Composting of organic waste project in Guangxi

Document Prepared by LGAI Technological Center, S.A. (Applus+ Certification)

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Report Title	Composting of organic waste project in Guangxi
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Work carried out by	Lead Auditor / Technical Expert: Doris Dai Technical Reviewer: Simon Shen

Summary:

LGAI Technological Center, S.A. (hereafter referred to as "Applus+ Certification") has been commissioned by Beijing Ruifang Technology Co., Ltd to perform the validation of project activity "Composting of organic waste project in Guangxi " (hereafter referred to as "the project activity") and reported in the Project Description.

The project activity is newly built composting plant which designed to treat organic wastes to produce organic fertilizer located in Guangxi Zhuang Autonomous Region, P. R. China. The project activity includes two project activity instances. One is located at Tiandong Petrochemical Industrial Park, Tiandong County, Baise City (hereafter referred to as Instance 1), another one is located at the Yizhou District, Hechi City (hereafter referred to as Instance 2). The instances 1 is designed to treat 400,000 tonnes wet organic waste per year and produce 300,000 tonnes fertilizer per year. The instances 2 is designed to treat 150,000 tonnes wet organic waste per year and produce 110,000 tonnes fertilizer per year. In absence of the project, the organic wastes would have been dumped in the landfill sites. This new project will avoid CH_4 emissions from the disposal of the waste in a landfill site in absence of the Project. It's estimated that the project activity could achieve GHG emission reductions of 6,199,571 tCO_2e emission reduction during the first 7 years' crediting period, at an average amount of 885,653 tCO_2e per year.

The objective of this validation activity is to have an independent third party for the assessment of the project design, IRR sheet, estimated ER sheet and to ensure a thorough assessment of the proposed project activity against the applicable CDM and VCS requirements. In particular;

- ACM0022: Alternative waste treatment process, version 03.0
- Emissions from solid waste disposal sites, version 08.0
- Combined tool to identify the baseline scenario and demonstrate additionality, version 07.0
- Tool to calculate the emission factor for an electricity system, version 07.0
- Project and leakage emissions from composting, version 02.0

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

The projects compliance with, the requirements of Article 12 of the Kyoto Protocol, the CDM Modalities and Procedures as agreed in the Marrakech Accords under decision 3/CMP.1, the annexes to this decision, subsequent decisions and guidance made by COP/MOP & CDM Executive Board and other relevant rules, including the Host Country legislation and sustainability criteria along with VCS guideline and standard version 4.1

- CDM Validation and Verification Standard for project activities version 03.0
- CDM Project Standard for project activities version 03.0
- VCS standard version 4.1
- VCS guideline version 4.0

Validation is a requirement for all VCS projects and is seen as necessary to provide assurance to stakeholders of the quality of the project and its intended generation of estimated verified emission reductions (VERs).

A risk-based approach has been followed to perform this validation and verification activity. In the course of Validation, 3 Corrective Action requests (CARs), 0 Clarification Requests (CLs), and 0 Forward action request (FARs) were raised and successfully closed. The review of the project description and additional documents related to baseline and monitoring methodology; the subsequent background investigation, follow-up interviews and project owners have provided LGAI Technological Center S.A. (Applus+ Certification) with sufficient evidence to verify the fulfilment of the stated criteria of VCS.

Contents

1 INTRODUCTION

1.1 Objective

LGAI Technological Center, S.A. (hereafter referred to as "Applus+ Certification") has been commissioned by Beijing Ruifang Technology Co., Ltd to perform the validation of project activity "Composting of organic waste project in Guangxi " (hereafter referred to as "the project activity") and reported in the Project Description.

LGAI Technological Center, S.A. as the validation body of the project activity has been accredited as a DOE by UNFCCC and also meets the competence requirements as set out in ISO 14065:2013.

The objective of this validation is to ensure that reported information in the Project Description of "Composting of organic waste project in Guangxi " is complete and accurate in accordance with applicable VCS standards and relevant UNFCCC requirements.

1.2 Scope and Criteria

The validation scope is defined as an independent and objective review of the project design (PD). The PD is reviewed against the criteria stated in Article 12 of the Kyoto Protocol, the CDM modalities and procedures as agreed in the Marrakech Accords and the relevant decisions by the CDM Executive Board, including the approved baseline and monitoring methodology ACM0022 version 03.0. The validation was based on the requirements in the CDM Validation and Verification standard for project activities version 03.0 and VCS guideline and standard version 4.1.

The validation is not meant to provide any consulting towards the project participants. However, stated requests for clarifications and/or corrective actions may have provided input for improvement of the project design.

1.3 Level of Assurance

The validation report is based on the VCS-PD, supporting evidences made available to the validator and information collected through performing interviews and during the on-site assessment.

The validation conclusion is assured a reasonable level of assurance.

1.4 Summary Description of the Project

Project title	Composting of organic waste project in Guangxi
Project Participants	Guangxi Liyuanbao Science and Technology Co., Ltd. (Project owner, host country, P. R. China)
Location of the project	Instance 1: Tiandong Petrochemical Industrial Park, Tiandong County, Baise City, Guangxi Zhuang Autonomous Region, P. R. China Geographic coordinates: longitude of 107°08′35″ E and latitude of 23°39′17″ N Instance 2: Tan Cun Village, Huaiyuan Town, Yizhou District, Hechi City, Guangxi Zhuang Autonomous Region, P. R. China Geographic coordinates: longitude of 108°26′52″ E and latitude of 24°34′19″ N
Project start date	06/01/2020, the commissioning start date of instance 1
Applied Methodology/Version	ACM0022, version 03.0
Scope/Technical Area	Sectoral scope 13: Waste handling and disposal

The project activity is newly built composting plant which designed to treat organic wastes to produce organic fertilizer located in Guangxi Zhuang Autonomous Region, P. R. China. The project activity includes two project activity instances. One is located at Tiandong Petrochemical Industrial Park, Tiandong County, Baise City (hereafter referred to as Instance 1), another one is located at the Yizhou District, Hechi City (hereafter referred to as Instance 2). The instances 1 is designed to treat 400,000 tonnes wet organic waste per year and produce 300,000 tonnes fertilizer per year. The instances 2 is designed to treat 150,000 tonnes wet organic waste per year and produce 110,000 tonnes fertilizer per year. In absence of the project, the organic wastes would have been dumped in the landfill sites. This new project will avoid CH_4 emissions from the disposal of the waste in a landfill site in absence of the Project. It's estimated that the project activity could achieve GHG emission reductions of 6,199,571 tCO_2e emission reduction during the first 7 years' crediting period, at an average amount of 885,653 tCO_2e per year.

2 VALIDATION PROCESS

2.1 Method and Criteria

Validation was conducted using Applus+ Certification's procedures in line with the requirements specified in the VCS Standard version 4.1, CDM M&P, the latest version of the CDM Validation and Verification Standard, and relevant UNFCCC requirements and applying standard auditing techniques. No sampling was utilized during the site visit as well as validation for project activity.

Applus+ Certification completed a strategic review and risk assessment of the project's activities and processes in order to gain a full understanding of (if applicable):

- Project Details;
- Application of Methodology;
- Estimated GHG Emission Reduction and Removals;
- Monitoring;
- Safeguards etc.

Applus+ Certification validate that the reported information in the Project Description are complete and accurate in question. This involved a site visit and a desk review of the Project Design. This Validation Report describes the findings of this assessment.

The information of the assessment team is included in below of this report.

Assessment team

According to the sectoral scopes / technical area and experiences in the sectoral or national business environment, Applus+ Certification has composed a project assessment team in accordance with the appointment rules in Applus+ Certification. The composition of assessment team has to be approved by the Applus+ Certification ensuring that the required skills are covered by the team. The four qualification levels for team members that are assigned by formal appointment rules as below:

- Leader Auditor (LA)
- Auditor (A)/ Auditor Trainee (AT)
- Technical Reviewer (TR)
- Technical Experts (TE)

Name	Qualification	Coverage of scope	Coverage of Technical Area	Host country experience
Doris Dai	*LA/TE*	*Y (13.1)*	*Y*	*Y*
Simon Shen	*TR*	*Y (13.1)*	*Y*	*Y*

Doris Dai (Master's Degree in Environmental Sciences, Bachelor's Degree in Environmental Technology) is an Auditor appointed by Applus+ LGAI for the GHG project assessment and auditing. She has more than 6 years of work experience in CDM/VCS project assessment. Before she joined Applus+ LGAI, she has been working for CTI Certification as senior GHG Auditor for 3.5 years.

Simon Shen (Master Degree in Thermal Energy Engineering, Bachelor Degree in Environmental Engineering) is an Auditor appointed by Applus+ LGAI for the GHG project assessment, auditing and technical review. He has more than 6 years of work experience in CDM/GS4GG/VCS project assessment and review with Applus+, apart from the years of experience working as GHG Auditor and ISO 9001/14001 in TUV SUD before he joined Applus+ for 3.5 years. Mr. Simon Shen has extensive experience also as former Applus+ Shanghai CDM Technical Manager.

2.2 Document Review

The VCS project design version 2.0 dated 21/10/2021, version 4.1 dated 15/06/2022 were assessed as part of the validation. Relevant documents were reviewed. A detailed documents reviewed are listed in Appendix 1 of the report.

2.3 Interviews

The key personnel interviewed are summarized in the table below:

Interviewed personnel	Role	Organization	Subject
Mr. Li Jingdong	Project Manager	Guangxi Liyuanbao Science and Technology Co., Ltd. (Instance 1)	Status of the project (including PPs); Applicability of selected methodology; Baseline of the project and its updates;

Mr. Qi Jianxun	Project Manager	Guangxi Liyuanbao Science and Technology Co., Ltd. (Instance 1)	Emission factors and their updates; Monitoring plan; Stakeholder consultation process and its outcomes. The process and participation of the stakeholder consultation; The impact of the project activity; The complaint by local stakeholders and the implementation of the mitigation measures; Data collection and ER calculation.
Mr. Zhang Guoliang	Project Manager	Guangxi Liyuanbao Science and Technology Co., Ltd. (Instance 2)	
Mr. Li Yong	Project Manager	Guangxi Liyuanbao Science and Technology Co., Ltd. (Instance 2)	
Mr. Sun Ming	Villager	Local Resident (Instance 1)	
Ms. Liu Chenxi	Villager	Local Resident (Instance 1)	
Mr. Lin Jianjun	Villager	Local Resident (Instance 2)	
Ms. Wang Yifen	Villager	Local Resident (Instance 2)	

2.4 Site Inspections

The assessment team performed the on-site validation (Tiandong County, Baise City, Guangxi Zhuang Autonomous Region, P. R. China for instance 1 and Tan Cun Village, Huaiyuan Town, Yizhou District, Hechi City, Guangxi Zhuang Autonomous Region, P. R. China for instance 2) on 11-12/11/2021. The interviewed personnel and objective are listed in above table.

2.5 Resolution of Findings

As an outcome of the validation process, the team can raise different types of findings.

Where a non-conformance arises the assessment team shall raise a Corrective Action Request (CAR). A CAR is issued, where:

a) Non-compliance with the monitoring plan or methodology are found in monitoring and reporting and has not been sufficiently documented by the project participants, or if the evidence provided to prove conformity is insufficient;

b) Modifications to the implementation, operation and monitoring of the project activity has not been sufficiently documented by the project participants;

c) Mistakes have been made in applying assumptions, data or calculations of emission reductions that will impact the quantity of emission reductions;

d) Issues identified in a FAR during validation to be verified during verification or previous verification(s) have not been resolved by the project participants.

The assessment team shall raise a Clarification Request (CL) if information is insufficient or not clear enough to determine whether the applicable CDM or VCS requirements have been met.

All CARs and CLs raised during validation shall be resolved prior to submitting a request for issuance.

The objective of this phase of the validation was to resolve the requests for corrective actions and clarification and any other outstanding issues which need to be clarified for LGAI Technological Center S.A. (Applus+ Certification)'s positive conclusion on the project design and Monitoring report. The Corrective Action Requests and Clarification Requests raised by LGAI Technological Center S.A. (Applus+ Certification) were resolved during communications between the Client and LGAI Technological Center S.A. (Applus+ Certification) to guarantee the transparency of the validation and verification process, the concerns raised, and responses given are summarized below in the appendix 2.

The final VCS PD version 4.1 submitted by project developer on 15/06/2022 serves as the basis for the final assessment presented. Additional changes to the project during the validation and verification process are not considered to be significant with respect to the main CDM/VCS objectives. The two CDM/VCS main objectives are the reduction of anthropogenic GHG emissions and the contribution of sustainable development to the host country.

Areas of validation and verification findings	No. of CL	No. of CAR	No. of FAR
Project design document and Monitoring report	00	00	00
Description of project activity	00	00	00
Application of selected baseline and monitoring methodology and selected standardized baseline			
- Applicability of methodology and standardized baseline	00	01	00
- Deviation from methodology	00	00	00
- Clarification on applicability of methodology, tool and/or standardized baseline	00	01	00
- Demonstration of additionality	00	00	00
- Emission reductions	00	00	00

- Monitoring plan	00	01	00
-Stakeholders consultation process	00	00	00
- Public comments	00	00	00
Others (please specify)-Matter related to double counting- for validation	00	00	00
Total	00	03	00

The list of findings and their resolution is presented in appendix II of this report.

2.5.1 Forward Action Requests

None FAR was raised during the validation process.

3 VALIDATION FINDINGS

3.1 Project Details

Project type, technologies and measures implemented, and eligibility of the project

The project activity is a new building composting plant which designed to treat organic wastes to produce organic fertilizer. The proposed project comprises of fermentation system and fertilizer production system, etc. The instances 1 is designed to treat 400,000 tonnes wet organic waste per year and produce 300,000 tonnes fertilizer per year. The instances 2 is designed to treat 150,000 tonnes wet organic waste per year and produce 110,000 tonnes fertilizer per year.

This project uses microbial aerobic fermentation technology. The mixed organic matter is directly sent to a fully enclosed three-dimensional dust removal and deodorization, automatic environmental protection fermentation system for efficient aerobic fermentation. In the process of fermentation and maturation of organic waste, water is evaporated, and the material is dried at the same time, so as to meet the water requirements for the production and processing of commercial ecological fertilizers. The produced manure powder is moved to manure workshop in where some auxiliary elements (Nitrogen, Phosphorus, Kalium etc.) are added for producing final manure. The wastewater produced during the composting is sprinkled back to composting workshop for keeping the temperature and humidity. Therefore, the wastewater is treated in aerobic conditions. All above information have been confirmed by site visit and checking FSR.

The project treats organic wastes to produce organic fertilizer. In absence of the project, the organic wastes would have been dumped in the landfill sites. This newly built project will avoid CH_4 emissions from the disposal of the waste in a landfill site in absence of the Project. The proposed project is estimated to deliver totally 6,199,571 tCO_2e emission reduction during the first 7 years' crediting period, at an average amount of 885,653 tCO_2e per year.

The project activity includes 2 instances. Instance 1 is located at Tiandong Petrochemical Industrial Park, Nanning City, Guangxi Zhuang Autonomous Region. Instance 1 has been developed by Guangxi Liyuanbao Science and Technology Co., Ltd. The geographic coordinates of the instance 1 is longitude of 107°08'35" E and latitude of 23°39'17" N. Instance 2 is located at Tan Cun Village, Huaiyuan Town, Yizhou District, Hechi City, Guangxi Zhuang Autonomous Region. Instance 2 has been developed by Guangxi Liyuanbao Science and Technology Co., Ltd. The geographic coordinates of the instance 2 is longitude of 108°26'52" E and latitude of 24°34'19" N. All above information are confirmed by site visit.

The Project activity has been approved by Chinese government by checking the Project approval and Environmental Impact Assessment (EIA) approval. The instance 1 started construction on 19/03/2018 confirmed by checking construction order and commissioned on 06/01/2020 by checking operation log and site visit. The instance 2 started construction on 20/04/2018

confirmed by checking construction order and commissioned on 15/01/2020 by checking operation log and site visit.

Project design, including eligibility criteria for grouped projects

The technical specifications are mentioned as below and the same were checked during site visit:

Number	Equipment	Instance 1	Instance 2
1	Belt conveyor	Type: LYBSSJ Rated power: 3 kW	Type: LYSSJ Rated power: 5.5 kW, 4.0 kW
2	Blender	Type: LYJBJ Rated power: 45 kW	Type: LYJBJ Rated power: 55 kW
3	Crusher	Type: LYLPJ Rated power: 45 kW	Rated power: 45 kW
4	Palletizer	Type: LYBMDJ Rated power: 22.5 kW	Rated power: 30 kW

This is not a grouped project activity. Thus, this section is not applicable for this project.

Project proponent and other entities involved in the project

Assessment team checked onsite and confirms that the details of the project proponent is as below:

Organization name	Guangxi Liyuanbao Science and Technology Co., Ltd.
Contact person	Liang Xin
Title	Manager
Address	Tiandong Petrochemical Industrial Park, Nanning City, Guangxi Zhuang Autonomous Region
Telephone	0772-4223121
Email	liangxi@vip.sina.com

Assessment team checked onsite and confirms that the details of the other entity involved is as below:

Organization name	Beijing Ruifang Technology Co., Ltd
Role in the project	Project developer
Contact person	Teng Haipeng
Title	-
Address	Haidian District, Beijing, P.R. China
Telephone	+86-10-86291231
Email	Teng_hp@126.com

Project Ownership

Guangxi Liyuanbao Science and Technology Co., Ltd. is the project owner and mother company of operation companies for instance 1 (Guangxi Woze biology Science and Technology Co., Ltd.) and instance 2 (Guangxi Tiandong Liyuanbao Science and Technology Co., Ltd.) of project activity and they have the legal right to control and operate the project activities.

By checking information on the National Enterprise Credit Publicity System (www.gsxt.gov.cn), it is confirmed that Guangxi Liyuanbao Science and Technology Co., Ltd. is the shareholder of Guangxi Woze Biology Science and Technology Co., Ltd as well as Guangxi Tiandong Liyuanbao Science and Technology Co., Ltd. Therefore, it is able to confirm Guangxi Liyuanbao Science and Technology Co., Ltd. hold the legal right to control and operate project.

The project ownership has been checked by the Assessment Team and demonstrated through checking business license and project approval.

Project Start Date

Start date of the project activity is 06/01/2020, which is the commissioning start date of instance 1. Assessment team checked operation log to confirm the date.

Project crediting period Date

The project activity adopts renewal crediting period of 3*7 years period.

Assessment team confirms that the crediting period dates for the project is as below:

Crediting Period Start date: 06/01/2020

Crediting Period End date: 05/01/2041

Project Scale and Estimated GHG Emission Reductions or Removals

Assessment team confirms that the project is a large-scale project under CDM scheme. The annually emission reductions is larger than 60,000 tCO_2e.

Project Scale	
Project	
Large project	✓

As the estimated annual average GHG emission reductions or removal per year is 885,653 tCO_2e which is larger than 300,000 tonnes of CO_2e per year, thus the project falls in the category of Large project.

Year	Estimated GHG emission reductions or removals (tCO_2e)
06/01/2020 -- 31/12/2020	258,332
2021	533,489
2022	757,640
2023	945,003
2024	1,102,396
2025	1,235,208
2026	1,347,733
01/01/2027 – 05/01/2027	19,770
Total estimated ERs	**6,199,571**
Total number of crediting years	**7**
Average annual ERs	**885,653**

The above estimated emission reduction is confirmed by assessment team via emission reduction calculation spreadsheet. The calculation is conservative and this acceptable to the assessment team.

Project location

The project activity includes 2 instances. Instance 1 is located at Tiandong Petrochemical Industrial Park, Nanning City, Guangxi Zhuang Autonomous Region. Instance 1 has been developed by Guangxi Liyuanbao Science and Technology Co., Ltd. The geographic coordinates of the instance 1 is longitude of 107°08'35" E and latitude of 23°39'17" N. Instance 2 is located at Tan Cun Village, Huaiyuan Town, Yizhou District, Hechi City, Guangxi Zhuang Autonomous Region. Instance 2 has been developed by Guangxi Liyuanbao Science and Technology Co., Ltd.

The geographic coordinates of the instance 2 is longitude of 108°26'52" E and latitude of 24°34'19" N. All information above are confirmed by site visit.

Conditions prior to project initiation

In absence of the project, the organic wastes would have been dumped in the landfill sites. This new project will avoid CH_4 emissions from the disposal of the waste in a landfill site in absence of the Project.

Project compliance with applicable laws, statutes and other regulatory frameworks

Assessment team confirms that the Project has been approved by Chinese government by checking the Project approval and Environmental Impact Assessment (EIA) approval.

By checking laws and regulation, it is confirmed that the project activity is in complicate with all laws and regulations in China.

Participation under other GHG programs

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. Applus+ Certification checked the REC Mechanism database of China and found that the project activity is not accredited / registered under REC mechanism. Further, declaration for the same is checked and found correct by the assessment team. Also, assessment team checked the following registries to confirm the same. The details of the registries checked are as follows:

- http://www.greenenergy.org.cn/

- http://www.irecstandard.org/

- http://cdm.unfccc.int/

- http://www.goldstandard.org/

Rejection by other GHG programs

The Project is not rejected by other GHG programs. A declaration for the same is checked and found correct by the assessment team. Also, assessment team checked the following registries to confirm the same. The details of the registries checked are as follows:

- http://www.greenenergy.org.cn/

- http://www.irecstandard.org/

- http://cdm.unfccc.int/

- http://www.goldstandard.org/

- http://verra.org/

Other forms of credit

Emissions trading programs and other binding limits

Applus+ Certification confirms that the Net GHG emission reductions or removals generated by the Project will not be used for compliance with an emissions trading program or to meet binding limits on GHG emissions in any Emission Trading program or other binding limits. Applus+ Certification checked the REC Mechanism database of China, International REC Mechanism and found that the project activity is not accredited/ registered under REC mechanism. Further, Declaration in effect of the same has been submitted by project proponent to audit team and found to be correct. Thus, it is concluded that the project activity not involved on other Emissions trading programs and other binding limits.

Other forms of environmental credit sought or received and eligible to be sought or received

The Project has no intend to generate any other form of GHG-related environmental credit for GHG emission reductions or removals claimed under the VCS Program.

Renewable energy certificates are available for trading in the host country. However, the same is not availed by the project proponent. The undertaking regarding the same is submitted by PP which is acceptable to the assessment team and assessment team also checked the REC web site (http://www.irecstandard.org/) and found the declaration to be correct.

Additional information relevant to the project

Leakage management for AFOLU projects

Not applicable to the project activity.

Commercially sensitive information

No commercially sensitive information has been excluded from the public version of the project description. The details are presented transparently to the assessment team for analysis which lead to positive conclusion for this validation and verification.

Sustainable development contributions

The project activity would contribute sustainable development in the region in following aspects confirmed by site visit:

- The project will avoid GHG emissions by treatment organic waste that would have been dumped in landfill site. Thus, will effectively improve the living circumstances for local people.

- This project will also improve soil condition by providing organic fertilizer for local people, boosting farm crop production and promote the incomes of local farmers.

- This project could provide job opportunities for local people, which is beneficial for local livelihood.

Overall, it is confirmed that the PD is accurate, complete, and provides an understanding of the nature of the project.

3.2 Safeguards

3.2.1 No Net Harm

The Environmental Impact Assessment (EIA) Report of the project activity (both instance) was compiled by Henan Lansen Environmental Science and technology Co., Ltd. and approved by Baise City Environmental and Protection Bureau on 13/02/2017 for instance 1 and approved by Hechi City Environmental and Protection Bureau on 15/01/2018 for instance 2. The assessment team confirm all environmental impacts has been analyzed and no net harm was detected.

3.2.2 Local Stakeholder Consultation

As per the VCS requirements, it is necessary to invite the relevant stakeholders, prior of the validation process. The assessment team checked the relevance of the dates during the validation site visit.

For instance 1, a local stakeholder consultation meeting was held on 07/09/2020 by the project owner. Before the stakeholder consultation meeting, the project information with contact information and the stakeholder meeting notice was put on local Village and near the power plant for public comment also to invite Local stakeholders.

For instance 2, a local stakeholder consultation meeting was held on 10/09/2020 by the project owner. Before the stakeholder consultation meeting, the project information with contact information and the stakeholder meeting notice was put on local Village and near the power plant for public comment also to invite Local stakeholders.

During the meeting, the project information and the continuous input / grievance mechanism have been introduced to the local stakeholders. The project information with contact information has also been posted on the bulletins at and nearby the project site.

During the meeting, a survey was carried out on the local residents and comments received from the survey are summarized as follows. The survey was conducted through distributing and collecting responses to a questionnaire. In total 60 out of 60 questionnaires (30 for each instance) were returned with a 100% response rate.

By checking the questionnaires, Applus+ Certification confirm that the local stakeholder has no negative comments for the construction of the project activity.

Thus, the assessment team is of the opinion that the stakeholder meeting was adequate and appropriate.

3.2.3 Environmental Impact

By checking Environmental Impact Assessment (EIA) Report compiled by Henan Lansen Environmental Science and technology Co., Ltd. for both instances, the environmental impact has been presented as below:

1. Atmosphere

In operation period, dust mainly comes from fermentation workshop, industrial furnace. Through treatment of two-alkali method, dust collector, the dust concentration is greatly decreased and then emitted into the atmosphere.

During the production process of feeding, granulation and cooling, some dust also occurred. By setting airtight cover, the dust concentration could greatly decreased.

Fermentation workshop may generate some malodorous gas. The fully enclosed three-dimensional dust removal and deodorization automatic environmental protection fermentation system can capture more than 80% of the fermentation malodorous gas. After the living photolysis evolution process, it is discharged through a 15m high exhaust tube at a high altitude.

2. Wastewater

During the construction and operation period, the major wastewater emission sources are domestic sewage. The wastewater will be treated by the wastewater treatment center of the proposed project site and the final flue complied with national discharge standard.

This project in the operation period only consume water for flushing. These flushing water will be precipitated in the sedimentation tank, and then reused for flushing.

3. Noise

Several measures have been taken to control and mitigate the noise impact of the proposed project. During the operation period, silencer will be installed to mitigate the noise impacts; for the workers, the proposed project owner will outfit them with the relevant noise reducing equipment in accordance with the national standard. The noise impact on the surrounding residents is acceptable.

4. Solid waste

Solid waste mainly includes waste bags, furnace ash, and daily life garbage. The waste bags are recycled for industry production material. Industrial kiln furnace ash are recycled for construction material. Ash from dust collector are recycled for composting process. Daily life garbage are transported to solid waste treatment plant. In conclusion, the solid wastes in this project has no negative impact on environment.

After the above measures are performed, the negative impacts on environment will be minimized below the requirements of laws and regulations during the construction and operational period.

3.2.4 Public Comments

Applus+ Certification noted that this project was open for public comment from 03/11/2021 to 03/12/2021. The detail was checked by the assessment team in the following web platform: https://registry.verra.org/app/projectDetail/VCS/2603.

During the period, no public comments were received.

3.2.5 AFOLU-Specific Safeguards

The project activity is not an AFOLU project. For non-AFOLU projects, this section is not required.

3.3 Application of Methodology

3.3.1 Title and Reference

Assessment team checked that following methodology and tools are applicable for the project activity. The details are as below:

Title: Alternative waste treatment process

Reference: The project activity meets the eligibility criteria of large-scale project as the estimated annual average GHG emission reductions or removal per year is 885,653 tCO_2e which is larger than 60,000 tonnes of CO_2e per year.

Methodology: Alternative waste treatment process, ACM0022, version 03.0

Type I and III: Energy industries (renewable / non-renewable sources); Waste handling and disposal

Sectoral scope(s): 13

Category: Large-scale Methodology

Tools referred with above methodology and applicable for project activity are:

- Emissions from solid waste disposal sites, version 08.0
- Combined tool to identify the baseline scenario and demonstrate additionality, version 07.0
- Tool to calculate the emission factor for an electricity system, version 07.0
- Project and leakage emissions from composting, version 02.0
- Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation, version 03
- Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion, version 03

3.3.2 Applicability

The applied baseline methodology is justified as it has been demonstrated that the proposed project activity is:

Applicability conditions of ACM0022, version 03.0

Applicability conditions	Justifications	Assessment opinion
This methodology covers project activities implementing and operating new plants for the treatment of fresh waste, that would otherwise be disposed in a solid waste disposal site (SWDS)	The project uses waste biomass, mulberry branch, sugarcane leaf from households sugarcane pitch from food companies, animal manure from farms, food waste from food company or restaurants, etc. In absence of the project, the solid waste would be disposed in a solid waste disposal site (SWDS).	By checking FSR and site visit interview, it is confirmed that the project uses waste biomass, mulberry branch, sugarcane leaf from households sugarcane pitch from food companies, animal manure from farms, food waste from food company or restaurants, etc. In absence of the project, the solid waste would be disposed in a solid waste disposal site (SWDS).
The methodology applies to project activities that install and operate new plants for the treatment of fresh waste through any combination of the following processes: (a) Composting process under aerobic conditions; (b) Anaerobic digestion with biogas recovery and flaring and/or its use;	This project installs new plants for the treatment of fresh waste by composting under aerobic conditions. (a) is applicable for this project	By checking FSR and site visit interview, it is confirmed that the project uses biomass, mulberry branch, sugarcane leaf, sugarcane pitch, animal manure, food waste, etc. In absence of the project, the solid waste would be disposed in a solid

(c) Co-composting of wastewater in combination with solid waste; (d) Anaerobic co-treatment of wastewater in combination with solid waste; (e) Mechanical/thermal treatment process to produce refuse-derived fuel (RDF) or stabilized biomass (SB) that is produced within the project boundary and its use; (f) Gasification process to produce syngas and its use; (g) Incineration of fresh waste for the generation of thermal/electric energy. (h) The following conditions apply to all project activities using this methodology: (i) The project plant only treats fresh waste/wastewater for which emission reductions are claimed, except for cases involving composting, co-composting and anaerobic digestion; (j) Neither the fresh waste nor the products from the project plant are stored on-site under anaerobic conditions; (k) Any wastewater discharge resulting from the project activity is treated in accordance with applicable regulations; (l) The project activity does not reduce the amount of waste that would be recycled in the absence of the project activity. This shall be		waste disposal site (SWDS). Therefore, (a) is applicable for this project

justified and documented in the clean development mechanism project design document (CDM-PDD); (m) When applicable regulations mandate any waste treatment process implemented under the project activity, the rate of compliance with such regulations for the treatment process is below 50 per cent; (n) Hazardous wastes/wastewater are not eligible under this methodology.		
The methodology is only applicable if the baseline scenario is: (a) The disposal of the fresh waste in a SWDS with or without a partial LFG capture system (M2 or M3); (b) In the case of co-composting or co-treatment of wastewater in an anaerobic digester, the treatment of organic wastewater in either an existing or new anaerobic lagoon or sludge pit without methane recovery (W1 or W4); (c) In the case of electricity generation, the electricity is generated in an existing/new captive fossil fuel fired power-only plant, captive cogeneration plant and/or the grid (P2, P4 or P6); (d) In the case of heat generation, the heat is generated in an existing/new fossil fuel fired	The baseline scenario is (a)	By checking FSR and site visit interview, it is confirmed that the project belongs to scenario (a).

cogeneration plant, boiler or air heater (H2 or H4).		
Specific applicability conditions for composting: **1) Applicable types of wastes that may be treated:** Types of waste as specified in the scope and applicability section of "TOOL13: Project and leakage emissions from composting"; Wastewater; Wastewater discharge **2) Applicable products and their use:** Compost: any use applicable **3) Applicable waste by-products:** Non-biodegradable materials that may have market value (i.e. glass, metals and plastics); Wastewater discharge	1) This project uses biomass, mulberry branch, sugarcane leaf, sugarcane pitch, animal manure, food waste, etc. 2) The product of this project is compost. 3) The project does not generate any by-product.	By checking FSR and site visit interview, it is confirmed that the project uses biomass, mulberry branch, sugarcane leaf, sugarcane pitch, animal manure, food waste, etc. The product of this project is compost. The project does not generate any by-product.

<u>Applicability conditions of "Emissions from solid waste disposal sites"</u>

(a) Application A: The CDM project activity mitigates methane emissions from a specific existing SWDS. Methane emissions are mitigated by capturing and flaring or combusting the methane (e.g. "ACM0022: Alternative waste treatment process"). The methane is generated from waste disposed in the past, including prior to the start of the CDM project activity. In these cases, the tool is only applied for an ex ante estimation of emissions in the project design document (CDM-PDD). The emissions will then be monitored during the crediting period using the applicable approaches in the relevant methodologies (e.g. measuring the amount of methane captured from the SWDS);

(b) Application B: The CDM project activity avoids or involves the disposal of waste at a SWDS. An example of this application of the tool is ACM0022, in which municipal solid waste (MSW) is treated with an alternative option, such as composting or anaerobic digestion, and is then prevented from being disposed of in a SWDS. The methane is generated from waste disposed or avoided from disposal during the crediting period. In these cases, the tool can be applied for both ex ante and ex post estimation of emissions. These project activities may apply the simplified approach detailed in 0 when calculating baseline emissions.

The project adopts Application B.

Applicability conditions of "Project and leakage emissions from composting"

Applicability conditions	Justifications	Assessment opinion
Scope: Typical applications of the tool include projects composting municipal solid wastes, agricultural wastes and digestate	This project uses solid wastes from agriculture and forestry.	By checking FSR and site visit interview, it is confirmed that the project use solid wastes from agriculture and forestry.
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 emission from composting are accounted. (b) CO_2 emissions from consumption of fossil fuels and electricity associated with composting are accounted (c) This project is not co-composting therefore, no CH_4 emissions from run-off wastewater is generated.	By checking FSR, PDD, ER and site visit interview, it is confirmed justification of project emission is accurate.
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.	By checking FSR and site visit interview, it is confirmed that the compost and waste are stored in aerobic condition.
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	Transport emissions are not accounted for the project.

Applicability conditions of "Tool to calculate the emission factor for an electricity system"

Applicability conditions	Justifications	Assessment opinion
This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity that is where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).	This project does not generate electricity. It will not result in savings of electricity that would have been provided by the grid. Therefore, this item is not applicable.	By checking FSR and site visit interview, the justification is correct.
Under this tool, the emission factor for the proposed project electricity system can be calculated either for grid power plants only or, as an option, can include off-grid power plants. In the latter case, two sub-options under the step 2 of the tool are available to the proposed project participants, i.e. option IIa and option IIb. If option IIa is chosen, the conditions specified in "Appendix 1: Procedures related to off-grid power generation" should be met. Namely, the total capacity of off-grid power plants (in MW) should be at least 10 per cent of the total capacity of grid power plants in the electricity system; or the total electricity generation by off-grid power plants (in MWh) should be at least 10 per cent of the total electricity generation by grid power plants in the electricity	The electricity consumed by this proposed project is from national grid. Therefore, this tool is applicable for calculate the project emission from electricity consumption. Only grid power plants are calculated.	The emission factor is correctly calculated and published by China DNA following the steps indicated in the tool.

system; and that factors which negatively affect the reliability and stability of the grid are primarily due to constraints in generation and not to other aspects such as transmission capacity.		

Applicability conditions of "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation"

Applicability conditions	Justifications	Assessment opinion
Scope: Depending on their specific scope, methodologies which refer to this tool should: (a) Specify clearly which sources of project, baseline and leakage electricity consumption should be calculated with this tool; and/or (b) Provide the procedures to determine the most likely baseline scenario for each source of baseline electricity consumption; and/or (c) Provide the procedures to determine the most likely baseline scenario for electricity generated and supplied by the proposed project power plant to the grid or consumers; and (d) Provide the procedures to determine the baseline CO_2 emission factors for the electricity generated and supplied by the proposed project power plant ($EF_{BL,grid,CO2,y}$ and $EF_{BL,facility,CO2,i,y}$).	The project does not generate electricity. The electricity consumed by this proposed project is from SCPG. *Therefore, this scope is applicable*	By checking FSR and site visit interview, the project electricity consumption is sources from SCPG.

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 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.	The electricity consumption is from grid. Therefore, scenario A is applicable.	By checking FSR and site visit interview, the project electricity consumption is sources from SCPG.

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 proposed 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.	The proposed project does not generate electricity. Therefore, this item is not applicable.	Not appliable as not electricity generation.
This tool is not applicable in cases where captive renewable power generation technologies are installed to provide electricity in the proposed project activity, in the baseline scenario or to sources of leakage. The tool only accounts for CO_2 emissions.	No captive renewable power stations are installed to provide electricity in baseline scenario, or project activity. Therefore, this tool is applicable for this project.	Not applicable as no captive renewable power stations installed.

In conclusion, the project meets all the applicable criterion in the selected methodology and corresponding tools.

3.3.3 Project Boundary

As per ACM0022, the spatial extent of the project boundary is the SWDS where the waste is disposed of in the baseline, anaerobic lagoons or sludge pits treating organic wastewater in the

baseline, and the site of the alternative waste treatment process(es). The boundary also includes on-site electricity and/or heat generation and use, on-site fuel use and the wastewater treatment plant used to treat the wastewater by-products of the alternative waste treatment process(es). The project boundary does not include facilities for waste collection and transport.

The sources and GHG gases involved for the Project activity are as below.

Source		Gas	Included?	Justification/Explanation
Baseline	Emissions at the SWDS	CH_4	Yes	The major source of emissions in the baseline
		N_2O	No	N_2O emissions are small compared to CH_4 emissions from landfills. Exclusion of this gas is conservative
		CO_2	No	CO_2 emissions from the decomposition of fresh waste are not accounted for
	Emissions from electricity generation	CO_2	No	No electricity generation is not included in this project
		CH_4	No	Excluded for simplification. This is conservative
		N_2O	No	Excluded for simplification. This is conservative
	Emissions from heat generation	CO_2	No	No heat generation is included in the project activity.
		CH_4	No	Excluded for simplification. This is conservative
		N_2O	No	Excluded for simplification. This is conservative
	Emissions from anaerobic lagoons or sludge pits	CO_2	No	CO_2 emissions from biomass source are considered GHG neutral
		CH_4	No	No anaerobic lagoons or sludge pits in the baseline scenario
		N_2O	No	Excluded for simplification. This is conservative
	Emissions from use of natural gas	CO_2	No	Excluded for simplification. This is conservative
		CH_4	No	No natural gas used in the baseline scenario
		N_2O	No	Excluded for simplification. This is conservative
Project activity	Emissions from on-site fossil fuel consumption due to the project activity other than for electricity generation	CO_2	No	Excluded because there is no fossil fuel consumption.
		CH_4	No	Excluded because there is no fossil fuel consumption.
		N_2O	No	Excluded because there is no fossil fuel consumption.
	Emissions from on-site electricity use	CO_2	Yes	Main emission source.
		CH_4	No	Excluded for simplification. This emission source is very small compared to CO_2 emissions.
		N_2O	No	Excluded for simplification. This emission source is very small compared to CO_2 emissions.
		CO_2	Yes	N_2O may be emitted from composting

Source		Gas	Included?	Justification/Explanation
	Emissions from the waste treatment processes	CH_4	No	CO_2 emissions from the decomposition or combustion of fresh waste are not accounted
		N_2O	Yes	CH_4 may be emitted from composting
	Emissions from wastewater treatment	CO_2	No	CO_2 emissions from the decomposition of fresh waste are not accounted
		CH_4	No	Aerobic treatment of wastewater shall not result in CH_4 emissions
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small

3.3.4 Baseline Scenario

According to ACM0022. Version 03.0, the baseline scenario and demonstrate additionality identification would be conducted by using Combined tool to identify the baseline scenario and demonstrate additionality version 07.0. The most plausible baseline scenario was determined as follows:

Step 0: Demonstration whether the proposed project activity is the first-of-its-kind

By checking FSR and professional knowledge of assessment team, the proposed project activity is not the first-of-its-kind in China.

Step 1: Identification of alternative scenarios

The project does not involve in treatment of the wastewater, electricity generation and heat generation, therefore, only the alternatives identify for treatment of the fresh waste are considered based on methodology as below:

Step 1a: Define alternative scenarios to the proposed CDM project activity

M1: The project activity without being registered as a CDM project activity;

M2: Disposal of the fresh waste in a SWDS with a partial capture of the LFG and flaring of the captured LFG;

M3: Disposal of the fresh waste in a SWDS without a LFG capture system;

M4: Part of the fresh fraction of the solid waste is recycled and not disposed in the SWDS;

M5: Part of the fresh fraction of the solid waste is treated aerobically and not disposed in the SWDS;

M6: Part of the organic fraction of the solid waste is incinerated and not disposed in the SWDS;

M7: Part of the organic fraction of the solid waste is gasified and not disposed in the SWDS;

M8: Part of the organic fraction of the solid waste is treated in an anaerobic digester and not disposed in the SWDS;

M9: Part of the organic fraction of the solid waste is mechanically or thermally treated to produce RDF/SB and not disposed in the SWDS.

Applus+ Certification confirmed that all plausible alternative scenarios for treatment of the fresh waste have been identified according to the methodology.

Step 1b: Consistency with mandatory applicable laws and regulations

The Technical code for municipal solid waste sanitary landfill (GB50869-2013) was available. GB50869-2013 specified concentration limits of methane in the air and methane venting measurements. GB50869-2013 also states (in clause 11.1.3 and clause 11.5.1) that landfill gas should be utilized (for gas that can be utilized) or flared (for gas that cannot be utilized). However, the statement is only a recommendation, not a compulsory requirement. As long as the landfill fulfils the safety requirements, the government must not enforce the utilization of LFG. This statement can also be seen in the other two national regulations (GB16889-2008, CJJ133-2009), which were issued and taken into effective since July 2008 and July 2010 respectively. However, the statement is only a recommendation, not a compulsory requirement. As long as the landfill fulfils the safety requirements, the government must not enforce the utilization of LFG.

Although China government encouraged the collection and utilization of LFG from waste dumps in the past few years, due to financial and technological difficulties most of the landfills just release LFG directly into the atmosphere without any recovery and flaring system.

Until now, China has not issued any mandatory laws or regulations to compulsorily recover and use the LFG from landfill sites. According to “2019 Statistical Yearbook of Urban and Rural Construction" and "2020 China Biomass Power Generation Industry Development Report", till 2019, there were 1,885 sanitary landfills in cities and counties across China, and only 216 biogas power generation projects were installed and connected to the grid. The occupying rate of landfill gas power plants are less than 12%. Therefore, it is obvious that LFG gas flaring or utilization is still exceptional and that under common practice conditions the LFG is not flared in China in baseline conditions. Therefore, it is justifiable to conclude that the specific requirements on LFG recovery and utilization as prescribed in the above-mentioned regulations have not been systematically enforced and that non-compliance with those requirements, namely uncontrolled emission of LFG to the atmosphere without any recovery and utilization, has been and is still widespread in China.

Therefore, it is the traditional way in China that LFG from the landfill is directly released to the atmosphere through vertical extraction trenches, without flaring. And this is the zero-cost way for LFG treatment without economically attractive, also without obligatory restriction by the new issued regulations.

By checking relevant laws and regulations in China, the assessment team was able to confirm that all 9 scenarios comply with laws and regulations. And for M3, although there are rules and regulations suggest the utilization of LFG, but this was never be enforced.

Step 2: Barrier analysis

Step 2a: Identify barriers that would prevent the implementation of alternative scenarios

Based on professional knowledge of the assessment team and checking relevant laws and regulations in China, it is confirmed that in the project site, the main barrier for treatment of fresh waste would be the waste sorting is not implemented in the project site.

Therefore, the main barrier is: waste sorting is not implemented in the project site.

Step 2b: Eliminate alternative scenarios which are prevented by the identified barriers

Based on professional knowledge of the assessment team and checking relevant laws and regulations in China, it is confirmed that, except for some cities and area (e.g. Shanghai, Beijing), waste sorting is still under a very initial stage in China.

And scenario M2, M4, M5, M6, M7, M8 and M9 relies on the waste sorting system. By site visit interview with local stakeholder, it is confirmed that waste sorting was still under plan stage in the project site. Therefore, M2, M4, M5, M6, M7, M8 and M9 are not plausible alternative scenarios.

M1 and M3 are plausible alternative scenarios left after this step.

Step 3: Investment analysis

The PP uses the investment analysis to demonstrate the additionality. For remain plausible alternative scenarios M1 and M3, based on the IRR calculation below, without the revenue of carbon credit, the IRR of scenario M1 which is the project scenario for instance 1 is 3.20%, for instance 2 is 1.71% all below the benchmark which is not financially attractive. As for M3, no more investment would be required, then comparing with M1, M3 is the plausible baseline scenario.

The IRR calculation process was presented and confirmed as below:

The parameters used in the financial calculations have been validated based on a review of the sources presented in the PD, including: FSR, Economic Evaluation Measurement and Parameters of Constructive Projects version 03, etc. The FSR of the project was completed by a qualified third-party design institute, China Light Industry Nanning Design Engineering Co., Ltd. Additionally, confirmation with the following documents and/or sources demonstrates that the parameters are plausible and acceptable under the project situation:

- Income Tax Law of the Peoples Republic of China for Enterprises issued by the Chairman of the People's Republic of China;

- Interim Regulation of VAT of the Peoples Republic of China issued by State Council etc.

Choice of approach

As the project generates financial and economic benefits other than VCS related income through the sales of fertilizers and other products and the alternative for the baseline scenario of the project does not involve an investment for the project participants, a benchmark analysis is justified for conducting the investment analysis of the project activity.

Benchmark Selection

The IRR benchmark (8%) used for the financial analysis in the FSR was obtained from the Economic Evaluation Measurement and Parameters of Constructive Projects, version 03 issued by NDRC and the Ministry of Construction. The benchmark IRR of capital Investment IRR (after tax) for waste treatment industry in China is 8%. As project activity involve in the treatment of waste in China, then 8% as benchmark can be applied to this project.

Thus, the assessment team was able to confirm the suitability of this benchmark.

Crosscheck of input parameters

The assessment team has verified and crosschecked all the input values used for the IRR calculations in the PD submitted for registration. The input parameters used in the financial analysis are sourced from FSR.

For both instances, an approval letter of the FSR is issued by the government only after it passes the assessment of the sector experts designated by the government. It is in the assessment team's opinion that a FSR can be regarded as a reliable and trustworthy source of information coming from a recognized entity once it has been approved by the government. The FSR for the project was developed by a qualified designing institute China Light Industry Nanning Design Engineering Co., Ltd and approved by Guangxi Development and Reform Committee on 01/12/2017 for instance 1 and 13/12/2017 for instance 2.

The assessment team compared the values stated in the PD with values determined in the FSR and was able to confirm that the input values are applied correctly in the PD.

Financial Parameters for Instance 1

Parameters	Value	Data source
Static total investment (10,000 RMB)	38,624	FSR
O&M cost (10,000 RMB/yr, excluding material cost)	9,602	FSR
Construction period (yr)	2	FSR
Operation period (yr)	20	FSR

Annual solid waste treatment amount (t/yr)	400,000	FSR
Purchase price for solid waste (RMB/t, including VAT)	300 for biomass; 260 for manure; 50 for food waste	FSR
Annual fertilizer generation (t/yr)	300,000	FSR
Fertilizer price (RMB/t, including VAT)	700 for organic fertilizer powder; 1,100 for columnar granular organic fertilizer; 770 for smart BB fertilizer	FSR
VAT for equipment and maintenance	17%	FSR
VAT for fertilizer, biomass and water	11%	FSR
Urban construction tax	5%	FSR
Education surcharges	3%	FSR
Income tax	25%	FSR
Discount on taxable profit	90%	FSR

Financial Parameters for Instance 2

Parameters	Value	Data source
Static total investment (10,000 RMB)	16,170	FSR
O&M cost (10,000 RMB/yr, excluding material cost)	3,493	FSR
Construction period (yr)	2	FSR
Operation period (yr)	20	FSR
Annual solid waste treatment amount (t/yr)	150,000	FSR

Purchase price for solid waste (RMB/t, including VAT)	300 for biomass; 260 for manure; 50 for food waste	FSR
Annual fertilizer generation (t/yr)	110,000	FSR
Fertilizer price (RMB/t, including VAT)	700 for Refined organic fertilizer; 1,200 for Bio-organic fertilizer; 790 for organic nutrient matrix	FSR
VAT for equipment and maintenance	17%	FSR
VAT for fertilizer, biomass and water	11%	FSR
Urban construction tax	5%	FSR
Education surcharges	3%	FSR
Income tax	25%	FSR
Discount on taxable profit	90%	FSR

The accuracy and suitability of the input values for the investment analysis were crosschecked as below:

Static Total Investment

Instance 1

The static total investment cost estimated in FSR is 38,624*10^4 RMB, the same data is stated in the FSR approval issued by Guangxi Development and Reform Committee on 01/12/2017.

By checking all main signed contract between the project owner and supplier for project construction, the assessment team confirmed that the investment cost of the project activity was 41,800*10^4 RMB, which is great than the value of static total investment in the FSR. Therefore, the assessment team was able to confirm that the static total investment in the FSR was reasonable.

Instance 2

The static total investment cost estimated in FSR is 16,170*10^4 RMB, the same data is stated in the FSR approval issued by Guangxi Development and Reform Committee on 13/12/2017.

By checking all main signed contract between the project owner and supplier for project construction, the assessment team confirmed that the investment cost of the project activity was 17,200*10^4 RMB, which is great than the value of static total investment in the FSR. Therefore, the assessment team was able to confirm that the static total investment in the FSR was reasonable.

O&M cost (excluding material cost)

Instance 1

The O&M cost (excluding material cost) estimated in FSR is 9,602*10^4 RMB/yr. Considering the FSR was compiled by an accredited third party institution and approved by the government, the assessment team consider the value indicated in the FSR is accurate. Moreover, given the project has started operation more than 1 year, the assessment team checked Financial Statement for year 2020 and confirmed the actual O&M cost (excluding material cost) in 2020 is around 9,900*10^4 RMB which is higher than the same in the FSR. Therefore, the assessment team was able to confirm that O&M cost (excluding material cost) in the FSR was reasonable and conservative.

Instance 2

The O&M cost (excluding material cost) estimated in FSR is 3,636*10^4 RMB/yr. Considering the FSR was compiled by an accredited third party institution and approved by the government, the assessment team consider the value indicated in the FSR is accurate. Moreover, given the project has started operation more than 1 year, the assessment team checked Financial Statement for year 2020 and confirmed the actual O&M cost (excluding material cost) in 2020 is around 3,700*10^4 RMB which is higher than the same in the FSR. Therefore, the assessment team was able to confirm that O&M cost (excluding material cost) in the FSR was reasonable and conservative.

Material cost

Instance 1

The Material cost is 11,344*10^4 RMB/yr determined by Annual solid waste treatment amount and Purchase price for solid waste.

Annual solid waste treatment amount was sourced from FSR and approved by government which is 400,000 t/yr (in which Biomass, 320,000 t/yr, Animal manure, 64,000 t/yr and Food waste, 16,000 t/yr). Purchase price for solid waste was sourced from FSR and approved by government (300 RMB/t for biomass; 260 RMB/t for manure and 50 RMB/t for food waste). As the project

has started operation more than 1 year since 2020. By checking Financial Statement for year 2020, the actual Material cost for instance 1 is around 12,300*10^4 which is higher than the estimated value indicated in the FSR. The assessment team was able to confirm that material cost in the FSR was reasonable and conservative.

Instance 2

The Material cost is 4,205*10^4 RMB/yr determined by Annual solid waste treatment amount and Purchase price for solid waste.

Annual solid waste treatment amount was sourced from FSR and approved by government which is 150,000 t/yr (in which Biomass, 115,500 t/yr, Animal manure, 27,000 t/yr and Food waste, 7,500 t/yr). Purchase price for solid waste was sourced from FSR and approved by government (300 RMB/t for biomass; 260 RMB/t for manure and 50 RMB/t for food waste). As the project has started operation more than 1 year since 2020. By checking Financial Statement for year 2020, the actual Material cost for instance 1 is around 4,570*10^4 which is higher than the estimated value indicated in the FSR. The assessment team was able to confirm that material cost in the FSR was reasonable and conservative.

Revenue from sold Fertilizer

Instance 1

The Revenue from sold Fertilizer 25,350*10^4 RMB/y determined by Annual fertilizer generation and Fertilizer price.

Annual fertilizer generation was sourced from FSR and approved by government which is 300,000 t/yr (in which organic fertilizer powder, 150,000 t/yr, columnar granular organic fertilizer, 100,000 t/yr and smart BB fertilizer, 50,000 t/yr). Given the project has started operation more than 1 year, the assessment team checked Financial Statement for year 2020 and confirmed actual fertilizer generation in 2020 is 266,000 t (in which organic fertilizer powder, 135,000 t, columnar granular organic fertilizer, 88,000 t and smart BB fertilizer, 43,000 t).

Fertilizer price was sourced from FSR and approved by government (700 RMB/t for organic fertilizer powder; 1,100 RMB/t for columnar granular organic fertilizer and 770 RMB/t for smart BB fertilizer). Given the project has started operation more than 1 year, the assessment team checked Financial Statement for year 2020 and confirmed actual fertilizer price in 2020 is 700 RMB/t for organic fertilizer powder; 1,000 RMB/t for columnar granular organic fertilizer and 750 RMB/t for smart BB fertilizer.

Therefore, based on above information, the actual Revenue from sold Fertilizer is around 21,000*10^4 RMB which is lower than the estimated value indicated in the FSR. The assessment team was able to confirm that Revenue from sold Fertilizer in the FSR was reasonable and conservative.

Instance 2

The Revenue from sold Fertilizer 9,560*10^4 RMB/y determined by Annual fertilizer generation and Fertilizer price.

Annual fertilizer generation was sourced from FSR and approved by government which is 110,000 t/yr (in which refined organic fertilizer, 40,000 t/yr, bio-organic fertilizer, 30,000 t/yr and organic nutrient matrix, 40,000 t/yr). Given the project has started operation more than 1 year, the assessment team checked Financial Statement for year 2020 and confirmed actual fertilizer generation in 2020 is 95,000 t (in which refined organic fertilizer, 36,000 t, bio-organic fertilizer, 26,000 t and organic nutrient matrix, 32,000 t).

Fertilizer price was sourced from FSR and approved by government (700 RMB/t for refined organic fertilizer; 1,200 RMB/t for bio-organic fertilizer and 790 RMB/t for organic nutrient matrix). Given the project has started operation more than 1 year, the assessment team checked Financial Statement for year 2020 and confirmed actual fertilizer price in 2020 is 700 RMB/t for refined organic fertilizer; 1,100 RMB/t for bio-organic fertilizer and 750 RMB/t for organic nutrient matrix.

Therefore, based on above information, the actual Revenue from sold Fertilizer is around 7,800*10^4 which is lower than the estimated value indicated in the FSR. The assessment team was able to confirm that Revenue from sold Fertilizer in the FSR was reasonable and conservative.

Taxes

The taxes applied in the financial assessment are listed as:

Items	Value
VAT for equipment and maintenance	17%
VAT for fertilizer, biomass and water	11%
Urban construction tax and educational surtax	8%
Income tax	25%
Discount on taxable profit	10%

VAT for equipment and maintenance is determined as 17% in the FSR which is consistent with that in “Order of the State Council of the People's Republic of China (No. 691)” issued on 19/11/2017. VAT for fertilizer, biomass and water is determined as 11% in the FSR which is consistent with that in “Order of the State Council of the People's Republic of China (No. 691)” issued on 19/11/2017.

By cross checking with the national taxation regulations, sectoral regulations and other evidences, i.e. the “Interim Rules on Additional Tax for City Development” and the “Provisional Regulations of the People’s Republic of China on Education tax”, the assessment team was able to confirm that the Urban construction tax and educational surtax in the financial assessment are all in line with national regulations.

An income tax of 25% is consistent with the Income Tax Law of the Peoples Republic of China or Enterprises issued by the Chairman of the People’s Republic of China on 16/03/2007 and effective since 01/01/2008.

Discount on taxable profit was determined as 10% in the FSR which is consistent with that in the "Catalogue of preferential Enterprise income tax for comprehensive utilization of resources". It is stipulated in the “Catalogue of preferential Enterprise income tax for comprehensive utilization of resources " that the Discount on taxable profit shall be 10% for renewable resource utilization project which the project belongs to. The assessment team confirm the apply for Discount on taxable profit is conservative.

Depreciation period and residual rate: 20 years and 5%

As per the FSR, the residual rate is determined as 5% of the total static investment and the depreciation period is 20 years. As per Article 31 of the "Rules for the Provisional Regulations on Enterprise Income Tax of the People's Republic of China", the ratio of residual value shall be within 5% of the original value and shall be determined by the enterprise. Therefore, the assessment team was able to confirm that a rate of 5% is reasonable.

According to the Enforcement Regulation of Income Tax Law of the Peoples Republic of China for Enterprises issued by State Council on 06/12/2007 and effective since 01/01/2008, it stipulates that the depreciation period of production equipments should be at least 10 years. Thereby the 20 years of depreciation periods of the project activity is appropriate.

The depreciation rate of 4.75% is determined based on a depreciation period of 20 years and a residual rate of 5%.

Lifetime: 21 years

The lifetime of the project activity was estimated to be 21 years in the FSR. The lifetime of the project activity has been crosschecked with the technical specification of equipment, in which the lifetime of the equipment is 20 years.

Conclusion

Based on the information verified, the assessment team confirms that all the input values for investment analysis are in reasonable ranges. In addition, the assessment team was able to confirm that the input parameters used in the financial analysis are reasonable and adequately represent the economic situation of the project.

Calculation and conclusion

The IRR calculation was provided in the calculation spreadsheet. The project IRR (after tax) is demonstrated to be 3.20% for instance 1 and 1.71% for instance without carbon revenues, which confirms that the project is unattractive without the carbon revenues by comparing with benchmark value 8%. Therefore, the project IRR analysis is considered correct.

The spreadsheet of IRR calculation has been checked by the assessment team with the support of financial expertise. The calculation of financial figures is correctly done. And the calculation is in compliance with latest version of Investment Analysis;

- Technical lifetime takes 20 years which is in the range of 10-20 years;

- Project IRR (after tax) is used, and the Project IRR benchmark (after tax) is compared;

- The Recovery of fluid capital and recovery of fixed assets residual value at the end of the assessment period are considered as cash flow-in in the financial analysis;

- The depreciation cost is not included in the O&M cost for avoiding double counting;

- The financial cost (i.e. the loan payment) is not included in the O&M cost;

- All formulae used in the analysis in the spreadsheet are readable and all relevant cells are viewable and unprotected.

Therefore, the assessment team confirms that the assumptions is investment analysis are appropriate and the financial calculations are correct.

Sensitivity analysis

5 variables for instance 1, i.e. Static total investment, O&M cost (excluding material cost), Biomass price/amount, Organic fertilizer powder price/generation and Columnar granular organic fertilizer price/generation; 6 variables for instance 2, i.e. Static total investment, O&M cost (excluding material cost), Biomass price/amount, Refined organic fertilizer price/amount, Bio-organic fertilizer price/generation and Organic nutrient matrix price/generation which constitute more than 20% of either total project costs or total project revenues are considered in the sensitivity analysis. As verified, no other variables would constitute more than 20% of either total project costs or total project revenues. A departure variations of a range of +10% and -10% is applied which is consistent latest version of Investment Analysis.

As a result of sensitivity analysis, within the reasonable variation (± 10%) of above variables, the IRR of project without VCS revenues is still lower than the benchmark.

Meanwhile, the assessment team assessed the possibility of the extreme points of the 5 variables (instance 1) and 6 variables (instance 2) to reach the benchmark 8%.

Instance 1:

Static total investment: If the static total investment decreased by 43.51%, the IRR would reach 8%. However, it has been validated in above section that the already contracted costs have exceed the estimated static total investment in the FSR. Therefore, it's unlikely that the static total investment decreased by 43.51%.

O&M cost (excluding material cost): If the O&M cost (excluding material cost) decreased by 18.85%, the IRR would reach 8%. Based on the public information, the CPI, PPI and average salary are continuously increase in recent year. Moreover, it has been validated in above section that O&M cost (excluding material cost) have exceed the estimated value in the FSR. Therefore, it's unlikely that the O&M cost (excluding material cost) decreased by 18.85%.

Biomass price/amount: If the Biomass price/amount decreased by 23.41%, the IRR would reach 8%. Biomass price are based on the long-term supply contract, by checking long-term supply contract, it is confirmed the price for biomass would be 330 RMB/t which is higher than the estimated value. Moreover, based on Financial Statement for year 2020, the actual Biomass price is the same as 330 RMB/t. Biomass amount is based on the supply capability of the site where project located which has been considered in the FSR. Furthermore, based on Financial Statement for year 2020, the actual biomass amount in the 2020 is close to the value estimated in the FSR. Therefore, it's unlikely that the Biomass price/amount decreased by 23.41%.

Organic fertilizer powder price/generation: If the Organic fertilizer powder price/generation increased by 21.70%, the IRR would reach 8%. Based on Financial Statement for year 2020, the actual Organic fertilizer powder price is 700 RMB/t which is even lower than the estimated value in the FSR. Organic fertilizer powder generation is limited to the design capacity which has been considered in the FSR. Furthermore, based on Financial Statement for year 2020, the actual Organic fertilizer powder generation in the 2020 is lower than the value estimated in the FSR. Therefore, it's unlikely that the Organic fertilizer powder price/generation increased by 21.70%.

Columnar granular organic fertilizer price/generation: If the Columnar granular organic fertilizer price/generation increased by 20.70%, the IRR would reach 8%. Based on Financial Statement for year 2020, the actual Organic fertilizer powder price is 1,000 RMB/t which is even lower than the estimated value in the FSR. Columnar granular organic fertilizer price/generation is limited to the design capacity which has been considered in the FSR. Furthermore, based on Financial Statement for year 2020, the actual Columnar granular organic fertilizer price/generation in the 2020 is lower than the value estimated in the FSR. Therefore, it's unlikely that the Columnar granular organic fertilizer price/generation increased by 20.70%.

Instance 2:

Static total investment: If the static total investment decreased by 56.58%, the IRR would reach 8%. However, it has been validated in above section that the already contracted costs have exceed the estimated static total investment in the FSR. Therefore, it's unlikely that the static total investment decreased by 56.58%.

O&M cost (excluding material cost): If the O&M cost (excluding material cost) decreased by 20.88%, the IRR would reach 8%. Based on the public information, the CPI, PPI and average salary are continuously increase in recent year. Moreover, it has been validated in above section that O&M cost (excluding material cost) have exceed the estimated value in the FSR. Therefore, it's unlikely that the O&M cost (excluding material cost) decreased by 20.88%.

Biomass price/amount: If the Biomass price/amount decreased by 18.10%, the IRR would reach 8%. Biomass price are based on the long-term supply contract, by checking long-term supply contract, it is confirmed the price for biomass would be 330 RMB/t which is higher than the estimated value. Moreover, based on Financial Statement for year 2020, the actual Biomass price is the same as 330 RMB/t. Biomass amount is based on the supply capability of the site where project located which has been considered in the FSR. Furthermore, based on Financial Statement for year 2020, the actual biomass amount in the 2020 is close to the value estimated in the FSR. Therefore, it's unlikely that the Biomass price/amount decreased by 18.10%.

Refined organic fertilizer price/generation: If the Refined organic fertilizer price/generation increased by 28.10%, the IRR would reach 8%. Based on Financial Statement for year 2020, the actual Refined organic fertilizer powder price is 700 RMB/t which is the same as the estimated value in the FSR. Refined organic fertilizer generation is limited to the design capacity which has been considered in the FSR. Furthermore, based on Financial Statement for year 2020, the actual Refined organic fertilizer generation in the 2020 is lower than the value estimated in the FSR. Therefore, it's unlikely that the Refined organic fertilizer price/generation increased by 28.10%.

Bio-organic fertilizer price/generation: If the Bio-organic fertilizer price/generation increased by 21.85%, the IRR would reach 8%. Based on Financial Statement for year 2020, the actual Bio-organic fertilizer price is 1,100 RMB/t which is even lower than the estimated value in the FSR. Bio-organic fertilizer price/generation is limited to the design capacity which has been considered in the FSR. Furthermore, based on Financial Statement for year 2020, the actual Bio-organic fertilizer generation in the 2020 is lower than the value estimated in the FSR. Therefore, it's unlikely that the Bio-organic fertilizer price/generation increased by 21.85%.

Organic nutrient matrix price/generation: If the Organic nutrient matrix price/generation increased by 24.90%, the IRR would reach 8%. Based on Financial Statement for year 2020, the actual Organic nutrient matrix price is 750 RMB/t which is even lower than the estimated value in the FSR. Organic nutrient matrix price/generation is limited to the design capacity which has been considered in the FSR. Furthermore, based on Financial Statement for year 2020, the actual Organic nutrient matrix generation in the 2020 is lower than the value estimated in the FSR. Therefore, it's unlikely that the Organic nutrient matrix price/generation increased by 24.90%.

It is assessment team's conclusion that sensitivity analysis used is appropriate and reasonable.

Step 4: Common practice analysis

Common practice analysis in the PD was conducted in accordance with the Common Practice version 03.1.

The assessment team interprets that the compost project is the measure of "Methane formation avoidance" listed in the Tool. Therefore, the assessment team validates in accordance with step 1 to step 4 stipulated in paragraph 47 of the Additionality Tool.

Step 1: Calculate applicable capacity or output range as +/-50% of the total design capacity or output of the proposed project activity.

The total design capacity of the Project Activity is about 450,000 t/yr, therefore the applicable output range is from 225,000 t/yr to 675,000 t/yr.

Step 2: Identify similar projects (both CDM and non-CDM) which fulfill all of the following conditions:

(a) The proposed projects are located in the applicable geographical area;

(b) The proposed projects apply the same measure as the proposed project activity;

(c) The proposed projects use the same energy source/fuel and feedstock as the proposed project activity, if a technology switch measure is implemented by the proposed project activity;

(d) The plants in which the proposed projects are implemented produce goods or services with comparable, properties and applications areas (e.g., clinker) as the proposed project plant;

(e) The capacity or output of the proposed projects is within the applicable capacity or output range calculated in Step 1;

(f) The proposed projects started commercial operation before the proposed project design document (CDM-PDD) is published for global stakeholder consultation or before the start date of proposed project activity, whichever is earlier for the proposed project activity.

Since location, investment circumstances and regulatory environment vary significantly among provinces in China, the geographical scope of the common analysis is limited to Guangxi Zhuang Autonomous Region.

The project activity is a composting project using the solid organic material as the energy source. Therefore, only composting projects using the solid organic material as the energy source are considered.

The project started construction on 19/03/2018, and the date of publishing for global stakeholder consultation is 03/11/2021. earlier date is chosen and therefore only projects which started commercial operation before 19/03/2018 are considered.

In conclusion, all new composting projects using the solid organic wastes as the energy source, located in Guangxi Province which are delivering the capacity within the applicable output range

between 225,000 t and 675,000 t and starting commercial operation before 19/03/2018 are identified as the similar projects.

Step 3: within the projects identified in Step 2, identify those that are neither registered CDM project activities, project activities submitted for registration, nor project activities undergoing validation. Note their number N_{all}.

By checking the relevant statistic website (ie. Guangxi Provincial Statistics Bureau website) and UNFCCC/ Verra/Gold Standard/CCER website, the assessment team was able to confirm that there were no similar projects, $N_{all} = 0$.

Step 4: within similar projects identified in Step 2, identify those that apply technologies that are different to the technology applied in the proposed project activity. Note their number N_{diff}.

Nall is identified as 0 in step 3, therefore $N_{diff} = 0$.

Step 5: Calculate factor $F=1-N_{diff}/N_{all}$ representing the share of similar projects (penetration rate of the measure/technology) using a measure/technology similar to the measure/technology used in the proposed project activity that deliver the same output or capacity as the proposed project activity.

According to the result identified in step 4, $N_{all} = N_{diff} = 0$, so F = 0, which is less than 0.2, $N_{all} - N_{diff} = 0 < 3$.

Therefore, the assessment team confirmed that the information source in the common practice analysis of the project is accurate and the set geographic scope is appropriate. This project is not a common practice in Guangxi Zhuang Autonomous Region.

3.3.5 Additionality

The project applied Combined tool to identify the baseline scenario and demonstrate additionality, version 07.0 for the baseline identification and additionality demonstration.

The assessment for the additionality has been made in 3.3.4 Baseline Scenario. Please refer to the above for more details.

3.3.6 Quantification of GHG Emission Reductions and Removals

Assessment team checked the baseline, project and leakage calculation and confirm that the evaluation of baseline, project and leakage is as per the approved methodology and formula used to calculate the same is correct. The detail analysis is as below:

Baseline emissions

$$BE_y = \sum_t \left(BE_{CH4,t,y} + BE_{WW,t,y} + BE_{EN,t,y} + BE_{NG,t,y}\right) \times (1 - RATE_{compliance,t})$$

Where:

BE_y	=	Baseline emissions in year y (tCO_2e)
$BE_{CH4,t,y}$	=	Baseline emissions of methane from the SWDS in year y (tCO_2e)
$BE_{ww,t,y}$	=	Baseline methane emissions from anaerobic treatment of the wastewater in open anaerobic lagoons or of sludge in sludge pits in the absence of the project activity in year y (tCO_2)
$BE_{EN,t,y}$	=	Baseline emissions associated with energy generation in year y (tCO_2)
$BE_{NG,t,y}$	=	Baseline emissions associated with natural gas use in year y (tCO_2)
$RATE_{compliance,t}$	=	Discount factor to account for the rate of compliance of a regulatory requirement that mandates the use of alternative waste treatment process t
t	=	Type of alternative waste treatment process

As confirmed above, the project does not involve in anaerobic treatment of the wastewater in open anaerobic lagoons or of sludge in sludge pits, energy generation and natural gas use. Also, for the project activity, the baseline emission is that Methane emissions from the SWDS in the absence of the project activity. There is no local or national environmental regulation that mandates the disposal of SWDS through incineration or composting in China at present. Thus, the compliance rate is determined zero for ex-ante calculation. The regulation situation and the compliance rate $RATE_{compliance,t}$ will be monitored ex-post based on the official reports.

Therefore, $BE_y = BE_{CH4,t,y}$

For the project, baseline emissions of methane from the SWDS ($BE_{CH4,t,y}$) is calculated using Emissions from solid waste disposal sites, version 08.0 as follows:

$$BE_{CH4,SWDS,y}=\varphi_y\times(1-f_y)\times GWP_{CH4}\times(1-OX)\times\frac{16}{12}\times F\times DOC_{f,y}\times MCF_y\times\sum_{x=1}^{y}\sum_{j}(W_{j,x}\times DOC_j\times e^{-k_j\times(y-x)}\times(1-e^{k_j})$$

Where:

$BE_{CH4,SWDS,y}$	=	Baseline, project or leakage methane emissions occurring in year y generated from waste disposal at a SWDS during a time period ending in year y (tCO_2e/yr)
x	=	Years in the time period in which waste is disposed at the SWDS, extending from the first year in the time period (x = 1) to year y (x = y)

y	=	Year of the crediting period for which methane emissions are calculated (y is a consecutive period of 12 months)
$DOC_{f,y}$	=	Fraction of degradable organic carbon (DOC) that can decomposes under the specific conditions occurring in the SWDS for year y (weight fraction)
$W_{j,x}$	=	Amount of solid waste type j disposed or prevented from disposal in the SWDS in the year x (t)
φ_y	=	Model correction factor to account for model uncertainties for year y
f_y	=	Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere in year y
GWP_{CH4}	=	Global Warming Potential of methane
OX	=	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)
F	=	Fraction of methane in the SWDS gas (volume fraction)
MCF_y	=	Methane correction factor
DOC_j	=	Fraction of degradable organic carbon in the waste type j (weight fraction)
k_j	=	Decay rate for the waste type j (1 / yr)
j	=	Type of residual waste or types of waste in the MSW

The parameters required to apply the FOD model is determined as:

Parameter	Application A	Justification
φ_y	0.85	Application B, Humid/wet conditions
GWP_{CH4}	28	IPCC AR5
OX	0.1	Default value
F	For instance 1:	Biomass Inspection report

	$F_{biomass}$ = 0.50 F_{manure} = 0.54 F_{food} = 0.61 For instance 2: $F_{biomass}$ = 0.51 F_{manure} = 0.53 F_{food} = 0.62	Manure Inspection report Food Waste Inspection report
$DOC_{f,y}$	For instance 1: $DOC_{biomass}$ = 0.95 DOC_{manure} = 0.92 DOC_{food} = 0.93 For instance 2: $DOC_{biomass}$ = 0.97 DOC_{manure} = 0.94 DOC_{food} = 0.91	Calculated based on the monitoring value of BMP_j, F and DOC_j
MCF_y	0.8	Default values (based on SWDS type)
BMP_j	For instance 1: $BMP_{biomass}$ = 0.29 BMP_{manure} = 0.35 BMP_{food} = 0.43 For instance 2: $BMP_{biomass}$ = 0.31 BMP_{manure} = 0.36 BMP_{food} = 0.42	Biomass Inspection report Manure Inspection report Food Waste Inspection report
k_j	0.17 for garden and park waste, (wet basis); 0.40 for food, food waste, sewage	IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Table 3.3)

	sludge, beverages and tobacco, (wet basis); 0.036 for wood, wood products and straw, manure	
DOC_j	For instance 1: $DOC_{biomass}$ = 32% DOC_{manure} = 37% $DOC_{food\ waste}$ = 40% For instance 2: $DOC_{biomass}$ = 33% DOC_{manure} = 38% $DOC_{food\ waste}$ = 39%	Monitored by PP

Determination of $W_{j,x}$

$W_{j,x} = W_x \times p_{j,x}$

Where:

W_x	=	Total amount of solid waste disposed or prevented from disposal in the SWDS in year x (t)
$p_{j,x}$	=	Average fraction of the waste type j in the waste in year x (weight fraction)
j	=	Types of solid waste
x	=	Years in the time period for which waste is disposed at the SWDS, extending from the first year in the time period (x = 1) to year y (x = y)

$$p_{j,x} = \frac{\sum_{n=1}^{Z_x} p_{n,j,x}}{Z_x}$$

Where:

$p_{j,x}$	=	Average fraction of the waste type j in the waste in year x (weight fraction)

$p_{n,j,x}$	=	Fraction of the waste type j in the sample n collected during the year x (weight fraction)
Z_x	=	Number of samples collected during the year x
n	=	Samples collected in year x
j	=	Types of solid waste
x	=	Years in the time period for which waste is disposed at the SWDS, extending from the first year in the time period (x = 1) to year y (x = y)

Project emissions

As per ACM0022, Project emissions are calculated as follows:

$$PE_y=PE_{COMP,y}+PE_{AD,y}+PE_{GAS,y}+PE_{RDF_{SB},y}+PE_{INC,y}$$

Where:

PE_y	=	Project emissions in year y (tCO_2/yr)
$PE_{COMP,y}$	=	Project emissions from composting or co-composting in year y (tCO_2e)
$PE_{AD,y}$	=	Project emissions from anaerobic digestion and biogas combustion in year y (tCO_2e)
$PE_{GAS,y}$	=	Project emissions from anaerobic digestion and biogas combustion in year y (tCO_2e)
$PE_{RDF\_SB,y}$	=	Project emissions associated with RDF/SB in year y (tCO_2e)
$PE_{INC,y}$	=	Project emissions from incineration in year y (tCO_2e)

As analysis above, the project activity does not include anaerobic digestion, biogas combustion, gasification, RDF/SB and incineration. Therefore,

$PE_y = PE_{COMP,y}$

$PE_{COMP,y}$ would be calculated according to Project and leakage emissions from composting version 02.0 as below formula:

$$PE_{COMP,y} = PE_{EC,y} + PE_{FC,y} + PE_{CH4,y} + PE_{N2O,y} + PE_{RO,y}$$

Where:

$PE_{EC,y}$	=	Project emissions from electricity consumption associated with composting in year y (tCO_2/yr)
$PE_{FC,y}$	=	Project emissions from fossil fuel consumption associated with composting in year y (tCO_2/yr)
$PE_{CH4,y}$		Project emissions of methane from the composting process in year y (tCO_2e/yr)
$PE_{N2O,y}$	=	Project emissions of nitrous oxide from the composting process in year y (tCO_2e/yr)
$PE_{RO,y}$	=	Project emissions of methane from run-off wastewater associated with co-composting in year y (tCO_2e)

As the project does not involve in treatment of run-off wastewater, $PE_{RO,y}$ is considered as zero.

As confirmed by checking FSR and site visit, there would be no fossil fuel consumed by the project. Project emissions from fossil fuel consumption associated with composting ($PE_{FC,y}$) is considered as zero.

Project emissions from electricity consumption associated with composting ($PE_{EC,y}$) was calculated based on Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation, version 03.0 as below:

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

According to Project and leakage emissions from composting, version 02.0, when applying Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation, version 03.0, if monitored data for electricity consumption is not available, then electricity consumption from composting ($EC_{PJ,comp,y}$) may be determined based on a default value for the specific quantity of electricity consumed per tonne of waste composted ($SEC_{comp,default}$).

$$EC_{PJ,comp,y} = Q_y \times SEC_{comp,default}$$

Where:

$EC_{PJ,comp,y}$	=	Quantity of electricity consumed for composting in year y (MWh/yr)
Q_y	=	Quantity of waste composted in year y (t/yr)
$SEC_{comp,default}$	=	Default value for the specific quantity of electricity consumed per tonne of waste composted (MWh/t)

For ex-ante estimation, $SEC_{comp,default}$ is used. For ex-post estimation, $EC_{PJ,comp,y}$ will be monitored.

As the electricity consumed by this project is from national grid. Therefore,

$EF_{EF,j,y} = EF_{grid,CM,y}$

$EF_{grid,CM,y}$ is calculated according to Tool to calculate the emission factor for an electricity system, version 07.0. Calculation based on public data issued by China's DNA.

Project emissions of methane from the composting process ($PE_{CH4,y}$) was calculated based on Project and leakage emissions from composting, version 02.0 as below:

$PE_{CH4} = Q_y \times EF_{CH4,y} \times GWP_{CH4}$

Where:

Q_y	=	Quantity of waste composted in year y (t/yr)
$EF_{CH4,y}$	=	Emission factor of methane per tonne of waste composted valid for year y (tCH_4/t)
GWP_{CH4}	=	Global Warming Potential of CH_4 (tCO_2e/tCH_4)

There are two options for determining $EF_{CH4,y}$.. This project uses option 2 (procedure using default values).

$EF_{CH4,y} = EF_{CH4,default}$

Project emissions of nitrous oxide from the composting process ($PE_{N2O,y}$) was calculated based on Project and leakage emissions from composting, version 02.0 as below:

$PE_{N2O,y} = Q_y \times EF_{N2O,y} \times GWP_{N2O}$

Where:

Q_y	=	Quantity of waste composted in year y (t/yr)
$EF_{N2O,y}$	=	Emission factor of nitrous oxide per tonne of waste composted valid for year *y* (tN_2O/t)
GWP_{N2O}	=	Global Warming Potential of N_2O ($tCO_2e/t\ N_2O$)

There are two options for determining $EF_{N2O,y}$.. This project uses option 2 (procedure using default values).

$EF_{CH4,y} = EF_{N2O,default}$

Leakage

Leakage emissions are associated with composting/co-composting, anaerobic digestion and the use of RDF/SB that is exported outside the proposed project boundary. For the case that waste by-products of the alternative waste treatment options are:

Used for soil application, this emission shall be neglected;

Composted or co-composted, then these shall be treated as fresh waste with emissions estimated according to the procedure project emissions from composting ($PE_{COMP,y}$).

Since the waste by-products of the alternative waste treatment option of the proposed project is for soil application, so there're no leakage emissions for the by-products of the proposed project activity.

For this project, the compost is in aerobic condition, not subjected to anaerobic storage or disposed of in a SWDS.

Therefore, no leakage was considered.

Emission Reductions

According to ACM0022, version 03.0, emission reductions are calculated as follows:

$ER_y = BE_y - PE_y - LE_y$

Where:

ER_y	=	Emission reductions in year y (tCO_2e/yr)
BE_y	=	Baseline emissions in year y (tCO_2e/yr)

PE_y = Project emissions in year y (tCO_2e/yr)

LE_y = Leakage in year y (tCO_2e/yr)

Hence for the project activity, the estimated amount of GHG emission reductions (ER_y) is 6,199,571 tCO_2e during the crediting period from 06/01/2020 to 05/01/2027, resulting in estimated average annual emission reductions of 885,653 tCO_2e.

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)
06/01/2020 - 31/12/2020	319,803	61,471	0	258,332
2021	596,237	62,748	0	533,489
2022	820,388	62,748	0	757,640
2023	1,007,751	62,748	0	945,003
2024	1,165,144	62,748	0	1,102,396
2025	1,297,956	62,748	0	1,235,208
2026	1,410,481	62,748	0	1,347,733
01/01/2027- 05/01/2027	20,631	861	0	19,770
Total	**6,638,391**	**438,820**	**0**	**6,199,571**

3.3.7 Methodology Deviations

No methodology deviation is applied in the project.

3.3.8 Monitoring Plan

Assessment team checked the monitoring practice onsite and also checked the guideline of respective State electricity regulatory commission. The detail analysis is as below:

Parameters determined ex-ante

Data / Parameter:	φ
Data unit:	/

Description:	Default value for the model correction factor to account for model uncertainties
Source of data used:	Default value from "Emissions from solid waste disposal sites
Value applied:	For baseline emissions, 0.85 is applied for Humid/wet conditions, application B For project emissions, φ =1

Data / Parameter:	GWP_{CH4}
Data unit:	tCO_2e/tCH_4
Description:	Global Warming Potential of methane
Source of data used:	IPCC
Value applied:	28

Data / Parameter:	OX
Data unit:	/
Description:	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)
Source of data used:	Based on an extensive review of published literature on this subject, including the IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value applied:	0.1
Data / Parameter:	MCF
Data unit:	/
Description:	Methane correction factor
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value applied:	0.8 for unmanaged solid waste disposal sites – deep

Data / Parameter:	k_j
Data unit:	1/yr

<table>
<tr><td>Description:</td><td>Decay rate for the waste type j</td></tr>
<tr><td>Source of data used:</td><td>IPCC 2006 Guidelines for National Greenhouse Gas Inventories</td></tr>
<tr><td>Value applied:</td><td>Default values for the decay rate (kj)
<table>
<tr><td rowspan="2"></td><td rowspan="2">Waste type j</td><td>Tropical (MAT > 20°C</td></tr>
<tr><td>Wet (MAP > 1,000 mm)</td></tr>
<tr><td rowspan="2">Slowly degrading</td><td>Pulp, paper and cardboard (other than sludge)</td><td>0.07</td></tr>
<tr><td>Wood, wood products and straw</td><td>0.035</td></tr>
<tr><td>Moderately degrading</td><td>Other(non-food) organic putrescible garden and park waste</td><td>0.17</td></tr>
<tr><td>Rapidly degrading</td><td>Food, food waste, beverages and tobacco (other than sludge)</td><td>0.40</td></tr>
</table>
The annual average temperature of Hechi City is 20.5 °C, and annual rainfall is 1,200-1,600 mm.
The annual average temperature of Baise City is 22 °C, and annual rainfall is 1,000 mm
All above weather information are confirmed by checking on-line information.</td></tr>
</table>

Data / Parameter:	$EF_{grid,CM,y}$
Data unit:	tCO_2/MWh
Description:	Emission factor for electricity generation for SCPG in year y
Source of data used:	2019 Baseline Emission Factors for Regional Power Grids in China dated 29/12/2020
Value applied:	0.50885

Data / Parameter:	$EF_{CH4,default}$
Data unit:	tCH_4/t
Description:	Default emission factor of methane per tonne of waste composted (wet basis)
Source of data used:	Project and leakage emissions from composting, version 02.0
Value applied:	0.002

Data / Parameter:	$EF_{N2O,default}$
Data unit:	tN_2O/t
Description:	Default emission factor of N_2O per tonne of waste composted (wet basis)
Source of data used:	Project and leakage emissions from composting, version 02.0
Value applied:	0.0002

Data / Parameter:	GWP_{N2O}
Data unit:	tCO_2e/tN_2O
Description:	Global Warming Potential of N_20
Source of data used:	IPCC
Value applied:	265

Data / Parameter:	$TDL_{k,y}$
Data unit:	%
Description:	Average technical transmission and distribution losses for providing electricity to SCPG in year y
Source of data used:	Default value from Baseline, project and or leakage emissions from electricity consumption and monitoring of electricity generation, version 03.0
Value applied:	3

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 used:	Default value from Baseline, project and or leakage emissions from electricity consumption and monitoring of electricity generation, version 03.0
Value applied:	20

Parameters determined ex-post

- Policy requirement: $RATE_{COMPLIANCE,t}$, f_y

Parameter title	Descriptions
$RATE_{COMPLIANCE,t}$	Rate of compliance with a regulatory requirement to implement the alternative waste treatment t implemented in the project activity
f_y	Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere in year y

$RATE_{COMPLIANCE,t}$ will be checked once through official studies, reports and certification from municipal authorities at the each beginning of crediting period.

f_y will be checked annually through public information.

- Waste Treatment: W_x, $p_{n,j,x}$, Z_x, F, DOC_j, BMP_j and $DOC_{f,y}$

Parameter title	Descriptions
W_x	Total amount of solid waste disposed or prevented from disposal in the SWDS in year x
$p_{n,j,x}$	Weight fraction of the waste type j in the sample n collected during the year x

Z_x	Number of samples collected during the year x
F	Fraction of methane in the SWDS gas
BMP_j	Biochemical methane potential for the residual waste type j disposed or prevented from disposal
DOC_j	Fraction of degradable organic carbon in the waste type j
$DOC_{f,y}$	Fraction of degradable organic carbon (DOC) that decomposes under the specific conditions occurring in the SWDS for year y

W_x will be determined by electronic weighbridge with accuracy of class III installed at project site, the weighbridge will be calibrated by national standard.

$p_{n,j,x}$ will be determined by measurement of project owner with three samples every three months through electronic platform scale with accuracy of class III. The electronic platform scale will be calibrated according to national standard.

Z_x will be at least three samples every three months.

F will be determined by Material inspection report issued by qualified party according to national standard and fixed during the crediting period.

BMP_j will be determined by Material inspection report issued by qualified party according to national standard and fixed during the crediting period.

DOC_j will be determined by Material inspection report issued by qualified party according to national standard and fixed during the crediting period.

$DOC_{f,y}$ will be calculated based on the monitoring value of BMP_j, F and DOC_j.

- Electricity consumption: $EC_{PJ,comp,y}$ ($EC_{PJ,j,y}$)

Parameter title	Descriptions
$EC_{PJ,comp,y}$ ($EC_{PJ,j,y}$)	Quantity of electricity consumed for composting in year y

$EC_{PJ,comp,y}$ ($EC_{PJ,j,y}$) will be determined by electricity meters installed at the electricity consumption sources with accuracy of 0.5s, the electricity meter will be calibrated by national standard.

Based on the on-site visit and interviewed with the Manager of Guangxi Liyuanbao Science and Technology Co., Ltd., the validation team confirmed that monitoring parameter has been correctly descried in the updated PD and in compliance with the methodology ACM0022 version 03.0 and the guidance given by EB via CDM Validation and Verification Standard for project activities version 03.0 and VCS via VCS standard version 4.1.

3.4 Non-Permanence Risk Analysis

Not applicable for the present project activity.

4 VALIDATION CONCLUSION

Applus+ Certification has been engaged by Beijing Ruifang Technology Co., Ltd to perform the validation of Composting of organic waste project in Guangxi.

The management of the project proponent/owner is responsible for the preparation of the GHG emissions data and the reported/estimated GHG emissions reductions on the basis set out within the project's Monitoring Plan in the VCS PD and the approved methodology ACM0022 version 03.0.

Our Validation approach was based on the requirements as defined under the Kyoto Protocol, Marrakesh accord, as well as those defined by the CDM Executive Board and VCS board. Our approach is risk-based, drawing on an understanding of the risks associated with estimated GHG emissions data and the controls in place to mitigate these. The validation can confirm that:

The projects description compliance with, the requirements of Article 12 of the Kyoto Protocol, the CDM Modalities and Procedures as agreed in the Marrakech Accords under decision 3/CMP.1, the annexes to this decision, subsequent decisions and guidance made by COP/MOP & CDM Executive Board and other relevant rules, including the Host Country legislation and sustainability criteria along with VCS guideline and standard version 4.1.

The project's baseline and additionality is assessed against ACM0022 version 03.0 for large scale project.

The project's monitoring plan is assessed against ACM0022 version 03.0 for large scale project.

A risk based approach has been followed to perform this validation activity. The review of the project description and additional documents related to baseline and monitoring methodology; the subsequent background investigation, follow-up interviews with Project Owner have provided LGAI Technological Center S.A. (Applus+ Certification) with sufficient evidence for positive validation opinion as per the requirement of VCS.

APPENDIX I: <REFERENCE LIST>

1. VCS project design version 2.0 dated 21/10/2021, version 4.1 dated 15/06/2022

2. Estimated ER calculation spreadsheet

3 VCS standard version 4.1

4 VCS guideline version 4.0

5. CDM Validation and Verification Standard for project activities version 03.0

6. CDM Project Standard for project activities version 03.0

7. Approved methodology ACM0022: Alternative waste treatment process, version 03.0

8. Tool to calculate the emission factor for an electricity system, version 07.0

9. Emissions from solid waste disposal sites, version 08.0

10. Combined tool to identify the baseline scenario and demonstrate additionality, version 07.0

11. Project and leakage emissions from composting, version 02.0

12. Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation, version 03.0

13. Business License

14. Feasible Study Report

15. Project approval

16. Environmental Impact Assessment Report

17. Environmental Impact Assessment (EIA) approval

18. Construction Order

19. Operation Log

20. Nameplate of the equipment

21. 2019 Baseline Emission Factors for Regional Power Grids in China dated 29/12/2020

22. Questionnaires for stakeholder meeting

23. Signed contract between the project owner and supplier for project construction

24. Technical code for municipal solid waste sanitary landfill (GB50869-2013)

25. 2019 Statistical Yearbook of Urban and Rural Construction

26. 2020 China Biomass Power Generation Industry Development Report

27. Income Tax Law of the Peoples Republic of China for Enterprises issued by the Chairman of the People's Republic of China

28. Interim Regulation of VAT of the Peoples Republic of China issued by State Council

29. Economic Evaluation Measurement and Parameters of Constructive Projects, version 03

30. Order of the State Council of the People's Republic of China (No. 691)

31. Interim Rules on Additional Tax for City Development

32. Provisional Regulations of the People's Republic of China on Education tax

33. Rules for the Provisional Regulations on Enterprise Income Tax of the People's Republic of China

34. Investment Analysis, version 11.0

35. IPCC

36. Catalogue of preferential Enterprise income tax for comprehensive utilization of resources

37. Monitoring Report for Fraction of degradable organic carbon in the waste type j issued by third-party inspection company

38. Financial Statement for year 2020

39. Biomass Inspection report

40. Manure Inspection report

41. Food Waste Inspection report

42. CPI, PPI and average salary information

43. Long-term supply contract

APPENDIX II: <CLARIFICATION REQUESTS, CORRECTIVE ACTION REQUESTS, FORWARD ACTION REQUESTS (CAR/CL/FAR)>

CAR ID	01	Section no.	3.3.1	Date: 15/11/2021
Description of CAR				
The latest version of ACM0022 should be applied in the VCS PD.				
Project proponent response				Date: 17/12/2021
Latest version of ACM0022 has been applied in the updated VCS PD.				
Documentation provided by project proponent				
Updated VCS PD				
VVB assessment				Date: 21/12/2021
By checking updated VCS PD, it is confirmed latest version of ACM0022 has been correctly applied in the updated VCS PD.				

CAR ID	02	Section no.	3.3.4	Date: 15/11/2021
Description of CAR				
The latest version of Combined tool to identify the baseline scenario and demonstrate additionality should be used for baseline identification and additionality demonstration according to the requirement of ACM0022.				
Project proponent response				Date: 17/12/2021

Combined tool to identify the baseline scenario and demonstrate additionality has been followed for baseline identification and additionality demonstration in the updated VCS PD.
Documentation provided by project proponent
Updated VCS PD
VVB assessment | **Date:** 21/12/2021
By checking updated VCS PD, it is confirmed Combined tool to identify the baseline scenario and demonstrate additionality has been followed for baseline identification and additionality demonstration, and confirmed to be correct.

CAR ID	03	**Section no.**	3.3.8	**Date:** 15/11/2021
Description of CAR				
The monitoring parameter $RATE_{COMPLIANCE,t}$ should be included in the monitoring plan.				
Project proponent response				**Date:** 17/12/2021
The monitoring parameter $RATE_{COMPLIANCE,t}$ has been added to the section 5 of Project Description version 3.0. Please refer to the Project Description version 3.0.				
Documentation provided by project proponent				
Updated VCS PD				
VVB assessment				**Date:** 21/12/2021
By checking updated VCS PD, it is confirmed the monitoring parameter $RATE_{COMPLIANCE,t}$ has been included in the monitoring plan.				