C) and 1 atm pressure
These two parameters do not require monitoring equipment, hence not shown in Figure 5-2 below	$W_{CH_4,y}$	Methane content in biogas in the year y applies a default value of 60%, no monitoring equipment is required.
	FE	The flare efficiency applies the default value of 90%. No monitoring equipment is required.
/	$N_{p,y}$	The number of swine produced in the farm will be recorded manually by the responsible staff.

/	$N_{da,y}$	The number of alive days of swine on the livestock farm will be recorded manually by the responsible staff.
/	nd_y	The actual number of days the treatment plant was operationally used in the monitoring periods will be monitored and recorded by staff.
E2	$T_{EG,m}$	Temperature in the exhaust gas of the enclosed flare in the minute m. It is continuously measured by monitoring port in the flare.
E1	$F_{RG,m}$	Flow rate of the residual gas on a dry basis at reference conditions in the minute m. It is continuously measured by flow meter with temperature sensor and pressure sensor at the inlet of the flare system.
This parameter does not require monitoring equipment, hence not shown in Figure 5-2 below	$SPEC_{flare}$	Manufacturer's flare operating specifications for temperature and flow rate.
E3	$Flame_m$	Flame detection of flare in the minute m. It is measured by using a fixed installation optical flame detector.
/	<i>Soil application</i>	Soil application of residual waste. And it is monitored and recorded by staff.
/	<i>Genetic source of swine</i>	Genetic source of the production operations swine. And it is monitored and recorded by staff.
/	<i>FFR</i>	Formulated feed rations. And it is monitored and recorded by staff.
/	<i>Swine Weight</i>	The project specific animal weights at project site. And it is monitored and recorded by staff.
/	<i>Steam output</i>	Heat generated by the boiler will be monitored and recorded monthly.

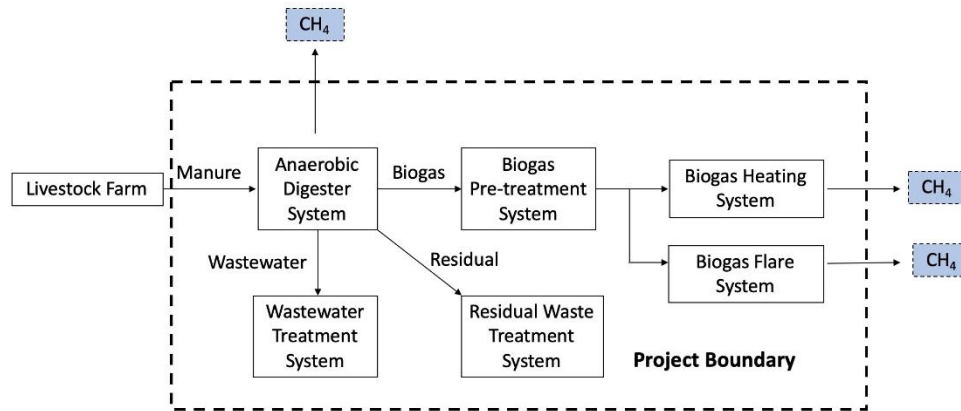


Figure 5-2 Project monitoring diagram

(C) Data collection

Monitoring officers are responsible for data collection. Designated teams will read and collect the monitored data regularly. The computer system will automatically monitor and record relevant meter data. The operation records will serve as the main data source for emission reductions calculation. All data files will be collected by a designated monitoring officer, who will prepare backup in time and archive all documents properly.

(D) Quality assurance

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

Error check routines will be established on site and at the point of data storage to detect data measuring/transmission failures as well as malfunctions. In the 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 flow meters will fulfill the national standard (MT448-2008). All the meters will be checked and maintained periodically.

(E) Data file management

All monitoring data will be electronically filed by the end of each month. Other documents in paper e.g. forms and environment assessment reports will be preserved as well. 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.

APPENDIX

The operating specification of the flare is listed below:

	Value	Unit
Model	HJ-200	/
Specification	580X5510	/
Capacity	2.2	kWh