# HENAN ZHUMADIAN YOURAN XIPING DAIRY FARM BIOGAS UTILIZATION PROJECT

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| Project title | **Henan Zhumadian Youran Xiping Dairy Farm Biogas Utilization Project** |
| Project ID | 5366 |
| Crediting period | 15-April-2023 to 14-April-2033 |
| Original date of issue | 18-November-2024 |
| Most recent date of issue | 18-November -2024 |
| Version | 1.0 |
| *VCS Standard* Version | 4.7 |
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# 1 PROJECT DETAILS

## 1.1 Summary Description of the Project

Henan Zhumadian Youran Xiping Dairy Farm Biogas Utilization Project (hereinafter referred to as "the Project") is locates in Hongcunpu Village, Leizu Town, Xiping County, Zhumadian City, Henan Province, P.R China. The project is owned and implemented by Zhumadian Youran Animal Husbandry Co., Ltd.

The project is to build a centralized anaerobic animal manure treatment system which collects manure waste from dairy cows from Zhumadian farm in Xiping County. 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 will be used for electricity generation at the project site. The residual waste from the CSTR digesters will be used to produce organic fertilizer at the project site.

The baseline scenario is the situation where, in the absence of the project activity, the animal manure waste are left to decay within the project boundary and methane is emitted to the atmosphere.

The project is expected to avoid GHG emission of methane through recovery and destruction of biogas.

The project started construction on 25-November-2021 and put into operation on 15-April-2023. The project is expected to achieve an annual emission reduction of 50,509 $tCO_2e$ and a total emission reduction of 505,090 $tCO_2e$ during the fixed 10-year crediting period.

## 1.2 Audit History

| Audit type | Period | Program | Validation/verification body name | Number of years |
|---|---|---|---|---|
| Validation | / | VCS | CTI Certification Co., Ltd. | / |

## 1.3 Sectoral Scope and Project Type

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| Sectoral scope[1] | 13 - waste handling and disposal |

[1] *Projects, activities, or methodologies may be developed under any of the 16 VCS sectoral scopes: https://verra.org/programs/verified-carbon-standard/vcs-program-details/#sectoral-scopes*

| Project activity type | Landfill Gas recovery and utilization |
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## 1.4 Project Eligibility

### 1.4.1 General eligibility

The scope of the VCS Program includes:

1) The seven Kyoto Protocol greenhouse gases: The emissions reduction of the project comes from two sources: 1) Methane ($CH_4$) emissions as a result of the previously vented landfill gas that will be captured and destroyed in the project scenario. 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 methodology AMS-III.D (Version 21.0) of the project utilized 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 does not belong to 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 4.7.

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

### 1.4.2 AFOLU project eligibility

Not applicable as the project is a Non-AFOLU project.

### 1.4.3 Transfer project eligibility

Not applicable as the project is neither a transfer project nor CPAs seeking registration.

## 1.5 Project Design

The project is designed as a single location project.

### 1.5.1 Grouped project design

Not applicable as the project is not a grouped project.

## 1.6 Project Proponent

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| **Organization name** | Zhumadian Youran Animal Husbandry Co., Ltd. |
| **Contact person** | Xiang Jingjing |
| **Title** | Senior Manager |
| **Address** | Hongcunpu Village, Leizu Town, Xiping County, Zhumadian City, Henan Province, P.R China |
| **Telephone** | +86 021-23019950 |
| **Email** | 3542346576@qq.com |

## 1.7 Other Entities Involved in the Project

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| **Organization name** | Climate Bridge (Shanghai) Ltd. |
| **Role in the project** | Consultancy |
| **Contact person** | Gao Zhiwen |
| **Title** | General Manager |
| **Address** | Block B, Level 24, Jiangong Mansion, 33 Fushan Road, Pudong New Area, Shanghai, China |
| **Telephone** | +86 021-62462036 |
| **Email** | gao.zhiwen@climatebridge.com |

## 1.8 Ownership

The project owner is Zhumadian Youran Animal Husbandry Co., Ltd. who has the legal right to control and operate the project activity. The business license, Project approval, approval of the Environmental Impact Assessment (EIA), the equipment purchasing contract, and the construction contract are evidence of the ownership of the project and carbon credits generated.

## 1.9 Project Start Date

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| **Project start date** | **15-April-2023** |

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| **Justification** | According to VCS standard v4.7, the project start date is the date on which the project began generating GHG emission reductions or removals. The project began generate biogas on 15-April-2023, which is the earliest date that the project started generating emission reductions. |

## 1.10 Project Crediting Period

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| **Crediting period** | ☐ **Seven years, twice renewable**<br>☒ **Ten years, fixed**<br>☐ **Other (state the selected crediting period and justify how it conforms with the VCS Program requirements)** |
| **Start and end date of first or fixed crediting period** | 15-April-2023 to 14-April-2033 |

## 1.11 Project Scale and Estimated GHG Emission Reductions or Removals

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

☒ < 300,000 $tCO_2e$/year (project)

☐ ≥ 300,000 $tCO_2e$/year (large project)

| Calendar year of crediting period | Estimated GHG emission reductions or removals ($tCO_2e$) |
|---|---|
| 15-April-2023 to 31-Dec-2023 | 36,117 |
| 01-Jan-2024 to 31-Dec-2024 | 50,509 |
| 01-Jan-2025 to 31-Dec-2025 | 50,509 |
| 01-Jan-2026 to 31-Dec-2026 | 50,509 |
| 01-Jan-2027 to 31-Dec-2027 | 50,509 |
| 01-Jan-2028 to 31-Dec-2028 | 50,509 |
| 01-Jan-2029 to 31-Dec-2029 | 50,509 |
| 01-Jan-2030 to 31-Dec-2030 | 50,509 |

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|---|---|
| 01-Jan-2031 to 31-Dec-2031 | 50,509 |
| 01-Jan-2032 to 31-Dec-2032 | 50,509 |
| 01-Jan-2033 to 14-April-2033 | 14,392 |
| **Total estimated ERRs during the first or fixed crediting period** | 505,090 |
| **Total number of years** | 10 |
| **Average annual ERRs** | 50,509 |

## 1.12 Description of the Project Activity

The project involves construction of a centralized animal manure management system which collects manure waste from dairy cow from Zhumadian farm in Xiping county. 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 will be used for electricity generation at the biogas power plant. 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. The installed capacity of the biogas power plant is 1MW. The electricity generated by the project is only use for internal use. The emission reductions from waste heat recovery and electricity generation will not be accounted for. 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.

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. Four CSTR digesters with effective volume of 7,000 $m^3$ each will be installed.

Biogas pre-treatment system

Before electricity generation, combustion or flaring, the biogas will be 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.

Digestate advanced treatment unit

The digestate from the anaerobic digesters will be sent to digestate advanced treatment units, it mainly involved filter press and then return to nearby field.

Biogas power generation system

The biogas electricity generation plant will be installed at the project site. The installed capacity of the project is 1MW (1MW×1). The type of generator is LSA50.2VL10C6S/4. The speed is 1500rpm. The electricity generated by the project is only use for internal use, no electricity supplied to the grid. 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.

Emergency flare system

An emergency flare system was installed to ensure all the biogas was destroyed in case the generator is defected. The power rate is 2 kW, the design discharge is 1900$m^3$/h.

## 1.13 Project Location

The Project is located at Hongcunpu Village, Leizu Town, Xiping County, Zhumadian City, Henan Province,P.R China. The coordinates of the project site are 33°25′0″N, 113°42′6″E. The project location is shown in Figure 1.1.

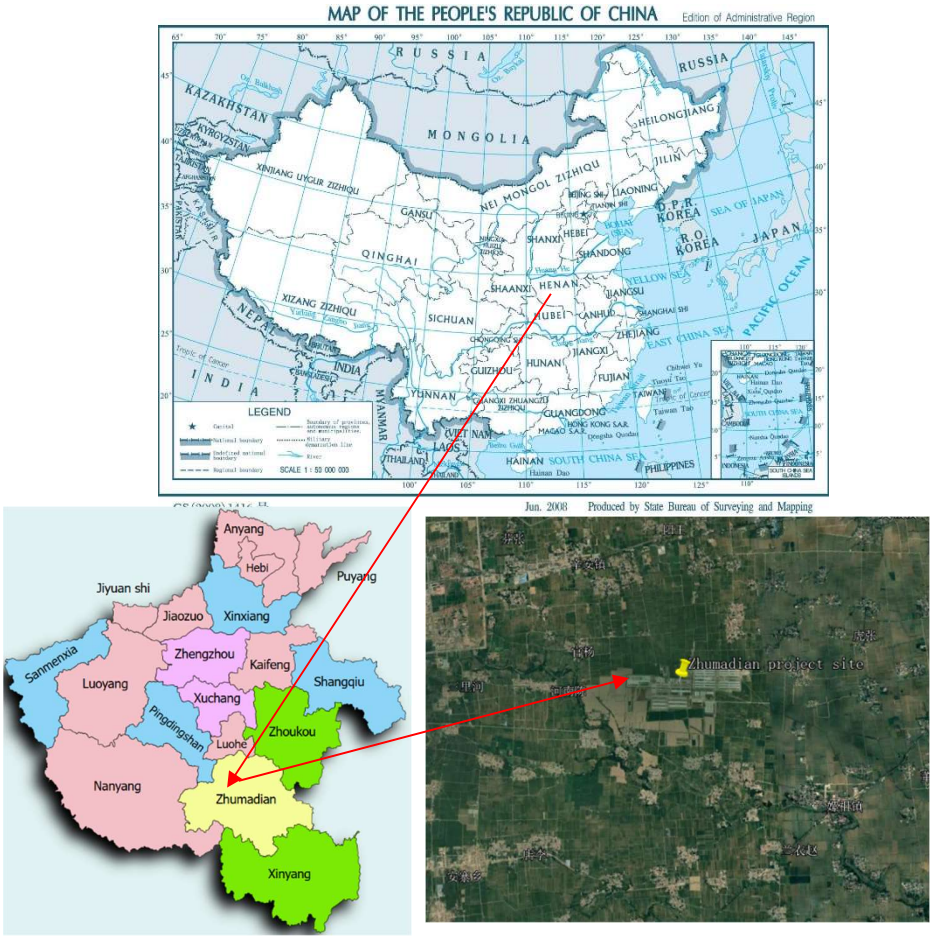



Figure 1.1 Location of the Project

## 1.14 Conditions Prior to Project Initiation

The baseline scenario is the same as the conditions existing prior to the project initiation. Please refer to Section 3.4 (Baseline Scenario).

In absence of the project, the animal manure waste would be disposed in uncovered anaerobic manure management system (lagoon) and methane is emitted to the atmosphere.

## 1.15 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];

[2] http://www.china-npa.org/uploads/1/file/public/201803/20180327160313_j8uwkhdxgn.pdf

2. Law of the People's Republic of China on the Prevention and Control of Solid Waste Pollution[3];
3. Regulations on prevention and control of pollution from large scale livestock and poultry breeding[4]
4. Renewable Energy Law of the People's Republic of China[5];
5. Catalogue for the Guidance of Industrial Structure Adjustment (2019 revision)[6];

The project has obtained the project approval and EIA approval from local government authorities: Daming County Administrative Examination and Approval Bureau. 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.

## 1.16 Double Counting and Participation under Other GHG Programs

### 1.16.1 No Double Issuance

Is the project receiving or seeking credit for reductions and removals from a project activity under another GHG program?

☐ Yes ☒ No

### 1.16.2 Registration in Other GHG Programs

Has the project registered under any other GHG programs?

☐ Yes ☒ No

### 1.16.3 Projects Rejected by Other GHG Programs

Has the project been rejected by any other GHG programs?

☐ Yes ☒ No

## 1.17 Double Claiming, Other Forms of Credit, and Scope 3 Emissions

### 1.17.1 No Double Claiming with Emissions Trading Programs or Binding Emission Limits

[3] https://www.mee.gov.cn/ywgz/fgbz/fl/202004/t20200430_777580.shtml

[4] http://www.gov.cn/flfg/2013-11/26/content_2535095.htm

[5] http://www.nea.gov.cn/2017-11/02/c_136722869.htm

[6] http://www.gov.cn/xinwen/2019-11/06/content_5449193.htm

Are project reductions and removals or project activities also included in an emissions trading program or binding emission limit? See the *VCS Program Definitions* for definitions of emissions trading program and binding emission limit.

☐ Yes ☒ No

The project owner is not part of any emission trading program. The net GHG emission reductions from the project will not be used for compliance with emission trading programs or to meet binding limits on GHG emissions. The project activity has not participated under any other GHG programs.

China has a national emissions trading scheme only cover the high-emission industries that emit at least 26,000 tons of (eg. petrochemical, chemical, building materials, iron and steel, non-ferrous, paper, aviation) $CO_2e$/year, not including renewable project[7]. And the project activity is not included the mandatory emission control scheme and there is no emission cap enforced for the project owner according to the enforced company list in public information[8]. The project did not register or applied for registration under the Chinese Pilot Market for Carbon Trading. The Chinese Pilot Market for Carbon Emission Trading built 7 pilot markets for carbon trading in 2011 in Beijing City, Shanghai City, Tianjin City, Chongqing City, Guangdong Province, Liaoning Province, and Shenzhen City[9]. The project locates in Liaoning Province, which was not part of the pilot markets. Furthermore, the project does not register or applies for registration under the Chinese Carbon Trading Market, which replaces the pilot market since 2021.

Hence, it is confirmed that the emission reductions will not be double counted.

### 1.17.2 No Double Claiming with Other Forms of Environmental Credit

Has the project activity sought, received, or is planning to receive credit from another GHG-related environmental credit system? See the *VCS Program Definitions* for definition of GHG-related environmental credit system.

☐ Yes ☒ No

### 1.17.3 Supply Chain (Scope 3) Emissions

Do the project activities specified in Section 1.12 affect the emissions footprint of any product(s) (goods or services) that are part of a supply chain?

☐ Yes ☒ No

[7] https://www.mee.gov.cn/xxgk2018/xxgk/xxgk05/202103/t20210330_826728.html

[8] http://sthjt.zj.gov.cn/art/2021/12/16/art_1229263559_4843729.html

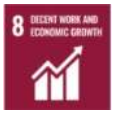
[9] https://www.gov.cn/xinwen/2021-08/03/content_5629115.htm

## 1.18 Sustainable Development Contributions

The Project contributes to sustainable development in the following ways:

- The project provides job opportunities and increase tax revenue, which will have a positive effect on the local economy. Thus, the project achieved SDG 8 Decent Work and Economic Growth[10].
- Reduce greenhouse gas emissions. The project recovers and destroys biogas that would otherwise be released directly into the atmosphere, effectively reducing greenhouse gas emissions, which contributes to China's commitment to peak carbon dioxide emissions before 2030. Thus, the project achieved SDG 13 Climate Action[11].

The project contributes to achieving Chinese sustainable development priorities is described as below:

| SDG Targets | | Chinese Sustainable Development Progress | Project activity contribution |
|---|---|---|---|
|  | 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". | China is deeply implementing the employment priority strategy, placing the promotion of employment as a top priority for economic and social development, and promoting decent work and comprehensive development for workers. Firstly, the scale of employment continues to expand, while the level of unemployment remains low. From 2015 to 2022, the average annual increase in urban employment was about 13 million, with 733.51 million employed people nationwide in 2022. The second is the continuous optimization of | The project activity can provide employment opportunities for local villagers. 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". |

[10] https://sdgs.un.org/goals/goal8

[11] https://sdgs.un.org/goals/goal13

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|---|---|---|---|
| | | the employment structure, and the employment structure of the "inverted pyramid" of the three industries is gradually forming. Thirdly, the quality of employment continues to improve, and the employment of key groups remains stable. | |
|  | 13.2 Integrate climate change measures into national policies, strategies and planning | China has promoted the clean, low-carbon and efficient use of energy, and made new achievements in the clean and low-carbon transformation of industry, construction, transportation and other fields. In 2022, China's energy consumption per unit of GDP was reduced by 35% compared with 2012. | The project is to utilize the LFG for electricity generation to avoid methane emissions and $CO_2$ emissions from the production of the equivalent amount of electricity replaced by the Project that would otherwise have been purchased from the CCPG. This contributes to achieve China's stated sustainable development priorities "China's carbon dioxide emissions would strive to peak by 2030 and strive to achieve carbon neutrality by 2060 ". |

## 1.19 Additional Information Relevant to the Project

### 1.19.1 Leakage Management

According to the methodology, no leakage effects are accounted for.

### 1.19.2 Commercially Sensitive Information

There is no commercially sensitive information has been excluded from the public version of the project description.

### 1.19.3 Further Information

There is no additional relevant legislative, technical, economic, sectoral, social, environmental, geographic, site-specific and/or temporal information that may have a bearing on the eligibility

of the project, the net GHG emission reductions or removals, or the quantification of the project's net GHG emission reductions or removals.

# 2 SAFEGUARDS AND STAKEHOLDER ENGAGEMENT

## 2.1 Stakeholder Engagement and Consultation

### 2.1.1 Stakeholder Identification

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| **Stakeholder Identification** | The stakeholder identification process for the project involved a step-by-step approach. Initially, the project owner performed a project scope analysis. This included evaluating the geographic boundary, potential environmental impacts, and the communities served by the project. Following this, the project owner engaged in a stakeholder mapping exercise, identifying individuals and organizations with a vested interest or potential influence over the project. Interviews and surveys were conducted with residents, businesses, and subject matter experts to gather various perspectives. In addition, the project owner reviewed regulatory standards and consulted with government entities to ensure compliance and to identify any legal stakeholders.<br><br>The following people are considered as the stakeholders of the project during the implementation stage.<br><br>▪ Residents of the nearby village.<br><br>▪ Relevant administrative staff of the local government. |
| **Legal or customary tenure/access rights** | Applicable legal frameworks govern land use and access rights. The project activity do not involve alterations to the existing legal or customary tenure/access rights of stakeholders, indigenous people (IPs), local communities (LCs), or customary rights holders, as the land is already designated for industrial purposes. |
| **Stakeholder diversity and changes over time** | The social diversity mainly includes the differences of age, education, and occupations. The nearby residents are dominated by farmers, who also have a relatively low level of education. The worker of the plant is in the range of legal enforcement which is between 22 and 60/55 (male/female) years old. From the public |

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| | recruitment information, workers of the project at least have accepted junior high school education. Experts and management personnel might be people who accept higher education or older. But it's not absolute.<br><br>The economic sources of the stakeholders mainly come from farming, migrant work, individual enterprises and working in enterprises and governments. There are some disparities in income between different staff members. The project employs some local residents to solve some employment problems and increase their income.<br><br>The stakeholders involved in the project are all Han, no minority ethnic groups are involved, and no obvious significate cultural diversity identified among Han people. The interactions between the stakeholder groups are mainly collaboratively, involves project information sharing and joint decision-making.<br><br>Over time, the members of each group will adjust, but their groups does not change much in terms of society, economy, culture, etc. |
| **Expected changes in well-being** | The project is expected to improve the local environment. Besides, the project provides numerous employment options for residents, which will subsequently lead to a reduction in the number of impoverished households. By increasing their income, these job opportunities will enable individuals to connect with one another and engage in more social activities, ultimately fostering greater interaction within the community. As a result, the overall welfare of the local communities will witness a substantial improvement. |
| **Location of stakeholders** | Stakeholders in this project located at the project site and within a few kilometers of it. |
| **Location of resources** | The project is not involved the territories and resources, or customary access of the stakeholders own. |

### 2.1.2 Stakeholder Consultation and Ongoing Communication

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| **Date of stakeholder consultation** | 11-May-2021 |

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| Stakeholder engagement process | Prior to the Project construction, the project owner conducted local stakeholder consultation by distributing survey questionnaires in May 2021, to get informed of the stakeholders' opinion about the Project in various aspects. A total of 30 questionnaires were distributed and collected for the survey. |
| Consultation outcome | No negative feedback was received in public announcement and the local community expressed their approval for the project. The 30 questionnaires were distributed to local stakeholders, and all questionnaires have been recollected.<br><br>All surveyed members of the public are aware of the construction of the project and believe that the construction of the project will be beneficial or basically have no impact on their lives, and all in favor of the construction of the project under the premise of taking environmental protection measures to ensure that the emission standards are met. |
| Ongoing communication | The project owner has set up an on-going communication mechanism to regularly hold stakeholder meetings, distribute questionnaires and give the response to various stakeholders. Communications with Local stakeholders are being carried out at periodic intervals. Moreover, local stakeholders can also raise their concerns and opinions directly by making a phone call to the project owner. |
| Stakeholder input | During the project operation, feedback from stakeholders through surveys, phone calls, etc., regarding the project were collected and regularly reported to company management. Regarding environmental impact or safety issues, the relevant responsible personnel would be promptly notified for inspection and corrective action upon receiving the feedback, and an immediate report would be submitted to the company management. |

### 2.1.3 Free Prior and Informed Consent

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| Obtaining consent | The project belongs to the emission reduction project and is supported and encouraged by the government. The project has obtained project approval and EIA approval from local government. Therefore, the project has been approved by the local government. Meanwhile, the project owner obtained the approval from the Landfill site through signing the cooperation Agreement on Landfill Gas Collecting and utilization. The project has maintained ongoing |

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| | communication with the local residents and has secured permission and support for its construction and operation, as detailed in section 2.1.2. There are no ongoing or unresolved conflicts. |
| Outcome of FPIC | Local stakeholders are supportive of the construction of the project. The project was constructed with the consent of government departments at all levels. The project has not encroached on land, relocated people without consent, and forced physical or economic displacement. Most surveyed stakeholders think the project improves regional economic development without adverse environmental impact. The survey shows that the stakeholders are supportive of the project. |

### 2.1.4 Grievance Redress Procedure

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| Development process | There is an opinion book about the project at the entrance of the project owner's company. The stakeholders can register any opinions and suggestions on the project in the opinion book at any time, or stakeholders can visit the official website of Yingkou City Ecological Environment Bureau[12] or call directly to reflect, report problem or give comments at any time.<br><br>The project owner designates a person responsible for recording and collecting conflicts and grievances of the local community, and the related resolution process is as follows. |
| Grievance redress procedure | Firstly, once getting the complaints or grievances, project owner shall contact and discuss with relevant community or other stakeholders within 3 days. Then the specific staff of project owner should propose a solution and mediation which is performed by relevant government agency within a week based on all collected information. Thirdly, the project owner will address their complaints or grievances by relevant legal method such as arbitration and courts if necessary. Finally, the entire complaints or grievances redress process shall be dealt within 30 days. |

### 2.1.5 Public Comments

This project will open for public comment during the public comment period . If comments are received in the future, we will respond within 1 to 2 weeks, and the response to the comments

[12] http://sthjj.yingkou.gov.cn/

will be implemented until the next verification, and the relevant evidence will be provided to VVB for review and confirmation.

| Comments received | Actions taken |
|---|---|
| Not Applicable. | Not Applicable. |

## 2.2 Risks to Stakeholders and the Environment

### 2.2.1 Management Experience

The project owner, Zhumadian Youran Animal Husbandry Co., Ltd. has sufficient capacity and experience in project management, and the project has been running since April 2023 without any problems. The technicians of project owner have professional licenses and extensive hands-on experience, and regular training is conducted to further improve the skills of its staff. As the parent company, Inner Mongolia Youran Animal Husbandry Co., Ltd. oversees a vast network of anaerobic fermentation of manure and utilization of biogas projects spread across multiple locations, such as Jinan Pingyin Youran Dairy Cattle Manure Management Project (VCS4443), which was operated by another subsidiary JInan Youran Animal Husbandry Co., Ltd., who can provide corresponding technical and management support and training to the project owmer.

Thus the management team has expertise and experience in implementing similar project activities and engaging communities.

### 2.2.2 Risk Assessment

| | Risks identified | Mitigation or preventative measure(s) taken |
|---|---|---|
| Natural and human-induced risks to stakeholders' wellbeing | No risk identified | The construction and operation of the project will strictly comply with all of national environmental emission standards and will not pose any risk to stakeholders. |
| Risks to stakeholder participation | No risk identified | The mechanism for on-going communication with local stakeholders has been set up<br>Stakeholders are free to reach the reflection portals anytime anywhere and face no barrier or pressure to report the problems without leaving their name or showing face. |
| Working conditions | No risk identified | The project has obtained project approval and EIA approval, in this sense, the project meets all the requirement of regulation and laws set up by |

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| | | Chinese government in aspect of environment, health and safety. According to EIA, the project owner has established and improved the safety production responsibility system; formulated safety production rules and regulations and operating procedures; formulated and implemented the safety production education and training plan. These measures ensure the effective implementation of safety production investment, eliminate safety hazards in time, and carry out the standardization construction of safety production. |
| Safety of women and girls | No risk identified | Article 12 of Labour Law of the People's Republic of China enforces: Labourers, regardless of their ethnic group, race, sex, or religious belief, shall not be discriminated against in employment. The project owner obeys the anti-discrimination rules set out in the law |
| Safety of minority and marginalized groups, including children | No risk identified | Article 12 of Labour Law of the People's Republic of China enforces: Labourers, regardless of their ethnic group, race, sex, or religious belief, shall not be discriminated against in employment. And article 15 enforces: The employing units are prohibited from recruiting minors under the age of 16. The project owner strictly obeys the law. |
| Pollutants (air, noise, discharges to water, generation of waste, and release of hazardous materials and chemical pesticides and fertilizers) | No risk identified | The Project owner entrusted a third party, Henan Guanyu Environmental Protection Technology Co., Ltd to conduct the Environmental Impact Assessment (EIA) of the project. The EIA report was completed in December 2020 and was approved by Yingkou Administrative Approval Bureau on 12-January-2021 (Zhuhuanshen (2021) No.5).<br>The environmental impacts of the project in operation period are summarized as follows.<br>1 Air pollution<br>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 to be treated through 2 stage purification equipment before being discharged through exhaust cylinders with 20m |

high. The dust from organic fertilizer plant is to be filtered by dust collector and reused in the organic fertilizer plant. The NOx, 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).

2 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 will also be recycled in anaerobic digesters, surplus biogas slurry will be used as material for organic fertilizer production. No wastewater will be discharged to the environment.

3.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.

4. 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 shall be properly collected and stored in the hazardous waste temporary deposit, and shall be submitted to the relevant qualified entities for centralized treatment regularly.

In conclusion, the environmental impact during the project operation will be minor. The project can reduce greenhouse gas emissions and environmental pollution caused by methane released. The Project owner takes appropriate

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| | | measures to minimize adverse environmental impacts. |

## 2.3 Respect for Human Rights and Equity

### 2.3.1 Labor and Work

| | Risks identified[13] | Mitigation or preventative measure(s) taken |
|---|---|---|
| Discrimination | No risk identified | Article 12 of Labour Law of the People's Republic of China enforces: Labourers, regardless of their ethnic group, race, sex, or religious belief, shall not be discriminated against in employment.<br>The project owner strictly obeys the anti-discrimination rules set out in the law. No discrimination has occurred or will occur. |
| Sexual harassment | No risk identified | Article 40 of Law of People's Republic of China for the Protection of Women's Rights and Interests enforces: Sexual harassment of women is prohibited. Women victims have the right to complain to their units and relevant authorities.<br>The project owner strictly obeys the anti-discrimination rules set out in the law. No discrimination or sexual harassment has occurred or will occur. |
| Equal pay for equal work | No risk identified | Article 46 of the Labour Law of the People's Republic of China stipulates that the distribution of wages shall be based on the principle of distribution according to work, with equal pay for equal work. The project owner strictly obeys the law. |
| Gender equity in labor and work | No risk identified | Chapter IV Labor and Social Security Rights and Interests of Law of People's Republic of China for the Protection of Women's Rights and Interests provide the legal enforcement for gender equity in labour and work. The project owner strictly obeys the law. |
| Forced labor | No risk identified | Article 244 of the Criminal Law of the People's Republic of China [Crime of Forced Labor] |

[13] The identified risks and commensurate mitigation or preventative measure(s) for forced labor, child labor, and human trafficking, must be inclusive of staff and contracted workers employed by third parties.

| | | |
|---|---|---|
| | | Anyone who forces another person to work by means of violence, threat or restriction of personal freedom shall be sentenced to fixed-term imprisonment of not more than three years or detention, and shall be fined; if the circumstances are serious, he shall be sentenced to fixed-term imprisonment of not less than three years but not more than 10 years, and shall be fined. The project owner strictly obeys the law. |
| **Child labor** | No risk identified | Article 15 of the Labor Law of the People's Republic of China states: "Employers are prohibited from employing minors under the age of sixteen. The project owner strictly obeys the law. |
| **Human trafficking** | No risk identified | All the labour is hired from normal paths. Labourers have the right to resign anytime. Article 15 of Labour Law of People's Republic of China enforces: The employing units are prohibited from recruiting minors under the age of 16. The project owner strictly obeys the law. |

### 2.3.2 Human Rights

| Risks identified | Mitigation or preventative measure(s) taken |
|---|---|
| No risk identified | The project strictly follows the Labour Law of in line with People's Republic of China. The legal rights and interests of all employees are protected. The project is committed to upholding the rights of IPs, LCs, and customary rights holders by engaging in ongoing, informed consultations, obtaining their free, prior, and informed consent for any activities, and ensuring that their cultural heritage and traditional knowledge are respected and preserved by international human rights law, the United Nations Declaration on the Rights of Indigenous Peoples, and ILO Convention 169. |

### 2.3.3 Indigenous Peoples and Cultural Heritage

| Risks identified | Mitigation(s) or preventative measure taken |
|---|---|
| No risk identified | The purpose of the project is to utilize landfill gas (LFG), which consists |

| | |
|---|---|
| | mainly of methane, for electricity generation.LFG collected will be used for electricity generation with internal combustion generators. Greenhouse gas (GHG) emissions will be reduced by avoiding $CO_2$ emissions from those fossil fuel-based power plants connected to the grid and by avoiding GHG emissions from releasing LFG into atmosphere at the landfill site. As the territories and resources occupied by the project is the area of Dashiqiao Huzhuang Landfill, where no indigenous peoples and cultural heritage involved. |

### 2.3.4 Property Rights

| Risks identified | Mitigation or preventative measure(s) taken |
|---|---|
| No risk identified | The project prioritizes protecting stakeholders' property rights by engaging in regular consultations, complying with legal standards, documenting rights, offering accessible conflict resolution, and ensuring fair benefit sharing and transparent monitoring.<br>Based on the Landfill Gas Power Generation Cooperation Agreement between the Dashiqiao Huzhuang Landfill and the project owner, the LFG power genaration project constructed and operated by Zhumadian Youran Animal Husbandry Co., Ltd. in Dashiqiao Huzhuang Landfill. |

### 2.3.5 Benefit Sharing

| | |
|---|---|
| **Process used to design the benefit sharing plan** | There is no considerable negative effect of project activities to any stakeholder groups.<br><br>The project has been approved by the local government. And by implementing the project, the local environment has been improved. The project does not result in any risks related to protecting and preserving the property rights of IPs, LCs, and customary rights holders, and to protecting legal or customary tenure/access rights to territories, property, and resources. Therefore, no benefit sharing plan is required. |
| **Summary of the benefit sharing plan** | As clarified above, no benefit sharing plan is required for the project. |
| **Approval and dissemination of** | As clarified above, no benefit sharing plan is required for the project. |

| | |
|---|---|
| benefit sharing plan | |

## 2.4 Ecosystem Health

| | Risks identified | Mitigation or preventative measure(s) taken |
|---|---|---|
| Impacts on biodiversity and ecosystems | No risk identified | The project activity is renewable electricity generation that avoids direct emissions of methane ($CH_4$) emissions from the anaerobic animal manure management system (lagoon) into the atmosphere, which has no negative impact to biodiversity and ecosystems. The project is also not located in the protected area. |
| Soil degradation and soil erosion | No risk identified | The EIA report states that a soil impact assessment is not required for this type of project. |
| Water consumption and stress | No risk identified | Based on the EIA report, the project will not cause water shortage. |
| Usage of fertilizers | No risk identified | 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. |

### 2.4.1 Rare, Threatened, and Endangered Species

Is the project located in or adjacent to habitats for rare, threatened, or endangered species?

☐ Yes ☒ No

| | Risks identified | Mitigation or preventative measure(s) taken |
|---|---|---|
| Habitats for rare, threatened, and endangered species | No risk identified | As per the EIA report, the project's location does not involve any habitats for rare, threatened, or endangered species. |
| Areas for habitat connectivity | No risk identified | The project's located in Hongcunpu Village, Leizu Town, Xiping County, Zhumadian City, there is no areas |

| | | |
|---|---|---|
| | | for habitat connectivity. |

### 2.4.2 Introduction of Species

Not applicable as the project does not plant or introduce any species.

### 2.4.3 Ecosystem Conversion

| | Risks identified | Mitigation or preventative measure(s) taken |
|---|---|---|
| **Ecosystem conversion** | No risk identified | Not applicable as the project is a non-AFOLU project. |

# 3 APPLICATION OF METHODOLOGY

## 3.1 Title and Reference of Methodology

| Type (methodology, tool or module). | Reference ID, if applicable | Title | Version |
|---|---|---|---|
| **Methodology** | AMS-III.D. | Methane recovery in animal manure management systems[14] | 21.0 |
| **Tool** | TOOL05 | Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation[15] | 03.0 |
| **Tool** | TOOL07 | Tool to calculate the emission factor for an electricity system[16] | 07.0 |
| **Tool** | TOOL14 | Project and leakage emissions from anaerobic digesters[17] | 03.0 |

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

https://cdm.unfccc.int/methodologies/DB/H9DVSB24O7GEZQYLYNWUX23YS6G4RC

[14] https://cdm.unfccc.int/UserManagement/FileStorage/1AWXEKHVTYF423LCN56Z9GIMQOS8JR

[15] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v3.0.pdf

[16] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf

[17] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-14-v3.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.

| 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.<br><br>The project is a centralized plant treats animal manure waste collected from Zhumadian farm. The project replaces existing anaerobic animal manure management systems (open lagoon) in livestock farms to achieve methane recovery and destruction by flaring/combustion or gainful use of the recovered methane. |
| 2 | This methodology is only applicable under the following conditions:<br><br>a) The livestock population in the farm is managed under confined conditions | Applicable.<br><br>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.<br><br>As per the FSR, 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.<br><br>The annual average temperature of baseline site where anaerobic manure treatment facility is located is higher than 5 °C. The average temperature in project site is 14.7～15.0℃[18]. |
| | d) In the baseline scenario the retention time of manure waste in the anaerobic treatment system is greater than one month, and if anaerobic | Applicable.<br><br>In the baseline scenario the retention time |

[18] https://www.zhumadian.gov.cn/html/site_gov/welcome/zjzmd/zjzmd/new/zrdl.html

| | | |
|---|---|---|
| | lagoons are used in the baseline, their depths are at least 1 m | of manure waste in the anaerobic lagoons is greater than one month, and their depths are at least 1 m. |
| | e) No methane recovery and destruction by flaring or combustion for gainful use takes place in the baseline scenario | Applicable.<br><br>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:<br><br>(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; | Applicable.<br><br>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. |
| | (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.<br><br>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.<br><br>The storage time of the manure after removal from the animal barns, including transportation will not exceed 45 days before being fed into the anaerobic digester. |
| 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 | Irrelevant.<br><br>The project does not involve landfill methane recovery, wastewater treatment, composting animal manure, or co-digestion of animal manure and other organic matters. |

| | | |
|---|---|---|
| | other organic matters shall use the methodology "AMS-III.AO Methane recovery through controlled anaerobic digestion". | |
| 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. | Irrelevant.<br>Part of the recovered biogas is used to generate electricity for the auxiliary equipment of the project activity, no electricity delivered electricity to the power grid, zero is used as its emission factor, and the project is not eligible as an SSC CDM Type I project component, which means no emission reductions will be claimed for this part of biogas utilization. |
| 6 | 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". | Applicable.<br>The project is a Greenfield project. The emission reduction sourced from methane recovery is 50,509 $tCO_2e/yr$, which is lower than the threshold of 60,000 $tCO_2e/yr$. 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.<br>The emission reductions from the recovery and destruction of methane (viz. Type III components of the project) is 50,509 $tCO_2e/yr$, which is less than 60 kt $CO_2$ equivalent. |

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

Table 3-2 Applicability of applied tools

| Tool | Applicability | The project |
|---|---|---|

| | | |
|---|---|---|
| Tool 05: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation (version 03.0) | 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:<br><br>(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;<br><br>(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<br><br>(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 | Applicable.<br><br>The source of electricity consumption of the project is Scenario A: Electricity consumption from the grid |

| | | |
|---|---|---|
| | be provided with 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:<br><br>(a) Scenario I: Electricity is supplied to the grid;<br><br>(b) Scenario II: Electricity is supplied to consumers/electricity consuming facilities; or<br><br>(c) Scenario III: Electricity is supplied to the grid and consumers/electricity consuming facilities. | Irrelevant.<br><br>The electricity generated by the project is only used for the auxiliary equipment of the project activity, no electricity delivered electricity to the power grid or other consumers/electricity consuming facilities. |
| | 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. | Applicable<br><br>No captive renewable power generation technologies are installed to provide electricity in the project activity, in the baseline scenario or to sources of leakage. |
| Tool 07: 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.<br><br>The project may import electricity from CCPG that dominated by fossil-fuel plants. Therefore the tool is applied to estimate the OM, BM and/or CM when calculating project 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 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. | 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. |
| | 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. | Applicable.<br>The project electricity system is located in a non-Annex I country. |
| | Under this tool, the value applied to the $CO_2$ emission factor of biofuels is zero. | The project is not involved in biofuels. |
| Tool 14: Project and leakage emissions from anaerobic digesters (version 03.0) | The following sources of project emissions are accounted for in this tool:<br>(a) $CO_2$ emissions from | Applicable.<br>All sources of project emissions have been accounted. |

| | | |
|---|---|---|
| | consumption of electricity associated with the operation of the anaerobic digester;<br><br>(b) $CO_2$ emissions from consumption of fossil fuels associated with the operation of the anaerobic digester;<br><br>(c) $CH_4$ emissions from the digester (emissions during maintenance of the digester, physical leaks through the roof and side walls, and release through safety valves due to excess pressure in the digester); and<br><br>(d) $CH_4$ emissions from flaring of biogas. | |
| | The following sources of leakage emissions are accounted for in this tool:<br><br>(a) $CH_4$ and $N_2O$ emission from composting of digestate;<br><br>(b) $CH_4$ emissions from the anaerobic decay of digestate disposed in a SWDS or subjected to anaerobic storage, such as in a stabilization pond. | Irrelevant. The project does not involve composting, anaerobic decay or anaerobic storage of digestate. |
| | Emission sources associated with $N_2O$ emissions from physical leakages from the digester, transportation of feed material and digestate or any other on-site transportation, piped distribution of the biogas, aerobic treatment of liquid digestate and land application of the digestate are neglected because these are minor emission sources or because they are accounted in the methodologies referring to this tool. | Applicable. As per the applied methodology, $N_2O$ emissions are neglected because these are minor emission sources. |

## 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 includes the physical and geographical sites of the livestock, the centralized animal manure management system, the biogas power plant. Figure 3-1 shows the project boundary of the Project Activity.

The diagram of the project boundary is shown in Figure 3.1.

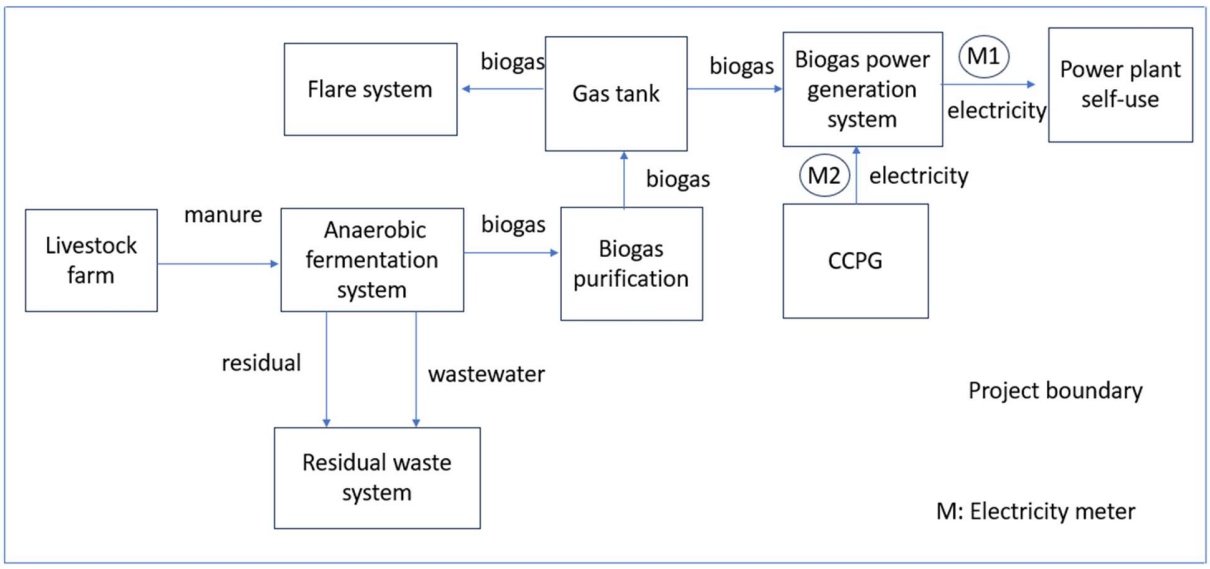


Figure 3.1 Diagram of the project boundary

The main emission sources and gases included in the project boundary are listed in table below:

| 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 |
| | | $N_2O$ | No | Excluded for simplification. |
| | Emissions | $CO_2$ | No | Excluded for simplification. |

| Source | | Gas | Included? | Justification/Explanation |
|---|---|---|---|---|
| | from electricity consumption /generation | $CH_4$ | No | Excluded for simplification. |
| | | $N_2O$ | 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. |
| | | $N_2O$ | No | Excluded for simplification. |
| | Emissions from flaring or combustion of the gas stream | $CO_2$ | No | Excluded for simplification. |
| | | $CH_4$ | No | Excluded for simplification. The enclosed flare is installed for emergency, the emissions are assumed to be very small. The project will not claim this part of emission reduction |
| | | $N_2O$ | 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.<br>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. |
| | | $N_2O$ | No | Excluded for simplification. |
| | Emissions from incremental transportation distances | $CO_2$ | No | Excluded for simplification. |
| | | $CH_4$ | No | Excluded for simplification. |
| | | $N_2O$ | 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 for. |
| | | $N_2O$ | 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 anaerobic manure management system (open lagoon) at the livestock farms and methane is emitted to the atmosphere directly without any methane recovery and destruction facility.

## 3.5 Additionality

The project uses the following steps to demonstrate additionality. The project meets the additionality criteria as outlined in the VCS methodology as:

Step 1: Regulatory Surplus: the project is not mandated by any legal requirements. Please refer to section 3.5.1 below for details.

### 3.5.1 Regulatory Surplus

Is the project located in an  or Non-Annex 1 country?

☐ Annex 1 country ☒ Non-Annex 1 country

Are the project activities mandated by any law, statute, or other regulatory framework?

☐ Yes ☒ No

If the project is located inside a Non-Annex 1 country and the project activities are mandated by a law, statute, or other regulatory framework, are such laws, statutes, or regulatory frameworks systematically enforced?

☐ Yes ☒ No

According to the relevant applicable laws and regulations at the time of submission of registration, i.e. Renewable Energy Law of the People's Republic of China which came into effect on 01-Jan-2006, Agenda for China's 14th Five-Year Plan (2021-2025), there are no new national and/or sectoral policies that could affect the baseline scenario during the crediting period. Therefore, the project is surplus to regulatory requirements.

### 3.5.2 Additionality Methods

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.

In line with AMS-III.D, the project recovers biogas to generate electricity with a total installed capacity of 1MW, which is lower than 5MW. 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. In line with AMS-III.D, the project is deemed automatically additional.

The additionality of the Project has thus been demonstrated.

## 3.6 Methodology Deviations

There is no methodology deviation for the project.

# 4 QUANTIFICATION OF ESTIMATED 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 2019 Refinement to the 2006 IPCC Guidelines). For this calculation, information about the characteristics of the manure and of the management systems in the baseline is required. Manure characteristics include the amount of volatile solids (VS) produced by the livestock and the maximum amount of methane that can be potentially produced from that manure ($B_o$);

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

The project applies option (a) to calculate baseline emissions from the manure management ($BE_y$), and baseline emissions are determined as follows:

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

Where:

| | | |
|---|---|---|
| $GWP_{CH4}$ | = | Global Warming Potential (GWP) of $CH_4$ applicable to the crediting period ($tCO_2e/tCH_4$) |
| $D_{CH4}$ | = | $CH_4$ 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 ($m^3CH_4$/kg-dm) |
| $N_{LT,y}$ | = | Annual average number of animals of type LT in year y (numbers) |
| $VS_{LT,y}$ | = | Volatile solids production/excretion per animal of livestock LT in year y (on a dry matter weight basis, kg-dm/animal/year) |
| $MS\%_{Bl,j}$ | = | Fraction of manure handled in baseline animal manure management system j |

a) Maximum methane producing potential of the manure ($B_0$):

As per the paragraph 18(a) of AMS-III.D (Version 21.0), the maximum methane-producing capacity of the manure ($B_{o,LT}$) varies by species and diet. The preferred method to obtain $B_{o,LT}$ measurement values is to use data from country-specific published sources, measured with a standardised method ($B_{o,LT}$ 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 $B_o$ values are not available, default values from tables 10.16 (UPDATED) of 2019 Refinement to the 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.

As per table 10.16 (UPDATED) of 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories volume 4 Chapter 10, the maximum methane producing potential (B0) for dairy cattle from other regions with high productivity systems is 0.24 $m^3CH_4$/kg-dm.

b) Volatile solids production/excretion per dairy cattle in year y ($VS_{LT,y}$):

As per the paragraph 18 (b) (iii) of AMS-III.D (Version 21.0), if country specific VS values are not available IPCC default values from 2019 Refinement to the 2006 IPCC Guidelines Volume 4 Chapter 10 table 10.13A 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; The default VS value of a dairy cattle from Asia is 9 kg-VS/1000kg-mass/day. Since this default value is based on a daily basis, we convert it to an annual value using the following equation.

According to the equation 10.22A(UPDATED) of 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories volume 4 Chapter 10, the volatile solids production/excretion per dairy cattle in year y ($VS_{LT,y}$) can be determined as follows:

$$VS_{LT,y} = VS_{(T,P)} = VS_{rate(T,P)} \times (\frac{TAM_{T,P}}{1000}) \times 365 \quad (2)$$

Where:

$VS_{(T,P)}$ = annual VS excretion for livestock category T, for productivity system P (when applicable), kg-VS/animal/yr

$VS_{rate(T,P)}$ = default VS excretion rate, for productivity system P (when applicable), kg-VS/1000 kg animal-mass/day

$TAM_{(T,P)}$ = typical animal mass for livestock category T, for productivity system P (when applicable), kg/animal

The project chooses the default value from the table 10.13A(NEW) of 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories volume 4 Chapter 10. The default VS value of a dairy cattle from Asia is 9 kg-VS/1000kg-mass/day. And according to the table 10A.5(New) of 2019 Refinement to the 2006 IPCC, the default weight of dairy cattle is 386kg. The average weight of dairy cattle of this project is over 386kg. Thus, choosing to use

the default value is more conservative. The default VS value of a dairy cattle is also equal to 1,268.01 kg-dm/animal/year[19].

c) Methane Conversion Factors (MCF):

As per the paragraph 18 (f) of AMS-III.D (Version 21.0), Methane Conversion Factors (MCF) values are determined for a specific manure management system and represent the degree to which $B_o$ 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(UPDATED) of 2019 Refinement to the 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.

For the MCF, the project applies the IPCC default values provided in table 10.17(UPDATED) of 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 10. According to figure 3A.5.1-3A.5.2 in 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 03, the climate zone of Xiping County, Zhumadian City belongs to Warm Temperate Dry, so the MCF of the project should apply 76%.

d) The annual average number of animals ($N_{LT,y}$):

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

$$N_{LT,y} = N_{da,y} \times \left(\frac{N_{p,y}}{365}\right) \quad (3)$$

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 ($PE_{flare,y}$);

[19] 1,268.01 kg-dm/animal/year = 9 (kg-VS/1000kg-mass/day) * (386 / 1000) *365

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

(d) $CO_2$ emissions from incremental transportation distances;

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

$$PE_y = PE_{PL,y} + PE_{flare,y} + PE_{power,y} + PE_{transp,y} + PE_{storage,y} \quad (4)$$

Where:

| | | |
|---|---|---|
| $PE_y$ | = | Project emissions in year *y* (t $CO_2e$) |
| $PE_{PL,y}$ | = | Emissions due to physical leakage of biogas in year *y* (t $CO_2e$) |
| $PE_{flare,y}$ | = | Emissions from flaring or combustion of the biogas stream in the year *y* (t $CO_2e$) |
| $PE_{power,y}$ | = | Emissions from the use of fossil fuel or electricity for the operation of the installed facilities in the year *y* (t $CO_2e$) |
| $PE_{transp,y}$ | = | Emissions from incremental transportation in the year *y* (t $CO_2e$), as per relevant paragraph in AMS-III.AO |
| $PE_{storage,y}$ | = | Emissions from the storage of manure (t $CO_2e$) |

**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:

$$PE_{PL,y} = 0.10 \times GWP_{CH4} \times D_{CH4} \times \sum_{i,LT} B_{0,LT} \times N_{LT,y} \times VS_{LT,y} \times MS\%_{i,y} \quad (5)$$

Where:

| | | |
|---|---|---|
| $GWP_{CH4}$ | = | Global Warming Potential (GWP) of $CH_4$ applicable to the crediting period (t $CO_2e$/t $CH_4$) |
| $D_{CH4}$ | = | $CH_4$ density (0.00067 t/m³ at room temperature (20 °C) and 1 atm pressure) |
| $LT$ | = | Index for all types of livestock |
| $j$ | = | Index for animal manure management system |
| $N_{LT,y}$ | = | 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) |

$MS\%_{i,y}$ = 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 paragraph18 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 03.0).

Based on the FSR, all the methane generated by the project will be used as energy supply. In order to ensure no biogas is released under exigencies, an emergency flare system is installed at the project site, this emergency flare system is not used under normal operation. In addition, in case this emergency flare system operated, the emissions reductions during this period will be excluded for conservativeness, thus $PE_{flare,y}$ is excluded as well, so $PE_{flare,y}$ = 0 $tCO_2e$.

**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. Thus, $PE_{FC,y}$ = 0 $tCO_2e$.

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:

$$PE_{EC,y} = \sum_j EC_{PJ,j,y} \times EF_{EL,j,y} \times (1 + TDL_{j,y}) \quad (6)$$

Where:

$PE_{EC,y}$ = Project emissions from electricity consumption in year y (t $CO_2$ / 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 $CO_2$/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%.

$EC_{PJ,j,y}$ is ex ante determined as 0 in the PD and will be monitored ex post in the verification period.

**Determination of the emission factor for electricity generation ($EF_{EL,j,y} = EF_{grid,CM,y}$)**

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

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

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

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

Step 5: Calculate the build margin (BM) emission factor;

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

Step 1: Identify the relevant electricity systems.

The delineation of the electricity systems in China is provided by Chinese DNA. Among the six regional power grids, Central China Power Grid (NCPG) covers Henan Province, Hubei Province ,Hunan Province and Jiangxi Province. Since the Project is located in Henan Province, NCPG is identified as the relevant electricity system.

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.

Considering the structure of China's power system, 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, detailed data from each power plant are sensitive business information and are mostly confidential and thus not publicly available. Therefore, method (c) are not suitable for the calculation.

The Simple OM method (a) can only be applied when low-cost/must run resources[20] constitute less than 50% of total grid generation in average of the five most recent years. According to the data from "2023 Baseline Emission Factors for Regional Power Grids in China", from year 2017 to year 2021, for the NCPG the project activity connected to, the low-cost/must-run electric power resources generation accounts for the total grid total are 36.99%, 35.75%, 36.66%, 40.78% and 41.27%[21], respectively, all 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.

[20] Low-cost/must-run resources are defined as power plants with low marginal generation costs or power plants that are dispatched independently of the daily or seasonal load of the grid. They typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. If coal is obviously used as must-run, it should also be included in this list, i.e. excluded from the set of plants.

[21] https://ccer.cets.org.cn/notice/noticeDetail?bulletinInfoId=1259913708889575424

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 $CO_2$ emissions per unit net electricity generation ($tCO_2/MWh$) 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 $CO_2$ 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:

$$EF_{grid,\ OMsimple,\ y} = \frac{\sum_{i,} (FC_{i,\ y} \times NCV_{i,\ y} \times EF_{CO2,\ i,\ y})}{EG_y} \quad (7)$$

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) |
| $EF_{CO2,i,y}$ | = $CO_2$ 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 CDM-PDD to the DOE for validation.

If available, $NCV_{i,y}$ and $EF_{CO2,i,y}$ 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 PDD, $NCV_{i,y}$ of different fuels are obtained from China Energy Statistical Yearbook 2022. Emission factors ($EF_{CO2,i,y}$ ) of each type of fossil fuel come from IPCC 2006 default values[22].

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 (2020~2022, published annually) and China Energy Statistical Yearbook (2020~2022). Based on these data, the Simple OM Emission Factor ($EF_{grid,OMsimple,y}$) of the Central China Power Grid is calculated as *0.8771 $tCO_2$*/MWh, which is confirmed by 2023 Baseline Emission Factors for Regional Power Grids in China published by the Ministry of Ecology and Environment of China.

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 joint PD&MR 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 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.

[22] There is no refinement in the most recent version of 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories regarding these data.

The PD for listing and the joint PD&MR choose 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 joint PD&MR 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 ($SET_{5-uni}$ ) and determine their annual electricity generation ($AEG_{SET-5-units}$, in MWh);

(b) Determine the annual electricity generation of the proposed 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% of $AEG_{total}$ (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) ($SET_{\geq 20\,percent}$) and determine their annual electricity generation ($AEG_{SET\geq 2\ \ percent}$, in MWh);

(c) From $SET_{5-uni}$ and $SET_{\geq 20\,percent}$ 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. In this case ignore Steps (d), (e) and (f).

Otherwise:

(d) Exclude from $SET_{sample}$ the power units which started to supply electricity to the grid more than 10 years ago. Include in that set the power units registered as CDM project activities, starting with power units that started to supply electricity to the grid most recently, until the electricity generation of the new set comprises 20% of the annual electricity generation of the proposed project electricity system (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) to the extent is possible. Determine for the resulting set ($SET_{sample-CDM}$) the annual electricity generation ($AEG_{SET-sample-CDM}$, in MWh); if the annual electricity generation of that set comprises at least 20% of the annual electricity generation of the proposed project electricity system (i.e. $AEG_{SET-sample-C}$ ≥ 0.2 × $AEG_{total}$), then use the sample group $SET_{sample-CDM}$ to calculate the build margin. Ignore steps (e) and (f).

Otherwise:

(e) Include in the sample group $SET_{sample-CDM}$ the power units that started to supply electricity to the grid more than 10 years ago until the electricity generation of the new set comprises 20%

of the annual electricity generation of the proposed project electricity system (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation);

(f) The sample group of power units m used to calculate the build margin is the resulting set ($SET_{sample-CDM->10yrs}$).

The BM emissions factor is the generation-weighted average emission factor ($tCO_2/MWh$) of all power units *m* during the most recent year y for which electricity generation data is available, calculated as follows:

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

Where:

| | | |
|---|---|---|
| $EF_{grid,BM,y}$ | = | Build margin $CO_2$ emission factor in year *y* (t $CO_2$/MWh) |
| $EG_{m,y}$ | = | Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh) |
| $EF_{EL,m,y}$ | = | $CO_2$ emission factor of power unit m in year *y* (t $CO_2$/MWh) |
| $m$ | = | Power units included in the build margin |
| $y$ | = | The most recent year for which the generation data is available |

As it is difficult to obtain the detailed data on the power generation, fuel consumption and thermal efficiency of each newly built power unit from public documents, a deviation of TOOL07 (07.0) is adopted following the clarifications[23] given by the CDM EB concerning the BM emission factor calculation:

(1) The CDM EB suggested using the efficiency level of the best technology commercially available in the provincial/regional or national grid of China, as a conservative proxy, for each fuel type in estimating the fuel consumption to estimate the build margin.

(2) The EB agreed the use of capacity additions during last 1 ~ 3 years for estimating the build margin emission factor for grid electricity.

(3) The EB also agreed to use of weights estimated using installed capacity in place of annual electricity generation.

The newly built power plants in the past few years are bundled into "grouped new power plant" according to their construction year, their province and their fuel type. The annual net electricity generation in year y of each "grouped new power plant" $EG_{m,y}$ is estimated according to their total capacity and the average utilization hours, using the following equation:

[23] http://cdm.unfccc.int/UserManagement/FileStorage/AM_CLAR_QEJWJEF3CFBP1OZAK6V5YXPQKK7WYJ ("Request for clarification on use of approved methodology AM0005 for several projects in China", the EB's guidance on DNV deviation request)

$$EG_{m,y} = CAP_m \times H_{m,y} \quad (9)$$

Where:

| | | |
|---|---|---|
| $EG_{m,y}$ | = | Annual net electricity generation the unit *m* in year y (MWh) |
| $CAP_m$ | = | Installed capacity of the unit *m* (MW) |
| $H_{m,y}$ | = | Utilization hour of the unit *m* in the year y (h), determined according to the average utilization hour of the same type of unit in the same province |
| $y$ | = | The most recent year for which the generation data is available. For the calculation of BM in 2023, *y* = 2021 |
| $m$ | = | grouped new power plant |

Since the newly built power plants in the same province (*A*), in the same year (*t*) and using the same fuel type (*k*) are grouped into "a grouped new power plant", $CAP_m$ represents the total installed capacity of fuel type *k* power plants located in the province *A* and in the year *t*:

$$CAP_m = CAP_{A,t,k} \quad (10)$$

Where:

| | | |
|---|---|---|
| $CAP_m$ | = | Installed capacity of the unit *m* (MW), with *m* representing the specified combination of *A*, *t*, and *k* |
| $CAP_{A,t,k}$ | = | Total installed capacity of fuel type *k* power plants located in the province *A* and in year *t* |
| $A$ | = | Provinces covered by NCPG, namely, Henan Province, Liaoning Province, Hunan Province, Jiangxi Province, Sichuan Province and Chongqing City |
| $t$ | = | Years related to the grouped new power plants; for the 2023 calculation, *t* represents 2021, 2020, 2019.... until the aggregated electricity generation of the grouped new power plants reaches 20% of the total electricity generation of NCPG |
| $k$ | = | Fuel type of the grouped new power plants, including hydro, thermal (coal, gas, oil, waste incineration, other thermal), nuclear, wind, solar and others. |

**Figure 4.1** shows the procedure applied to determine the sample group of power units *m*.

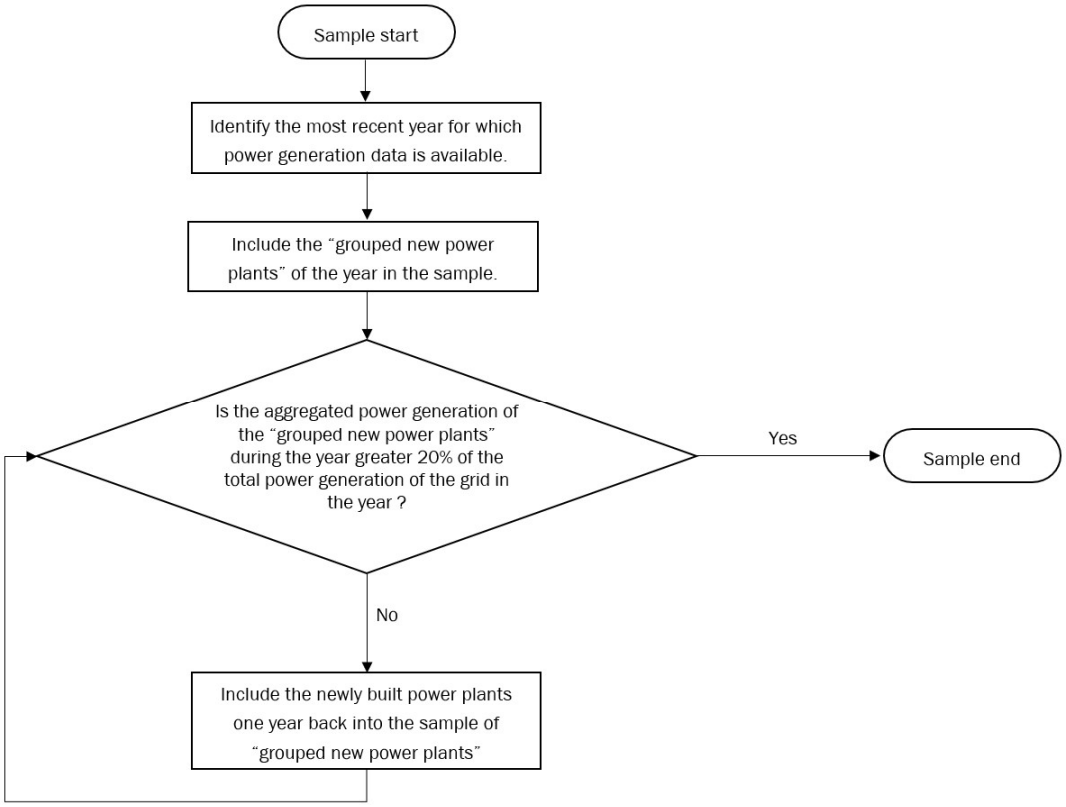


Figure 4.1 Procedure to determine the sample group of power units *m*

The emission factors of each fuel type $EF_{EL,m,y}$ are determined according to Option A2 in TOOL07 (version 07.0), as the following equation:

$$EF_{EL,m,y} = \frac{EF_{CO2,m,i,y} \times 3.6}{\eta_{m,y}} \quad (11)$$

Where:

| | | |
|---|---|---|
| $EF_{EL,m,y}$ | = | $CO_2$ emission factor of power unit *m* in year *y* (t $CO_2$/MWh) |
| $EF_{CO2,m,i,y}$ | = | Average $CO_2$ emission factor of fuel type *i* used in power unit *m* in year *y* (t $CO_2$/GJ) |
| $\eta_{m,y}$ | = | Average net energy conversion efficiency of power unit *m* in year *y* (ratio) |
| $m$ | = | All power units serving the grid in year y except low-cost / must-run power units |
| 3.6 | = | Conversion factor (GJ/MWh) |

Among the fuel types, the emission factors of hydro, nuclear, wind, solar, other thermal and others are 0. Concerning the emission factors of coal, gas, oil and waste incineration, Equation (19) takes the following form, to be conservative:

$$EF_{best,m,y} = \frac{EF_{CO2,m,i,y} \times 3.6}{\eta_{best,y}} \quad (12)$$

Where:

$EF_{best,m,y}$ = Emission factor of power unit m with the best technology commercially available in year *y* (t $CO_2$/MWh)

$\eta_{best,y}$ = Power generation efficiency of the best technology commercially available in year *y*

$m$ = Power units serving the grid with coal, gas, oil or waste incineration in year *y*

The emission factors of coal, natural gas, fuel oil and municipal solid waste (MSW) are sourced from *2006 IPCC Guidelines for National Greenhouse Gas Inventories*, and the lower values of the 95% confidence interval are applied to be conservative.

The calculation result of the BM emission factor $EF_{grid,BM,y}$ for NCPG is 0.2696 t$CO_2$/MWh, as is confirmed by 2023 Baseline Emission Factors for Regional Power Grids *in China* published by the Development and Reform Commission of China.

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

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 should be used as the preferred option. The simplified CM method can only be used if the project activity is located in a Least Developed Country (LDC) or in a country with less than 10 registered CDM projects at the starting date of validation or a Small Island Developing States (SIDS), which means this method is not applicable.

Option A (weighted average CM) is applied.

The combined margin (CM) emission factor $EF_{grid,CM,y}$ of the baseline scenario is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM} \quad (13)$$

Where:

$EF_{grid,OM,y}$ = Build margin $CO_2$ emission factor in year *y* (t$CO_2$/MWh)

$EF_{grid,BM,y}$ = Operating margin $CO_2$ emission factor in year *y* (t$CO_2$/MWh)

$w_{OM}$ = Weighting of build margin emissions factor (%)

$w_{BM}$ = Weighting of operating margin emissions factor (%)

As per TOOL07, $w_{OM}$ and $w_{BM}$ are both 50% during the crediting period. Therefore, the baseline CM emission factor:

$EF_{grid,CM,y}$=0.8771 × 50% + 0.2696 × 50% = 0.5734 $tCO_2$/MWh.

**4. Emissions from incremental transportation in the year y**

According to AMS-III.D, emission from transportation of animal manure between livestock farms and the project site is calculated using relevant paragraph in AMS-III.AO as below:

$PE_{transp,y} = (Q_y/CT_y)*DAF_w*EF_{CO2,transport} + (Q_{res\cdot waste,y}/CT_{res\cdot waste,y})*DAF_{res\cdot waste}*EF_{CO2,transport}$ (14)

Where:

| | | |
|---|---|---|
| $Q_y$ | = | Quantity of raw waste/manure treated and/or wastewater co-digested in the year y(tonnes) |
| $CT_y$ | = | Average truck capacity for transportation (tonnes/truck) |
| $DAF_w$ | = | Average incremental distance for raw solid waste/manure and/or wastewater transportation (km/truck) |
| $EF_{CO2,\ transport}$ | = | $CO_2$ emission factor from fuel use due to transportation ($kgCO_2$/km, IPCC default values or local values may be used) |
| $Q_{res\cdot waste,y}$ | = | Quantity of residual waste produced in year y (tonnes) |
| $CT_{res,waste,y}$ | = | Average truck capacity for residual waste transportation (tonnes/truck) |
| $DAF_{res\cdot waste}$ | = | Average distance for residual waste transportation (km/truck) |

The project site is at the east side of the pasture and waste from the pasture will all enter the receiving tank of the pre-treatment system through tight pipeline, thus there is no emission from transportation of animal manure between livestock farms and the project site. $PE_{transp,y}$ = 0.

**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 EIA report and actual operation log, the manure from Daming farm is sent to anaerobic digester through pipeline and enter into digester with 24 hours, normally 12 hours, but not exceed 24 hours., hence emissions from the storage of manure is not accounted for, $PE_{storage,y}$ = 0 $tCO_2e$.

## 4.3 Leakage Emissions

According to AMS-III.D Methane recovery in animal manure management systems (version 21.0): Leakage is determined by following the relevant procedure in the methodological tool "Project and leakage emissions from anaerobic digesters".

As per "Project and leakage emissions from anaerobic digesters" (version 02.0): The following sources of leakage emissions are accounted for in this tool:

(a) $CH_4$ and $N_2O$ emission from composting of digestate;

(b) $CH_4$ emissions from the anaerobic decay of digestate disposed in a SWDS or subjected to anaerobic storage, such as in a stabilization pond.

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 emissions associated with composting of the digestate.

The digestate produced after anaerobic fermentation is separated by solid-liquid separation, and the solid part is squeezed twice before entering the drying drum. The dried part is used as cow bedding material, and the liquid part is treated with aerobic aeration before being returned to farmland for fertilizer. The liquid part will be sent to aerobic treatment as soon as digestate is separated by solid-liquid separation. Digestate will not be stored under anaerobic conditions. In addition, the project does not involve anaerobic composting of digestate. Therefore, leakage emissions of the project associated with the anaerobic digester is not accounted for, leakage emission is 0.

## 4.4 Estimated GHG Emission Reductions and Carbon Dioxide Removals

The emission reductions achieved by the project activity will be determined ex post through direct measurement of the amount of methane fueled, 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. $N_{LT,y}$, $MS\%_{i,y}$, as well as $VS_{LT,y}$ in cases where adjusted values for animal weight are used). The emission reductions achieved in any year are the lowest value of the following:

$$ER_{y,ex\ post} = \min\left[\left(BE_{y,ex\ post} - PE_{y,ex\ post}\right), \left(MD_y - PE_{power,y,ex\ post}\right)\right] \quad (15)$$

Where:

$ER_{y,ex\ post}$ = Emission reductions achieved by the project activity based on monitored values for year y ($tCO_2e$)

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

$PE_{y,ex\ post}$ = Project emissions calculated using equation 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* ($tCO_2e$)

$PE_{power,y,ex\ post}$ = Emissions from the use of fossil fuel or electricity for the operation of the installed facilities based on monitored values in the year *y* ($tCO_2e$)

As per para.30 of AMS-III.D, if project activities utilize the recovered methane for power generation, methane captured and destroyed or used gainfully by the project activity may be calculated as follows, based on the amount of monitored electricity generation, without monitoring methane flow and concentration:

$$MD_y = \frac{EG_y \times 3600}{NCV_{CH4} \times EE_y} \times D_{CH4} \times GWP_{CH4} \quad (16)$$

Where:

$EG_y$ = Total electricity generated from the recovered biogas in year *y* (MWh)

$3600$ = Conversion factor (1 MWh = 3600 MJ)

$NCV_{CH4}$ = NCV of methane ($MJ/Nm^3$) (use default value: 35.9 $MJ/Nm^3$)

$EE_y$ = Energy conversion efficiency of the project equipment, which is determined by adopting one of the following criteria:

Specification provided by the equipment manufacture. The equipment shall be designed to utilize biogas as fuel, and efficiency specification is for this fuel. If the specification provides a range of efficiency values, the highest value of the range shall be used for the calculation;

Default efficiency of 40 %.

**1. Calculation of baseline emissions:**

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

| Parameter | Value | Data sources |
|---|---|---|
| $GWP_{CH4}$ | 28 $tCO_{2e}/tCH_4$ | IPCC Fifth Assessment Report (AR5) |
| $D_{CH4}$ | 0.67 $kg/m^3$ | AMS-III.D |
| $UF_b$ | 0.94 | AMS-III.D |

| | | |
|---|---|---|
| $MCF_j$ | 76% | Table 10.17 of 2019 refinement to 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 10 |
| $B_{o,LT}$ | Dairy cattle:0.24 $m^3CH_4$/kg-VS | Table 10.16 (UPDATED) of 2019 refinement to 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 10 |
| $VS_{default}$ | Dairy cattle:<br>9 kg-VS/1000kg-mass/day | Table 10.13A (NEW) of 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories volume 4 Chapter 10 |
| $MS\%_{Bl,j}$ | 100% | FSR |
| $nd_y$ | 365 days | FSR |
| $N_{da,y}$ | 365 days | FSR |
| $N_{p,y}$ | 14,400 | FSR |

As per equations (1), the result of the ex-ante calculated baseline emissions of methane from the manure treatment processes of the project is:

Table 4-2: Ex-ante Baseline Emissions $BE_y$

| Index for all types of livestock (LT) | The annual average number of animals ($N_{LT,y}$) | Volatile solids production of livestock LT in year y ($VS_{LT,y}$) (kg-dm/animal/year) | Baseline Emissions ($BE_y$) $tCO_2e$ |
|---|---|---|---|
| - | $N_{LT,y} = N_{da,y} \times (\frac{N_{p,y}}{365})$ | $VS_{LT,y} = \mathrm{VS}_{(T,\mathrm{P})} = \mathrm{VS}_{\mathrm{rate(T,P)}} \times (\frac{\mathrm{TAM_{T,P}}}{1000}) \times 365$ | $BE_y = GWP_{CH4} \times D_{CH4} \times UF_b \times \sum_{j,LT} MCF_j \times B_{0,LT} \times N_{LT,y} \times VS_{LT,y} \times MS\%_{Bl,j}$ |
| Dairy cattle | 14,400 | 1,268.01 | 58,731 |
| Total | - | - | 58,731 |

**2. Calculation of project emissions**

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

| Parameter | Value | Data sources |
|---|---|---|
| $GWP_{CH4}$ | 28 $tCO_2e/tCH_4$ | IPCC Fifth Assessment Report (AR5) |

| | | |
|---|---|---|
| $D_{CH4}$ ($\rho_{CH4}$) | 0.67 kg/m³ | AMS-III.D |
| $B_{o,LT}$ | Dairy cattle:0.24 $m^3CH_4$/kg-VS | Table 10.16 (UPDATED) of 2019 refinement to 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 10 |
| $VS_{default}$ | Dairy cattle:<br>9 kg-VS/1000kg-mass/day | Table 10.13A (NEW) of 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories volume 4 Chapter 10 |
| $MS\%_{i,y}$ | 100% | FSR |
| $N_{da,y}$ | 365 days | FSR |
| $N_{p,y}$ | 14,400 | FSR |
| $f_{CH4, default}$ | 0.6 | "Tool to Project and leakage emissions from anaerobic digesters" |

### 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 per equations (4).

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

| Index for all types of livestock (LT) | The annual average number of animals ($N_{LT,y}$) | Volatile solids production of livestock LT in year y ($VS_{LT,y}$) (kg-dm/animal/year) | Physical leakage of biogas ($PE_{PL,y}$) $tCO_2e$ |
|---|---|---|---|
| - | $N_{LT,y} = N_{da,y} \times (\frac{N_{p,y}}{365})$ | $VS_{LT,y} = VS_{(T,P)} = VS_{rate(T,P)} \times (\frac{TAM_{T,P}}{1000}) \times 365$ | $PE_{PL,y} = 0.10 \times GWP_{CH4} \times D_{CH4} \times \sum_{j,LT} B_{0,LT} \times N_{LT,y} \times VS_{LT,y} \times MS\%_{i,y}$ |
| Dairy cattle | 14,400 | 1,268.01 | 8,222 |
| Total | - | - | 8,222 |

So, the ex-ante calculated result of the project's Physical leakage of biogas is 8,222 $tCO_2e$.

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

As described above, in case this emergency flare system operated, the $PE_{flare,y}$ will be monitored and calculated ex post. The estimated $PE_{flare,y}$ is 0 $tCO_2e$ ex ante.

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

As described in 4.2, the electricity consumption of the project site is ex ante determined as 0 in the PD and will be monitored ex post in the verification period. Thus, $PE_{EC,y} = 0$.

### 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, $PE_{storage,y} = 0\ tCO_2e$.

So, the ex-ante estimated project emission shall calculate as per equation (4):

$$PE_y = PE_{PL,y} + PE_{flare,y} + PE_{power,y} + PE_{transp,y} + PE_{storage,y} = PE_{PL,y} = 8{,}222\ tCO_2e$$

## 3. Calculation of 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 used to produce 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.

Thus, $LE_y = 0$.

## 4. Calculation of the emission reductions

The estimated emission reductions of the 10-year crediting period are calculated as follows:

| Vintage period | Estimated baseline emissions ($tCO_2e$) | Estimated project emissions ($tCO_2e$) | Estimated leakage emissions ($tCO_2e$) | Estimated reduction VCUs ($tCO_2e$) | Estimated removal VCUs ($tCO_2e$) | Estimated total VCUs ($tCO_2e$) |
|---|---|---|---|---|---|---|
| 15-April-2023 to 31-Dec-2024 | 41,997 | 5,879 | 0 | 36,117 | 0 | 36,117 |
| 01-Jan-2025 to 31-Dec-2025 | 58,731 | 8,222 | 0 | 50,509 | 0 | 50,509 |
| 01-Jan-2026 to 31-Dec-2026 | 58,731 | 8,222 | 0 | 50,509 | 0 | 50,509 |
| 01-Jan-2027 to 31-Dec-2027 | 58,731 | 8,222 | 0 | 50,509 | 0 | 50,509 |
| 01-Jan-2028 to 31-Dec-2028 | 58,731 | 8,222 | 0 | 50,509 | 0 | 50,509 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 01-Jan-2029 to 31-Dec-2029 | 58,731 | 8,222 | 0 | 50,509 | 0 | 50,509 |
| 01-Jan-2030 to 31-Dec-2030 | 58,731 | 8,222 | 0 | 50,509 | 0 | 50,509 |
| 01-Jan-2031 to 31-Dec-2031 | 58,731 | 8,222 | 0 | 50,509 | 0 | 50,509 |
| 01-Jan-2032 to 31-Dec-2032 | 58,731 | 8,222 | 0 | 50,509 | 0 | 50,509 |
| 01-Jan-2033 to 31-Dec-2033 | 58,731 | 8,222 | 0 | 50,509 | 0 | 50,509 |
| 01-Jan-2034 to 14-April-2033 | 16,734 | 2,343 | 0 | 14,392 | 0 | 14,392 |
| **Total** | 587,310 | 82,220 | 0 | 505,090 | 0 | 505,090 |

# 5 MONITORING

## 5.1 Data and Parameters Available at Validation

| Data / Parameter | $GWP_{CH_4}$ |
|---|---|
| Data unit | t $CO_2e$/t $CH_4$ |
| Description | Global warming potential of $CH_4$ |
| Source of data | IPCC Fifth Assessment Report (AR5) |
| 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 |
| Comments | The parameter will be updated according to the latest requirement of VCS Standard as well as the IPCC report. |

| Data / Parameter | $D_{CH4}$ |
|---|---|
| Data unit | kg/m$^3$ |

| | |
|---|---|
| Description | $CH_4$ density |
| Source of data | AMS-III.D (Version 21.0) |
| 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 (Version 21.0) |
| 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 | 2019 refinement to 2006 IPCC Guidelines for National Greenhouse Gas Inventories |
| Value applied | 76% |
| Justification of choice of data or description of measurement methods | No country or regional specific value is available. Default value from table 10.17 of 2019 refinement to 2006 IPCC Guidelines for |

| | |
|---|---|
| and procedures applied | National Greenhouse Gas Inventories Volume 4 Chapter 10 is applied.<br>The annual average temperature of baseline site where anaerobic manure treatment facility is located is around 13°C[24] and ratio of potential evapotranspiration to precipitation is less than 1. The climate zone is warm temperature dry. Thus, the corresponding annual methane conversion factor (MCF) is 76%. |
| 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 | Table 10.16 of 2019 refinement to 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 10 |
| Value applied | Animal type: Dairy cattle; $B_{0,LT}$: 0.24 |
| Justification of choice of data or description of measurement methods and procedures applied | No country or regional specific value is available. Default values from table 10.16 (UPDATED) of 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories volume 4 Chapter 10 is applied.<br>The project adopts data from other regions with high productivity systems. |
| Purpose of Data | Calculation of baseline emissions and project emissions |
| Comments | - |

| | |
|---|---|
| Data / Parameter | $MS\%_{BL,i}$ |
| Data unit | - |
| Description | Fraction of manure handled in baseline animal manure management system j |

[24] http://www.weixian.gov.cn/article/256/42972.html

| | |
|---|---|
| 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 | $N_{da,y}$ |
| Data unit | Day |
| Description | Number of days animal is alive in the farm in the year y |
| Source of data | FSR |
| Value applied | 365 |
| Justification of choice of data or description of measurement methods and procedures applied | - |
| Purpose of Data | To calculate the annual average number of animals ($N_{LT,y}$) |
| 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 | 2019 refinement to 2006 IPCC Guidelines for National Greenhouse Gas Inventories |
| Value applied | Animal type: Dairy cattles; $VS_{default}$: 3.474 |
| Justification of choice of data or description of measurement methods | Calculated via equation 10.22A in 2019 Refinement to 2006 IPCC Guidelines for National Greenhouse Gas Inventories. |

| | |
|---|---|
| and procedures applied | $VS_{default}$ =$VS_{rate(T)}$ * TAM / 1000 = 9.0 * 386 / 1000<br>TAM: Default Values for livestock weight for Animal Categories in Asia area is 386kg(mean) for dairy cattle<br>$VS_{rate(T)}$ = Default Values for Volatile Solid Excretion Rate, 9.0 kg VS 1000 kg animal $mass^{-1}$ $day^{-1}$ for dairy cattle sourced from Volume 4, chapter 10, table 10.13A of 2019 Refinement to 2006 IPCC Guidelines for National Greenhouse Gas Inventories. |
| Purpose of Data | Calculation of baseline emissions and project emissions |
| Comments | - |

| | |
|---|---|
| Data / Parameter | $\boldsymbol{EF_{EL,j,y}}$ $\boldsymbol{(EF_{grid,CM,y})}$ |
| Data unit | $tCO_2/MWh$ |
| Description | Combined margin emission factor for the grid in year *y* |
| Source of data | 1. 2023 Baseline Emission Factors for Regional Power Grids *in China*[25]<br>2. Calculated based on TOOL07: "Tool to calculate the emission factor for an electricity system" (version 07.0) |
| Value applied | 0.5734 |
| Justification of choice of data or description of measurement methods and procedures applied | Calculated as per TOOL07 (version 07.0) based on official data published by the Ministry of Ecology and Environment of China |
| Purpose of Data | Calculation of baseline emissions |
| Comments | The ex ante option is selected to calculate $EF_{grid,OM,y}$ and $EF_{grid,BM,y}$ and hence $EF_{grid,CM,y}$, which will be fixed throughout the crediting period; therefore, both parameters $EF_{grid,y}$ and is fixed throughout the crediting period. |

| | |
|---|---|
| Data / Parameter | $NCV_{CH4}$ |
| Data unit | $MJ/Nm^3$ |
| Description | NCV of methane |
| Source of data | AMS-III.D |
| Value applied | 35.9 |

[25] https://ccer.cets.org.cn/notice/noticeDetail?bulletinInfoId=1175122354980917248

| | |
|---|---|
| Justification of choice of data or description of measurement methods and procedures applied | Default value from methodology is applied |
| Purpose of Data | Calculation of emission reductions |
| 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 | Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation (version 03.0) |
| Value applied | 20% |
| Justification of choice of data or description of measurement methods and procedures applied | Default value of 20% is applied |
| Purpose of Data | Calculation of project emissions |
| Comments | - |

| | |
|---|---|
| Data / Parameter | $\boldsymbol{EE_y}$ |
| Data unit | % |
| Description | Energy Conversion Efficiency of the project equipment |
| Source of data | AMS-III.G. (version 10.0). |
| Value applied | 40% |
| Justification of choice of data or description of measurement methods and procedures applied | Default valued |
| Purpose of Data | Calculation of baseline emissions |
| 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** | FSR |
| **Description of measurement methods and procedures to be applied** | all manure would be handled in this project, 100% is applied for $MS\%_{i,y}$ in ex-ante estimation. This parameter will be monitored in verification period. |
| **Frequency of monitoring/recording** | Annually, based on daily measurement and monthly aggregation |
| **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** | Project proponents |
| **Description of measurement methods and procedures to be applied** | The number of Dairy cows produced in the farm will be recorded manually by the responsible staff. |
| **Frequency of monitoring/recording** | Annually, based on monthly records |
| **Value applied** | 14,400 (estimated ex ante and will be monitored ex post) |
| **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 | $nd_y$ |
| Data unit | number |
| Description | The number of days the treatment plant was operational in year y. |
| Source of data | Project proponents |
| 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 | Annually, based on daily records and monthly aggregation |
| Value applied | 365 |
| 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 | $VS_{LT,y}$ |
| Data unit | Kg-dm/animal/year |
| Description | Volatile solids production/excretion per animal of livestock LT in year y |

| | |
|---|---|
| **Source of data** | 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories |
| **Description of measurement methods and procedures to be applied** | Default value from table 10.13A (NEW) of 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories volume 4 Chapter 10 is applied.<br>The animal weight is 360kg, according to equation 10.22A from 2019 Refinement to the 2006 IPCC Guidelines, VS can be calculated as follows<br>$VS_{LT,y} = VS_{rate} * TAM/1000 * 365$<br>$VS_{rate}$ is 9 kg VS (1000kg animal mass)/day for dairy cow from Asia, which is default value from 2019 Refinement to the 2006 IPCC Guidelines Volume 4 Chapter 10 table 10.13A<br>The default value for weight of Dairy cattle is 386 kg from Asia from 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 chapter 10 table 10A.5(New). The default VS value of a dairy cattle is 9 kg-VS/day. Thus, $VS_{LT,y}$ is 1,268.01 Kg-dm/animal/year for ex-ante estimation. |
| **Frequency of monitoring/recording** | Annually |
| **Value applied** | Animal type: Dairy cattles; $VS_{LT,y}$: 1,268.01 |
| **Monitoring equipment** | - |
| **QA/QC procedures to be applied** | - |
| **Purpose of data** | Calculation of baseline emissions and project emissions |
| **Calculation method** | - |
| **Comments** | - |

| | |
|---|---|
| **Data / Parameter** | $EG_y$ |
| **Data unit** | MWh |
| **Description** | Total electricity generated from the recovered biogas in year y |
| **Source of data** | Electricity meter |

| | |
|---|---|
| Description of measurement methods and procedures to be applied | Measured by electricity meter installed at the outlet of biogas generators. |
| Frequency of monitoring/recording | Continuously monitored and monthly recorded |
| Value applied | 16,510 (Ex-ante estimation) |
| Monitoring equipment | Electricity meter |
| QA/QC procedures to be applied | The electricity meter(s) will be periodically checked and maintained. Calibration will be carried out once a year to ensure normal operation. The accuracy of the meter is not less than 0.5s. |
| Purpose of data | Calculation of emission reductions |
| Calculation method | - |
| Comments | - |

| | |
|---|---|
| Data / Parameter | $EC_{PJ,j,y}$ |
| Data unit | *MWh* |
| Description | Quantity of electricity consumed by the project in year y |
| Source of data | Electricity meter |
| 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 at least monthly recorded |
| Value applied | 0 (estimated ex-ante) |
| Monitoring equipment | Electricity meter |
| QA/QC procedures to be applied | The data will be cross checked with Electricity Transaction Note. The metering instruments with accuracy of 0.2S (satisfied the requirement of no less than 0.5S) will be calibrated annually in accordance with "DL/T448–2016 Technical Administrative Code of Electric Energy Metering" which is the latest version of "Technical administrative code of electric energy metering". |

| | |
|---|---|
| Purpose of data | Calculation of project emissions |
| 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 period. The details of the monitoring plan are specified as follows.

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) Management 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 of extracted gas, electricity generation and consumption etc. are carried out by a few 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.

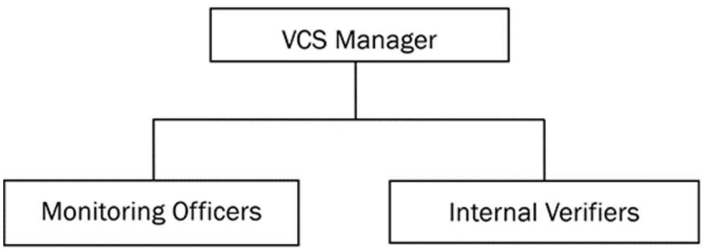


Figure 5.1 Operation and management structure of the project

**(B) Data and Parameters to be monitored**

Figure 5.1 shows the parameters to be monitored as well as the positions of the monitoring instruments; Table 5.1 further explains each of the monitored parameters.

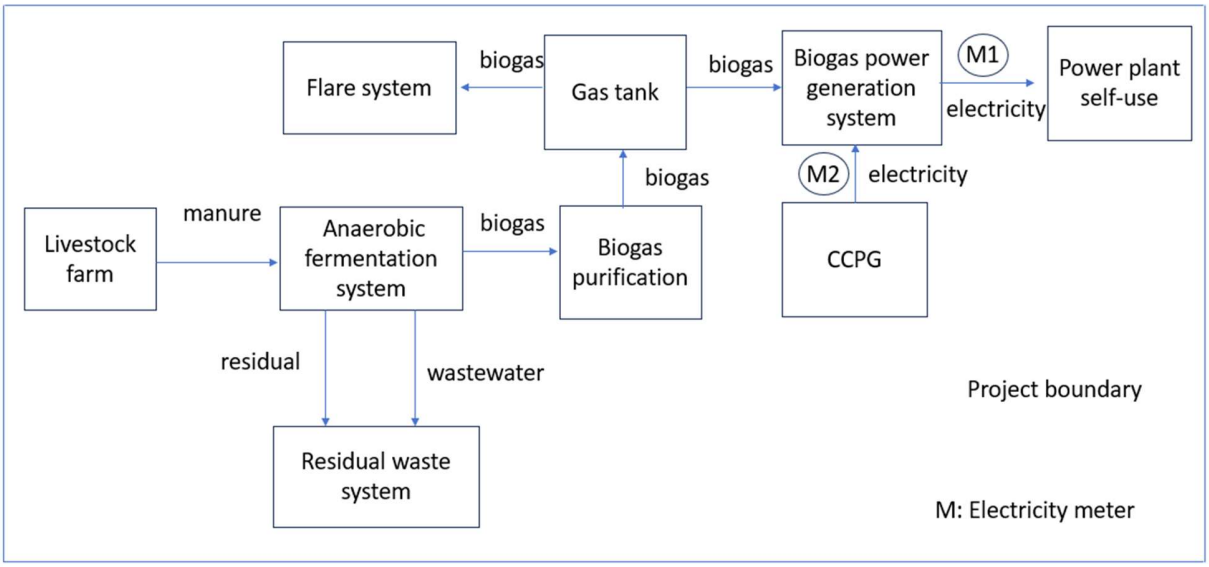


Figure 5.2 Project monitoring diagram

Table 5.1 Description of the monitored parameters

| Parameter to be Monitored | Description |
|---|---|
| $MS\%_{i,y}$ | Fraction of manure handled in system i in year y is 100%. |
| $N_{p,y}$ | The actual number of Dairy cattles produced in the farm will be recorded manually by the responsible staff. |
| $N_{da,y}$ | The actual number of days animal is alive in the farm in the monitoring periods will be monitored and recorded by staff. |
| $VS_{LT,y}$ | Volatile solids for Dairy cattles entering the animal manure management system in year y is 1,433.90 Kg-dm/animal/year. |
| $EG_y$ | Amount of electricity generated from the recovered biogas by the project activity is continuously monitored by electricity meter installed at the outlet of gas generator and at east monthly recorded.<br>The metering instruments with accuracy of no less than 0.5S will be calibrated annually in accordance with the "DL/T448–2016 Technical Administrative Code of Electric Energy Metering" which is the latest version of "Technical administrative code of electric energy metering". |
| $EC_{PJ,j,y}$ | Quantity of electricity consumed by the project in year y is continuously measured by electricity meter installed between the project site and the grid and at east monthly recorded.<br>The metering instruments with accuracy of no less than 0.5S will be calibrated annually in accordance with the "DL/T448–2016 Technical Administrative Code of Electric Energy Metering" which is the latest version of "Technical administrative code of electric energy metering". |

(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. Automatic records will serve as the main data source for emission reductions calculation. All data files, relevant purchase invoices and sales receipts will be collected by a designated monitoring officer, who will prepare backup in time and archive all documents properly.

(D) Quality assurance

All the monitoring instruments are chosen in compliance with VCS requirements, and will be calibrated regularly for accuracy by qualified third-party organizations according to the national regulations during the entire crediting period. To assist in future verifications, the project owner preserves the calibration records, along with the files of monitored data.

Error-checking is carried out regularly on site and at the point of data storage to detect data measuring/transmission failures as well as malfunctions. In case of malfunction of any measuring instrument, the instrument supplier will provide technical support to solve the problem promptly, and the emission reductions during the troubleshooting period will be calculated conservatively.

The installation of the electricity metering equipment will fulfill the requirements of “DL/T448–2016 Technical Administrative Code of Electric Energy Metering”. The accuracy should not be less than 0.5S. All the meters will be checked and maintained periodically.

(E) Data file management

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