SHUNFENG ERHAI COMPOSTING PROJECT IN YOUSUO

Document Prepared by Baineng New Energy (Shen Zhen) Co., Ltd

Project Title	Shunfeng Erhai Composting Project in Yousuo
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1 PROJECT DETAILS

1.1 Summary Description of the Project

Shunfeng Erhai Composting project in Yousuo (hereinafter as "the project") involves installing 2 composting plants respectively in Songqu Village, Yousuo Town, Eryuan County (Plant 1) and Fengyi Town, Dali City (Plant 2), Dali Bai Autonomous Prefecture, Yunnan Province, China. The 2 composting plants are invested and owned by Dali Erhai Biological Fertilizer Co., Ltd. The purpose of the project activity is to avoid methane emissions through controlled aerobic treatment by composting of manure.

In absence of the project, all manure waste produced was left to decay in uncovered anaerobic lagoons, which is the most economic, viable and reasonable for livestock farm owners, and methane would emit to the atmosphere.

The project is designed to treat livestock manure collected from surrounding towns around Erhai basin to produce organic fertilizer. The proposed comprises of composting system and fertilizer packaging system. It is estimated that about 168,088 tons of cattle manure, 127,688 tons of swine manure, 8,842 tons of chicken manure and 66,960 tons of straw will be treated to produce 200,000 tons of organic fertilizer annually. The organic fertilizer produced will be sold to local government, farmers and businesses. Without this project, the manure produced in these farms in project areas remain conditions of uncovered anaerobic lagoons that may bring a larger amount of GHG emissions sent to the atmosphere.

The project activity will reduce GHG in the atmosphere by avoiding methane emissions through controlled aerobic treatment of organic waste. During the implementation of the project, it is estimated that about 57,435 tCO_2e emission reductions will be generated annually, and total 574,350 tCO_2e in a 10-year crediting period.

1.2 Sectoral Scope and Project Type

The project falls under Sectoral Scope 13, "Waste handling and disposal" and Sectoral Scope 15, "Livestock and manure management". The project is not AFOLU project and is not a grouped project.

The project type of this project belongs to Type III "Other project activities not included in Type I or Type II that result in GHG emission reductions not exceeding 60 kt CO_2e per year in any year of the crediting period", which is defined in para.119 of CDM document "CDM project standard for project activities"(version 03.0).

1.3 Project Eligibility

As per section 2.1.1 of VCS standard (version 4.4), the scope of the VCS Program includes:

1) The six Kyoto Protocol greenhouse gases: The project activity treats livestock manure to product fertilizer by controlled aerobic compost treatment system which can avoid Methane (CH_4) emissions from uncovered anaerobic lagoons in the baseline 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 applied methodology AMS-III.F (Version 12.0) of the project are methodologies approved under CDM Program, which is a VCS approved GHG program.

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

Furthermore, the project does not belong to the project activities excluded in Table 1 of VCS Standard 4.4. Therefore, the proposed project activity is eligible under the scope of the VCS program.

1.4 Project Design

The project activity was designed to treat livestock manure for 2 composting plants in Dali Autonomous Prefecture to produce organic fertilizer, as per the proposed project description in Section 1.1 and the detail of installed technology in Section1.11. Total 2 composting plants are included in this project activity, which belongs to multiple project activity instances, but it's not being developed as a grouped project.

Eligibility Criteria

The project is not a grouped project.

1.5 Project Proponent

Organization name	Dali Erhai Biological Fertilizer Co., Ltd
Contact person	Chunrong Wang
Title	Project Manager
Address	Songqu Villsge, Dengchuan Industrial Park, Yousuo Town, Eryuan County, Dali Bai Autonomous Prefecture, Yunnan Province, China

Telephone	+86 13887219081
Email	dalilerhaifeiye@163.com

1.6 Other Entities Involved in the Project

Organization name	Baineng New Energy (Shenzhen) Co., Ltd
Role in the project	Consultant
Contact person	Zexu Zhang
Title	Project Manager
Address	Room 302, No.2815 Longteng Avenue, Shanghai
Telephone	+86 15623507976
Email	project@cypressenergy.cn

1.7 Ownership

The project is owned by Dali Erhai Biological Fertilizer Co., Ltd. (hereinafter as "Erhai" or "the project proponent"), who has the legal right to operate the project activities. The project approval, approval of Environmental Impact Assessment (EIA), and the business license of the project owner are evidence of legislative rights. Besides, the equipment purchasing contract and the construction contracts are evidence for the plant and equipment ownership.

Baineng New Energy (Shenzhen) Co., Ltd. (hereinafter as "Baineng" or "Consultant") was entrusted and appointed by the project proponent as the developer of the emission reduction project. As a consultant, Baineng is responsible for helping project sponsors in the development and management of carbon projects, including preparing monitoring plans, organizing training, etc.

1.8 Project Start Date

As per Section 3.8 of VCS Standard (Version 4.4), the project start date of a non-AFOLU project is the date on which the project began generating GHG emission reductions or removals. Accordingly, the start date of plant 1 and plant 2 of the project was on 1-March-2022. It is the date when plants started the treatment and processing of solids from manure, as well as the earliest date started generating emission reductions. Thus, the project start date is 1-March-2022.

1.9 Project Crediting Period

The project crediting period is from 1-March-2022 to 29-Febuary-2032 (both days included), with a total of 10 years fixed.

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

Project Scale	
Project	√
Large project	

Year	Estimated GHG emission reductions or removals (tCO_2e)
Year 1	57,435
Year 2	57,435
Year 3	57,435
Year 4	57,435
Year 5	57,435
Year 6	57,435
Year 7	57,435
Year 8	57,435
Year 9	57,435
Year 10	57,435
Total estimated ERs	574,350
Total number of crediting years	10
Average annual ERs	57,435

1.11 Description of the Project Activity

This project activity is designed to install a set of organic fertilizer production lines to treat livestock manure to produce organic fertilizer. The project comprises of fermentation system and fertilizer production system. This project uses microbial aerobic fermentation technology, which follows a step-by-step method as given below:

1. Mixing and stirring of raw materials: The livestock manure and auxiliary are transported from outside into the project site. The manure and the auxiliary materials are mixed in the fermentation

workshop, at the same time, microbial agents are added to promote the fermentation process. All the material are stack up after mixed with forklift.

2. Fermentation: the materials are fermented using vat composing process, the stacked materials are in natural ventilation, the fermentation temperature will be maintained about 50~60℃. And the fermentation process will last about 10~15 days.

3. Aging: When the first fermentation is finished, the organic material will be transported to aging workshop. The aging process adopts piling and natural ventilation to keep aerobic. During the aging process, the organic matter will be further broken down into more stable organic matter such as humus and amino acids, and the aging process will last about 20 days.

4. Packing: After aging, the materials will be dosed by the batching system, and then crushed, sieved granulated and then packed.

Table 1-1 The main technical parameters of turnover machine

Compost Turner	
Parameter	Value
Model	FD800
Power	110Kw
Max Capacity	1000m^3/h
Size	3900*3450*3250mm

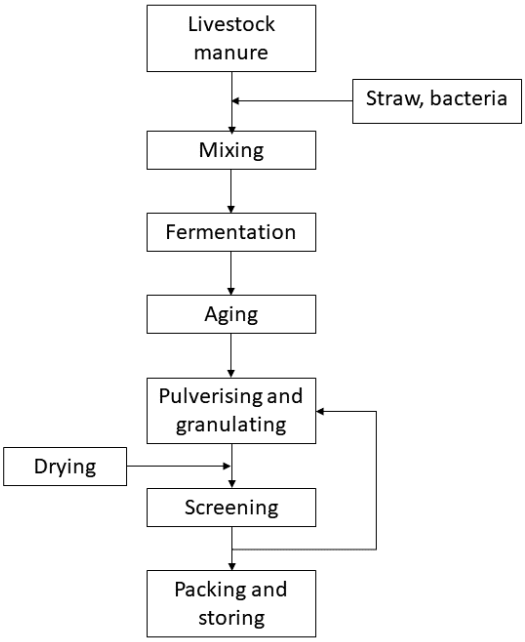

Figure 1-1 The process flow diagram of the project

1.12 Project Location

The project included 2 composting plants, Plant 1 is located in Songqu Village, Eryuan County, Dali Bai Autonomous Prefecture, Yunnan Province, China, and Plant 2 is located in Fengyi town, Dali City, Dali Bai Autonomous Prefecture, Yunnan Province, China. The center coordinates of the Plant 1 are 100.123146°E, 26.027558°N, the center coordinates of the Plant 2 are 100.338925°E, 25.537422°N. The geographical location of the project is shown in Figure 1-2.

中国地图

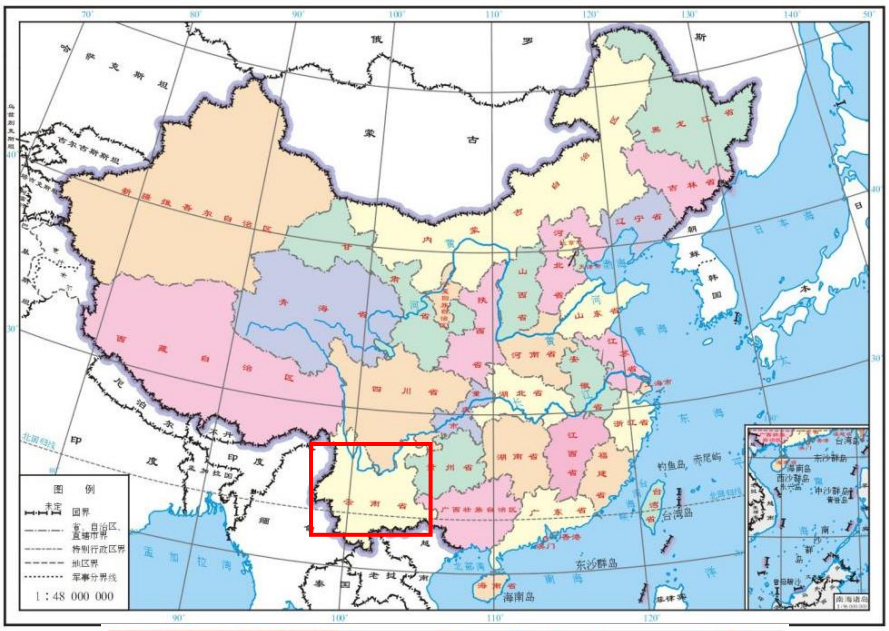
图 例
国界
省、自治区、直辖市界
特别行政区界
地区界
军事分界线
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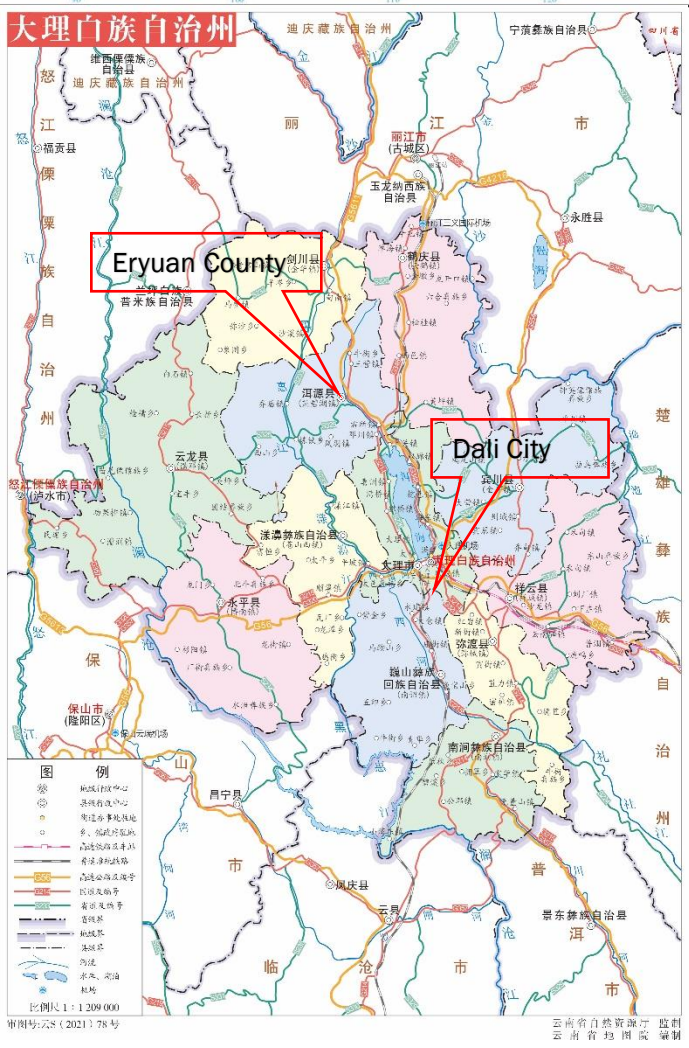
台湾岛
东沙群岛
海南岛


大理白族自治州
迪庆藏族自治州
宁蒗彝族自治县
维西傈僳族自治县
怒江傈僳族自治州
福贡县
丽江市（古城区）
玉龙纳西族自治县
永胜县
Eryuan County
剑川县
鹤庆县
兰坪白族普米族自治县
洱源县
Dali City
云龙县
漾濞彝族自治县
大理市
祥云县
宾川县
弥渡县
巍山彝族回族自治县
南涧彝族自治县
水平县
保山市（隆阳区）
昌宁县
凤庆县
云县
景东彝族自治县
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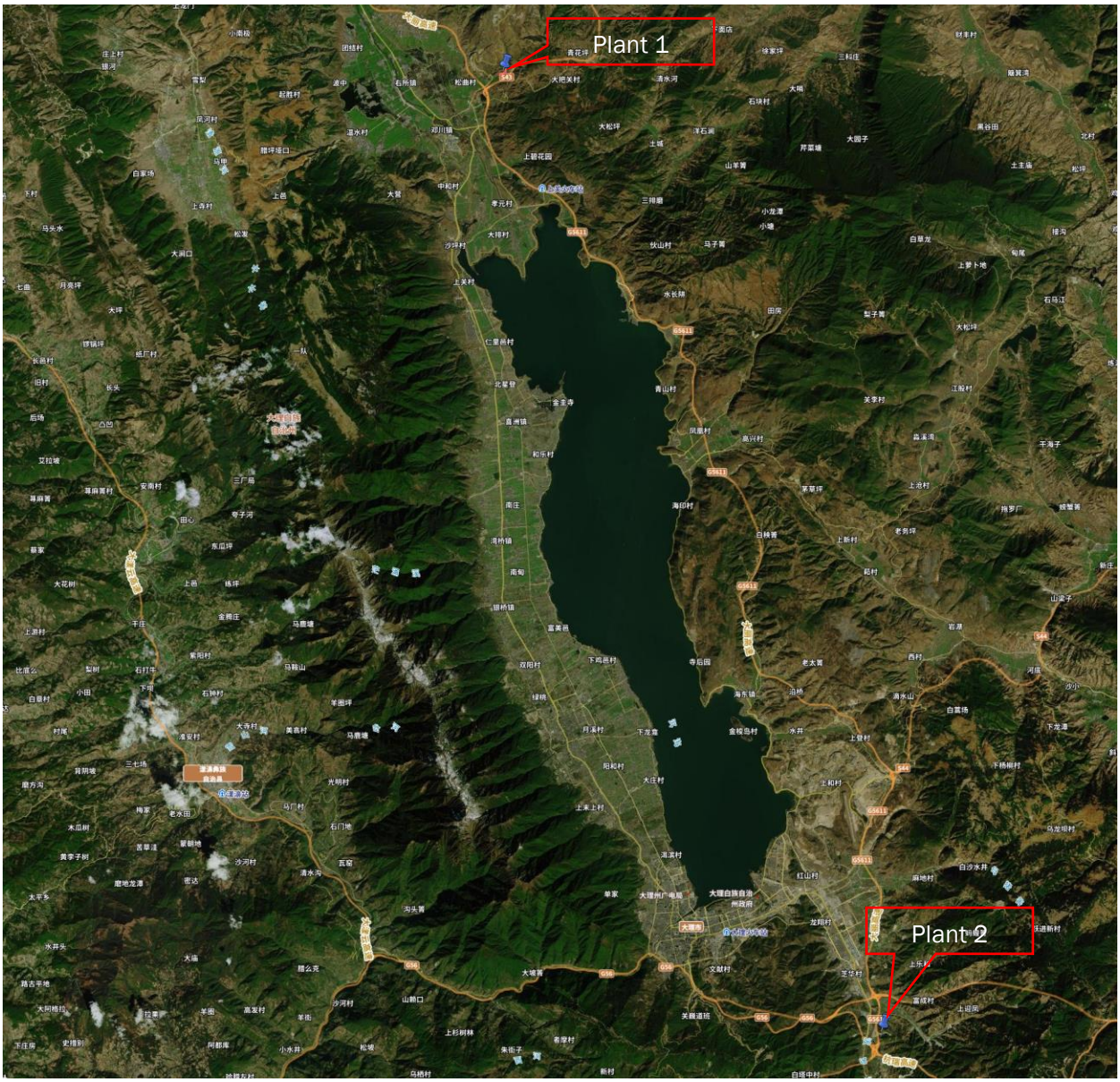

Figure 1-2 The location of the project activity

1.13 Conditions Prior to Project Initiation

The project is a Greenfield project. In the absence of the project, the livestock manure was left to decay in uncovered anaerobic lagoons, which is the most economic, viable and reasonable for livestock farm owners. The baseline scenario is the same as the conditions existing prior to the project initiation. Refer section 3.4 of the PD for detailed baseline scenario.

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

According to Recordation Certificate of Project and the approval of EIA of the project, the project complies with all Chinese relevant laws and regulations. Mainly include:

1. Environmental Protection Law of the People's Republic of China;

2. Administrative Licensing Law of the People's Republic of China;

3. Regulations on prevention and control of pollution from large scale livestock and poultry breeding.

4. Law of the People's Republic of China on the Prevention and Control of Solid Waste Pollution.

The project has obtained Recordation Certificate of Project issued by local Development and Reform Bureau, also, the project has obtained the EIA approval from local Environmental Protection Agency. The approvals well demonstrate that local government permits the construction of the project. Consequently, the project is compliance with laws, status and other regulatory frameworks.

1.15 Participation under Other GHG Programs

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

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

1.15.2 Projects Rejected by Other GHG Programs

The project activity is not participating in other environment credits, other GHG programs and has not been rejected by any other GHG Programs.

1.16 Other Forms of Credit

1.16.1 Emissions Trading Programs and Other Binding Limits

The project proponent 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.

There is a cap & trade scheme in China. However, China's national emissions trading scheme (ETS), which is at its very early stage, only includes 2,225 fossil fuel-fired power plants in the power sector[1], and the project proponent is not included in the list. China's ETS is expected to include all companies with annual GHG emissions greater than 26,000 tCO_2e in eight emission intensive industries including power generation, petrochemicals, chemicals, building materials,

[1] http://mee.gov.cn/xxgk2018/xxgk/xxgk03/202012/W020201230736907682380.pdf

non-ferrous metals, papermaking, steel and aviation[2]. As the annual GHG emissions of the project proponent will not be greater than 26,000 tCO_2e, it will not be included in the national ETS; no emission cap will be enforced on the project proponent, nor can it participate in carbon transactions in the national ETS. Therefore, 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.

In addition, the project owner has signed the Declaration of No Double Counting Statement and Declaration of neither been registered and rejected nor seeking registration under any other GHG programs and not participating in other environment credits, other GHG programs other than VCS.

1.16.2 Other Forms of Environmental Credit

The project hasn't sought or received another form of environmental credits.

Supply Chain (Scope 3) Emissions

The project is a manure management project, which reduces GHG emission reductions by avoiding GHG emission of methane from the uncovered open lagoon. Therefore, the project's GHG emission reductions or removals are not in a supply chain, and thus the Supply Chain (Scope 3) Emissions are not applicable.

1.17 Sustainable Development Contributions

The project activity implemented by the project owner can contribute to sustainable development as defined by and tracked against the United Nations Sustainable Development Goals (SDGs). The specific analysis is as follows:

SDG8 Decent Work and Economic Growth

Temporary and permanent job opportunities are created for locals during the construction and operation period of the project. The project will achieve SDG8 Decent Work and Economic Growth. This contributes to one of the China's actions for promoting sustainable. "Increase labor force participation rate through implementation of the classification policy. Vigorously enforce the law on Promotion of Employment".

SDG12 Responsible consumption and production

The project activity is designed to install a set of organic fertilizers production lines to treat the manure from the nearby farms and Biomass waste residue, so the organic fertilizers will be produced, which are sold as organic fertilizer.

SDG13: Climate Action

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

Prior to the implementation of the project, the animal manure waste was left to decay in uncovered open lagoon at the livestock farms and the biomass waste residue was left to decay in the SWDS, where the methane is emitted to the atmosphere directly without any methane recovery and destruction facility. The project activity will reduce of GHG in the atmosphere through avoiding methane emissions from aerobic treatment of the waste. So, the impact parameter of the proposed project on SDG13 is the amount of GHGs emission reductions. It is estimated that 57,435 tCO_2e emission reductions can be produced annually.

1.18 Additional Information Relevant to the Project

Leakage Management

Not applicable. The project is greenfield project and all equipment applied is new, it does not involve the equipment transferred from another activity or if the existing equipment is transferred to another activity as per section 5.5 of the methodology. And the compost won't be subjected to anaerobic storage, neither disposed in a SWDS. Therefore, leakage emissions are not taken into account for the project activity.

Commercially Sensitive Information

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

Further Information

Not applicable.

2 SAFEGUARDS

2.1 No Net Harm

The environmental impact assessment (EIA) Report for the project has been approved by local Environmental Protection Agency. Every aspect of environmental impact has been considered in the EIA report with corresponding measures during project development, the construction of the project is in the line with national policies and no net harm has been detected. Meanwhile, the implementation of the project will improve local-socio economic development through creating career opportunities.

2.2 Local Stakeholder Consultation

In order to solicit the opinions and attitudes of various stakeholders on the construction of this project, the project owner issued a stakeholder survey questionnaire to investigate the opinions

of local stakeholders on the construction of this project. Local stakeholders included relevant personal of the livestock farms, local villagers and government officials. The survey questionnaire was designed to access the project impacts on the local environment and social economic development. Totally, 53 questionnaires were sent and 53 responses were collected.

The questionnaires mainly focus on following issues:

-Do you know the purpose of this project?

-What do you think of the impact of the implementation of this project on the local environment?

- What impact do you think the implementation of this project will have on your life?

-Are you satisfied with the environmental protection measures that the proposed project has made?

-What do you think of the impact of the proposed project on local employment?

-What do you think of the impact of the proposed project on local economy?

-Are you agree or disagree with the construction of the proposed project?

-Do you think other regions should also vigorously promote this type of technology?

-Do you have any suggestions on this project?

The structure of survey respondents is listed in Table 2-1 below.

Table 2-1 Structure of stakeholder survey

Items		Amount
Gender stakeholders surveyed	Male	28
	Female	25
Age	<25	6
	25-55	32
	>55	15
Education	Junior high school or below	32
	Senior high school	10
	College or above	11
Occupation	Worker	25
	Farmer	13
	Management personnel	8

	Civil servant	7

Comments from these questionnaires are summarized as follows:

-96.23% of the respondents understand this project.

-88.68% of the respondents think the proposed project would not generate environment problem.

-92.45% of the respondents believe that the implementation of the project will bring economic benefits to their lives, because they get organic fertilizer at cheaper market prices.

-89.36% of the respondents are satisfied about the environment protection measures that the proposed project has made.

-90.57% of the respondents believe that the implementation of this project can promote employment growth.

-92.45% of the respondents think the proposed project has good impact on local economy.

-94.34% of the respondents agree with the construction of the proposed project.

In general, local stakeholders are supportive of the project construction. The survey shows that a majority of local stakeholders think the project will help improve the life of local people and promote local economic development without much adverse environmental impact. And the implementation of the project will be strict accordance with the requirements in the EIA and EIA approval. There is no suggestion about the project design.

2.3 Environmental Impact

EIA of the project has been approved by local Environmental Protection Agency. A short summary of the environmental impacts is presented below.

1. Construction phase

Implement the pollution prevention and control measures proposed in the EIA during construction period. The project site should be set up as a fence and timely water to reduce dust, transport vehicles should take measures to prevent spilling of materials. The domestic wastewater generated during the construction period of the project is collected by the septic tanks and is not discharged, the engineering wastewater is collected in sedimentation tanks for reuse at the site. Domestic waste is collected and disposed of by the local sanitation department, the project site is far away from residential areas and will not have an environmental impact.

2. Operation phase

Wastewater

Wastewater generated during the piling of livestock manure will be collected and treated by the sewage treatment facilities, domestic wastewater and washing wastewater are collected and

treat by sewage treatment facilities. After being treated by the sewage treatment facilities, the wastewater will be used for production and landscaping.

Air pollution

The main air pollutants generated of the project are malodorous gases produced in the fermentation workshop. Aeration systems are installed at the bottom of the fermentation plant, and the deodorizers will be added while turning the manure to reduce the generation of malodorous. Dust generated during the sieving process will be collected by dedust system. Exhaust gas should meet the requirements of Table 2 in the Comprehensive Emission Standard of Air Pollutants (GB16297-1996) and Table 1 and Table 2 in the Emission Standard of Odor Pollutants (GB14554-1993).

Solid waste

Solid waste generated in the project are domestic waste, sieved residue and collected dust. Domestic waste will be collected and uniformly transported by the local sanitation department; the sieved residue and dust collected by dedust system will be used to produce organic fertilizers.

Noise

Low-noise equipment is applied in the project, the equipment is equipped with vibration damping mats and the equipment are placed uniformly in the workshop to reduce the impact of its noise on the surrounding environment by the blocking of the wall. Noise at the boundary of the plant shall meet the requirements of category 2 standard of the "Environmental Noise Emission Standard for Industrial Enterprise Plant Boundary" (GB12348-2008).

In conclusion, the project will not have a significant impact on the surrounding environment during the construction and operation period. On the contrary, the project activity can reduce greenhouse gas emissions and environmental population caused by methane release.

2.4 Public Comments

Besides, as per section 3.18 of the VCS Standard (Version 4.4), all projects are subject to a 30-day public comment period. The date on which the project is listed on the project pipeline marks the beginning of the project's 30-day public comment period. This project will be open for public comment on the verra website. The project shall be listed, and comments shall be incorporated later.

2.5 AFOLU-Specific Safeguards

The project is not an AFOLU project. Thus, this section is not applicable to the project.

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

The following methodologies are applicable to the project activity.

AMS-III.F Avoidance of methane emissions through composting, version 12.0

For the baseline manure emissions, this methodology refers to "AMS-III.D: Methane recovery in animal manure management systems", version 21.0.

The latest version of the following tools will also be used in this Project activity:

Tool 03: "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (version 03.0)"

Tool 05:" Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation (Version 08.0)"

Tool 13:" Project and leakage emissions from composting (Version 02.0)"

Tool 21:" Demonstration of additionality of small-scale project activities (Version 13.1)"

All above methodology and tools can be found through:

https://cdm.unfccc.int/Reference/tools/index.html.

3.2 Applicability of Methodology

Justification for the choice of the selected methodology is shown in the following table:

AMS-III.F Avoidance of methane emissions through composting, version 12.0	
Applicability Criteria	**Justification**
1.This methodology is applicable to the composting of the organic fraction of municipal solid waste and biomass waste from agricultural or agro-industrial activities including manure.	The proposed project is designed to treat the livestock manure to produce the organic fertilizers through aerobic composting.
2. This methodology includes construction and expansion of treatment facilities as well as activities that increase capacity utilization at an existing facility. For project activities that increase capacity utilization at existing facilities, project participant(s) shall demonstrate that special efforts are made to increase the capacity utilization, that the existing facility meets all applicable laws and regulations, and that the existing facility is not included in a separate CDM project activity. The special efforts should be identified and described.	Not applicable. The project is a new facility and does not involve expansion of any existing facility.

3. This methodology is also applicable for co-composting wastewater and solid biomass waste, where wastewater would otherwise have been treated in an anaerobic wastewater treatment system without biogas recovery. The wastewater in the project scenario is used as a source of moisture and/or nutrients to the biological treatment process e.g., composting of empty fruit bunches (EFB), a residue from palm oil production, with the addition of palm oil mill effluent (POME) which is the wastewater co-produced from palm oil production.	Not applicable. The project does not involve co-composting wastewater and solid biomass waste
4. In case of co-composting, if it cannot be demonstrated that the organic matter would otherwise been left to decay anaerobically, baseline emissions related to such organic matter shall be accounted for as zero, whereas project emissions shall be calculated according to the procedures presented in this methodology for all co-composted substrates.	Not applicable. This project activity does not involve co-composting
5. The location and characteristics of the disposal site of the biomass, animal manure and co-composting wastewater in the baseline condition shall be known, in such a way as to allow the estimation of its methane emissions, using the provisions of AMS-III.G, AMS-III.E (concerning stockpile), AMS-III.D "Methane recovery in animal manure management systems" or AMS-III.H respectively.	The location and characteristics of the disposal site of the animal manure and biomass in the baseline condition are well known. The estimation of manure methane emissions as the latest version of AMS-III.D (Version 21.0).
6. Blending materials may be added in the project scenario to increase the efficiency of the composting process (e.g., to achieve a desirable C/N ratio or free air space value), however, only monitored quantity of solid waste or manure or wastewater diverted from the baseline treatment system is used for emission reduction calculation. Project activities for composting of animal manure shall also meet the requirements under paragraphs 3 and 4(c) of the latest version of AMS-III.D.	A small blending material i.e., bacterium agent decomposing agent is added in the process of composting, which will not be included in the emission reduction calculations. For this project, livestock manure as primary material is used for composting, therefore it meets the requirements under paragraphs 3 and 4(c) of the latest versions of AMS-III.D.
7. For solid wastes diverted from a solid waste disposal site, the following requirement shall be	Not applicable. The project does not involve solid wastes diverted from a solid waste disposal site.

checked ex ante at the beginning of each crediting period: (a) Establish that identified landfill(s)/stockpile(s) can be expected to accommodate the waste to be used for the project activity for the duration of the crediting period; or (b) Establish that it is common practice in the region to dispose of the waste in solid waste disposal site (landfill)/stockpile(s).	
8. The project participants shall clearly define the geographical boundary of the region referred in paragraph 11(b), and document it in the CDM-PDD. In defining the geographical boundary of the region, project participants should take into account the source of the waste i.e., if waste is transported up to 50 km, the region may cover a radius of 50 km around the project activity. In addition, it should also consider the distance to which the final product after composting will be transported. In either case, the region should cover a reasonable radius around the project activity that can be justified with reference to the project circumstances but in no case, it shall be more than 200 km. Once defined, the region should not be changed during the crediting period(s).	The waste being used in the project activity is livestock manure. The livestock manure used in this project comes from local farm around the project site, which is also within a radius of 50 km. The final compost obtained are sold to local farmers and business near the project site with a radius of less than 200 km.
9. In case produced compost is handled aerobically and submitted to soil application, the proper conditions and procedures (not resulting in methane emissions) must be ensured.	The compost produced will be used as fertilizer for the soil. The compost will be applied to the soil similarly to the way used for chemical fertilizers. The low agglutination of the compost and the short time needed to apply it ensure that there is not enough time available to develop anaerobic conditions. Therefore, the proper conditions and procedures (not resulting in methane emissions) can be ensured.
10. In case produced compost is treated thermally/mechanically, the provisions in AMS-III.E related to thermal/mechanical treatment shall be applied.	Not applicable. This project activity does not involve thermal/mechanical treatment to the compost once it is produced.

11. In case produced compost is stored under anaerobic conditions and/or delivered to a landfill, emissions from the residual organic content shall be taken into account and calculated as per the latest version of the methodological tool "Emissions from solid waste disposal sites".	The project activity will involve storage in aerobic conditions and kept in packed bags for a limited period before it is applied by the user. Thus, the project does not involve storage of produced compost in an anaerobic condition, nor would it be delivered back to landfill.

Further information on applicability condition (6) is provided below:

The project activity also meets the requirements of paragraph paragraphs 3 and 4(c) from methodology AMS-III.D.-" Methane recovery in animal manure management systems", version 21, as below:

Paragraphs 3

(a) The livestock population in the farm is managed under confined conditions;

The livestock manure used to produce organic fertilizer was sourced from the nearby farms. The livestock are managed under confined conditions, which can be confirmed during the site visit.

(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;

Livestock manure is dumped into open anaerobic lagoons and it is prohibited to discharge into any natural water resources without treatment according to Regulations on Prevention and Control of Pollution from Livestock and Poultry Farming.

(c) The annual average temperature of baseline site where anaerobic manure treatment facility is located is higher than 5°C;

The annual average ambient temperature at the site is 13.9°C[3], which is higher than 5°C.

(d) In the baseline scenario the retention time of manure waste in the anaerobic treatment system is greater than one month, and if anaerobic lagoons are used in the baseline, their depths are at least 1 m;

The minimum retention time of manure waste in the open anaerobic lagoons is not less than 45 days in the baseline scenario. The open anaerobic lagoons considered in the baseline scenario are designed for deep storage and has a depth of 3-5 meters in accordance with the" design code for wastewater stabilization ponds (GJJ/T54-93)"

[3] http://www.eryuan.gov.cn/eyxrmzf/c102725/201904/adfb00c128b9422f826e18a742ed71bb.shtml

(e) No methane recovery and destruction by flaring or combustion for gainful use takes place in the baseline scenario.

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

Paragraphs 4(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.

The livestock manure used in this project is transported directly from the farm to the project site by closed transport vehicles, and the livestock manure at the project site is not stored but instead goes directly to the mixing workshop; thus, the storage time of the manure does not exceed 45 days.

Tool 03: "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (version 03.0)"	
This tool provides procedures to calculate project and/or leakage CO_2 emissions from the combustion of fossil fuels. It can be used in cases where CO_2 emissions from fossil fuel combustion are calculated based on the quantity of fuel combusted and its properties. Methodologies using this tool should specify to which combustion process j this tool is being applied.	This project may consume fossil fuel during the composting process.

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: (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	All the electricity used by the project will be from the South China Power Grid[4], which falls under scenario A of Tool 05 (Version 03.0). Therefore, emissions related to electricity consumption need to be calculated based on Tool 05.

[4] https://www.mee.gov.cn/ywgz/ydqhbh/wsqtkz/202012/t20201229_815386.shtml

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; (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 (c) Scenario C: Electricity consumption from the grid and (a) fossil fuel fired captive power plant(s). One or more fossil fuel fired captive power plants operate at the site of the electricity consumer. The captive power plant(s) can provide electricity to the electricity consumer. The captive power plant(s) is/are also connected to the electricity grid. Hence, the electricity consumer can be provided with electricity from the captive power plant(s) and the grid.	
This tool can be referred to in methodologies to provide procedures to monitor amount of electricity generated in the project scenario, only if one out of the following three project scenarios applies to the recipient of the electricity generated: (a) Scenario I: Electricity is supplied to the grid; (b)Scenario II: Electricity is supplied to consumers/ electricity consuming facilities; or (c) Scenario III: Electricity is supplied to the grid and consumers/electricity consuming facilities.	This methodological tool is applied for calculating for emission by electricity consumption in project activity. The proposed project does not generate electricity. So, this criterion is not applicable.
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.	No captive renewable power generation technologies are installed to provide electricity in the project activity, in the baseline scenario or to sources of leakage. So, this criterion is not applicable.
Tool 13: "Project and leakage emissions from composting (version02.0)"	

Typical applications of the tool include projects composting municipal solid wastes, agricultural wastes and digestate.	Applicable. The proposed project is designed to treat livestock manure to produce the organic fertilizers through aerobic composting.
The following sources of project emissions are accounted for in this tool: (a) CH_4 and N_2O emission from composting; (b) CO_2 emissions from consumption of fossil fuels and electricity associated with composting; and (c) CH_4 emissions from run-off wastewater associated with co-composting.	(a)CH_4 and N_2O emissions from composting are accounted. (b)CO_2 emissions from the consumption of fossil fuels and electricity associated with composting are accounted. (c)This project does not involve co-composting; therefore, no CH_4 emissions from run-off wastewater is generated.
The following source of leakage emissions is accounted for in this tool: (a) CH_4 emissions from the anaerobic decay of the residual organic content of compost disposed of in a landfill or subjected to anaerobic storage.	The compost and waste are stored in aerobic condition, not anaerobic condition. Therefore, leakage is not accounted.
Transport emissions are not accounted for in this tool because it is assumed that similar transportation activities would occur in the baseline.	Transport emissions are not accounted.
The applicability conditions of the tools referred below also apply.	The tools referred by this project is listed in above tables. This project involves composting of manure through controlled aerobic treatment. No greenhouse gas produced during in the process of composting. Therefore, "Tool to determine the mass flow of a greenhouse gas in a gaseous Stream (version 03.0)" are not applicable for this project.
Tool 21: "Demonstration of additionality of small-scale project activities (version13.1)"	
This methodological tool provides a general framework for demonstrating and assessing additionality and is applicable to a wide range of project types.	The proposed project is designed to treat livestock manure to produce organic fertilizers through aerobic composting. The applied methodology is AMS-III.F, as per applied methodology, the demonstration of additionality should apply this tool.
In validating the application of this methodological tool, Designated Operation Entities (DOEs) shall carefully assess and verify	All the data, rationales, assumptions, justifications and documentation will be provided by project participants to VVB to

the reliability and creditability of all data, rationales, assumptions, justifications and documentation provided by project participants to support the demonstration of additionality. The elements checked during this assessment and the conclusions shall be documented transparently in the validation report.	support the demonstration of additionality in validating the application of this methodological tool, and the elements checked during this assessment and the conclusions has been documented transparently in the validation report.
The use of the methodological tool "Demonstration of additionality of small-scale project activities" is not mandatory for project participants when proposing new methodologies. Project participants and coordinating/managing entities may propose alternative methods to demonstrate additionality for consideration by the Executive Board.	Project participants will not proposing new methodologies and will not propose alternative methods to demonstrate additionality. PP will use this tool to demonstrate the additionality of the proposed project.
Project participants and coordinating /managing entities may also apply "Tool 19: Demonstration of additionality of microscale project activities" as applicable.	The proposed is a small-scale project not a microscale project, therefore, Tool 19 cannot be used to prove the additionality of this project activity.

3.3 Project Boundary

According to methodology AMS-III.F., version 12.0, the project boundary applicable to the proposed project activity is the physical geographical site.

Table 3-1 Project boundary application

No.	Methodology requirement	Project activity
a	Where the solid waste would have been disposed and the methane emission occurs in absence of the proposed project activity;	Included. The project involves livestock manure for composting. All manure waste produced was left to decay in uncovered anaerobic lagoons prior to the project.
b	In the case of projects co-composting wastewater, where the co-composting wastewater would have been treated anaerobically in the absence of the project activity;	The project does not involve co-composting wastewater.
c	Where the treatment of biomass through composting takes place;	Included, composting plants
d	Where the products from composting (compost) is handled, disposed, submitted to soil application, or treated thermally/mechanically;	Included, Fields where compost will be used as fertilizers for soil application.

e	And the itineraries between them (a, b, c and d) where the transportation of waste, wastewater, where applicable manure, product of treatment (compost) occurs.	Included, Transportation of waste to the project site and transportation of composting for soil application.

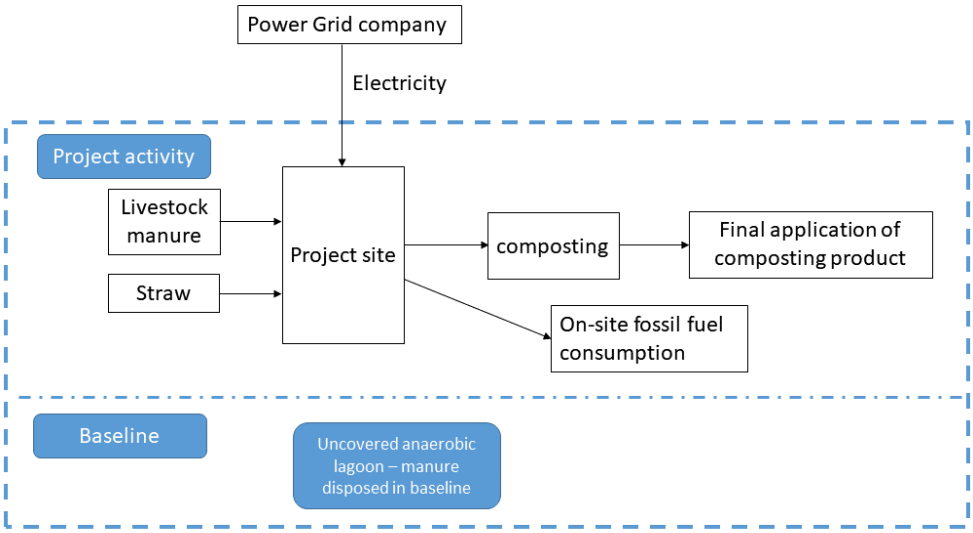

Figure 3-1 Project boundary

The greenhouse gases included or excluded from the project boundary are summarized in Table 3-2 below:

Table 3-2 Emissions sources included in or excluded from the project boundary

Source		Gas	Included?	Justification/Explanation
Baseline	Biomass disposed in solid waste	CO_2	No	CO_2 emissions from the decomposition of organic waste are not accounted
		CH_4	Yes	The major source of emissions in the baseline
		N_2O	No	Excluded for simplification. This is conservation
Project	Emissions from transport	CO_2	No	According to Tool 13 "project and leakage emission from composting (version 02.0)", transport emission is not accounted
		CH_4	No	Excluded for simplification
		N_2O	No	Excluded for simplification
	Emissions from on-site electricity use	CO_2	Yes	An important emission source since the electricity consumed by the projects is from the grid company
		CH_4	No	Excluded for simplification
		N_2O	No	Excluded for simplification

Source		Gas	Included?	Justification/Explanation
	Emissions from fossil fuel consumption	CO_2	Yes	An important emission source since fossil fuel can be used by the project
		CH_4	No	Excluded for simplification
		N_2O	No	Excluded for simplification
	Emissions from composting processes	CO_2	Yes	May be an important emission source
		CH_4	No	Excluded for simplification
		N_2O	Yes	May be an important emission source
	Emissions from run-off water	CO_2	No	Excluded. The project is not involving composting
		CH_4	No	Excluded. The project is not involving composting
		N_2O	No	Excluded. The project is not involving composting

3.4 Baseline Scenario

According to the methodology AMS-III.F Avoidance of methane emissions through composting, version 12.0, the baseline scenario is the situation where, in the absence of the project activity, biomass and other organic matter (including manure where applicable) are left to decay within the project boundary and methane is emitted to the atmosphere.

For the proposed project, livestock manure is used for composting. In absence of the project, all manure waste was disposed in uncovered anaerobic lagoons and methane is emitted to the atmosphere.

3.5 Additionality

Section 3.14 in VCS standard (V4.4) states that "A project activity is additional if it can be demonstrated that the activity results in emission reductions or removals that are in excess of what would be achieved under a 'business as usual' scenario and the activity would not have occurred in the absence of the incentive provided by the carbon markets". 0

Moreover, Section 3.14.1 clearly mandates that "Additionality shall be demonstrated and assessed in accordance with the requirements set out in the methodology applied to the project".

The applied methodology of this project is AMS-III.F. "Avoidance of methane emissions through composting"(Version 12.0), as per paragraph 18 in the applied methodology, Project participants shall apply the general guidelines for the SSC CDM methodologies and the Tool for demonstration of additionality of SSC project activities available at http://cdm.unfccc.int/Reference/index.html, so the additional analysis should be based on the Tool 21 "Demonstration of additionality of small-scale project activities" (version 13.1).

According to the Tool 21, project participants shall provide an explanation to show that the project activity would not have occurred anyway due to at least one of the following barriers:

a) Investment barrier: a financially more viable alternative to the project activity would have led to higher emissions

b) Technological barrier: a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions;

c) Barrier due to prevailing practice: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions;

d) Other barriers: without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

Project participant has opted to demonstrate the additionality of the project by option a): investment barrier, which is discussed below:

As per Tool 21: Project participant may like to refer to "Non-binding best practice examples to demonstrate additionality for SSC project activities". As per described in "Non-binding best practice examples to demonstrate additionality for SSC project activities", Best practice examples include but are not limited to, the application of investment comparison analysis using a relevant financial indicator, application of a benchmark analysis or a simple cost analysis (where CDM is the only revenue stream such as end-use energy efficiency). It is recommended to use national or global accounting practices and standards for such an analysis.

As the application of investment comparison analysis using a relevant financial indicator is only applicable when alternatives are also an investment project. However, the alternative baseline of this project is not a new investment project, so the investment comparison analysis using a relevant financial indicator is not appropriate.

As this project activity will have revenue by sales of composting products and VCUs, so a simple cost analysis is not appropriate.

In conclusion, the benchmark analysis should be carried out, and IRR is identified as the financial indicator for the benchmark analysis.

There is no benchmark for composting industry. The production of organic fertilizer and chemical fertilizers belongs to fertilizer manufacturing industry as per Industrial classification for national economic activities (GB/T 4754—2017)[5]. Therefore, according to the "Notice on adjusting financial benchmark rate of return of construction projects in some industries" issued by NDRC and Ministry

[5] https://images3.mca.gov.cn/www/file/201711/1509495881341.pdf

of Housing and Urban-Rural Development of PRC in 2013[6], the benchmark of total investment financial internal rate of return (IRR) of chemical fertilizers production (after tax) is 10%[7].

A) Basic parameters

Item	Value	Source
Annual Organic waste treatment quantity	371,578 t	Project evaluation project
Annual organic fertilizers sales	200,000 t	Project evaluation report
Sales Price of organic fertilizers	380 RMB/t	Project evaluation report
Total static investment	11,304*10^{4}RMB	Project evaluation report
O&M cost	6,038.13*10^{4}RMB	Project evaluation report
Operation period	15 years	Project evaluation report
Emission reductions	57,345 t CO_2e/yr	Calculated
Price of VCUs	50 RMB/t CO_2e	Expected

B) Comparison of the project IRR for the proposed project and the benchmark following table

Without income from selling VCUs, the IRR of proposed project is 9.44%, lower than the benchmark IRR 10% and the proposed project is financially unacceptable because of its low profitability. While considering such income, the IRR of the proposed project is 11.75%, higher than the benchmark, and the proposed project is financially acceptable.

Item	Without income from VCUs	Benchmark IRR	With income from VCUs
The Project IRR	9.44%	10%	11.75%

Sensitivity analysis

The purpose of this step is to examine whether the conclusion regarding the financial attractiveness is robust to reasonable variations of the critical assumptions.

According to Guidance on the Assessment of Investment Analysis, the "variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues should be subjected to reasonable variation". Therefore, the total static investment, and organic fertilizers sales were taken as uncertain factors for sensitive analysis. Furthermore, the

[6] https://www.ndrc.gov.cn/fggz/gdzctz/tzfg/201907/t20190729_1197578.html?code=&state=123

[7] https://www.ndrc.gov.cn/fggz/gdzctz/tzfg/201907/W020191104862129391071.pdf

O&M cost which was widely included in the sensitivity analysis for projects in China was also examined in the analysis. As a result, the following parameters are selected for the analysis:

Total static Investment

Annual organic fertilizers sales

O&M cost

The variation range of -10%~10% which was employed in the Project technical evaluation report. The result of sensitivity analysis of three parameters of the proposed project are shown in the table 3-3:

Table 3-3 Sensitivity analysis of the Anaerobic Digester-Aerobic Treatment （10^4 RMB）

Item	-10%	-5%	0	5%	10%
Total static investment	10.85%	10.11%	9.44%	8.82%	8.24%
Annual organic fertilizers sales	-10.03%	2.57%	9.44%	15.50%	21.35%
O&M cost	14.19%	11.87%	9.44%	6.84%	3.99%

To summarize, “the project is undertaken without being registered as a VCS project activity” is not financially attractive to investors, thus it is not feasible. Being registered as a VCS project, the VCUs revenues can alleviate the identified barriers, therefore the proposed project is additional.

3.6 Methodology Deviations

There is no methodology deviation for the project.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

As per applied methodology, the baseline emissions are the amount of methane emitted from the decay of the degradable organic carbon in the biomass solid waste or manure. When wastewater is co-composted, baseline emissions include emissions from wastewater co-composted in the project activity. The yearly Methane Generation Potential for the solid waste is calculated using the first order decay model as described in the latest version of the methodological tool “Emissions from solid waste disposal sites”. Baseline emissions from the manure composted are calculated as per the procedures of AMS-III.D. Where bedding material is used in the baseline/project activity, the calculation shall be based on the method of paragraph 16(a) (i.e., based on animal population) of AMS-III.D (ver. 21.0). Where no bedding material is used in baseline/project activity, any of the methods provided in paragraph 16(a) and 16(b) of AMS-III.D may be used.

Baseline emissions are:

$$BE_y = BE_{CH_4,SWDS,y} + BE_{ww,y} + BE_{CH_4,manure,y} - MD_{y,reg} \times GWP_{CH_4}$$ Equation 1

Where:

BE_y	=	Baseline emissions in the year y (t CO_2e)
$BE_{CH_4,SWDS,y}$	=	Yearly methane generation potential of the solid waste composted by the project activity during the years x from the beginning of the project activity (x=1) up to the year y estimated as per the latest version of the methodological tool 04 "Emissions from solid waste disposal sites" (tCO_{2eq}). The tool may be used with the factor "f=0.1" taking into account the methane oxidation effect by the upper layer of the landfill. With the definition of year x as 'the year since the project activity started diverting wastes from landfill disposal, x runs from the first year of crediting period (x=1) to the year for which emissions are calculated (x=y)'
$MD_{y,reg}$	=	Amount of methane that would have to be captured and combusted in the year y to comply with the prevailing regulations (tonne)
$BE_{CH_4,manure,y}$	=	Where applicable, baseline emissions from manure composted by the project activities, as per the procedures in AMS-III.D (t CO2e)
$BE_{ww,y}$	=	Where applicable, baseline emissions from the wastewater co-composted, calculated as per the procedures in AMS-III.H (t CO2e)
GWP_{CH_4}	=	Global Warming Potential for CH_4 applicable to the crediting period (t CO_2e/t CH_4)

1) Baseline CH_4 emissions ($BE_{CH_4,SWDS,y}$)- Biomass waste residue

Straw are used as auxiliaries of composting in this project, but for conservative, the baseline emissions of straw are not accounted. So, $BE_{CH_4,SWDS,y}$=0.

2) Baseline emissions from wastewater co-composted ($BE_{ww,y}$)

Since there is no co-composting in this project, therefore $BE_{ww,y}$=0

3) Baseline emissions from manure ($BE_{CH_4,manure,y}$)

As per paragraph 17 of "AMS-III.D: Methane recovery in animal manure management systems" version 21.0, Baseline emissions ($BE_{CH_4,y}$) are calculated by using the following two options:

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

produced by the livestock and the maximum amount of methane that can be potentially produced from that manure (Bo);

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

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

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

Equation 2

where:

$BE_{CH_4,manure,y}$	=	Baseline CH_4 emissions in year y (t CO_2e)
$Q_{manure,j,LT,y}$	=	Quantity of manure treated from livestock type LT and animal manure management system j (tonnes/year, dry basis)
$SVS_{j,LT,y}$	=	Specific volatile solids content of animal manure from livestock type LT and animal manure management system j in year y (tonnes/tonnes, dry basis)
GWP_{CH_4}	=	Global Warming Potential (GWP) of CH_4 applicable to the crediting period (t CO_2e/t CH_4)
D_{CH_4}	=	Density of CH_4 (0.00067t/m^3 at room temperature (20 ℃) and 1 am pressure)
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 by animal type LT (m^3 CH_4/kg -dm)
UF_b	=	Model correction factor to account for model uncertainties (0.94)

Estimation of various variable and parameters for above equations:

(a) Maximum methane producing potential ($B_{0,LT}$)

The maximum methane-producing capacity of the manure ($B_{0,LT}$) varies by spices and diet. The preferred method to obtain $B_{0,LT}$ measurement values is to use data from country-specific published sources, measured with a standardized method ($B_{0,LT}$ shall be based on total as-excreted VS). These values shall be compared to IPCC default values and any significant differences shall be explained. If country specific $B_{0,LT}$ values are not available, default values from tables 10 A-4 to 10 A-9 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories

volume 4 Chapter 10 can be used, provided that the project participants assess the suitability of those data to the specific situation of the treatment site.

According to Table 10A-4~10A-9 of IPCC 2006 Guidelines for National Greenhouse Gas Inventories volume 4, chapter 10, the maximum methane producing potential ($B_{0,LT}$) for other cattle in Asia is 0.1 m³ CH_4/kg-dm, the maximum methane producing potential ($B_{0,LT}$) for swine in Asia is 0.29 m³ CH_4/kg-dm and the maximum methane producing potential ($B_{0,LT}$) for layers in developing country is 0.24 m³ CH_4/kg-dm .

(b) Annual methane conversion factor (MCF_j) for the baseline AWMS$_j$

The MCF_j values given in Table 10.A-7, chapter 10, volume 4, IPCC 2006 Guidelines should be used. MCF_j values depend on 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 this project, the annual average temperature is 13.9℃, so the value of 71% is applied.

Specific volatile solids

In order to determine the $SVS_{j,LT,y}$, the value from other document is taken as reference. The value in "Gas-producing variance analysis of different animal manures[8]" is used for ex-ante calculation. As $SVS_{j,LT,y}$ is a monitored parameter, the actual $SVS_{j,LT,y}$ will be determined according to the guideline in annex 2 of AM0073.

4) $MD_{y,reg}$

No regulation requirements specify the amount or methane that should be captured or combusted. And therefore $MD_{y,reg}$=0.

4.2 Project Emissions

As per applied methodology, Project emissions from composting process (PE_y) shall be determined as per the Methodology Tool 13:" Project and leakage emissions from composting (Version 02.0)". PE_y is equivalent to parameter $PE_{COMP,y}$ in the tool.

As per paragraph 13 in Tool 13, Project emissions are estimated as follows:

$$PE_y = PE_{COMP,y} = PE_{EC,y} + PE_{FC,y} + PE_{CH_4,y} + PE_{N_2O,y} + PE_{RO,y}$$

Equation 3

where:

$PE_{COMP,y}$ = Project emissions associated with composting in year y (t CO2e/yr)

[8] Fen Chen, Wei Li, Fenwu Liu, et al. Gas-producing variance analysis of different animal manures [J]. Chinese Journal of Environmental Engineering, 2015,9(09):4540-4546.

$PE_{EC,y}$ = Project emissions from electricity consumption associated with composting in year y (t CO_2/yr)

$PE_{FC,y}$ = Project emissions from fossil fuel consumption associated with composting in year y (t CO_2/yr)

$PE_{CH_4,y}$ = Project emissions of methane from the composting process in year *y* (t CO_2e/yr)

$PE_{N_2O,y}$ = Project emissions of nitrous oxide from the composting process in year *y* (t CO_2e/yr)

$PE_{RO,y}$ = Project emissions of methane from run-off wastewater associated with co-composting in year *y* (t CO_2e/yr)

1) Project emissions from electricity consumption associated with composting in year y ($PE_{EC,y}$)

The electricity used in the project comes from regional power grid, i.e., China Southern Power Grid, $PE_{EC,y}$ shall be calculated using the Tool 05 "Baseline, Project and/or leakage emissions from electricity consumption and monitoring of electricity generation", where the project emission source j referred to in the tool is composting.

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

Equation 4

where:

$PE_{EC,y}$ = Project emissions from electricity consumption in year y (t CO_2e)

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

$EF_{EF,j,y}$ = Emission factor for electricity generation for source j in year y (t CO_2/MWh)

$TDL_{j,y}$ = Average technical transmission and distribution losses for providing electricity to source j in year y

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

The determination of the emission factor for generation is performed as per Option A1: Calculate the combined margin emission factor of the applicable electricity system using Tool 07 "Tool to calculate the emission factor for an electricity system" (Version 07.0). And $EF_{EL,j,y}$=$EF_{grid,CM,y}$.

The tool determines the CO_2 emission factor for the displacement of electricity generated by power plants in an electricity system, by calculating the "combined margin" emission factor (CM) of the electricity system. The CM is the result of a weighted average of two emission factors pertaining to the electricity system: the "operating margin" (OM) and the "building margin" (BM). The operating margin is the emission factor that refers to the group of existing power plants whose current electricity generation would be affected by the proposed project activity. The build margin is the emission factor that refers to the group of power plants whose construction and future operation would be affected by the proposed project activity.

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times \omega_{OM} + EF_{grid,BM,y} \times \omega_{BM}$$

Equation 5

Where:

$EF_{grid,OM,y}$	=	Operating margin CO_2 emission factor in year y, t CO_2/MWh
$EF_{grid,BM,y}$	=	Building margin CO_2 emission factor in year y, t CO_2/MWh
ω_{OM}	=	Weighting of operating margin emissions factor
ω_{BM}	=	Weighting of building margin emissions factor

As per 2019 Baseline Emission Factors for Regional Power Grids in China, published by China DNA, $EF_{grid,OM,y}$of NCPG is 0.8042 t CO_2/MWh and $EF_{grid,BM,y}$ of NCPG is 0.2135 t CO_2/MWh.

As per paragraph 86(b) of Tool 07 (version 07.0), ω_{OM}=0.5 is used for 1st crediting period, and ω_{BM}=0.5 is used for the 1st crediting period.

Based on equation 14, $EF_{grid,CM,y}$ can be calculated as

0.8042 t CO_2/MWh×0.5+0.2135 t CO_2/MWh×0.5=0.50885 t CO_2/MWh

2) Project emissions from fossil fuel consumption associated with composting in year y ($PE_{FC,y}$)

Where the composting activity involves fossil fuel consumption, project participants may choose between the following two options to calculate $PE_{FC,y}$:

Option 1: Procedure using monitored value

$PE_{FC,y}$ shall be calculated using the latest approved version of the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion", where the project emission source j referred to in the tool is composting.

Option 2: Procedure using a default value

Project emissions from fossil fuel consumption associated with composting are calculated as follows:

$$PE_{FC,y} = Q_y \times EF_{FC,default}$$

Equation 7

where:

$PE_{FC,y}$	=	Project emissions from fossil fuel consumption associated with composting in year y (t CO_2/yr)
Q_y	=	Quantity of waste composed in year y (t/yr)
$EF_{FC,default}$	=	Default emission factor for fossil fuels consumed by the composting activity per tonne of waste (t CO_2/t)

The project applies option (1) to calculate project emissions from fossil fuel consumption associated with composting ($PE_{FC,y}$).

As per methodology Tool 03 "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (Version03.0)", CO_2 emissions from fossil fuel combustion in process j are calculated based on the quantity of fuels combusted and the CO_2 emission coefficient of those fuels, as follows:

$$PE_{FC,j,y} = \sum_i FC_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,y}$$

Equation 8

where:

$PE_{FC,j,y}$ = the CO_2 emissions from fossil fuel combustion in process j during the year y (t CO_2/yr)

$FC_{i,j,y}$ = the quantity of fuel type i combusted in process j during the year y (mass or volume unit/yr)

$NCV_{i,y}$ = the weighted average net calorific value of the fuel type i in year y (GJ/mass or volume unit)

$EF_{CO_2,i,y}$ = the weighted average CO_2 emission factor of fuel type i in year y (t CO_2/GJ)

3) Project emissions of methane from the composting process in year y ($PE_{CH_4,y}$)

$$PE_{CH_4,y} = Q_y \times EF_{CH_4,y} \times GWP_{CH_4}$$

Equation 9

where:

$PE_{CH_4,y}$ = Project emissions of methane from the composting process in year y (t CO_2e/yr)

Q_y = Quantity of waste composted in year y (t/yr)

$EF_{CH_4,y}$ = Emission factor of methane per tonne of waste composted valid for year y (t CH_4/t)

GWP_{CH_4} = Global Warming Potential of CH_4 (t CO_2e/t CH_4)

Determining parameter of $EF_{CH_4,y}$

There are two options which project participants may choose for determining $EF_{CH_4,y}$

Option 1: Procedure using monitored data

$EF_{CH_4,y}$ is determined based on measurements of the methane emissions during a composting cycle ($ECC_{CH_4,c}$), as follows:

$$EF_{CH_4,y} = \frac{\sum_{c=1}^{x} ECC_{CH_4,c}/Q_c}{x}$$

Equation 10

where:

$EF_{CH_4,y}$	=	Emission factor of methane per ton of waste composted valid for year *y* (t CH_4/t)
$ECC_{CH_4,c}$	=	Methane emissions from composting during the composting cycle *c* (t CH_4)
Q_c	=	Quantity of waste composted in composting cycle c (t)
c	=	Composting cycles for which measurements were undertaken
x	=	Number of composting cycles *c* for which emissions were measured in year *y* (at least three)

Option 2: Procedure using default values

A default value is used: $EF_{CH_4,y}$=$EF_{CH_4,default}$. The default value is provided in the "Data and parameters not monitored" section of this tool.

For this project, default value for $EF_{CH_4,y}$ is adopted, which is listed in the "Data and parameters available at validation" section.

4) Project emissions of nitrous oxide from the composting process ($PE_{N_2O,y}$)

$$PE_{N_2O,y} = Q_y \times EF_{N_2O,y} \times GWP_{N_2O}$$

Equation 11

where:

$PE_{N_2O,y}$	=	Project emissions of nitrous oxide from the composting in year y (t CO_2e/yr)
Q_y	=	Quantity of waste composted in year y (t/yr)
$EF_{N_2O,y}$	=	Emission factor of nitrous oxide per tonne of waste composted valid for year y (t N_2O/t)
GWP_{N_2O}	=	Global Warming Potential of N_2O (t CO_2e/t N_2O)

Determining parameter of $EF_{N_2O,y}$

There are two options which project participants may choose for determining $EF_{N_2O,y}$:

Option 1: Procedure using monitored data

$EF_{N_2O,y}$ is determined based on measurements of the methane emissions during a composting cycle ($ECC_{N_2O,y}$), as follows:

$$EF_{N_2O,y} = \frac{\sum_{c=1}^{x} ECC_{N_2O,y}/Q_c}{x}$$

Equation 12

where:

$EF_{N_2O,y}$	=	Emission factor of nitrous oxide per ton of waste composted valid for year *y* (t N_2O/t)

$ECC_{N_2O,y}$	=	Nitrous oxide emissions from composting during the composting cycle *c* (t N_2O)
Q_c	=	Quantity of waste composted in composting cycle c (t)
c	=	Composting cycles for which measurements were undertaken
x	=	Number of composting cycles *c* for which emissions were measured in year *y* (at least three)

Option 2: Procedure using default values

A default value is used: $EF_{N_2O,y}$= $EF_{N_2O,default}$. The default value is provided in the "Data and parameters not monitored" section of this tool.

For this project, default value for $EF_{N_2O,y}$ is adopted, which is listed in the "Data and parameters available at validation" section.

5) Project emissions from run-off wastewater ($\boldsymbol{PE_{RO,y}}$)

Project emissions of methane from run-off wastewater ($PE_{RO,y}$) are calculated only for the case of co-composting.

The proposed project does not involve co-composting, therefore $PE_{RO,y}$=0.

4.3 Leakage

As per the methodology, If the project technology is the equipment transferred from another activity or if the existing equipment is transferred to another activity, leakage effects are to be considered (LEy). However, in case of the project activity there is no equipment transferred from another activity nor is any existing equipment transferred to another activity. The project is greenfield project and all equipment applied is new.

In case compost is subject to anaerobic storage or disposed of in a SWDS, leakage shall be estimated to account for methane emissions from the anaerobic decay of compost. However, the compost won't be subjected to anaerobic storage, neither disposed in a SWDS.

Therefore, this is no leakage emissions associated the project activity.

4.4 Net GHG Emission Reductions and Removals

As per applied methodology, in the case of construction of new composting facilities or expansion of capacity of existing composting facilities, the emission reduction achieved by the project activity will be measured as the difference between the baseline emission and the sum of the project emission and leakage. The project belongs to the construction of new composting facilities; therefore, the calculation is as following:

$$ER_y = BE_y - (PE_y + LE_y)$$

Equation 14

where:

ER_y = Emission reduction in the year y (t CO_2e)

BE_y = Baseline emission in the year y (t CO_2e)

PE_y = Project emission in the year y (t CO_2e)

LE_y = Leakage emission in the year y (t CO_2e)

As per described above, Ex-ante calculation result of GHG emission reductions is as following:

1. Calculation of baseline emissions:

Table 4-1 Ex-ante calculation of $BE_{CH4,manure,y}$

Parameter	Value	Unit	Source
GWP_{CH4}	27.9	t CO_2/t CH_4	IPCC AR6
D_{CH4}	0.00067	t/m³	AMS-III.D: Methane recovery in animal manure management systems", version 21.0
UF_b	0.94	-	AMS-III.D: Methane recovery in animal manure management systems", version 21.0
MCF_j	71%	-	AMS-III.D: Methane recovery in animal manure management systems", version 21.0, temperature of the project site is 13.9 ℃
$B_{o,other\ cattle}$	0.1	m³ CH_4/kg-dm	IPCC 2006 table10A-5, chapter10, volume4
$Q_{manure,j,other\ cattle,y}$	41,958	tons/yr, dry basis	Project evaluation report
$SVS_{j,other\ cattle,y}$	74.77%	tons/tons, dry basis	Fen Chen, Wei Li, Fenwu Liu, et al. Gas-producing variance analysis of different animal manures [J]. Chinese Journal of Environmental Engineering, 2015,9(09):4540-4546.
$B_{o,swine}$	0.29	m³ CH_4/kg-dm	IPCC 2006 table10A-7 and table 10A-8, chapter10, volume4
$Q_{manure,j,swine,y}$	27,146	tons/yr, dry basis	Project evaluation report
$SVS_{j,swine,y}$	60.49%	tons/tons, dry basis	Fen Chen, Wei Li, Fenwu Liu, et al. Gas-producing variance analysis of different animal manures [J]. Chinese Journal of Environmental Engineering, 2015,9(09):4540-4546.
$B_{o,layers}$	0.24	m³ CH_4/kg-dm	IPCC 2006 table10A-9, chapter10, volume4
$Q_{manure,j,layers,y}$	4217	tons/yr, dry basis	Project evaluation report
$SVS_{j,layers,y}$	64.43%	tons/tons, dry basis	Fen Chen, Wei Li, Fenwu Liu, et al. Gas-producing variance analysis of different animal manures [J]. Chinese Journal of Environmental Engineering, 2015,9(09):4540-4546.
$BE_{CH4,manure,y}$	106,684	t CO_2e	Calculated

Table 4-2 The results of $BE_{CH4,y}$

Year	$BE_{CH4,manure,y}$ (t CO_2e)	$BE_{CH4,y}$ (t CO_2e)
Year1	106,684	106,684
Year 2	106,684	106,684
Year 3	106,684	106,684
Year 4	106,684	106,684
Year 5	106,684	106,684
Year 6	106,684	106,684
Year 7	106,684	106,684
Year 8	106,684	106,684
Year 9	106,684	106,684
Year 10	106,684	106,684

2. Calculation of project emissions:

Table 4-6 Ex-ante calculation of $PE_{EC,y}$

Parameter	Value	Unit	Source
$EC_{PJ,j,y}$	12932.618	MWh/yr	Project evalution report
$EF_{EF,j,y}$	0.50885	t CO_2/MWh	Published by DNA
$TDL_{j,y}$	20%	-	Baseline,project and/or leakage emissions from electricity consumption and monitoring of electricity generation
$PE_{EC,y}$	7,896	t CO_2e	Calculated

Table 4-7 Ex-ante calculation of $PE_{FC,y}$

Parameter	Value	Unit	Source
$FC_{i,j,y}$	0	ton/yr	Project evalution report
$NVC_{i,y}$	50.4	GJ/ton	Natural gas, upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC
$EF_{CO2,i,y}$	0.0583	t CO_2/GJ	Natural gas, upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC
$PE_{FC,y}$	0	t CO_2e	Calculated

Table 4-8 Ex-ante calculation of $PE_{CH4,y}$

Parameter	Value	Unit	Source
Qy	374,579	ton/yr	Project evaluation report
GWP_{CH4}	27.9	t CO_2/t CH_4	IPCC AR6
$EF_{CH4,y}$	0.002	t CH_4/t	Tool 13: “Project and leakage emissions from composting (Version 02.0)”
$PE_{CH4,y}$	20,901	t CO_2e	Calculated

Table 4-9 Ex-ante calculation of $PE_{N2O,y}$

Parameter	Value	Unit	Source
Qy	374,579	ton/yr	Project evaluation report
GWP_{N2O}	273	t CO_2/t CH_4	IPCC AR6
$EF_{N2O,y}$	0.0002	t CH_4/t	Tool 13: "Project and leakage emissions from composting (Version 02.0)"
$PE_{N2O,y}$	20,452	t CO_2e	Calculated

Table 4-10 The result of PE_y

Year	$PE_{EC,y}$ (t CO_2e)	$PE_{FC,y}$ (t CO_2e)	$PE_{CH4,y}$ (t CO_2e)	$PE_{N2O,y}$ (t CO_2e)	PE_y (t CO_2e)
Year 1	7,896	0	20,901	20,452	49,249
Year 2	7,896	0	20,901	20,452	49,249
Year 3	7,896	0	20,901	20,452	49,249
Year 4	7,896	0	20,901	20,452	49,249
Year 5	7,896	0	20,901	20,452	49,249
Year 6	7,896	0	20,901	20,452	49,249
Year 7	7,896	0	20,901	20,452	49,249
Year 8	7,896	0	20,901	20,452	49,249
Year 9	7,896	0	20,901	20,452	49,249
Year 10	7,896	0	20,901	20,452	49,249
Total	78,960	0	209,010	204,520	492,490

Year	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)
Year 1	106,684	49,249	0	57,435
Year 2	106,684	49,249	0	57,435
Year 3	106,684	49,249	0	57,435
Year 4	106,684	49,249	0	57,435
Year 5	106,684	49,249	0	57,435
Year 6	106,684	49,249	0	57,435
Year 7	106,684	49,249	0	57,435

Year 8	106,684	49,249	0	57,435
Year 9	106,684	49,249	0	57,435
Year 10	106,684	49,249	0	57,435
Total	1,066,840	492,490	0	574,350

5 MONITORING

5.1 Data and Parameters Available at Validation

Data / Parameter	GWP_{CH4}
Data unit	t CO_2/t CH_4
Description	Global Warming Potential of CH_4
Source of data	IPCC Sixth Assessment Report
Value applied	27.9
Justification of choice of data or description of measurement methods and procedures applied	100-year values are adopted from Table 9, IPCC AR6 Climate Change 2022: Mitigation of Climate Change, which complies with the requirement described in Section 3.15.4 of VCS Standard 4.4
Purpose of Data	Calculation of baseline emissions and project emissions
Comments	N/A

Data / Parameter	GWP_{N2O}
Data unit	t CO_2e/t N_2O
Description	Global Warming Potential of N_2O
Source of data	IPCC Sixth Assessment Report
Value applied	273
Justification of choice of data or description of measurement methods and procedures applied	100-year values are adopted from Table 9, IPCC AR6 Climate Change 2022: Mitigation of Climate Change, which complies with the requirement described in Section 3.15.4 of VCS Standard 4.4

Purpose of Data	Calculation of baseline emissions and project emissions
Comments	N/A

Data / Parameter	D_{CH4}
Data unit	t/m^3
Description	Density of CH_4
Source of data	AMS-III.D Version 21.0
Value applied	0.00067
Justification of choice of data or description of measurement methods and procedures applied	0.00067 t/m^3 at room temperature 20℃ and 1 atm pressure.
Purpose of Data	Calculation of baseline emissions
Comments	N/A

Data / Parameter	MCF_j
Data unit	-
Description	Methane conversion factor for the baseline AWMSj
Source of data	IPCC 2006 table 10.17, chapter 10, volume 4
Value applied	71%
Justification of choice of data or description of measurement methods and procedures applied	MCFj value for uncovered anaerobic lagoon (baseline AWMS) is chosen. For this project, the annual average temperature is 13.9℃, so the conservative value of 71% is applied.
Purpose of Data	Calculation of baseline emissions
Comments	N/A

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	As per the methodology AMS-III.D, the value of this parameter is 0.94
Purpose of Data	Calculation of baseline emissions
Comments	N/A

Data / Parameter	$EF_{CH4,default}$
Data unit	t CH_4/t
Description	Default emission factor of methane per tonne of waste composted (wet basis)
Source of data	Tool 13:" Project and leakage emissions from composting (Version 02.0)"
Value applied	0.002
Justification of choice of data or description of measurement methods and procedures applied	As per Tool 13 (Version 02.0), the value of this parameter should apply 0.002
Purpose of Data	Calculation of project emission
Comments	Applicable to Option 2 in the step "Determination of methane and nitrous oxide emissions from the composting process"

Data / Parameter	$EF_{N2O,default}$
Data unit	tN_2O/t
Description	Default emission factor of nitrous oxide per tonne of waste composted (wet basis)
Source of data	Tool 13:" Project and leakage emissions from composting (Version 02.0)"
Value applied	0.0002
Justification of choice of data or description of measurement methods and procedures applied	As per Tool 13 (Version 02.0), the value of this parameter should apply 0.0002

Purpose of Data	Calculation of project emission
Comments	Applicable to Option 2 in the step “Determination of methane and nitrous oxide emissions from the composting process”

Data / Parameter	$EF_{grid,OM,y}$
Data unit	tCO_2/MWh
Description	Operating margin CO_2 emission factor in year y
Source of data	2019 Baseline Emission Factors for Regional Power Grids in China
Value applied	0.8042
Justification of choice of data or description of measurement methods and procedures applied	Official publication data from the DNA of China
Purpose of Data	Calculation of project emission
Comments	-

Data / Parameter	$EF_{grid,BM,y}$
Data unit	tCO_2/MWh
Description	Building margin CO_2 emission factor in year y
Source of data	2019 Baseline Emission Factors for Regional Power Grids in China
Value applied	0.2135
Justification of choice of data or description of measurement methods and procedures applied	Official publication data from the DNA of China
Purpose of Data	Calculation of project emission
Comments	-

5.2 Data and Parameters Monitored

Data / Parameter	$B_{0, LT}$
Data unit	$m^3CH_4/kg\text{-}dm$
Description	Maximum methane producing potential of the volatile solid generated by animal type *LT*
Source of data	IPCC 2006 table 10A-4~10A-9, 10 chapter 10, volume 4
Description of measurement methods and procedures to be applied	$B_{0, LT}$ can be measured as per ISO 11734:1995. As this parameter is not monitored in the actual operation. So, in the monitoring period 0.1 m^3 CH_4/kg -dm, 0.29 m^3 CH_4/kg -dm and 0.24 m^3 CH_4/kg -dm are still applied.
Frequency of monitoring/recording	Annually
Value applied	$B_{0, LT}$ (Other Cattle) =0.1 $B_{0, LT}$ (Swine) =0.29 $B_{0, LT}$ (Layers) =0.24
Monitoring equipment	N/A
QA/QC procedures to be applied	The value is taken from published sources. The parameter value should be updated on latest available public data source.
Purpose of Data	Calculation of baseline emissions
Calculation method	N/A
Comments	N/A

Data / Parameter	$Q_{manure,LT,y}$
Data unit	Tons-dm/year
Description	Quantity of manure treated from livestock type *LT* at animal manure management system *j*
Source of data	Data sourced from Project proponents and this parameter can be calculated by the Quantity of manure (wet basis) and the moisture content of manure (wet basis).

Description of measurement methods and procedures to be applied	Quantity of manure (wet basis) is measured by electronic truck scale in project site. Moisture content of manure (wet basis) is measured by electronic balance and Electric heating blast drying oven as per GB/T25169 Technical specifications for monitoring of animal manure. The electronic balance is used to measure the net weight of container (m_0), the weight of wet basis manure with container (m_1), the weight of dry manure with the container (m_2). The process of the manure from the wet basis to the dry basis is realized by drying in the electric heating blast drying oven. The moisture content in livestock manure can be calculated by the formula: $\frac{m_2-m_0}{m_1-m_0} \times 100\%$
Frequency of monitoring/recording	The Quantity of daily manure (wet basis) entering the project site is measured by electronic truck scale and the data is summarized monthly. The moisture content of daily manure entering the project site needs to be measured. The monthly moisture content used in the emission reduction calculation is calculated by the weighted average of the daily moisture content and the daily quality of livestock manure entering the project site.
Value applied	41,958 tons of cattle manure (dry basis), 27,146 tons of swine manure (dry basis) and 4,217 tons of layers manure (dry basis) used for ex-estimated which are sourced from project evaluation report.
Monitoring equipment	electronic truck scale, electronic balance and Electric heating blast drying oven
QA/QC procedures to be applied	Calculated by the Quantity of manure (wet basis) multiply (1- moisture content of manure (wet basis)). The Periodic calibration of electronic truck scale and electronic balance should be conducted by an independent accredited laboratory, and which is mandatory. Calibration and frequency of calibration is according to manufacturer's specifications. The electric heating blast drying oven do not require calibration.
Purpose of data	Calculation of baseline emissions
Calculation method	Quantity of manure (dry basis) = quantity of manure (wet basis) × (1- moisture content of manure (wet basis))
Comments	N/A

Data / Parameter	$SVS_{j,LT,y}$
Data unit	tons VS/tons--dm

Description	Specific volatile solids content of animal manure from livestock type *LT* and animal manure management system *j* in year *y*
Source of data	Data sourced from Project proponents, which is measured as per the guideline in annex 2 of AM0073.
Description of measurement methods and procedures to be applied	Method for determination of Volatile Solids in animal waste. From: USDA. Agricultural Waste Management Field Handbook. Chapter 4 - Agricultural Waste Characteristics. Page 2. Definitions ● Total Solids: Residue remaining after water is removed from waste material by evaporation; dry matter; ● Volatile Solids: The part of total solids driven off as volatile (combustible) gases when heated to 600ºC; organic matter; ● Fixed Solids: The part of total solids remaining after volatile gases driven off at 600ºC; ashes. Determination method 1 - Evaporate free water on steam able and dry in oven at 103°C for 24 hours or until constant weight to obtain the Total Solids. 2 - Place Total Solids residue in furnace at 600ºC for at least 1 hour. Volatile Solids are determined from weight difference of total and Fixed Solids. $$volatile\ matter(drybasis) = \frac{W_2 - W_f}{W_2 - W_1}$$ Where W_1 is the weight of sample container, W_2 is combined weight of the sample container and oven dried sample, W_f is the combined constant weight of the sample container and sample after heating at 600ºC
Frequency of monitoring/recording	Annually
Value applied	74.77% for cattle manure, 60.49% for swine manure and 64.43% for layers manure are used for ex for ex-ante calculation. $SVS_{j,LT,y}$ will be determined as the guideline in annex 2 of AM0073 during the monitoring period.
Monitoring equipment	Electronic balance and Muffle furnace. Electronic balance is used to measure the net weight of Evaporating dish (W_1), the weight of Evaporating dishes and dry manure (W_2), the weight of Evaporating dishes and the manure after 600 ℃ burning (W_f). The muffle furnace is used to heat the dry basis manure to 600℃ to remove the volatile solids in the dry basis manure.

QA/QC procedures to be applied	The Periodic calibration of electronic balance should be conducted by an independent accredited laboratory, and which is mandatory. Calibration and frequency of calibration is according to manufacturer's specifications. The Muffle furnace do not require calibration.
Purpose of data	Calculation of baseline emissions
Calculation method	N/A
Comments	Sampling procedures and method is described in Section 5.3 of PD.

Data / Parameter	$EC_{PJ,j,y}$
Data unit	MWh
Description	Quantity of electricity consumed by the proposed project in year y
Source of data	Direct measurement from electricity meter
Description of measurement methods and procedures to be applied	Measured by electricity meter.
Frequency of monitoring/recording	Continuous measurement and at least monthly recording
Value applied	12,932.618 MWh for ex-ante estimation, which sourced from Project evaluation report. During the monitoring period, the Quantity of electricity consumed by the proposed project will be determined as per the electricity meter monitoring and Cross-check with the "monthly production record".
Monitoring equipment	electricity meter
QA/QC procedures to be applied	The calibration of meter, including the frequency of calibration, should be done in accordance with national standards or requirements.
Purpose of data	Calculation of project emissions
Calculation method	N/A
Comments	N/A

Data / Parameter	$EF_{EF,j,y}$

Data unit	tCO_2/MWh
Description	Emission factor for electricity generation
Source of data	Published by Ministry of Ecology and Environment of China, which is the DNA of China
Description of measurement methods and procedures to be applied	This parameter can be obtained from the "Emission Factors of China's Regional Power Grid Baseline for Emission Reduction Projects" published by the Ministry of Ecology and Environment of China, which is the DNA of China.
Frequency of monitoring/recording	This value will change once the latest data is published
Value applied	0.50885
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of Data	Calculation of project emission
Calculation method	N/A
Comments	N/A

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	Tool 05" Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation"
Description of measurement methods and procedures to be applied	According to Tool 05" Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation"
Frequency of monitoring/recording	This value will change once the tool is updated
Value applied	20%
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A

Purpose of data	Calculation of project emissions
Calculation method	N/*A*
Comments	N/*A*

Data / Parameter	$FC_{i,j,y}$
Data unit	tonne
Description	Quantity of fuel type *i* combusted by the proposed project during the year *y*
Source of data	Direct measurement by electronic flowmeter
Description of measurement methods and procedures to be applied	Measured by electronic flowmeter
Frequency of monitoring/recording	Continuously monitored by electronic flowmeter and at least monthly recording
Value applied	The project does not involves fossil fuel, which sourced from Project evaluation report. During the monitoring period, the natural gas consumption will be recorded in "Natural gas usage record" and Cross-check with the "purchase and stock change record".
Monitoring equipment	Electronic flowmeter
QA/QC procedures to be applied	Archive electronically during project plus 5 years. The calibration of electronic flowmeter, including the frequency of calibration, should be done in accordance with national standards or requirements.
Purpose of data	Calculation of project emissions
Calculation method	N/A
Comments	N/A

Data / Parameter	$NCV_{i,y}$
Data unit	GJ/ton
Description	Weighted average net calorific value of fuel type i in year y

Source of data	Upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC
Description of measurement methods and procedures to be applied	Default value of IPCC are applied. Any future revision of the IPCC Guidelines should be taken into account.
Frequency of monitoring/recording	This value will change once the latest data can be obtained
Value applied	Natural gas: 50.4
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of Data	Calculation of project emission
Calculation method	N/A
Comments	Applicable to Option 1 in the step "Determination of project emissions from fossil fuel consumption ($PE_{FC,y}$)"

Data / Parameter	$EF_{CO2,i,y}$
Data unit	t CO_2/GJ
Description	Weighted average CO_2 emission factor of fuel type i in year y
Source of data	Upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC
Description of measurement methods and procedures to be applied	Default value of IPCC are applied. Any future revision of the IPCC Guidelines should be taken into account.
Frequency of monitoring/recording	This value will change once the latest data can be obtained
Value applied	Natural gas: 0.0583
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of Data	Calculation of project emission

Comments	Applicable to Option 1 in the step "Determination of project emissions from fossil fuel consumption ($PE_{FC,y}$)"

Data / Parameter	Q_y
Data unit	ton
Description	Quantity of waste composted in year *y* (t/yr)
Source of data	Recorded by project participant
Description of measurement methods and procedures to be applied	This parameter can be obtained by sum of the quantity of manure (wet basis) and the total amount of waste disposed in a SWDS. The quantity of manure (wet basis) is measured by electronic truck scale. Total amount of waste disposed in a SWDS measured on wet basis by Belt scale 1
Frequency of monitoring/recording	Continuously
Value applied	371,578 tons of organic waste (304,618 tons of livestock manure and 66,960 tons of straw) composted for Ex-ante calculation which is sourced from project evaluation report.
Monitoring equipment	Electronic truck scale and Belt scale 1 in project site
QA/QC procedures to be applied	This parameter can be sourced from "monthly production record" recorded by project participant. Archive electronically during project plus 5 years. Periodic calibration against a primary device provided by an independent accredited laboratory is mandatory. Calibration and frequency of calibration is according to manufacturer's specifications.
Purpose of data	Calculation of project emissions
Calculation method	This parameter can be obtained by sum of the quantity of manure (wet basis) and the total amount of waste disposed (wet basis) in a SWDS.
Comments	N/A

Data / Parameter	The amount of the organic fertilizers generated
Data unit	tons

Description	The amount of the organic fertilizers generated
Source of data	Recorded by project participant
Description of measurement methods and procedures to be applied	The amount of the organic fertilizers generated is measured by belt scale 2 in project site.
Frequency of monitoring/recording	Continuously
Value applied	200,000 tons of organic fertilizer which is sourced from project evaluation report.
Monitoring equipment	Belt scale 2
QA/QC procedures to be applied	This parameter can be sourced from "monthly production record" recorded by project participant. Archive electronically during project plus 5 years. Periodic calibration against a primary device provided by an independent accredited laboratory is mandatory. Calibration and frequency of calibration is according to manufacturer's specifications.
Purpose of data	To demonstrate the contribution of SDG12
Calculation method	N/A
Comments	N/A

5.3 Monitoring Plan

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

1. Monitoring framework

The project owner will be responsible for the whole monitoring work. The VCS Monitoring Team will be established to collect and record monitoring data within the project boundary. The VCS monitoring team will be responsible for the normal operation of the manure treatment system and the collection and record of all the monitoring data. All the data will be reviewed by the project developer and VVB. Each member of the VCS monitoring team will be trained by the project owner at least once a year. The overall monitoring system structure of the project shows as below:

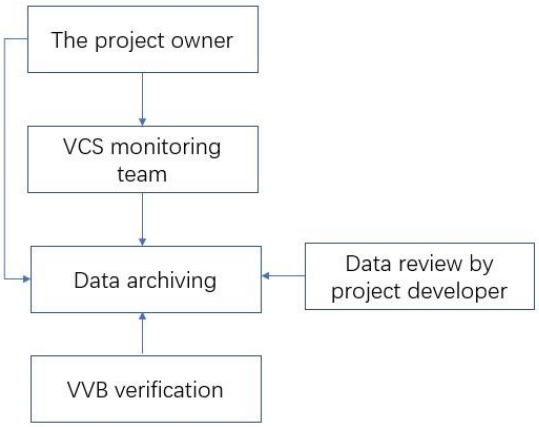

Figure 5-1 The Organization Structure of the Monitoring Team

2. Monitoring equipment and installation

Installation and configuration of monitoring equipment are shown as Figure 5-2. In order to ensure measurements with a low degree of uncertainty, the data monitoring equipment will be calibrated and checked by an appropriately qualified third party according to an appropriate national standard. The calibration records will be appropriately maintained and made available for review by VVB.

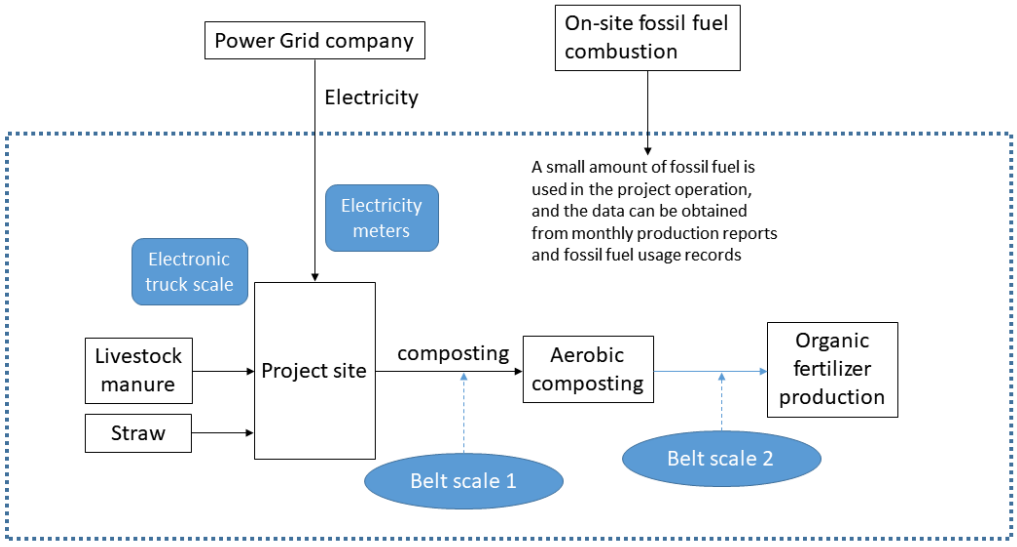

Figure 5-2 Installation and Configuration of Meters

3. Principle of Monitoring

All the data to be monitored in this project has been descripted in section 5.2 in this PD.

The installation of relevant monitoring instruments and meters shall be carried out in accordance with industry requirements and manufacturer specifications and shall be calibrated regularly as required.

If monitoring instruments is changed or added during the crediting period, this should be documented transparently in the monitoring reports, and the procedure for post registration changes shall be followed.

4. Parameters to be monitored

The monitoring requirements for this methodology include the monitoring of parameters for both baseline and project emissions calculations. All provisions in the methodology and relevant tools shall apply, as described for each parameter in section 5.2 of this PD.

For this project, the parameters that need to be monitored as the description of section 5.2 are as follows:

a) Maximum methane producing potential of the volatile solid generated by animal type LT, $B_{0,\,LT}$

b) Quantity of manure treated from livestock type LT at animal manure management system j, $Q_{manure,LT,y}$

c) Specific volatile solids content of animal manure from livestock type LT and animal manure management system j in year y, $SVS_{j,LT,y}$

d) Quantity of electricity consumed by the proposed project in year y, $EC_{PJ,j,y}$

e) Emission factor for electricity generation, $EF_{EF,j,y}$

f) Average technical transmission and distribution losses for providing electricity to source j in year y, $TDL_{j,y}$

g) Quantity of fuel type i combusted by the proposed project during the year y, $FC_{i,j,y}$

h) Weighted average net calorific value of fuel type i in year y, $NCV_{i,y}$

i) Weighted average CO_2 emission factor of fuel type i in year y, $EF_{CO2,i,y}$

j) Quantity of waste composted in year y (t/yr), Q_y

k) The amount of the organic fertilizers generated.

For $B_{0,LT}$, a default value from IPCC 2006 is applied, therefore it is not monitored during the operation period.

Quantity of manure (dry base) treated from livestock type LT at animal manure management system can be calculated by the Quantity of manure (wet base) multiply (1- moisture content of manure (wet basis)). The Quantity of manure (wet base) measured by electronic truck scale; the moisture content of manure (wet basis) can be measured by electronic balance and Electric heating blast drying oven as per GB/T25169 Technical specifications for monitoring of animal manure.

For $SVS_{j,LT,y}$, this parameter was determined according to the guideline in annex 2 of AM0073. This parameter can be sourced from "Volatile Solids Test Record".

The quantity of electricity consumed by the proposed project was measured by electricity meter, the data can be sourced from the "Electricity consumption daily record" and cross-checked by the "monthly production record".

The value of $EF_{EF,j,y}$ is sourced from the "Emission Factors of China's Regional Power Grid Baseline for Emission Reduction Projects" published by the Ministry of Ecology and Environment of China, which is the DNA of China, therefore it is not monitored during the monitoring period. This value will be updated according to the latest published document.

Average technical transmission and distribution losses for providing electricity to source j is sourced from the tool 05" Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" and will be updated once the tool is updated.

For Quantity of fuel type i combusted by the proposed project during the year y was measured by electronic Flowmeter and recorded in "Diesel usage record", so the data can be sourced from "Diesel usage record" and cross-checked by "purchase and stock change record".

For $NCV_{i,y}$ and $EF_{CO2,I,y}$, the source of data applied the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC, therefore it is not to be monitored during the monitoring period. This value will be updated once the IPCC is updated.

For the Quantity of waste composted in year y, the value can be calculated by adding the total amount of waste disposed in a SWDS and the Quantity of manure (wet base) treated. This data can be sourced from "monthly production record".

For the amount of the organic fertilizers generated can be measured by Belt scale 2 and the data can be sourced from "monthly production record".

5. **Quality control and quality assurance procedures**

A quality management system will be established, which ensures the quality and accuracy of the measured data. Training

For all members involved in the project, necessary trainings will be provided by the project owner. Besides, the project owner should ensure that only skilled employees are allowed to undertake the monitoring work. The training contents should be regard to the general and technical aspects of the project to the extent appropriate, as well as basic understandings of VCS Standard and climate change.

Data management

All data collected as part of monitoring plan should be saved with at least 1 backup copy until the end of the crediting period. After the crediting period ends, the data should be archived

electronically on hard disks and be kept at least 2 years after the end of the last crediting period.
Corrective actions

The project signs an agreement that it is not participate in other environment credits, other GHG programs and has not been rejected by any other GHG Programs. The whole VCS monitoring team follow recognized standard data evaluation methods to guarantee that the data is reliable and accurate. The quality control and quality assurance procedures include the handling and correction of nonconformities in the implementation of the project or the monitoring plan. In case such nonconformities are observed:

- An analysis of the nonconformity and its causes should be carried out immediately by the project owner, with the help of external experts if necessary.

- A corrective action plan should then be developed to eliminate the non-conformity and its causes to prevent its recurrence.

- Corrective actions are implemented and reported back to the VCS monitoring team.

- Relative information should be included in the monitoring report and reported to VVB during the verification.

If the data record is missing or damaged during the monitoring periods, the following makeup process should be conducted:

- The general principle is that Conservative value will be used for the missing or damaged data. This is most conservative approach. The monitoring personnel will be trained before the starting of the project operation to ensure that each team member is fully aware of and able to strictly follow this conservative principle. During the monitoring process, the monitoring personnel will be required to strictly abide by the above conservative principle in data recording, i.e., use Conservative value for all the missing or damaged data.

- If this is due to the working error of the monitoring personnel, further train the person until he or she can perform the job properly. And in the meantime, use Conservative value for the missing or damaged data;

- If this is due to the inability or attitude of a particular worker in monitoring team, dismiss such worker and re-hire those with proper ability and attitude. And in the meantime, use Conservative value for the missing or damaged data;

- If some data recorded are significantly higher than the normal range, the monitoring personnel should ask for the reason. If the measurement is high due to the damage of measurement equipment, Conservative value is used for that day's data. And need to calibrate and maintain the measuring equipment immediately and avoid this situation in the future.

If the monitoring results are satisfactory in terms of correct reporting, data completeness and correct analysis, the data is accepted for the monitoring report.

6. Sample plan

The sampling objective

To determining the specific volatile solids content of manure ($SVS_{j,LT,y}$) during the crediting period with a 90/10 confidence/precision.

The determination of sampling sizes

According to the methodology AMS-III.D (Version 21.0)", PP shall use 90/10 confidence/precision as the criteria for the reliability of sampling efforts for large-scale project.

According to the CDM guideline "Sampling and surveys for CDM project activities and programs of activities" (Version 04.0), the sample size can be calculated by the following equation:

$$n = (\frac{t_{n-1} \times CV}{0.1})^2$$

n = Sample size

t_{n-1} = the value of the t-distribution for 90% confidence when the sample size is n, i.e., 1.645

CV = The coefficient of variation. 2% was used as per the public literature

So, the sample size n is rounded to an integer as 1. Also, as per the methodology AMS-III.D (Version 21.0), the Monitoring frequency of this parameter is annually, so during the monitoring period, the value of SVS will be measured once annually, and in order to ensure the accuracy and rationality of the data, three parallel samples will be taken during the measurement, so the sample size is 3.

Testing method

As per methodology AMS-III.D, the testing shall be performed according to the guideline in annex 2 of AM0073. The details as follows:

1 - Evaporate free water on steam able and dry in oven at 103°C for 24 hours or until constant weight to obtain the Total Solids.

2 - Place Total Solids residue in furnace at 600ºC for at least 1 hour. Volatile Solids are determined from weight difference of total and Fixed Solids.

$$volatile\ matter(drybasis) = \frac{W2 - Wf}{W2 - W1}$$

Where W_1 is the weight of sample container, W_2 is combined weight of the sample container and oven dried sample, W_f is the combined constant weight of the sample container and sample after heating at 600ºC.

Procedures for Administering Data Collection and Minimizing Non-sampling Errors

During the yearly monitoring activities, the Specific volatile solids content of livestock manure was recorded in the" Volatile Solids Test Record". Then average Specific volatile solids content in the three parallel samples will be used in the calculation of emission reductions. The data will be reviewed by the project developer and VVB.

If the recorded raw data on the "Volatile Solids Test Record" are reasonable and basically consistent with the actual proportion of each component in livestock manure, the raw data is archived.

If the data record is missing or damaged during the monitoring periods, the following makeup process should be conducted:

1) The general principle is that conservative value sourced from the publicly available information is used for the missing or damaged data. This is most conservative approach. The monitoring personnel are trained before the starting of the project operation to ensure that each team member is fully aware of and able to strictly follow this conservative principle. During the monitoring process, the monitoring personnel are required to strictly abide by the above conservative principle in data recording, i.e., use conservative value sourced from the publicly available information for all the missing or damaged data.

2) If this is due to the working error of the monitoring personnel, further train the person until he or she can perform the job properly. And in the meantime, use conservative value sourced from the publicly available information for the missing or damaged data;

3) If this is due to the inability or attitude of a particular worker in monitoring team, dismiss such worker and re-hire those with proper ability and attitude. And in the meantime, use conservative value sourced from the publicly available information for the missing or damaged data;

4) If some data recorded are significantly higher than the normal range, the monitoring personnel should ask for the reason. If the measurement is high due to the damage of weighing scales or other measurement equipment, the data needs to be remeasured. And need to calibrate and maintain the weighing scale or replace the measuring equipment immediately and avoid this situation in the future.

If the monitoring results are satisfactory in terms of correct reporting, data completeness and correct analysis, the data is accepted for the monitoring report.

QA/QC Procedures

Before implementing the project, the project owner trains the personnel of monitoring teams on how to properly conduct the monitoring process.

If the data reported by the team member significantly deviates from the normal range, the monitoring personnel should write down the reasons and report to the team leader, any action is forbidden before the permission. The monitoring team arrange research according to the attached form. At the same time, when the verification group has any doubt with the right result, they can arrange related research.

The project owner should enter all the measured data into the data sheet, using Excel to calculate the mean value of Specific volatile solids content of livestock manure in the three parallel sample, compared with the publicly available data.