



GUANGZHOU EASTERN SOLID RESOURCE RECYCLING CENTER MSW INTEGRATED TREATMENT PLANT PROJECT



Document Prepared by Shenzhen CTI International Certification Co., Ltd

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Summary:

Shenzhen CTI International Certification Co., Ltd. (hereafter referred to as "CTI") has been commissioned by Climate Bridge (Shanghai) Ltd. to perform the validation and verification of project activity "Guangzhou Eastern Solid Resource Recycling Center MSW Integrated Treatment Plant Project" (hereafter referred to as "the project activity") and reported in the joint Validation & Verification Report.

The main purpose of the project activity is to treat MSW with anaerobic digesters of fresh waste from Guangzhou City and utilize recovered biogas for electricity generation, which is located at Solid Resource Recycling Center, Fushan Village, Jiulong Town, Luogang District, Guangzhou City, Guangdong Province, P.R China. The fresh waste of the project is mainly kitchen and catering waste from Guangzhou City. The project activity includes MSW collection, MSW pre-treatment system, biodiesel production system, anaerobic digester, biogas purification, electricity generation system and waste heat recovery. In terms of the biodiesel production system and waste heat recovery, waste oil sourced from MSW pre-treatment system will be used for biodiesel production, and the waste heat will be recovered to be the source of heat supply for the operation. To be conservative, emission reductions will not be claimed for waste heat recovery and biodiesel production system. The design processing capacity of the project is 2,040 tonnes fresh waste per day. The total installed capacity of the project activity is 10.34 MW, consisting of 4 sets of 1.063 MW generators and 2 sets of 3.044 MW generators. The project uses fresh waste, mainly kitchen and catering waste of the Guangzhou City. During the 3*7 years renewal crediting period, the annual power generated by the project is expected to be 61,842 MWh which will be exported to the grid. The Project can reduce GHG emissions by replacing the electricity generated by fossil fuel fired power plants of China South Power Grid (CSPG). Meanwhile by utilization biogas recovered from anaerobic digestion by project, the project activity avoids the emission of methane that would be venting into atmosphere at the landfill site. It's estimated that the project activity could achieve average annual GHG emission reductions of 359,014 tCO₂e during the first crediting period.

In the course of the validation and verification, 4 Corrective Action Requests (CARs) were raised and successfully closed. No Clarification Requests (CLs) or Forwarded Action Requests (FARs) was raised.

Validation Summary

The validation objective is an independent assessment by a Third Party of a proposed project activity against all defined criteria set for the registration under the VCS. In order to confirm that the project activity, as documented, is sound reasonable and meets the identified criteria, the validation involves the assessment of: project conformance to VCS standards/programs, project conformance to the applied methodology, including the procedure for the demonstration of additionality specified in the methodology; and likelihood that methods

and procedures set out in the Joint Project Description and Monitoring Report (hereafter refer to as "joint PD & MR") will generate verifiable GHG data and information when implemented. Validation is a requirement and is seen as necessary to provide assurance to stakeholders of the quality of project and its intended generation of VCUs. Validation is part of the VCS project cycle and will finally result in a conclusion by the executing VVB whether a project activity is valid to be submitted for registration to Verra registry.

Validation is conducted using CTI procedures in line with the requirements specified in the latest version of the VCS Validation and Verification Manual and applying auditing techniques. The assessment team assessed the project activity's compliance against the VCS Version 4.2, the selected CDM methodology and the joint PD & MR. The project is eligible under non-AFOLU project. The validation criteria followed the guidance documents provided by VCS and the selected CDM methodology and tool includes:

- CDM Validation and Verification Standard for project activities version 03.0;
- CDM Project Standard for project activities version 03.0;
- CDM project cycle procedure for project activities version 03.0;
- VCS standard v4.2;
- VCS program guideline v4.1;
- ACM0022: Alternative waste treatment processes, Version 03.0;
- Combined tool to identify the baseline scenario and demonstrate additionality (version 07.0);
- Common practice (version 03.1);
- Investment analysis (version 11.0);
- Emissions from solid waste disposal sites (version 08.0);
- Project and leakage emissions from anaerobic digesters (version 02.0);
- Tool to calculate the emission factor for an electricity system (version 07.0);
- Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation (version 03.0);
- Tool to determine the mass flow of a greenhouse gas in a gaseous stream (version 03.0);
- Project emissions from flaring (version 04.0);

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 activity. The review of the joint PD & MR and additional documents related to baseline and monitoring methodology; the subsequent background investigation, follow-up interviews and project owners have provided Shenzhen CTI International Certification Co., Ltd (CTI) with sufficient evidence to verify the fulfilment of the stated criteria of VCS.

Verification Summary

CTI has performed the verification of the emission reductions reported for the project activity "Guangzhou Eastern Solid Resource Recycling Center MSW Integrated Treatment Plant Project" (VCS Project ID: 2746) for the monitoring period 01/04/2020 to 31/12/2021 to review and determine the monitored reductions in GHG emissions that have occurred as a result of the project activity. These emission reductions are claimed as Verified Carbon Units (VCU) under the Verified Carbon Standard (VCS) version 4.2.

The verification was performed on the basis of VCS Programme Guide version 4.1 and VCS standard version

4.2 for the VCS projects, as well as criteria given to provide for consistent project operations, monitoring and reporting. The verification was conducted by means of document review, follow-up interviews and site inspections, and the resolution of outstanding issues.

In CTI's opinion, the GHG emission reductions reported for the project in the joint PD & MR (version 2.1 dated 14/07/2022) are fairly stated. The GHG emission reductions were calculated correctly on the basis of approved methodology ACM0022 "Alternative waste treatment processes" (Version 03.0) and the monitoring plan contained in the joint PD & MR (version 2.1 dated 14/07/2022).

CTI does not assume any responsibility towards the issuance and utilization of the VCU's hereby verified and certified. Request for issuance of VCU's shall be made by the project proponent to an approved VCS Program Registry based on the requirements set out under the most recent version of the VCS Program Guidelines clause on VCS Registration.

The verification of reported emission reductions is based on the information made available to CTI and the engagement conditions detailed in this report. CTI cannot be held liable by any party for decisions made or not made based on this report. Hence, CTI is able to certify that the emission reductions from the "Guangzhou Eastern Solid Resource Recycling Center MSW Integrated Treatment Plant Project" during the period amount to 332,556 tCO₂e.

CONTENTS

1 INTRODUCTION	7
1.1 Objective	7
1.2 Scope and Criteria	7
1.3 Level of Assurance	8
1.4 Summary Description of the Project	8
2 VALIDATION AND VERIFICATION PROCESS	10
2.1 Method and Criteria	10
2.2 Document Review	11
2.3 Interviews	12
2.4 Site Inspections	12
2.5 Resolution of Findings	12
3 VALIDATION FINDINGS	14
3.1 Project Details	14
3.2 Participation under Other GHG Programs	18
3.3 Safeguards	21
3.4 Application of Methodology	23
3.5 Non-Permanence Risk Analysis	82
4 VERIFICATION FINDINGS	83
4.1 Accuracy of GHG Emission Reduction and Removal Calculations	83
4.2 Quality of Evidence to Determine GHG Emission Reductions and Removals	98
5 VALIDATION AND VERIFICATION CONCLUSION	98
APPENDIX 1: ABBREVIATIONS	102
APPENDIX 2: <COMPETENCE OF TEAM MEMBERS AND TECHNICAL REVIEWERS> .	104

APPENDIX 3: <REFERENCE LIST>	108
APPENDIX 4: <CLARIFICATION REQUESTS, CORRECTIVE ACTION REQUESTS, FORWARD ACTION REQUESTS (CAR/CL/FAR)>	111

1 INTRODUCTION

1.1 Objective

Climate Bridge (Shanghai) Ltd. has commissioned the CTI to carry out the Verified Carbon Standard (VCS) validation of the project "Guangzhou Eastern Solid Resource Recycling Center MSW Integrated Treatment Plant Project" (VCS ID 2746).

The objective of validation is an independent assessment by a Third Party of a proposed project activity against all defined criteria set for the registration under the VCS. In order to confirm that the project activity, as documented, is sound reasonable and meets the identified criteria, the validation involves the assessment of: project conformance to VCS standards/programs, project conformance to the applied methodology, including the procedure for the demonstration of additionality specified in the methodology; and likelihood that methods and procedures set out in the project description will generate verifiable GHG data and information when implemented. Validation is a requirement and is seen as necessary to provide assurance to stakeholders of the quality of project and its intended generation of VCU. Validation is part of the VCS project cycle and will finally result in a conclusion by the executing VVB whether a project activity is valid to be submitted for registration to Verra registry.

The objective of verification is the periodic independent review and ex-post determination by an accredited Third Party of the monitored reductions in GHG emissions that have occurred as a result of the VCS project activity during a defined verification period. A verification statement is the written assurance that, during a specific period in time, a project activity achieved the emission reductions as verified. For the project activity, the verification was to verify and provide a verification statement of emission reductions reported for the period 01/04/2020 to 31/12/2021.

1.2 Scope and Criteria

The validation scope is defined as an independent and objective review of the joint Project Design and Monitoring Report to validate that (a) the project design is actual, (b) the baseline scenario is correctly defined as per the applied methodology and related tools, (c) the project is additional, (d) the monitoring plan can be implemented and is transparent and adequate and (e) all data and information used for ex-ante calculation of emission reductions is of projected and/or hypothetical nature. The joint PD & MR is reviewed against the criteria stated in VCS standard version 4.2 /4/ and the approved baseline and monitoring methodology ACM0022, Version 03.0. The validation was based on the requirements VCS Validation and Verification Manual and VCS program guide version 4.1 /5/ and VCS standards version 4.2 /4/ applying auditing techniques. 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.

The scope of the verification is to verify that actual monitoring systems and procedures are in compliance with the monitoring systems and procedures described in the monitoring plan; evaluate the GHG emission reduction data and express a conclusion with a reasonable level of assurance about whether the reported GHG emissions reduction data is free from material misstatement; verify that reported GHG emissions data is sufficiently supported by evidence. The verification is conducted as per VCS Program Guide (version 4.1), VCS Standard (version 4.2), other relevant requirements defined by Verra and the approved methodology ACM0022 (Version 03.0) applied by the project. The verification shall ensure that reported emission reductions are complete and accurate in order to be verified.

1.3 Level of Assurance

The joint validation and verification report is based on the joint PD & MR, 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.

The joint validation and verification report expresses a conclusion with a reasonable level of assurance about whether the reported GHG emissions reduction data is free from material misstatement. CTI applied a materiality threshold of 1% (for large project with emission reductions greater than 300,000 tonnes of CO₂e per year) with respect to omission or misstatements concerning reported quantities as per VCS standard.

1.4 Summary Description of the Project

Project title	Guangzhou Eastern Solid Resource Recycling Center MSW Integrated Treatment Plant Project
Project Participants	Guangzhou LEO-KING Environmental Technology Co., Ltd. (Project Owner, host country, P. R. China)
Location of the project	The Solid Resource Recycling Center, Fushan Village, Jiulong Town, Luogang District, Guangzhou City, Guangdong Province, P.R China. Geographic coordinates: longitude of 113°30'54"E and latitude of 23°17'4"N
Project start date	01/04/2020, the operation start date
Applied Methodology/Version	ACM0022, Version 03.0
Scope/Technical Area	Scope 01: energy industries (renewable-/non-renewable sources) and sectoral scope 13: Waste handling and disposal
VCS crediting period	01/04/2020 to 31/03/2027 (1 st crediting period)

The purpose of the project activity is to treat MSW with anaerobic digesters and utilize recovered biogas for electricity generation located at Solid Resource Recycling Center, Fushan Village, Jiulong Town, Luogang District, Guangzhou City, Guangdong Province, P.R China. The project activity includes MSW collection, MSW pre-treatment system, biodiesel production system, anaerobic digester, biogas purification, electricity generation system and waste heat recovery. In terms of the biodiesel production system and waste heat recovery, waste oil sourced from MSW pre-treatment system will be used for biodiesel production, and the waste heat will be recovered to be the source of heat supply for the operation. To be conservative, emission reductions will not be claimed for waste heat recovery and biodiesel production system. The design processing capacity of the project is 2,040 tonnes fresh waste per day. The total installed capacity of the project activity is 10.34 MW, consisting of 4 sets of 1.063 MW generators and 2 sets of 3.044 MW generators. The project uses fresh waste, mainly kitchen and catering waste of the Guangzhou City. During the 3*7 years renewal crediting period, the annual power generated by the project is expected to be 61,842 MWh which will be exported to the grid. The Project can reduce GHG emissions by replacing the electricity generated by fossil fuel fired power plants of China South Power Grid (CSPG). Meanwhile by utilization biogas recovered from anaerobic digestion by project, the project activity avoids the emission of methane that would be venting into atmosphere at the landfill site. It's estimated that the project activity could achieve average annual GHG emission reductions of 359,014 tCO₂e during the first 7-year crediting period.

2 VALIDATION AND VERIFICATION PROCESS

2.1 Method and Criteria

A project specific validation and verification plan was developed to guide the validation and verification auditing process to ensure efficiency and effectiveness.

The purpose of the validation and verification is to present a risk assessment for determining the nature and extent of validation and verification procedures necessary to ensure the risk of auditing error is reduced to a reasonable level. According to the ISO14064-3, the criteria are the policy, procedure or requirement used as reference against which evidence is compared. The validation and verification were performed through means of the following three phases in accordance with the requirement of the applied methodology, and the VCS Standard (version 4.2) and other relevant VCS requirements.

- A desk review of the joint PD & MR and all support documents;
- Follow-up interviews with project stakeholders and site inspection;
- The resolution of outstanding issues and the issuance of the joint validation and verification report and statement.

CTI 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.

CTI also verified the emission reductions through assessing all factors and issues that constitute the basis for emission reductions from the project, including:

- The emission reduction calculations and the relevant data records;
- The calibration and maintenance records for the monitoring instruments;
- The management systems to support the project operation and monitoring.

CTI assessed that the reported information in the joint PD & MR are complete and accurate in question. This joint validation and verification report describes the findings of this assessment. The information of the assessment team has been included in below of this report.

2.2 Document Review

The joint PD & MR /1/ and supporting background documents related to the project implementation were reviewed. Documents review was conducted to ensure consistency with and identify any deviation from VCS program requirements. Desk review included an examination of the project design details, baseline scenario, additionality, ex ante and monitoring data and parameters, and ex ante quantification of GHG emission reductions. The assessment team also used additional documentation by third parties like host party legislation, technical reports referring to the project design details, baseline scenario, additionality, monitoring or to the basic conditions and technical data.

Furthermore, the joint PD & MR /1/ and emission reduction calculation spreadsheet of monitoring period from 01/04/2020 to 31/12/2021, relevant decisions, clarifications and guidance from the Verra, other information and references relevant to the project activity have also been assessed during the desk review.

CTI has applied standard auditing techniques to assess the quality of information provided, including a review of the data and information presented to verify their completeness; a review of the monitoring plan and monitoring methodology, paying particular attention to the frequency of measurements, the quality of metering equipment including calibration requirements, and the quality assurance and quality control procedures; and an evaluation of data management and the quality assurance and quality control system in the context of their influence on the generation and reporting of emission reductions.

The references used in the course of this validation and verification are summarized in Appendix 3. The validation and verification were performed basing on the documents check and site inspection/measurements, refer to the section 3 of this report for the validation process detail, section 3 of this report for the verification process detail, and Appendix 3 for corresponding documents review.

According to the sectoral scopes / technical area and experiences in the sectoral or national business environment, CTI has composed a project assessment team in accordance with the appointment rules in CTI. The composition of CTI assessment team has to be approved by the CTI 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:

Function	Name	Technical competence	Task Performance*
Team Leader	Du Wenjun	1, 13	☒ DR ☒ SV ☒ RP ☐ TR
Technical Reviewer	Zhang Lei	1, 4, 13	☒ DR ☐ SV ☐ RP ☒ TR

*DR=Document review; SV=Site visit; RP=Reporting; TR=Technical review

2.3 Interviews

The objective of the interview process was to solicit important information from personnel related to project and relevant to the validation and verification process. Onsite interviews and information discussions were conducted with PP. The key personnel interviewed are summarized in the table below:

Interviewed personnel	Role	Organization	Subject
Mr. Cao Jian	General Engineer	Guangzhou LEO-KING Environmental Technology Co., Ltd.	Status of the project (including PPs); Applicability of selected methodology; Baseline of the project and its updates; Emission factors and their updates; Monitoring plan; Stakeholder consultation process and its outcomes; Operation of the project activity; Implementation of the monitor plan of the project activity; Data collection and data achievement; Calibration of meters and equipment maintenance; Data collection and ER calculation.
Mr. Luo Xin	Archive Administrator		
Mr. Chen Debiao	Staff		
Mr. Zhao Jianhua	Vice Department Director	Local Development and Reform Committee	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.
Mr. Chen Danqing	Vice Director	Guangzhou City Ecology and Environment Bureau	
Mr. Liu Yuhe	Department Director	Urban Administration Bureau	
Ms. Fang Ling	Villager	Local Village	
Mr. Lian Jie	Villager	Local Village	
Ms. Peng Yumei	General Engineer	Climate Bridge (Shanghai) Ltd.	Data collection and ER calculation.

2.4 Site Inspections

The assessment team performed the on-site validation and verification (the Solid Resource Recycling Center, Fushan Village, Jiulong Town, Luogang District, Guangzhou City, Guangdong Province, P.R China) from 12/01/2022 to 14/01/2022. 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 CTI's positive conclusion on the joint PD & MR /1/. 0 Clarification Requests (CLs), 4 Corrective Action requests (CARs) and 0 Forward action request (FARs) raised by CTI. And communications were made between the Client and CTI to guarantee the transparency of the validation and verification process, the concerns raised, and responses given are summarized below in the appendix 4.

The final joint PD & MR version 2.1 dated 14/07/2022 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 Description 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	00	00
- Deviation from methodology	00	00	00
- Clarification on applicability of methodology, tool and/or standardized baseline	00	00	00
- Demonstration of additionality	00	1	00

- Emission reductions	00	2	00
- Monitoring plan	00	1	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
Others (please specify) - Matter related to Emission reduction calculation - for verification	00	00	00
ER achieved, Matter related to feeder details, breakdown and Calibration - for verification	00	00	00
Total	00	4	00

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 to treat MSW with anaerobic digesters and utilize recovered biogas for electricity generation. The project uses fresh waste, mainly kitchen and catering waste of the Guangzhou City. During the 3*7 years renewal crediting period, the annual power generated by the project is expected to be 61,842 MWh which will be exported to the grid. The Project can reduce GHG emissions by replacing the electricity generated by fossil fuel fired power plants of China South Power Grid (CSPG). Meanwhile by utilization biogas recovered from anaerobic digestion by project, the project activity avoids the emission of methane at the landfill site. It's estimated that the project activity could achieve average annual GHG emission reductions of 359,014 tCO₂e during the first 7-year crediting period.

The project activity includes MSW collection, MSW pre-treatment system, biodiesel production system, anaerobic digester, biogas purification, electricity generation system and waste heat recovery. In terms of the biodiesel production system and waste heat recovery, waste oil sourced from MSW pre-treatment system will be used for biodiesel production, and the waste heat will be recovered to be the source of heat supply for the operation. To be conservative, emission reductions will not be claimed for waste heat recovery and biodiesel production system. The design processing capacity of the project is 2,040 tonnes fresh waste per day. The total installed capacity of the project activity is 10.34 MW, consisting of 4 sets of 1.063 MW generators and 2 sets of 3.044 MW generators.

The project activity is located at Solid Resource Recycling Center, Fushan Village, Jiulong Town, Luogang District, Guangzhou City, Guangdong Province, P.R China. The project activity has been developed by Guangzhou LEO-KING Environmental Technology Co., Ltd.. The geographic coordinates of the project activity are longitude of 113°30'54"E and latitude of 23°17'4"N which is confirmed by site visit.

By checking the Project Approval /26/, the assessment team confirmed that the Project activity has been approved by Guangzhou City Development and Reform Commission on 02/12/2016. By checking Environmental Impact Assessment (EIA) approval, the assessment team confirmed that the project activity has been approved by Guangzhou City Environment Bureau on 02/05/2017. By checking the Completion acceptance report /69/, the assessment team confirmed that the project started construction on 12/10/2017. By checking Operation Logs /24/ of the project activity and site interview, the assessment team confirmed that the project activity started operation on 01/04/2020, when biogas began to be recovered for electricity generation and the project activity began generating GHG emission reductions.

Project design, including eligibility criteria for grouped projects

Through document review and site visit, the nameplate of the generators and enclosed flare /20/ are confirmed by the assessment team, which are listed as follows:

Gas generator		
Manufacturer	GE Jenbacher GmbH &Co OG	
Type	JMS 620 GS-B.L	JGS 320GS-L.L
Quantity	2	4
Rated capacity	3.044	1.063 MW
Rated power factor	1	1
Rated frequency	50HZ	50HZ
Rated Voltage	10500V	10500V
Rotate Current	167A	58A
Enclosed flare		
Manufacturer	Nanjing Carbon Cycling Biomass Technology Co., Ltd.	
Quantity	1	
Model	Φ3100*14000	
Temperature range	0~1200℃	
Pressure range	0~20Kpa	
Flow range	450~4500m ³ /h	

The project activity is not a grouped project activity. Therefore, this section is not applicable.

Project proponent and other entities involved in the project

Through document review and site interview, the assessment team confirmed the details of the project proponent as:

Organization name	Guangzhou LEO-KING Environmental Technology Co., Ltd.
Contact person	Ding Lu
Title	General manager
Address	No.118 fushantandong Road, Huangpu District, Guangzhou City, Guangdong Province, P.R China.
Telephone	+86-21 62462036
Email	3542346576@qq.com

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

Project Ownership

By checking business license and Notice on Approval of Registration Change (approval on change of project owner's enterprise name) /25/, Project Approval /26/, BOT franchise agreement /32/ and General Construction Contract /21/, the assessment team confirmed that Guangzhou LEO-KING Environmental Technology Co., Ltd. is the project owner and also project proponent (PP) of project activity. Therefore, Guangzhou LEO-KING Environmental Technology Co., Ltd. has the legal right to control and operate the project activities.

Project Start Date

By checking Operation Logs /24/ of the project activity and site interview, the assessment team confirmed that the project activity started operation on 01/04/2020, which is the start date of the project activity.

Project crediting period Date

The project activity adopts 7*3 renewal crediting period. the assessment team confirms that the starting and ending dates of first 7-year crediting period is as below:

Crediting Period Start date: 01/04/2020

Crediting Period End date: 31/03/2027

Project Scale and Estimated GHG Emission Reductions or Removals

The total installed capacity of the project activity is 10.34 MW, consisting of 4 sets of 1.063 MW generators and 2 sets of 3.044 MW generators. As the estimated annual average GHG emission reductions or removal per year is 359,014 tCO₂e which is more than 300,000 tonnes of CO₂e per year, thus the project falls in the category of Large Project. Therefore, the assessment team confirms that the project scale falls under Large Project.

Project Scale	
Project	
Large project	✓

Through checking emission reductions calculation spreadsheet provided by PP, the assessment team was able to confirm that the estimated GHG Emission Reductions or Removals of the project activity in the first 7-year crediting period is as follows:

Year	Estimated GHG emission reductions or removals (tCO ₂ e)
01/04/2020~31/12/2020	120,089
01/01/2021~31/12/2021	241,497
01/01/2022~31/12/2022	324,942
01/01/2023~31/12/2023	382,808
01/01/2024~31/12/2024	420,831
01/01/2025~31/12/2025	445,354
01/01/2026~31/12/2026	462,562
01/01/2027~31/03/2027	115,015
Total estimated ERs	2,513,097
Total number of crediting years	7
Average annual ERs	359,014

The above estimated emission reduction is confirmed by the assessment team via emission reduction calculation spreadsheet. the assessment team confirmed that the calculation is correct and conservative.

Project location

The project activity is located at Solid Resource Recycling Center, Fushan Village, Jiulong Town, Luogang District, Guangzhou City, Guangdong Province, P.R China. The project activity has been developed by Guangzhou LEO-KING Environmental Technology Co., Ltd.. The project is located at longitude of 113°30'54"E and latitude of 23°17'4"N which is confirmed by site visit.

Conditions prior to project initiation

Before the implementation of the project activity, the electricity generated by the project would be supplied by CSPG in the baseline scenario and the fresh waste would be treated in a landfill site with a partial capture of the landfill gas (LFG) and flaring of the captured LFG.

Project compliance with applicable laws, statutes and other regulatory frameworks

The assessment team confirms that the Project has been approved by Chinese government by checking the Project approval /26/, Environmental Impact Assessment (EIA) approval /31/, and BOT franchise agreement /32/.

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

In conclusion, based on the above justification, the assessment team confirmed that the description in the joint PD & MR are accurate, complete, and has provided an understanding of the nature of the project. Furthermore, the assessment team confirmed that the project has been implemented as described in the joint PD & MR.

3.2 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. A declaration from PP has been provided and checked by CTI.

Also, the assessment team checked the registries of CDM EB and Goldstandard through website <http://cdm.unfccc.int/> and <http://www.goldstandard.org/> to confirm the same.

- Rejection by other GHG programs

The Project is not rejected by other GHG programs. A declaration for the same has been provided and checked by CTI.

Also, the assessment team checked the registries of CDM EB, Goldstandard and Verra through website <http://cdm.unfccc.int/>, <http://www.goldstandard.org/> and <http://verra.org/> to confirm the same.

Other forms of credit

- Emissions trading programs and other binding limits

The assessment team 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. The assessment team checked the REC Mechanism database of China and Chinese Emission Trading System (Chinese ETS) and found that the project activity is not accredited / registered under REC mechanism or Chinese ETS. Further, Declaration in effect of the same has been submitted by project proponent to the assessment team and found to be correct. Thus, the assessment team concluded that the project activity not involved on other Emissions trading programs and other binding limits.

Furthermore, as per “Notice on Strengthening Enterprise Greenhouse Gas Emission Report Management” /75/ issued by National Development and Reform Committee of P.R.China, China has a national emissions trading scheme only cover the high-emission industries, including thermal power generation, petrochemical, chemical, building materials, iron and steel, non-ferrous, paper, aviation and other key emission industries that emitted at least 26,000 tons of CO₂e/year. By checking “List of key emissions in the national carbon emissions transaction quota management in 2019-2020” /76/ issued by Ministry of Ecology and Environment of P.R.China, the project activity is not included in the mandatory emission control scheme and thus no emission cap was enforced for the project activity.

- 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. the assessment team also checked the REC website and found the declaration to be correct.

Additional information relevant to the project

- Leakage management for AFOLU projects

The project activity is not a AFOLU project, therefore, this section is Not applicable.

- 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.

- Sustainable development contributions

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

By checking EIA Report, Staff roster, China's National Plan on Implementation of the 2030 Agenda for Sustainable Development and 17 SDGs defined by UNDP, interviewing stakeholders during site visit, the assessment team confirmed that the project activity would contribute sustainable development in the region and China's Sustainable Development Goals (SDG). The employment opportunities created have been assessed through checking Staff roster and other relevant employment records. The parameters in relation with electricity generated through making use of biogas from anaerobic digestion have been included in section 5.2 and 6.1 of the joint PD&MR. These parameters will be monitored as per ACM0022 and relevant methodology tools. The validation process of monitoring of these parameters have been included in section 3.4.8 and 4.1.1 of the joint validation & verification report. The specific sustainable development goals that the project activity could achieve have been listed as follows:

- SDG13 "Take urgent action to combat climate change and its impacts": the project will utilize fresh waste to generate biogas that would otherwise be treated in a landfill site with a partial capture of the landfill gas (LFG) and flaring of the captured LFG, effectively reducing GHG emissions and air pollution in the surrounding area and decreasing odour nuisance and minimizing health risks of local residents. This contributes to achieve one of China's stated sustainable development priorities "Actively adapt to climate change and strengthen resistance capacity to climate risks in agriculture, forestry, water resources and other key fields, as well as cities, coastal regions and ecologically vulnerable areas".

- SDG7 "Ensure access to affordable, reliable, sustainable and modern energy for all": the project activity will provide clean and renewable energy source through making use of fresh waste to generate biogas for power generation, displacing the power generation of fossil fuel power plants by using renewable energy sources, reducing fossil fuel consumption in NEPG.

This contributes to one of the China's actions for promoting sustainable developing, "By 2030, increase the share of non-fossil fuels in primary energy consumption to about 20 percent".

- SDG 8 "Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all": the project activity will increase employment opportunities for the management, operation and maintenance of the power plant. This contributes to one of the China's actions for promoting sustainable developing, " increase labor force participation rate through implementation of the classification policy. Vigorously enforce the Law on Promotion of Employment".

Therefore, the assessment team confirmed that the joint PD & MR is accurate, complete, and provides an understanding of the nature of the project.

3.3 Safeguards

3.3.1 No Net Harm

The Environmental Impact Assessment (EIA) Report of the project activity was approved by the Guangzhou City Environment Bureau on 02/05/2017. The assessment team confirm all environmental impacts has been analyzed and no net harm was detected. Refer to section 3.3.3 of this report for detailed environmental impacts arising from the Project construction and operation.

Through interview with local stakeholders, it is confirmed by the assessment team the implementation of the project will improve local socio-economic development and contribute to the sustainable development as described in section 3.2 of this report above.

In conclusion, it is confirmed by the assessment team the project has no negative impacts on local environment and socio-economy. And no net harm on local environment and social community has been detected for the project.

3.3.2 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.

Local stakeholder consultation was conducted through distributing questionnaires /54/ to local stakeholders on 20/08/2017 by the project owner. The survey was conducted through distributing and collecting responses of questionnaires. The questionnaire was reasonably designed to assess the project impacts on the local environment and social economic development. In total 40 out of 40 questionnaires were returned with a 100% response rate.

Furthermore, through site interview, the assessment team confirmed that communications with stakeholders were conducted at periodic intervals. Key implementation schedules or changes of the project has been and will be communicated to the local authority, who will inform the neighbourhood committee and the local residents. The comments and suggestions from residents will be collected by the local authority and feedback to project owner. Local government agencies and authorities will conduct spot checks on the implementation of the project, and give suggestions to the project owner on the involved rectification problems.

By checking the questionnaires, the assessment team confirm that the local stakeholder has no negative comments for the construction of the project activity. Meanwhile, by checking the filled questionnaires from local stakeholders, the assessment team confirmed that communications with local stakeholders was being carried out in 14/01/2021 by the project owner during this monitoring period. There are no negative comments received for the project during this monitoring period.

Furthermore, via checking questionnaires from local stakeholders and interviewing with staff from local Environment Bureau and local residents during the site visit, it is confirmed by the assessment team that during the implementation stage of this monitoring period, local authority has conducted follow-up interviews and ongoing communication with local stakeholders to collect any comments or inputs to the project implementation. It is confirmed by the assessment team that there were no negative comments and issues from the local stakeholders during this monitoring period and the project passed all the periodic spot checks by local government.

Therefore, the assessment team was able to confirm that the stakeholder meeting was adequate and appropriate.

3.3.3 Environmental Impact

An Environmental Impact Assessment has been conducted by the project participants. The assessment team has reviewed the documentation of the presented information, eg. EIA Report /27/ and EIA Approval /31/. The EIA Approval confirms the correctness of the approach used by PPs. In conclusion, the PPs have followed the requirements of the host country with regards to addressing environmental impacts as below:

Air quality

By checking EIA Report /27/, EIA Approval /31/ and site interview with stakeholders, the assessment team confirmed the contribution of exhaust contaminants from the project emissions to prediction is small, and the impact of contaminants on the surrounding area is relatively light.

Wastewater

By checking EIA Report /27/, EIA Approval /31/ and site interview with stakeholders, the assessment team confirmed wastewater concentration of the project is within the acceptable range of the sewage plant and has no impact on the surface water environment. According to the latest technical Guidelines for environmental impact Assessment (HJ610-2016), groundwater impact assessment is not required for the project.

Noise

By checking EIA Report /27/, EIA Approval /31/ and site interview with stakeholders, the assessment team confirmed after the facilities of each workshop are rationally arranged, and the main noise equipment is noise-isolated and noise-muffled, which has a small impact on the surrounding sound environment during the operation period, and the contribution value of the noise at the plant boundary can meet the requirements of II in the Environmental Noise Emission Standard for Industrial Enterprises at the Plant Boundary (GB12348-2008). It does not affect sensitive points of sound environment outside the field boundary.

Solid waste

By checking EIA Report /27/, EIA Approval /31/ and site interview with stakeholders, the assessment team confirmed after effective treatment measures are taken, all kinds of solid wastes generated during the operation of the project can be effectively treated and not be directly discharged into the external environment, so there is no adverse impact on the surrounding ecological environment.

In conclusion, 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.

3.3.4 Public Comments

The assessment team noted that this project was open for public comment from 21/12/2021 to 20/01/2022. The detail was checked by the assessment team in the following web platform: <https://registry.verra.org/app/projectDetail/VCS/2746>.

During the period, no public comments were received.

3.3.5 AFOLU-Specific Safeguards

The project activity is not an AFOLU project.

For non-AFOLU projects, this section is not required.

3.4 Application of Methodology

3.4.1 Title and Reference

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

Title	Alternative waste treatment processes
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 359,014 tCO ₂ e which is more than 60,000 tonnes of CO ₂ e per year.
Methodology	Alternative waste treatment processes, ACM0022, Version 03.0
Type I	Energy industries (renewable / non-renewable sources)
Sectoral scope(s)	01 and 13
Category	Approved Consolidated Methodology
Tools	Tools referred with above methodology and applicable for project activity are: - Combined tool to identify the baseline scenario and demonstrate additionality (version 07.0); - Common practice (version 03.1); - Investment analysis (version 11.0); - Emissions from solid waste disposal sites (version 08.0); - Project and leakage emissions from anaerobic digesters (version 02.0); - Tool to calculate the emission factor for an electricity system (version 07.0); - Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation (version 03.0); - Tool to determine the mass flow of a greenhouse gas in a gaseous stream (version 03.0); - Project emissions from flaring (version 04.0).

3.4.2 Applicability

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

Applicability criteria	Justification of the project situation
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; (c) Co-composting of wastewater in	By checking FSR /28/ and through site visit, the assessment team confirmed that the project activity utilizes the biogas from anaerobic digestion of fresh waste for power generation. Therefore, the project is applicable to (b). As per condition h, conditions i to n is applicable to all project activity using this methodology.

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 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.	<u>(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;</u> By checking FSR /28/ and through site visit, the assessment team confirmed that the project activity utilizes fresh waste for anaerobic digestion, only emission reductions from treatment of fresh waste are claimed, emission reductions from waste heat recovery and biodiesel production system are not claimed. Therefore, condition (i) is applicable. <u>(j) Neither the fresh waste nor the products from the project plant are stored on-site under anaerobic conditions;</u> By checking FSR /28/ as well as interviewing with PP and stakeholder through site visit, the assessment team confirmed that fresh wastes are treated through anaerobic digestion, which are not stored on-site; digestate produced from the anaerobic digestion of the project activity will be transported outside for incineration by thermal power plant, which are not stored on-site. Furthermore, no fresh wastes and digestate were identified through on site inspection. Therefore, condition (j) is applicable. <u>(k) Any wastewater discharge resulting from the project activity is treated in accordance with applicable regulations;</u> By checking EIA Approval and through site visit, the assessment team confirmed that wastewater produced by the project will be treated aerobically by wastewater treatment plant nearby in accordance with applicable regulations. Therefore, condition (k) is applicable. <u>(i) The project activity does not reduce the amount of waste that would be recycled in the absence of the project activity. This shall be justified and documented in the clean development mechanism project design document (CDM-PDD);</u> By checking FSR /28/, as well as interview PP and stakeholder through site visit, the assessment team confirmed that prior to the implementation of the project activity,
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	the fresh waste was disposed at nearby landfill with a partial LFG capture system. The project will not reduce the amount of waste that would be recycled in the absence of the project activity. Therefore, condition (i) is applicable. <u>(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;</u> By checking public information, the assessment team confirmed that no regulations that mandates the waste treatment process implemented under the project activity. Landfill is the most common disposal method for fresh waste. Therefore, condition (m) is applicable. <u>(n) Hazardous wastes/wastewater are not eligible under this methodology.</u> The fresh waste utilized by the project activity is municipal solid waste (MSW), not hazardous wastes or wastewater. Therefore, condition (n) is applicable.
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 cogeneration plant, boiler or air heater (H2 or H4).	By checking FSR /28/ and through site visit, the assessment team confirmed that prior to the implementation of the project activity, the fresh waste was disposed at nearby landfill with a partial LFG capture system. Therefore, M2 is baseline scenario of the project activity. By checking FSR /28/ and through site visit, the assessment team confirmed that the electricity generated by the project activity is supplied to CSPG which is dominated by coal-fired power stations. Therefore, P6 is baseline scenario of the project activity. Therefore, criteria (a) and (c) is applicable.
Specific applicability conditions for the different processes are provided in Table 2 of ACM0022 (Version 03.0).	By checking FSR /28/ and through site visit, the assessment team confirmed that the project activity utilizes biogas from

	anaerobic digestion of fresh waste. By checking Summary Table of quantity and fraction of treated fresh waste /63/, it is confirmed the fresh waste of the project is mainly kitchen and catering waste from Guangzhou City. The production of this project activity is biodiesel and electricity, there is no non-biodegradable materials of waste by-products that may have market value. "Project and leakage emissions from anaerobic digesters" (version 02.0) is applicable to this project activity.
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Applicability conditions of "Project and leakage emissions from anaerobic digesters" (version 02.0)

Applicability criteria	Justification of the project situation
The following sources of project emissions are accounted for in this tool: (a) CO₂ emissions from consumption of electricity associated with the operation of the anaerobic digester; (b) CO₂ emissions from consumption of fossil fuels associated with the operation of the anaerobic digester; (c) CH₄ emissions from the digester (emissions during maintenance of the digester, physical leaks through the roof and side walls, and release through safety valves due to excess pressure in the digester); and (d) CH₄ emissions from flaring of biogas.	By checking FSR /28/ of the project activity, the assessment team confirmed that the source (a), (b) and (d) are accounted for the project emissions of the project activity. Source (b) are not accounted for the project emissions of the project activity. Therefore, this criteria is applicable.
The following sources of leakage emissions are accounted for in this tool: (a) CH₄ and N₂O emission from composting of digestate; (b) CH₄ emissions from the anaerobic decay of digestate disposed in a SWDS or subjected to anaerobic storage, such as in a stabilization pond.	By checking the FSR /28/ and through on-site interview, the assessment team confirmed that the digestate from anaerobic digestion in the project will be outward transported and incinerated directly in thermal power plant. Furthermore, no digestate or composting equipment was identified through on-site inspection. Therefore, the project activity does not involve composting of digestate or the anaerobic decay of digestate disposed in a SWDS or subjected to anaerobic storage, such as in a stabilization pond. Therefore, sources (a) and (b) are not accounted for the leakage emissions of the

	project activity.
Emission sources associated with N ₂ O emissions from physical leakages from the digester, transportation of feed material and digestate or any other on-site transportation, piped distribution of the biogas, aerobic treatment of liquid digestate and land application of the digestate are neglected because these are minor emission sources or because they are accounted in the methodologies referring to this tool.	By checking the FSR /28/ and through on-site interview, the assessment team confirmed that the project activity involve N ₂ O emissions from physical leakages from the digester, transportation of feed material and digestate or any other on-site transportation, piped distribution of the biogas, which are minor emission sources of the project and was neglected. Therefore, this criteria is applicable.

Applicability conditions in tool "Emissions from solid waste disposal sites" (version 08.0)

Applicability criteria	Justification of the project situation
The tool can be used to determine emissions for the following types of applications: (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. "ACM0001: Flaring or use of landfill gas"). 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	By checking the FSR /28/ and through on-site interview, the assessment team confirmed that application B, the project activity avoids or involves the disposal of waste at a SWDS is applicable and ACM0022 is applicable for the project activity, in which municipal solid waste (MSW) is treated and with an alternative option 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. By checking the joint PD&MR (version 2.1 dated 14/07/2022), it is confirmed PP chooses to apply this tool for both ex ante and ex post estimation of emissions other than simplified approach. By checking the FSR /28/ and through on-site interview, the assessment team confirmed that the project utilizes MSW which mainly includes kitchen and catering waste of Guangzhou City, then tool should be applied separately to the MSW.

simplified approach detailed in 0 when calculating baseline emissions. These two types of applications are referred to in the tool for determining parameters. In the case that: (a) different types of residual waste are disposed or prevented from disposal; or that (b) both MSW and residual waste(s) are prevented from disposal, then the tool should be applied separately to each residual waste and to the MSW.	
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Applicability conditions of "Tool to calculate the emission factor for an electricity system" (version 07.0)

Applicability criteria	Justification of the project situation
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).	By checking the PPA /23/ of the project activity, the assessment team confirmed that the electricity supplied by the project was exported to CSPG. OM, BM and CM are estimated using the tool for calculating baseline emissions for the project activity.
Under this tool, the emission factor for the project electricity system can be calculated either for grid power plants only or, as an option, can include off-grid power plants. In the latter case, two sub-options under the step 2 of the tool are available to the project participants, i.e. option 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 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.	By checking the PPA /23/ of the project activity, the assessment team confirmed that the electricity generated by the project activity was exported to CSPG. The emission factor for the project electricity system is calculated for grid power plants.
In case of CDM projects the tool is not applicable if the project electricity system is located partially or totally in an Annex I	By checking the Project Approval /26/ of the project activity, the assessment team confirmed the project activity is located in P.

country.	R. China, not in any Annex I country.
Under this tool, the value applied to the CO ₂ emission factor of biofuels is zero.	By checking the FSR /28/ and through on-site interview, the assessment team confirmed that the project activity does not involve biofuels.

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

Applicability criteria	Justification of the project situation
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. Hence, the electricity consumer can be provided with electricity from the captive power plant(s) and the grid.	For the project activity, emissions are calculated for electricity consumption from grid and the electricity is purchased from grid only. Therefore, Scenario A "Electricity consumption from the grid" was applies to the sources of electricity consumption for the project activity.
This tool can be referred to in methodologies to provide procedures to monitor amount of electricity generated in the project scenario, only if one out of the following three project scenarios applies to the recipient of the electricity generated: (a) Scenario I: Electricity is supplied to the grid;	This tool can be referred to in methodologies to provide procedures to monitor amount of electricity generated in the project scenario, and Scenario I: "Electricity is supplied to the grid" applies to the recipient of the electricity generated.

(b) Scenario II: Electricity is supplied to consumers/electricity consuming facilities; or (c) Scenario III: Electricity is supplied to the grid and consumers/electricity consuming facilities.	
This tool is not applicable in cases where captive renewable power generation technologies are installed to provide electricity in the project activity, in the baseline scenario or to sources of leakage. The tool only accounts for CO₂ emissions.	Through on-site interview, the assessment team confirmed that no captive renewable power generation technologies are installed to provide electricity in the project activity, in the baseline scenario or to sources of leakage. Therefore, the assessment team confirmed that the tool is applicable for the project activity.

Applicability conditions of "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 03.0)

Applicability criteria	Justification of the project situation
Typical applications of this tool are methodologies where the flow and composition of residual or flared gases or exhaust gases are measured for the determination of baseline or project emissions.	The project uses biogas recovered from anaerobic digestion for power plant. For ex post emission reduction calculation, this tool will be applied.
Methodologies where CO₂ is the particular and only gas of interest should continue to adopt material balances as the means of flow determination and may not adopt this tool as material balances are the cost effective way of monitoring flow of CO₂.	The project activity adopts ACM0022. By checking the FSR /28/ and through on-site interview, the assessment team confirmed that The biogas produced from anaerobic digestion of fresh waste includes CH₄, CO₂, NH₃ etc. and CO₂ is not the particular or only gas of interest. Therefore, the assessment team confirmed that the tool is applicable.
The underlying methodology should specify: (a) The gaseous stream the tool should be applied to; (b) For which greenhouse gases the mass flow should be determined; (c) In which time intervals the flow of the gaseous stream should be measured; and (d) Situations where the simplification offered for calculating the molecular mass of the gaseous stream (equations (3) or (17)) is not valid (such as the gaseous stream is predominantly composed of a gas other than	The project activity adopts ACM0022: (a) the amount of biogas recovered from anaerobic digestion which is used for electricity generation for the project activity in year y is determined using the tool; (b) CH₄ is the greenhouse gas that the mass flow should be determined; (c) The mass flow should be calculated on an hourly basis for each hour h in year y; (d) The simplification offered for calculating the molecular mass of the gaseous stream is valid (equations (3) or (17) in the tool).

N2).

Applicability conditions in tool "Combined tool to identify the baseline scenario and demonstrate additionality" (version 07.0)

Applicability criteria	Justification of the project situation
The tool is applicable to all types of proposed project activities. However, in some cases, methodologies referring to this tool may require adjustments or additional explanations as per the guidance in the respective methodologies. This could include, inter alia, a listing of relevant alternative scenarios that should be considered in Step 1, any relevant types of barriers other than those presented in this tool and guidance on how common practice should be established.	The project activity utilized biogas from anaerobic digestion of fresh wastes and applies the methodology ACM 0022. Therefore, this criteria is applicable.

Applicability conditions in tool "Common practice" (version 03.1)

Applicability criteria	Justification of the project situation
This methodological tool is applicable to project activities that apply the methodological tool "Tool for the demonstration and assessment of additionality", the methodological tool "Combined tool to identify the baseline scenario and demonstrate additionality", or baseline and monitoring methodologies that use the common practice test for the demonstration of additionality. In case the applied approved baseline and monitoring methodology defines approaches for the conduction of the common practice test that are different from those described in this methodological tool, the requirements contained in the methodology shall prevail.	As per the Methodology ACM 0022, the project activity adopts the methodological tool "Tool for the demonstration and assessment of additionality", therefore, this criteria is applicable. The latest version of "Common practice" is applied for the project activity.

Applicability conditions in tool " investment analysis" (version 11.0)

Applicability criteria	Justification of the project situation
This methodological tool is applicable to project activities that apply the methodological tool "Tool for the demonstration and assessment of additionality", the methodological tool "Combined tool to identify the baseline scenario and demonstrate additionality", the guidelines "Non-binding best practice examples to demonstrate additionality	The project activity adopts the methodological tool "Tool for the demonstration and assessment of additionality"for the demonstration of additionality and/or the identification of the baseline scenario. Therefore, this criteria is applicable.

for SSC project activities”, or baseline and monitoring methodologies that use the investment analysis for the demonstration of additionality and/or the identification of the baseline scenario. In case the applied approved baseline and monitoring methodology contains requirements for the investment analysis that are different from those described in this methodological tool, the requirements contained in the methodology shall prevail.	
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Applicability conditions in tool "Project emissions from flaring" (version 03.0)

Applicability criteria	Justification of the project situation
This tool provides procedures to calculate project emissions from flaring of a residual gas. The tool is applicable to enclosed or open flares and project participants should document in the CDM-PDD the type of flare used in the project activity.	By checking the FSR /28/ and through on-site interview, the assessment team confirmed that the project activity includes enclosed flare and the type of flare used in the project activity has been documented in the joint PD&MR. Therefore, this criteria is applicable.
This tool is applicable to the flaring of flammable greenhouse gases where: (a) Methane is the component with the highest concentration in the flammable residual gas; and (b) The source of the residual gas is coal mine methane or a gas from a biogenic source (e.g. biogas, landfill gas or wastewater treatment gas).	By checking the FSR /28/ and through on-site interview, the assessment team confirmed that the project activity utilizes biogas produced by anaerobic digestion for power generation. The main component of biogas is methane. Therefore, this criteria is applicable.
The tool is not applicable to the use of auxiliary fuels and therefore the residual gas must have sufficient flammable gas present to sustain combustion. For the case of an enclosed flare, there shall be operating specifications provided by the manufacturer of the flare.	By checking the FSR /28/ and through on-site interview, the assessment team confirmed that the project activity does not use auxiliary fuels. By checking Technical Agreement of the enclosed flare of the project activity /46/ of the enclosed flare of the project activity and Statistic of production data covering this monitoring period /66/, it is confirmed that the methane content is greater than 50% and therefore, the assessment team deemed that the residue gas have sufficient flammable gas present to sustain combustion.

The assessment team confirmed that the application of the baseline methodology is transparent and conservative and confirms that the chosen baseline and monitoring methodology i.e. ACM0022 Version 03.0 is applicable to the project activity.

The project activity qualifies as Type I during every year of the crediting period in accordance with applicable provisions for project activity eligibility as discussed above. Also, annual average GHG emission reductions or removal per year of the project activity is 359,014 tCO₂e, more than 60,000 tonnes of CO₂e per year, which is applicable as per large scale project activities methodology ACM0022 Version 03.0.

3.4.3 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. In the case that the project provides electricity to a grid, then the spatial extent of the project boundary will also include those plants connected to the energy system to which the plant is connected. If upgraded biogas is fed to a natural gas distribution system, then the natural gas distribution system is also included in the boundary.

Therefore, the assessment team confirmed that the spacial extent of project boundary of the project activity includes SWDS where the waste is disposed of in the baseline, the anaerobic digestion system, the biogas power plant, and those plants connected to CSPG to which the plant is connected. According to China DNA¹, CSPG covers Guangdong Province, Guangxi Autonomous Region, Yunnan Province, Guizhou Province and Hainan Province.

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

Source		Gas	Included	Justification/explanation
Baseline	Emissions from heat generation	CO ₂	No	The emission reductions for heat generation is excluded for simplification. This is conservative. Therefore, it is reasonable the emission sources in the baseline are excluded.
		CH ₄	No	
		N ₂ O	No	
	Emissions at the SWDS	CH ₄	Yes	The major source of emissions in the baseline
		N ₂ O	No	As per ACM 0022, N ₂ O emissions are small compared to CH ₄ emissions from landfills. Exclusion of this gas is conservative.
		CO ₂	No	As per ACM 0022, for the project activity, CO ₂ emissions from the decomposition of fresh waste are not accounted for.

¹ <http://www.mee.gov.cn/ywgz/ydqhbh/wsqtz/202012/W020201229610353340851.pdf>

Source		Gas	Included	Justification/explanation
	Emissions from anaerobic lagoons or sludge pits	CO ₂	No	By checking FSR /28/ and through site visit, it is confirmed that the project activity does not involve anaerobic lagoons or sludge pits. Therefore, the emissions from anaerobic lagoons or sludge pits are excluded.
		CH ₄	No	
		N ₂ O	No	
	Emissions from electricity generation	CO ₂	Yes/	As per ACM 0022, it is a major source as electricity generation is included in the project activity and is sent to the grid or displaces fossil fuel fired electricity generation in the baseline.
		CH ₄	No	As per ACM 0022, it is excluded for simplification. This is conservative.
		N ₂ O	No	As per ACM 0022, it is excluded for simplification. This is conservative.
	Emissions from use of natural gas	CO ₂	No	By checking FSR /28/ and through site visit, it is confirmed that the project activity does not involve use of natural gas. Therefore, Emissions from use of natural gas are excluded.
		CH ₄	No	
		N ₂ O	No	
Project activity	Emissions from on-site fossil fuel consumption due to the project activity other than for electricity generation	CO ₂	No	By checking FSR /28/ and through site visit, it is confirmed that the project activity does not involve on-site fossil fuel consumption. Therefore, Emissions from on-site fossil fuel consumption due to the project activity other than for electricity generation are excluded.
		CH ₄	No	
		N ₂ O	No	
	Emissions from on-site electricity use	CO ₂	Yes	As per ACM 0022, for the project activity, it is an important emission source.
		CH ₄	No	As per ACM 0022, it is excluded for simplification. This emission source is assumed to be very small.
		N ₂ O	No	As per ACM 0022, it is excluded for simplification. This emission source is assumed to be very small.
	Emissions from the waste treatment processes	N ₂ O	No	By checking FSR /28/ and through site visit, it is confirmed that the project activity does not involve composting, incineration, syngas produced or RDF/SB combustion. Therefore, N ₂ O emitted from composting, incineration, syngas produced and RDF/SB combustion are excluded.
		CO ₂	No	By checking FSR /28/ and through site visit, it is confirmed that the project activity does not involve incineration, gasification or combustion of fossil-based waste. Therefore, CO ₂ emitted from incineration, gasification or combustion of fossil-based waste are excluded. Also, as per ACM 0022, for the project activity, CO ₂ emissions from the decomposition or combustion of fresh waste are not accounted.
		CH ₄	Yes	By checking FSR /28/ and through site visit, it is confirmed that the project activity does not involve incineration, gasification, composting and RDF/SB combustion. Therefore, CH ₄ emitted

Source		Gas	Included	Justification/explanation
				from incineration, gasification, composting and RDF/SB combustion are excluded. As per ACM 0022, for the project activity, CH ₄ leakage from the anaerobic digester and incomplete combustion in the flaring process are potential sources of project emissions.
	Emissions from wastewater treatment	CO ₂	No	As per ACM 0022, for the project activity, CO ₂ emissions from the decomposition of fresh waste are not accounted.
		CH ₄	No	By checking FSR /28/ and through site visit, it is confirmed that the project activity does not involve anaerobic treatment of wastewater. Therefore, CH ₄ emitted from anaerobic treatment of wastewater are excluded.
		N ₂ O	No	As per ACM 0022, it is excluded for simplification. This emission source is assumed to be very small.

3.4.4 Baseline Scenario

As per ACM0022 (Version 03.0), using "TOOL02: Combined tool to identify the baseline scenario and demonstrate additionality" (version 07.0) to identify the baseline scenario and demonstrate additionality.

As per "TOOL02: Combined tool to identify the baseline scenario and demonstrate additionality" (version 07.0), PP shall apply the following four Steps:

- (a) STEP 0. Demonstration that a proposed project activity is the first-of-its-kind;
- (b) STEP 1. Identification of alternative scenarios;
- (c) STEP 2. Barrier analysis;
- (d) STEP 3. Investment analysis (if applicable);
- (e) STEP 4. Common practice analysis.

STEP 0. Demonstration that a proposed project activity is the first-of-its-kind

The project activity utilizes biogas recovered from the anaerobic digestion of fresh waste, which is not a first-of-its-kind project activity in China. As per "TOOL02: Combined tool to identify the baseline scenario and demonstrate additionality" (version 07.0), for the project activity, Outcome of Step 0 is **Conclusion II: The proposed project activity is not the first-of-its-kind.**

STEP 1. Identification of alternative scenarios

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

The project activity utilized biogas recovered from anaerobic digestion of fresh waste for electricity generation.

As per ACM0022 (Version 03.0), For the treatment of the fresh waste, the following alternatives or combinations of these alternatives shall, inter alia, be considered:

Alternatives scenarios	Justification/explanation
M1: The project activity without being registered as a VCS project activity (i.e. any (combination) of the waste treatment processes listed in Table 2);	M1 is the project activity undertaken without being registered as a VCS project activity. High investment and operational cost results in the investment barrier. M1 does not violate laws and regulations and therefore M1 is an alternative scenario .
M2: Disposal of the fresh waste in a SWDS with a partial capture of the LFG and flaring of the captured LFG;	By checking public information, it is confirmed that LFG is not compulsorily recycled by laws and regulations in China. As per "Technical code for municipal solid waste sanitary landfill" (CJJ17-2004) /43/, landfills are required to be equipped with effective landfill gas from a safety perspective and shall take the initiative to adopt flaring treatment method. However, due to financial and/or technical difficulties, these regulations have not been widely implemented in China. As per the Development Overview of China's Urban Domestic Waste Treatment Industry in 2014 /44/, by the end of 2013, China had a total of 942 waste landfills, but only about 50 of them collected and utilized landfill gas or burned it by torch. As per published Article "Gas generation and collection and utilization in landfill" in 2015 /45/, most landfills in China are not equipped with gas collection devices, and the technology level is low, thus a large amount of gas is discharged in disorder. However, by checking Guangzhou municipal solid waste environmental pollution prevention information announcement from Guangzhou Municipal Ecological Bureau website, it is confirmed that 5 landfills with sufficient landfill capacity to treat MSW in Guangzhou City, only one landfill with a partial LFG capture system. Thus, the assessment team deemed that sufficient landfill capacity would be available to dispose waste at a SWDS with a comparable annual waste acceptance rate and with the same operating lifetime as the project activity. Although most landfills in China are not equipped with gas collection devices, scenario M2 selected which is more conservative than scenario M3. Therefore, M2 is a realistic and credible alternative scenario, which is conservative.

M3: Disposal of the fresh waste in a SWDS without a LFG capture system;	As justified above, M2 is a realistic and credible alternative scenario, which is conservative. Therefore, M3 is not a realistic and credible alternative scenario.
M4: Part of the fresh fraction of the solid waste is recycled and not disposed in the SWDS;	As justified above, through interviewing with PP and stakeholder through site visit, the assessment team confirmed that prior to the implementation of the project activity, the fresh waste was disposed at nearby landfill with a partial LFG capture system and therefore, it is deemed that Landfill is the most common disposal method for domestic waste including fresh waste currently. Therefore, M4 is not a realistic and credible alternative scenario.
M5: Part of the fresh fraction of the solid waste is treated aerobically and not disposed in the SWDS;	As justified above, Landfill is the most common disposal method for domestic waste including fresh waste currently. By checking FSR /28/ of the project activity, as well as interviewing with PP and stakeholders during site visit, it is confirmed that there is no such facilities in local area for aerobic treatment of fresh waste. Therefore, M5 is not a realistic and credible alternative scenario.
M6: Part of the organic fraction of the solid waste is incinerated and not disposed in the SWDS;	As justified above, Landfill is the most common disposal method for domestic waste including fresh waste currently. By checking FSR /28/ of the project activity, as well as interviewing with PP and stakeholders during site visit, it is confirmed that there is no such facilities for incineration of organic fraction of the solid waste. Therefore, M6 is not a realistic and credible alternative scenario.
M7: Part of the organic fraction of the solid waste is gasified and not disposed in the SWDS;	As justified above, Landfill is the most common disposal method for domestic waste including fresh waste currently. By checking FSR /28/ of the project activity, as well as interviewing with PP and stakeholders during site visit, it is confirmed that there is no such facilities for gasification of organic fraction of the solid waste. Therefore, M7 is not a realistic and credible alternative scenario.
M8: Part of the organic fraction of the solid waste is treated in an anaerobic digester and not disposed in the SWDS;	As justified above, Landfill is the most common disposal method for domestic waste including fresh waste currently. By checking FSR /28/ of the project activity, as well as interviewing with PP and stakeholders during site visit, it is confirmed that there is no such facilities for anaerobic digestion of organic fraction of the solid waste. Therefore, M8 is not a realistic and credible alternative scenario.
M9: Part of the organic fraction of the solid waste	As justified above, Landfill is the most common disposal method

is mechanically or thermally treated to produce RDF/SB and not disposed in the SWDS.	for domestic waste including fresh waste currently. By checking FSR /28/ of the project activity, it is confirmed that there is no such facilities for mechanically or thermally treatment of organic fraction of the solid waste to produce RDF/SB. Therefore, M9 is not a realistic and credible alternative scenario.
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As per ACM0022 (Version 03.0), For electricity generation the following alternatives or combinations of these alternatives, inter alia, shall be considered:

Alternatives scenarios	Justification/explanation
P1: Electricity generated as an output of one of the waste treatment processes listed in Table 1, not undertaken as a CDM project activity;	The project scenario is electricity generated as an output of biogas recovered from anaerobic digestion of fresh waste. P1 is the project activity undertaken without being registered as a VCS project activity. High investment and operational cost results in the investment barrier. P1 does not violate laws and regulations and therefore P1 is an alternative scenario .
P2: Use of an existing or construction of a new on-site or off-site fossil fuel fired cogeneration plant;	By checking FSR /28/ of the project activity and through on site inspection, it is confirmed that there is no existing of on-site or off-site fossil fuel fired cogeneration plant in the project site. Furthermore, the project activity recovers biogas from anaerobic digestion of fresh waste for electricity generation, not involving construction of a new on-site or off-site fossil fuel fired cogeneration plant. Therefore, P2 is not an alternative scenario.
P3: Existing or new construction of an on-site or off-site renewable based cogeneration plant;	By checking FSR /28/ of the project activity and through on site inspection, it is confirmed that there is no existing of on-site or off-site renewable based cogeneration plant in the project site. Furthermore, the project activity recovers biogas from anaerobic digestion of fresh waste for electricity generation, not involving construction of a new on-site or off-site renewable based cogeneration plant. Therefore, P3 is not an alternative scenario.
P4: Existing or new construction of an on-site or off-site fossil fuel fired electricity plant;	According to Chinese power regulation /30/, the construction of thermal power plant with a capacity of 135MW or below is prohibited. Therefore, construction of a thermal power plant with the same capacity as the project activity using fossil fuel would be prohibited. Therefore, P4 is not an alternative scenario.
P5: Existing or new construction of an on-site or off-site renewable based electricity plant;	Wind, solar photovoltaic, hydro, biomass and geothermal energy are feasible renewable energy sources and that renewable electricity can be applied to CSPG. The project site is in Guangzhou City, capital city of Guangdong

	Province, which belongs to IV area with relatively scarce wind resources /47/. Furthermore, it is not suitable to construction wind farms in the project site. The project site is in Guangzhou City, capital city of Guangdong Province, which belongs to III area with relatively scarce solar resources /48/. Furthermore, it is not suitable to construction wind farms in the project site. The project site is in Guangzhou City, capital city of Guangdong Province. Although Guangdong Province is rich in water resources, the water resources of Guangzhou City, where the project is located, are at a low-medium level compared with Yangtze and Yellow river basins /71/. Furthermore, since the project is located in the provincial capital city area, which is not suitable for the construction of hydropower stations. Biomass energy in China is mainly distributed in the Shandong Province. Anhui Province, Heilongjiang Province, Hubei Province and Jiangsu Province /49/. The project site is in Guangzhou City, capital city of Guangdong Province, with no rich biomass resources. Geothermal resources is mainly distributed in southern Tibet, western Sichuan and western Yunnan /50/. The project site is in Guangzhou City, capital city of Guangdong Province, with no rich geothermal resources. Therefore, P5 is not an alternative scenario.
P6: Electricity generation in existing and/or new grid-connected electricity plants.	P6 is the current situation before implementation of the project activity, which complies with relevant laws and regulations. Therefore, P6 is an alternative scenario.

Outcome of Step 1a: as justified above, the list of plausible alternative scenarios to the project activity is M1 and M2 for the treatment of the fresh waste, P1 and P6 for electricity generation.

Step 1b: Consistency with mandatory applicable laws and regulations

As justified above, M1, M2, P1 and P6 are consistent with mandatory applicable laws and regulations.

Scenario ID	Treatment of the fresh waste	Electricity generation	Justification/explanation
Combined alternative scenario 1 (M1+P1):	M1	P1	Scenario 1 is the project activity undertaken without being registered as a VCS project activity. However, high investment and operational cost results in the investment barrier. Refer to investment analysis in 3.4.5 of this report.

Combined alternative scenario 2 (M1+P6):	M1	P6	M1 is biogas recovery by anaerobic digestion. Under this scenario, electricity is generated through biogas recovered. Therefore, M1 is conflict with P6 and scenario 2 is not a possible baseline scenario alternative.
Combined alternative scenario 3 (M2+P1):	M2	P1	P1 is electricity generated as an output through biogas recovery by anaerobic digestion. Under this scenario, fresh waste is disposed through anaerobic digestion. Therefore, P1 is conflict with M2 and scenario 3 is not a possible baseline scenario alternative.
Combined alternative scenario 4 (M2+P6):	M2	P6	This is the continuation of business as usual. This is a possible baseline scenario alternative.

Outcome of Step 1b: as justified above, the list of plausible alternative scenarios to the project activity is scenario 1 (M1+P1) and scenario 4 (M2+P6).

Step 2: Barrier analysis

The project activity is not the first-of-its-kind project. The combination of scenario 4 (M2+P6) is not prevented by any barrier. The remaining alternative scenario 1 (M1+P1) include the proposed project activity undertaken without being registered as a VCS project activity.

As per "TOOL02: Combined tool to identify the baseline scenario and demonstrate additionality" (version 07.0), If more than one alternative scenario is not prevented by any barrier, and if the proposed project activity is not the first-of-its-kind, and the remaining alternative scenarios include the proposed project activity undertaken without being registered as a VCS project activity, then proceed to Step 3 (Investment Analysis).

Outcome of Step 2: **proceed to Step 3 (Investment Analysis).**

3.4.5 Additionality

According to the methodology ACM0022 (Version 03.0), using "TOOL02: Combined tool to identify the baseline scenario and demonstrate additionality" (version 07.0) to identify the baseline scenario and demonstrate additionality.

Step 3: Investment analysis

The objective of Step 3 is to compare the economic or financial attractiveness of the alternative scenarios remaining after Step 2 by conducting an investment analysis.

The parameters used in the financial calculations have been validated based on a review of the sources presented in the joint PD&MR, including: FSR /28/, Economic Evaluation Measurement and Parameters of Constructive Projects version 03 /33/ etc. The FSR /28/ of

the project was completed by a qualified third-party design institute - China Light Industry Guangzhou Academy of Engineering. The time period between the finalization of the FSR /28/ (Nov 2016) and the investment decision (15/09/2016) is about 2 month, therefore it's unlikely that the input values have significantly changed. 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 People's Republic of China for Enterprises issued by the Chairman of the People's Republic of China /36/;

- Interim Regulation of VAT of the People's Republic of China issued by State Council /37/.

Choice of approach

Scenario 4 (M2+P6) is the continuation of current business-as-usual scenario, which does not involve an investment from the project participants and therefore no investment analysis is required for this scenario.

Scenario 1 (M1+P1) is the implementation of project activity without VCS, utilizing biogas recovered from anaerobic digestion of fresh waste for electricity generation. As the project generates financial and economic benefits other than VCS related income through the sales of electricity and biodiesel. A Benchmark Analysis was chosen and conducted for investment analysis of scenario 1 (M1+P1) and the financial indicator - IRR, was chosen.

Benchmark Selection

The project activity produces biodiesel and electricity, of which biodiesel revenue is the main revenue of the project activity. The IRR benchmark (12%) used for the financial analysis in the FSR /28/ was obtained from the Economic Evaluation Measurement and Parameters of Constructive Projects, version 03 issued by NDRC and the Ministry of Construction /33/. The benchmark IRR of total investment (before tax) for Petroleum Processing and Petroleum Products Manufacturing industry in China is 12%. As project activity produces electricity and biodiesel, the benchmark IRR of Petroleum Processing and Petroleum Products Manufacturing industry in China 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 joint PD & MR submitted for registration and issuance. The input parameters used in the financial analysis are sourced from FSR /28/.

An approval letter of the FSR /28/ 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 /28/ 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 /28/

for the project was developed by a qualified designing institute - China Light Industry Guangzhou Academy of Engineering and approved by Guangzhou City Development and Reform Commission on 02/12/2016.

The assessment team compared the values stated in the joint PD & MR with values determined in the FSR /28/ and was able to confirm that the input values are applied correctly in the joint PD & MR.

Item		Unit	Value	Source
Installed capacity		MW	10.34	FSR /28/
Total investment		CNY	853,592,601	FSR /28/
Working capital		CNY	3,007,000	FSR /28/
Plant load factor		%	85.34	FSR /28/
Annual electricity generation		MWh/year	77,303	FSR /28/
Power self-consumption ratio		%	20%	FSR /28/
Annual electricity exported		MWh/year	61,842	FSR /28/
Electricity Tariff (including VAT)		CNY/kWh	689	FSR /28/
Biodiesel quantity		T	13,200	FSR /28/
Biodiesel price (including VAT)		CNY/t	7,000	FSR /28/
Subsidy price		CNY/t	109	FSR /28/
MSW quantity		T	673,200	FSR /28/
Value added tax (VAT)		%	17	FSR /28/
Value Added Tax (VAT) refund for biodiesel		%	70	FSR /28/
Urban maintenance and construction tax		% of VAT	7	FSR /28/
Surtax for education		% of VAT	5	FSR /28/
Depreciation period		Year	25	FSR /28/
Deductible equipment VAT		CNY	74,020,412	FSR /28/
Fixed assets		CNY	746,704,466	FSR /28/
Annual operation and management (O&M) cost	Total	CNY	119,705,508	FSR /28/
	Annual maintenance cost	CNY	17,920,907	FSR /28/
	Annual staff salary and welfare	CNY	26,174,400	FSR /28/
	Annual insurance	CNY	1,866,761	FSR /28/
	Annual material fee	CNY	44,090,000	FSR /28/
	Waste treatment fee	CNY	20,570,000	FSR /28/
	Annual other cost	CNY	9,083,440	FSR /28/
Construction period		Year	2	FSR /28/
Operation period		Year	25	FSR /28/

Expected VER Price	CNY/tCO ₂ e	20	Assumption
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The accuracy and suitability of the input values for the investment analysis were crosschecked as below:

Total Investment: 853,592,601 CNY

Total Static Investment: 820,724,800 CNY

Fixed assets: 746,704,466 CNY

The total investment cost estimated in FSR /28/ is 853,592,601 CNY. The same data is stated in the FSR /28/ approval issued by Guangzhou City Development and Reform Commission on 02/12/2016.

By checking FSR /28/, it is confirmed that the total Static Investment is 820,724,800 CNY. total Static Investment is calculated as: Total Static Investment = Total Investment - Interest during construction - Fluid capital. By checking FSR /28/, it is confirmed that interest during construction and Fluid capital was 29,860,723 CNY and 3,007,000 CNY. By checking the Construction General Contract /21/, Equipment Purchase Contract /51/ and list of contracts of the project activity /19/, the assessment team confirmed that the investment cost of the project activity was 850,253,190.4CNY, which is greater than the value of static total investment in the FSR /28/. Therefore, the assessment team was able to confirm that the static total investment in the FSR was reasonable and conservative.

By checking FSR /28/, it is confirmed that the equipment cost is 509,434,600CNY. By checking Interim Regulation of VAT of the People's Republic of China issued by State Council /37/, it is confirmed that the VAT of equipment is 17%. Considering 17% VAT rate of equipment, the Deductible VAT cost of equipment is calculated to be $509,434,600 / (100\% + 17\%) * 17\% = 74,020,412$ CNY. Therefore, the fixed assets is calculated to be total static investment - deductible VAT cost = $820,724,800 - 74,020,412 = 746,704,466$ CNY.

O&M cost: 119,705,508 CNY

The O&M cost is consistent of Annual maintenance cost, Annual staff salary and welfare, Annual insurance, Annual material fee, Waste treatment fee and Annual other cost. Each component has been verified by the assessment team.

a) Annual maintenance cost: 17,920,907 CNY

The annual maintenance cost was estimated as 17,920,907 CNY in IRR calculation, which accounts for 2.4% of fixed asset investment. The assessment team did not find suitable guidelines for maintenance cost of the specific project activity. However, the rate 2.4% of annual maintenance cost is considered by the technical expertise in the assessment team as appropriate and conservative because as per the publication issued by China Planning Press -

Financial Evaluation Practice and Analysis of Difficult Problems-Feasibility study and evaluation of Bank loan projects /42/, such rate is 3%~5%.

Meanwhile, the assessment team has crosschecked the cost rate against public available information. According to the literature "Project Economic Evaluation"public available /54/ that as the common practice, a rate of 3%~5% is adopted as the ratio of maintenance cost to the fixed assets value for investment projects in China. Therefore, the maintenance cost rate estimated in the project activity is considered not over estimated.

b) Annual staff salary and welfare: 26,174,400 CNY

Annual staff salary and welfare was estimated to be 328 persons*70,000 CNY/person year, and the Rate of welfare expense is 14%. According to 2016 Guangzhou Statistic Yearbook /39/, the average wage of employees in Petrochemical Industry in Guangzhou City of year 2015 is 95,315 CNY/year and that in Power Industry in Guangzhou City of year 2015 is 112,095 CNY/year. The estimation of wage and welfare of the employees is 79,800 (70,000*(1+14%)) CNY/person per year which is lower than local industrial average wage level when FSR /28/ was compiled.

328 employees will be employed due to the implementation of the project activity. The number is appropriate by checking staff roster /74/, considering operators and technicians should be available for the newly installed large scale project activity. Therefore it's considered that the wage and welfare is not over estimated.

c) Annual insurance: 1,866,761 CNY

The annual insurance was estimated as 1,866,761 CNY in FSR /28/, which accounts for 0.25% of the fixed assets. The assessment team did not find suitable guidelines for equipment insurance of the specific project activity. The rate 0.25% of fixed assets is considered by the technical expertise in the assessment team as appropriate and conservative because the value was below the reasonable range (0.3%~0.6%) mentioned in Compilation method of municipal engineering investment estimation issued by Ministry of Construction of China /40/ and public available at internet.

d) Annual material fee: 44,090,000 CNY

The annual material fee was estimated as 44,090,000 CNY in FSR /28/, with unit raw material price of 3,340 CNY/t. The assessment team did not find suitable guidelines for material fee of the specific project activity. Instead, the assessment team crosschecked the annual material fee of the project activity (3,340 CNY/t) with one other CDM project with UNFCCC ID. 8158 (4,456 CNY/t) and considers annual material fee of the project activity as conservative. Furthermore, by checking 2021 Financial Cost Statement /72/, it is confirmed the actual material fee of year 2021 was 81,823,930 CNY, which is larger than that estimated in the FSR and therefore, the assessment team considers the annual material fee in the FSR /28/ was conservative and not over estimated.

e) Waste treatment fee: 20,570,000 CNY

The waste treatment fee was estimated as 20,570,000 CNY in FSR /28/. Considering 45% ratio between input and output solid and liquid waste and its traffic expense, the unit waste treatment cost was calculated as 67.9 CNY/tonne in the FSR /28/. The assessment team did not find suitable guidelines for waste treatment cost of the specific project activity. Instead, the assessment team checked 2021 Financial Cost Statement /72/ and confirmed the actual waste treatment fee of year 2021 was 20,603,294 CNY and the waste produced by the project activity during year 2021 was 294,332t, thus, the actual unit waste treatment cost of year 2021 was calculated to be 70 CNY, which is almost the same as that estimated in the FSR. Therefore, the assessment team was able to confirm that the waste treatment fee in the FSR /28/ was reasonable.

f) Annual other cost: 9,083,440 CNY

The annual other cost was estimated as 9,083,440 in FSR /28/. The assessment team did not find suitable guidelines for waste treatment cost of the specific project activity. Instead, the assessment team checked 2021 Financial Cost Statement /72/ and confirmed the actual other cost of year 2021 was 10,526,200 CNY, which is larger than that estimated in the FSR. Thus, the annual other cost applied in the FSR /28/ was conservative and not overestimated.

In general, each component of the O&M cost is crosschecked with plausible evidences.

Annual electricity generation: 77,303 MWh

Annual electricity exported: 61,842 MWh

The total installed capacity of the biogas generators are 10.34 MW. The annual average operational hours of the biogas generators are about 7,476 hours = 77,303 MWh / 10.34 MW, and the plant load factor is 85.34% = 7,476 h / 8,760 h. The plant self-consumption rate is 20%. The project activity have many equipment, such as MSW pre-treatment system, biodiesel production system, anaerobic digester, biogas purification system, electricity generation system and waste heat recovery system, which consume more power, therefore, the assessment team considers the 20% self-consumption rate as reasonable. Even if the self-consumption rate is 0, the IRR will be 9.14%, much lower than the benchmark. The annual operational hours as well as the plant load factor was determined ex-ante in the FSR /28/ completed by an independent and qualified 3rd party design institute - China Light Industry Guangzhou Academy of Engineering. The FSR /28/ has been approved by the government. Therefore, the assessment team considers that the determination of the plant load factor is reasonable.

The annual operational hours of the biogas generator are considered high. The assessment team crosschecked the annual operational hours biogas generators other registered CDM project activity using the same Methodology ACM0022, e.g. Project UNFCCC ID. 8461. The annual operational hours of biogas generators in Project UNFCCC ID. 8461 are 7,088 hours,

which is lower than that of the project activity. Therefore, it's considered by the assessment team that the annual operational hours of the project activity are not under estimated.

Meanwhile, if the biogas generators work at full load (i.e. operating for 8,760 hours a year), the annual electricity exported would be 72,463 MWh. Even the figure is used for investment analysis for calculating the IRR, the IRR will be 8.76%, still lower than benchmark.

Electricity tariff: 0.689 CNY/kWh including VAT

The electricity generated by the biogas generators will be supplied to CSPG. The same has been validated by the assessment team against the Power Purchase Agreement signed between the project owner and local power grid company. In the FSR /28/, the purchasing price of electricity was estimated as the electricity tariff for financial analysis. Therefore, it's confirmed that the electricity tariff of the project activity is not under estimated.

Biodiesel quantity: 13,200t

Biodiesel price: 7,000 CNY/t including VAT

The annual biodiesel quantity was estimated as 13,200t in FSR /28/. By checking Biodiesel Sales Statistic /52/, it is confirmed that the amount of biodiesel production in year 2021 was 8,670.3t, which is less than the designed value. Therefore, it's confirmed that the biodiesel quantity of the project activity is not under estimated.

The biodiesel price was estimated as 7,000 CNY/t including VAT in FSR /28/. By checking Sample of Biodiesel Purchase Agreement /53/, it is confirmed that the price of biodiesel is 7,900 CNY/t. If the figure is used for investment analysis for calculating the IRR, the IRR will be 9.37%, still lower than benchmark. Therefore, it's confirmed that the biodiesel price in the FSR /28/ is reasonable.

MSW quantity: 673,200t

MSW subsidy: 109 CNY/t including VAT

The annual MSW quantity was estimated as 673,200t in FSR /28/. By checking Summary Table of quantity and fraction of treated fresh waste /63/, it is confirmed that the amount of MSW from April 2020 to December 2021 (21 months) was 1,136,624.69t, that is to say, the actual annual average MSW quantity is 649,500t, which is less than the designed value. Therefore, it's confirmed that the MSW quantity of the project activity is not under estimated.

The MSW subsidy was estimated as 109 CNY/t including VAT in FSR /28/. By checking the BOT franchise agreement /32/, it is confirmed that the MSW subsidy is 109 CNY/t. Therefore, it's confirmed that the MSW subsidy of the project activity is not under estimated.

Taxes: see below

The taxes applied in the financial assessment are listed as:

Items	Value
Value Added Tax (VAT) for electricity and biodiesel	17%
Value Added Tax (VAT) refund for biodiesel	70%
Urban maintenance and construction tax	7%
Surtax for education	5%
Income tax	25%

Value Added Tax (VAT) for electricity is determined as 17% in the FSR /28/ 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 /29/. Value Added Tax (VAT) refund for biodiesel is determined as 70% in the FSR /28/ which is consistent with that in VAT refund policies issued by China State Taxation Administration /29/.

By cross checking with the national taxation regulations, sectoral regulations and other evidences, i.e. the "Interim Rules on Additional Tax for City Development" /34/ and the "Provisional Regulations of the People's Republic of China on Education tax" /35/, the assessment team was able to confirm that the Urban maintenance and construction tax and Surtax for education 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 People's Republic of China or Enterprises /36/ issued by the Chairman of the People's Republic of China on 16/03/2007.

Depreciation period and residual rate: 25 years and 5%

As per the FSR /28/, the residual rate is determined as 5% of the depreciation base (total static investment + interest during construction - Deductible equipment VAT) and the depreciation period is 25 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 People's Republic of China for Enterprises /36/ issued by State Council on 06/12/2007, it stipulates that the depreciation period of production equipments should be at least 10 years. Thereby the 25 years of depreciation periods of the project activity is appropriate.

The depreciation rate of 3.8% is determined based on a depreciation period of 25 years and a residual rate of 5%.

Long-term loan Interest: 4.90%

Short-term loan interest: 4.35%

As per the FSR /28/, the Interest of long-term loan and Interest of short-term loan is determined as 4.90% and 4.35%. By checking latest loan interest from official website of China People's Bank of China, since 24/10/2015, the short-term (shorter than 1 year) loan interest is 4.35% and long-term (longer than 5 years) loan Interest was 4.90%. Therefore, it is confirmed the short-term loan interest and long-term loan Interest applied for investment analysis is appropriate.

Lifetime: 25 years

The lifetime of the project activity was estimated to be 25 years in the FSR /28/. The lifetime of the project activity has been crosschecked with BOT franchise agreement /32/, in which the lifetime of the project activity is 25 years. Therefore, the assessment team was able to confirm that the lifetime estimated in FSR /28/ is reasonable and the project operation period could cover the 3*7 years crediting period without affecting the additionality of the project activity.

Conclusion

In conclusion, based on the information validated, 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. Therefore, the assessment team confirms that the assumptions in investment analysis are appropriate and the financial calculations are correct.

Sensitivity analysis

8 variables, i.e. total static Investment and annual O&M cost which constitute more than 20% of total project costs, and variables that will impact total project revenues, i.e. annual electricity generation and electricity tariff, biodiesel quantity and biodiesel price, MSW quantity and subsidy price 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 with the applicable CDM and VCS requirements.

As a result of sensitivity analysis, within the reasonable variation ($\pm 10\%$) 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 8 variables to reach the benchmark 12%.

Total static Investment: If the total static investment decreased by 24.83%, the IRR would reach 12%. However, it has been validated in above section that the already contracted costs have exceeded the estimated total static investment in the FSR /28/. Therefore, it's unlikely that the static total investment decreased by 24.83%.

Annual O&M cost: if the annual O&M cost is decreased by 26.92%, the IRR would reach 12%. However, considering the actual annual operation cost (159,549,224 CNY for year 2021) has been larger than that estimated in the FSR and increasing price index, the assessment team validated that the fluctuation of the variable will not make the IRR reach the benchmark.

Annual electricity generation and electricity tariff: If annual electricity generation increased by 85.56%, the IRR would reach 12%. However, even if the biogas generators work at full load (i.e. operating for 8,760 hours a year), the annual electricity exported would be 72,463 MWh. Even the figure is used for investment analysis for calculating the IRR, the IRR will be 8.76%, still lower than benchmark.

The electricity tariff is fixed in the Power Purchase Agreement signed between the project owner and local power grid company /23/. Therefore, the assessment team deemed it is unlikely that the electricity tariff could increased by 85.56%.

Biodiesel quantity and biodiesel price: If biodiesel quantity increased by 36.77%, the IRR would reach 12%. However, the biodiesel quantity is determined based on the MSW quantity. As per FSR /28/, the maximum amount of MSW quantity is 673,200t per year, which brings about maximum amount of biodiesel (production). Furthermore, by checking Biodiesel Sales Statistic /52/, it is confirmed that the amount of biodiesel production in year 2021 was 8,670.3t, which is much lower than the designed value. Therefore, it is unlikely that biodiesel quantity increased by 36.77%.

As per policies issued by China National Energy Bureau /73/, it is confirmed the biodiesel price will be stabled through policy measures. Therefore, the assessment team deemed it is unlikely that the biodiesel price could increase by 36.77%.

MSW quantity and subsidy price: If MSW quantity increased by 43.91%, the IRR would reach 12%. As per FSR /28/, the maximum amount of MSW quantity is 673,200t per year. Furthermore, By checking Summary Table of quantity and fraction of treated fresh waste /63/, it is confirmed that the amount of MSW from April 2020 to December 2021 (21 months) was 1,136,624.69t, that is to say, the actual annual average MSW quantity is 649,500t, which is less than the designed value. Therefore, it is unlikely that biodiesel quantity increased by 36.77%.

The subsidy price is fixed in the BOT franchise agreement /32/, it is confirmed that the MSW subsidy is 109 CNY/t. Therefore, the assessment team deemed it is unlikely that the subsidy price could increased by 43.91%.

It is assessment team's conclusion that sensitivity analysis used is appropriate and reasonable. Scenario 1 (M1+P1), which is the implementation of project activity without VCS, is not financially attractive to the project owner, and it is thus not a baseline scenario. Therefore, only one alternative scenario (Scenario 4 (M2+P6)) is left and is determined as baseline scenario of the project activity.

Common practice analysis

Common practice analysis in the joint PD&MR was conducted in accordance with the "Tool of common practice (version 03.1)".

As per the tool "Combined tool to identify the baseline scenario and demonstrate additionality" (version 07.0), If the proposed CDM project activity(s) applies measure(s) including step 1, step 2 and step 3, proceed to Step 4 a,

Step 4a: The proposed VCS project activity(s) applies measure(s) that are listed in the definitions section in the methodological tool "Combined tool to identify the baseline scenario and demonstrate additionality" (version 07.0)

- 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 10.34 MW, therefore the applicable output range is between 5.17 MW and 15.51 MW.

- 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 Guangdong Province.

The project activity recovers biogas from anaerobic digestion of fresh waste for electricity generation. Therefore, only projects recovers biogas from anaerobic digestion of fresh waste for electricity generation are considered.

The project started date (real action) of the project activity is 15/08/2017 when Equipment Purchase Contract was signed, therefore only projects which started commercial operation before 15/08/2017 are considered.

In conclusion, all projects recovers biogas from anaerobic digestion of fresh waste for electricity generation, located in Guangdong Province, delivering the capacity within the applicable output range between 5.17 MW and 15.51 MW, and starting commercial operation before 15/08/2017 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. Guangdong 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} .

N_{all} 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 reasonable and the set geographic scope is appropriate. This project is not a common practice in Guangdong Province.

Outcome of step 4: based on the above justification, it is confirmed that the baseline scenario of the project activity was:

Scenario 4 (M2+P6) - the continuation of current business-as-usual scenario, i.e. the electricity generated by the project would be supplied by CSPG in the baseline scenario and the fresh waste would be treated in a landfill site with a partial capture of the landfill gas (LFG) and flaring of the captured LFG.

By checking public information (national and local government websites), it is confirmed that no new national and/or sectoral policies that could affect the baseline scenario during the crediting period. By checking relevant applicable laws and regulations at the time of submission of registration, i.e. Renewable Energy Law of the People's Republic of China which came into

effect on 01/01/2006, Agenda for China's 14th Five-Year Plan (2021-2025), it is confirmed that the project is surplus to regulatory requirements.

3.4.6 Quantification of GHG Emission Reductions and Removals

The 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

As per ACM 0022, baseline emissions are determined as follows:

$$BE_y = \sum_t (BE_{CH_4,t,y} + BE_{WW,t,y} + BE_{EN,t,y} + BE_{NG,t,y}) \times (1 - RATE_{compliance,t}) \quad \text{Equation (1)}$$

Where:

BE_y	=	Baseline emissions in year y (t CO ₂ e)
$BE_{CH_4,t,y}$	=	Baseline emissions of methane from the SWDS in year y (t CO ₂ e)
$BE_{WW,t,y}$	=	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 (t CO ₂ e)
$BE_{EN,t,y}$	=	Baseline emissions associated with energy generation in year y (t CO ₂)
$BE_{NG,t,y}$	=	Baseline emissions associated with natural gas use in year y (t CO 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

The project activity does not associated with anaerobic treatment of the wastewater and natural gas use by checking FSR /28/, thus, $BE_{WW,t,y} = 0$ and $BE_{NG,t,y} = 0$. The project activity utilizes biogas recovered from anaerobic digestion of fresh waste, mainly consistent of kitchen and catering waste from the Guangzhou City. Furthermore, by checking public information, it is confirmed that kitchen and catering waste is not compulsorily treated by anaerobic digestion by laws and regulations in China. Currently, landfill is the most common disposal method of such waste. Therefore, it is confirmed that $RATE_{compliance,t} = 0$, as per ACM0022, this parameter is determined once for the first crediting period.

Therefore, for the project activity, $BE_y = BE_{CH_4,t,y} + BE_{EN,t,y}$

▪ **Baseline emissions of methane from the SWDS ($BE_{CH_4,t,y}$)**

As per ACM0022, Baseline methane emissions from the SWDS are determined using "Emissions from solid waste disposal sites" (version 08.0). The following requirements shall be complied with when applying the tool:

(a) $W_{j,x}$ in the tool is the amount of organic fresh waste prevented from disposal in the baseline SWDS due to its treatment in any (combination) alternative waste treatment process;

(b) Emission amounts are calculated using **Application B** in the tool, only fresh waste avoided from disposal after the start of the first crediting period shall be considered;

(c) Sampling to determine the fractions of different waste types is necessary (note that for the case that the waste is combusted in the project activity, then the parameter $Q_{j,c,y}$ in this methodology is equivalent to the variable $W_{j,x}$ in the tool);

(d) The tool instructs that f_y shall be determined based on historic data or contract or regulation requirements specifying the amount of methane that must be destroyed/used (if available). The following additional instruction applies:

(i) If the regulation requirements specify a percentage of the LFG that is required to be flared, the amount shall equal f_y ;

(ii) If the regulation requirements do not specify the amount or percentage of LFG that should be destroyed but require the installation of a capture system, without requiring the captured LFG to be flared then $f_y = 0$; and

(iii) If the requirement does not specify any amount or percentage of LFG that should be destroyed but require the installation of a system to capture and flare the LFG, then it is assumed $f_y = 0.2$.

By checking FSR /28/ and through site interview, it is confirmed that the project activity utilized biogas recovered from anaerobic digestion of fresh waste, mainly consistent of kitchen and catering waste from the Guangzhou City, avoiding such fresh waste from disposal after the start of the first crediting period. Therefore, As per ACM0022, Emission amounts are calculated using Application B in "Emissions from solid waste disposal sites" (version 08.0).

By checking public information, it is confirmed that no regulations or laws in China specify the amount or percentage of LFG that should be destroyed but require the installation of a system to capture and flare the LFG, therefore, as per ACM0022, it is assumed $f_y = 0.2$.

Baseline emissions of methane from the SWDS ($BE_{CH_4,t,y}$) is determined as follows:

$$BE_{CH_4,SWDS,y} = \phi_y \times (1 - f_y) \times GWP_{CH_4} \times (1 - OX) \times \frac{16}{12} \times F \times DOC_{f,y} \times MCF_y \times \sum_{x=1}^y \sum_j (W_{j,x} \times DOC_j \times e^{-k_j \cdot (y-x)} \times (1 - e^{-k_j})) \quad \text{Equation (2)}$$

Where:

$BE_{CH_4, SWDS, y}$	=	Baseline methane emissions occurring in year y generated from waste disposal at a SWDS during a time period ending in year y (t CO ₂ e/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 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_{CH_4}	=	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 for year y
DOC_j	=	Fraction of degradable organic carbon in the waste type j (weight fraction)
k	=	Decay rate for the waste type j (1 / yr)
j	=	Type of residual waste or types of waste in the MSW

As per Application B in "Emissions from solid waste disposal sites" (version 08.0),

$$W_{j, x} = W_x \times p_{j, x} = W_x \times \frac{\sum_{n=1}^{Z_x} P_{n, j, x}}{Z_x} \quad \text{Equation (3)}$$

Where:

$W_{j, x}$	=	Amount of solid waste type j disposed or prevented from disposal in the SWDS in the 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 in which waste is disposed at the SWDS, extending from the first year in the time period (x = 1) to year y (x = y)
$P_{n, j, x}$	=	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

The parameters required to calculate $BE_{CH_4,t,y}$ is determined as:

Parameter	Data unit	Value applied		Data source
Φ_y	/	0.85		Default values from "Emissions from solid waste disposal sites" Application B
f_y	/	0.2		Requirement from ACM0022
GWP	tCO ₂ e/t CH ₄	28		IPCC Fifth Assessment Report (AR5)
OX	/	0.1		IPCC 2006 Guidelines for National Greenhouse Gas Inventories
F	/	0.5		IPCC 2006 Guidelines for National Greenhouse Gas Inventories
DOC _{f,y}	Weight fraction	0.5		IPCC 2006 Guidelines for National Greenhouse Gas Inventories
MCF _y	/	1.0		Default values from "Emissions from solid waste disposal sites" Application B, 1.0 for anaerobic managed solid waste disposal sites was applied for the project activity.
W _x	t	673,200		As per FSR /28/, the collected fresh waste is 2,040t per day. Considering 330 operation day of a year, W _x is calculated to be 2,040*330=673,200t/yr.
P _{n,j,x} (Weight fraction of waste type j in the fresh waste)	/	Wood	0.66%	FSR /28/
		Paper	5.12%	
		Food	75%	
		Textile	3.26%	
		Garden and park waste	0	
		Others (plastic, glass, metal,etc)	15.96%	
		Total	100%	
DOC _j	/	Waste type j DOC _j (% wet waste)		As per "Emissions from solid waste disposal sites" (version 08.0), data source of this parameter is IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Tables 2.4 and 2.5).
		Wood and wood products	43	
		Pulp, paper and cardboard (other than sludge)	40	
		Food, food waste, beverages and tobacco (other than sludge)	15	
		Textiles	24	
		Garden, yard and park waste	20	
		Glass, plastic, metal, other inert waste	0	

Waste type j		Boreal and Temperate (MAT≤20°C)		Tropical (MAT>20°C)	
		Dry (MAP/PET <1)	Wet (MAP/PET >1)	Dry (MAP < 1000m)	Wet (MAP > 1000m)
Slowly degrading	Pulp, paper, cardboard (other than sludge), textiles	0.04	0.06	0.045	0.07
	Wood, wood products and straw	0.02	0.03	0.025	0.035
Moderately degrading	Other (non-food) organic putrescible garden and park waste	0.05	0.10	0.065	0.17
Rapidly degrading	Food, food waste, sewage sludge, beverages and tobacco	0.06	0.185	0.085	0.40

Apply the following default values for the different waste types j:

As per Guangzhou Statistics data, the climate data for the location is:

MAT – Mean annual temperature: 23°C

MAP – Mean annual precipitation: 1722 mm

Therefore, the value of k_j under tropical (MAT > 20°C), wet (MAP > 1000m) is applied for the project activity.

▪ Baseline emissions associated with energy generation ($BE_{EN,t,y}$)

The baseline emissions associated with electricity generation in year y ($BE_{EN,t,y} = BE_{EC,y}$) shall be calculated using the "Tool 5: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (version 03.0). When applying the tool:

(a) The electricity sources k in the tool correspond to the sources of electricity generated identified in the selection of the most plausible baseline scenario; and

(b) $EC_{BL,k,y}$ in the tool is equivalent to the net amount of electricity generated using LFG in year y ($EG_{PJ,y}$).

$$BE_{EC,y} = \sum_k EC_{BL,k,y} \times EF_{EL,k,y} \times (1 + TDL_{k,y}) \quad \text{Equation (4)}$$

$BE_{EC,y}$ = Baseline emissions from electricity consumption in year y (tCO₂/yr)

$EC_{BL,k,y}$ = Quantity of electricity that would be consumed by the baseline electricity consumption source k in year y (MWh/yr)

$EF_{EL,k,y}$ = Emission factor for electricity generation for source k in year y (tCO₂/MWh)

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

k = Sources of electricity consumption in the baseline

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

Before the implementation of the project activity, the electricity generated by the project would be supplied by CSPG in the baseline scenario and the fresh waste would be treated in a landfill site with a partial capture of the landfill gas (LFG) and flaring of the captured LFG, Scenario A of the "Methodological tool: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" applies. $EF_{EL,k,y}$ shall therefore be determined in accordance with Option A1 of the tool, i.e. the applied emission factor shall be

the combined margin emission factor of the CSPG, calculated in accordance with the "Tool to calculate the emission factor of an electricity system" ($EF_{EL,k,y} = EF_{grid,CM,y}$).

The grid emission factor is calculated as the weighted average of the operating margin (0.5) and build margin (0.5) values. The value of combined margin is sourced from 2019 Baseline Emission Factors for Regional Power Grids in China dated 29/12/2020 published by China DNA. /22/ calculates the data based on "Tool to Calculate the Emission Factor for an Electricity System", Version 07.0. No further assessment is required for grid emission calculation as the ex-ante value is sourced directly from the Chinese DNA. The grid emission factor is fixed ex-ante for the crediting period, which is calculated as:

$$EF_y = EF_{grid,CM,y} = 0.8042 \times 0.5 + 0.2135 \times 0.5 = 0.50885 \text{ tCO}_2/\text{MWh}.$$

According to the methodological tool "Emissions from solid waste disposal sites" (version 08.0), the amount of methane generated from disposal of waste at the SWDS for year y ($BE_{CH_4,SWDS,y}$) is calculated using first order decay (FOD) model mentioned above. The biogas will be deliver to generators for generating electricity and the remaining biogas will be flaring if the gas tank malfunctions or its storage capacity is full. A theoretical calculation of methane destroyed by capacity of 10.34MW is ex-ante estimated using parameters from FSR /28/, including designed annual operating hours (7,920 hours), the power generation efficiency (42%), plant self-consumption rate (20%), methane calorific value (0.0504 TJ/tCH₄). The detailed calculation process in the ER calculation spreadsheet /2/ has been confirmed by the assessment team to be correct as follows:

Year	$BE_{CH_4,SWDS,y} - BE_{CH_4,t,y}$ (CO ₂ e)	$Q_{CH_4,y}$ (t)	Theoretical installed capacity (MW)	Actual installed capacity (MW)	Electricity generation (MWh)	Plant self- consumption rate (%)	$EG_{t,y} = EC_{BL,k,y}$ (MWh)
01/04/2020~31/12/2020	113,279	4,046	3.99	10.34	23,809	20%	19,047
01/01/2021~31/12/2021	227,822	8,137	6.71	10.34	47,831	20%	38,266
01/01/2022~31/12/2022	306,541	10,948	8.59	10.34	64,361	20%	51,489
01/01/2023~31/12/2023	361,118	12,897	9.9	10.34	75,850	20%	60,679
01/01/2024~31/12/2024	399,394	14,264	10.82	10.34	81,034	20%	64,827
01/01/2025~31/12/2025	426,632	15,237	11.47	10.34	81,893	20%	65,514
01/01/2026~31/12/2026	446,367	15,942	11.95	10.34	81,893	20%	65,514
01/01/2027~31/03/2027	111,162	3,970	11.95	10.34	20,193	20%	16,154
Total	2,392,315	85,440	/	/	476,863	20%	381,490

Parameter	$EG_{t,y} = EC_{BL,k,y}$ (MWh)	$EF_{EL,k,y} = EF_{grid,CM,y}$ (tCO ₂ /MWh)	$TDL_{k,y}$	$BE_{EN,t,y} = BE_{EC,y}$ (t CO ₂ e)
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01/04/2020 to 31/12/2020	19,047	0.50885	3%	9,983
01/01/2021 to 31/12/2021	38,266	0.50885	3%	20,055
01/01/2022 to 31/12/2022	51,489	0.50885	3%	26,986
01/01/2023 to 31/12/2023	60,679	0.50885	3%	31,802
01/01/2024 to 31/12/2024	64,827	0.50885	3%	33,976
01/01/2025 to 31/12/2025	65,514	0.50885	3%	34,336
01/01/2026 to 31/12/2026	65,514	0.50885	3%	34,336
01/01/2027 to 31/03/2027	16,154	0.50885	3%	8,466
Total	/	/	/	199,940

The baseline emission of the project activity is calculated as:

Year	$BE_{CH_4, SWDS, y} = BE_{CH_4, t, y}$	$BE_{EN, t, y} = BE_{EC, y}$	BE_y
Unit	tCO ₂ e	tCO ₂ e	tCO ₂ e
01/04/2020 to 31/12/2020	113,279	9,983	123,262
01/01/2021 to 31/12/2021	227,822	20,055	247,876
01/01/2022 to 31/12/2022	306,541	26,986	333,526
01/01/2023 to 31/12/2023	361,118	31,802	392,920
01/01/2024 to 31/12/2024	399,394	33,976	433,369
01/01/2025 to 31/12/2025	426,632	34,336	460,967
01/01/2026 to 31/12/2026	446,367	34,336	480,703
01/01/2027 to 31/03/2027	111,162	8,466	119,628
Total (tones of CO₂e)	2,392,315	199,940	2,592,251

Project emissions

The project emissions in year y are calculated for each alternative waste treatment process implemented in the project activity as follows:

$$PE_y = PE_{COMP, y} + PE_{AD, y} + PE_{GAS, y} + PE_{RDF_SB, y} + PE_{INC, y} \quad \text{Equation (5)}$$

Where:

$$PE_y = \text{Project emissions in year y (t CO}_2\text{e)}$$

$PE_{COMP,y}$ = Project emissions from composting or co-composting in year y (t CO₂e)

$PE_{AD,y}$ = Project emissions from anaerobic digestion and biogas combustion in year y (t CO₂e)

$PE_{GAS,y}$ = Project emissions from gasification in year y (t CO₂e)

$PE_{RDF_SB,y}$ = Project emissions associated with RDF/SB in year y (t CO₂e)

$PE_{INC,y}$ = Project emissions from incineration in year y (t CO₂e)

The project activity utilizes biogas from anaerobic digestion of fresh waste from Guangzhou City for power generation and is not involved in composting or co-composting, gasification, RDF/SB or incineration. Therefore, $PE_{COMP,y}=0$, $PE_{GAS,y}=0$, $PE_{RDF_SB,y}=0$, $PE_{INC,y}=0$ and $PE_y=PE_{AD,y}$.

▪ **Project emissions from anaerobic digestion and biogas combustion ($PE_{AD,y}$)**

As per ACM 0022, $PE_{AD,y}$ is calculated according to "Project and leakage emissions from anaerobic digesters" (version 02.0) and the project emissions associated with the anaerobic digester ($PE_{AD,y}$) are determined as follows:

$$PE_{AD,y} = PE_{EC,y} + PE_{FC,y} + PE_{CH_4,y} + PE_{flare,y} \quad \text{Equation (6)}$$

Where:

$PE_{EC,y}$ = Project emissions from electricity consumption associated with the anaerobic digester in year y (t CO₂e)

$PE_{FC,y}$ = Project emissions from fossil fuel consumption associated with the anaerobic digester in year y (t CO₂e)

$PE_{CH_4,y}$ = Project emissions of methane from the anaerobic digester in year y (t CO₂e)

$PE_{flare,y}$ = Project emissions from flaring of biogas in year y (t CO₂e)

As per "Project and leakage emissions from anaerobic digesters" (version 02.0), these parameters are determined through the steps outlined below.

Step 1: Determination of the quantity of methane produced in the digester ($Q_{CH_4,y}$)

As per "Project and leakage emissions from anaerobic digesters" (version 02.0), there are two different procedures to determine the quantity of methane produced in the digester in year y ($Q_{CH_4,y}$). For large scale projects only Option 1 shall be used. For small scale projects, project participants may choose between Option 1 or Option 2.

Annual average GHG emission reductions or removal per year of the project activity is 359,014 tCO₂e, more than 60,000 tonnes of CO₂e per year, which is applicable as per large scale project activities, option 1 is applied to determine the quantity of methane produced in the digester in year y ($Q_{CH_4,y}$).

Option 1: Procedure using monitored data

$Q_{CH_4,y}$ shall be measured using the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 03.0). When applying the tool, the following applies:

- (a) The gaseous stream to which the tool is applied is the biogas collected from the digester;
- (b) CH₄ is the greenhouse gas i for which the mass flow should be determined; and
- (c) The flow of the gaseous stream should be measured on an hourly basis or a smaller time interval; and then accumulated for the year y. Please note that units need to be converted to tons, when applying the results in this tool.

Through site visit, it is confirmed that the flow meter of the project activity is installed at the back end of desulfurization and dehydration process. That is to say, the monitored flow rate and methane content of the biogas after dehydration treatment and filtration are all in the dry base state, therefore, **Option A** in the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 03.0) is applied to determine the parameter of $Q_{CH_4,y}$.

Option A

Flow measurement on a dry basis is not doable for a wet gaseous stream. In order to determine that the biogas is in a dry state, there are two ways to do this:

- (a) Measure the moisture content of the gaseous stream ($C_{H_2O,t,db,n}$) and demonstrate that this is less or equal to 0.05 kg H₂O/m³ dry gas; or
- (b) Demonstrate that the temperature of the gaseous stream (T_t) is less than 60°C (333.15 K) at the flow measurement point.

By checking FSR /28/ of the project activity, it is confirmed that the temperature of the gaseous stream after desulfurization and cooling dehydration process is about 15 °C, which is less than 60 °C. On a dry basis and under normal conditions ($P_n=101,325$ Pa and $T_n= 273.15K$), the mass flow of greenhouse gas i ($F_{i,t}$) is determined as follows:

$$F_{i,t} = V_{t,db} \times v_{i,t,db} \times \rho_{i,n} \quad \text{Equation (7)}$$

With:

$$\rho_{i,n} = \frac{P_n \times MM_i}{R_u \times T_n} \quad \text{Equation (8)}$$

Where:

$F_{i,t}$ = Mass flow of greenhouse gas i in the gaseous stream in time interval t (kg

		gas/h)
$V_{t,db}$	=	Volumetric flow of the gaseous stream in time interval t on a dry basis (m^3 dry gas/h)
$v_{i,t,db}$	=	Volumetric fraction of greenhouse gas i in the gaseous stream in a time interval t on a dry basis (m^3 gas i/ m^3 dry gas)
$\rho_{i,n}$	=	Density of greenhouse gas i in the gaseous stream in time interval t (kg gas i/ m^3 gas i)
P_n	=	Absolute pressure of the gaseous stream in time interval t (Pa)
MM_i	=	Molecular mass of greenhouse gas i (kg/kmol)
R_u	=	Universal ideal gases constant ($Pa.m^3 / kmol.K$)
T_n	=	Temperature of the gaseous stream in time interval t (K)

Therefore, Quantity of methane produced in the digester is calculated as:

$$Q_{CH_4,y} = \frac{F_{i,t} \times h}{1000} \quad \text{Equation (9)}$$

Where:

$Q_{CH_4,y}$	=	Quantity of methane produced in the digester in year y (t CH_4)
$F_{i,t}$	=	Mass flow of greenhouse gas i in the gaseous stream in time interval t (kg gas/h)
h	=	The total operation hours of the project (h)

$Q_{CH_4,y}$ is ex ante estimated based on the amount of methane generated from disposal of waste at the SWDS for year y ($BE_{CH_4,SWDS,y}$), using first order decay (FOD) model. and will be monitored ex post through parameters listed in equation 7~9 above. This is in compliance with ACM 0022 and any other relevant tools and requirements.

A theoretical calculation of methane destroyed by capacity of 10.34MW is ex-ante estimated using parameters from FSR /28/, including designed annual operating hours (7,920 hours), the power generation efficiency (42%), plant self-consumption rate (20%), methane calorific value (0.0504 TJ/t CH_4). it is estimated that methane destroyed is 13,927 t CH_4 /year for the capacity of 10.34 MW. The biogas will be deliver to generators for generating electricity and the remaining biogas will be flaring if the gas tank malfunctions or its storage capacity is full. The detailed calculation process in the ER calculation spreadsheet /2/ has been confirmed by the assessment team to be correct as follows:

Year	$BE_{CH_4,SWDS,y}$ - $BE_{CH_4,y}(CO_2e)$	$Q_{CH_4,y}$ (t)	Theoretical installed capacity (MW)	Actual installed capacity (MW)	Electricity generation (MWh)
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01/04/2020~31/12/2020	113,279	4,046	3.99	10.34	23,809
01/01/2021~31/12/2021	227,822	8,137	6.71	10.34	47,831
01/01/2022~31/12/2022	306,541	10,948	8.59	10.34	64,361
01/01/2023~31/12/2023	361,118	12,897	9.9	10.34	75,850
01/01/2024~31/12/2024	399,394	14,264	10.82	10.34	81,034
01/01/2025~31/12/2025	426,632	15,237	11.47	10.34	81,893
01/01/2026~31/12/2026	446,367	15,942	11.95	10.34	81,893
01/01/2027~31/03/2027	111,162	3,970	11.95	10.34	20,193
Total	2,392,315	85,440	/	/	476,863

Step 2: Determination of project emissions from electricity consumption ($PE_{EC,y}$)

As per "Project and leakage emissions from anaerobic digesters" (version 02.0), this step is applicable if the anaerobic digester consumes electricity, such as for mixing, recirculation of digestate, or processing of feed material. If the electricity consumed is generated on-site using biomass residues, wind, hydro or geothermal power, then $PE_{EC,y} = 0$. Otherwise, the project participants may choose between the following two options to calculate $PE_{EC,y}$.

By checking FSR /28/ and through site interview, it is confirmed that the electricity consumed is either self consumption electricity or imported from local power grid, not using biomass residues, wind, hydro or geothermal power and PP chose option 1 from "Project and leakage emissions from anaerobic digesters" (version 02.0) for calculation of $PE_{EC,y}$.

Option 1: Procedure using monitored data

As per "Project and leakage emissions from anaerobic digesters" (version 02.0), $PE_{EC,y}$ shall be calculated using the "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (version 03.0), where the project emission source j referred to in the tool is the total electricity consumption associated with the anaerobic digestion facility.

According to "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (version 03.0), project emissions from consumption of electricity are calculated as follows:

$$PE_{EC,y} = \sum_j EC_{PJ,j,y} \times EF_{EL,j,y} \times (1 + TDL_{j,y}) \quad \text{Equation (10)}$$

Where:

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

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

- $EF_{EL,j,y}$ = Emission factor for electricity generation for source j in year y (t CO₂/MWh)
 $TDL_{j,y}$ = Average technical transmission and distribution losses for providing electricity to source j in year y
j = Sources of electricity consumption in the project

For the determination of $EF_{EL,j,y}$, Option A1 is chosen as:

Option A1: Calculate the combined margin emission factor of the applicable electricity system, using the procedures in the latest approved version of the "Tool to calculate the emission factor for an electricity system" ($EF_{EL,j,y} = EF_{grid,CM,y}$). $EC_{PJ,j,y}$ is ex ante determined as 0 and will be monitored ex post.

Step 3: Determination of project emissions from fossil fuel consumption ($PE_{FC,y}$)

By checking FSR /28/ and through site visit, it is confirmed that the anaerobic digester facility of the project will not use fossil fuels, therefore, $PE_{FC,y}=0$

Step 4: Determination of project emissions of methane from the anaerobic digester ($PE_{CH4,y}$)

As per "Project and leakage emissions from anaerobic digesters" (version 02.0), project emissions of methane from the anaerobic digester include emissions during maintenance of the digester, physical leaks through the roof and side walls, and release through safety valves due to excess pressure in the digester. These emissions are calculated using a default emission factor ($EF_{CH4,default}$), as follows:

$$PE_{CH4,y} = Q_{CH4,y} \times EF_{CH4,default} \times GWP_{CH4} \quad \text{Equation (11)}$$

Where:

- $PE_{CH4,y}$ = Project emissions of methane from the anaerobic digester in year y (t CO₂e)
 $Q_{CH4,y}$ = Quantity of methane produced in the anaerobic digester in year y (t CH₄)
 $EF_{CH4,default}$ = Default emission factor for the fraction of CH₄ produced that leaks from the anaerobic digester (fraction)
 GWP_{CH4} = Global warming potential of CH₄ (tCO₂ /tCH₄)

The detailed calculation process in the ER calculation spreadsheet /2/ has been confirmed by the assessment team to be correct as follows:

Year	$Q_{CH4,y}$ (t CH ₄)	$EF_{CH4,default}$	GWP_{CH4}	$PE_{CH4,y}$ (tCO ₂ e)
01/04/2020~31/12/2020	4,046	0.028	28	3,173
01/01/2021~31/12/2021	8,137	0.028	28	6,379

01/01/2022~31/12/2022	10,948	0.028	28	8,584
01/01/2023~31/12/2023	12,897	0.028	28	10,112
01/01/2024~31/12/2024	14,264	0.028	28	11,184
01/01/2025~31/12/2025	15,237	0.028	28	11,946
01/01/2026~31/12/2026	15,942	0.028	28	12,499
01/01/2027~31/03/2027	3,970	0.028	28	3,113
Total				66,989

Step 5: Determination of project emissions from flaring of biogas ($PE_{flare,y}$)

As per "Project and leakage emissions from anaerobic digesters" (version 02.0), If the project activity includes flaring of biogas, then project emissions from flaring of biogas ($PE_{flare,y}$) shall be estimated using the "TOOL06: Project emissions from flaring". The following applies:

- (a) For small scale projects, project participants may adopt a default value for the fraction of methane in the biogas ($f_{CH_4,default}$) in applying the tool; and
- (b) The tool provides default factors for the flare efficiency, which can be used for large or small scale projects as described in the tool.

As per "TOOL06: Project emissions from flaring", the project emissions calculation procedure is given in the following steps:

- (a) **STEP 5.1:** Determination of the methane mass flow of the residual gas;
- (b) **STEP 5.2:** Determination of the flare efficiency;
- (c) **STEP 5.3:** Calculation of project emissions from flaring.

Step 5.1: Determination of the methane mass flow in the residual gas

As per "TOOL06: Project emissions from flaring", the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" shall be used to determine the following parameter $F_{CH_4,m}$. $F_{CH_4,m}$, which is measured as the mass flow during minute m , shall then be used to determine the mass of methane in kilograms fed to the flare in minute m ($F_{CH_4,RG,m}$). $F_{CH_4,m}$ shall be determined on a dry basis.

By checking FSR /28/ and through site inspection, it is confirmed that the project activity installs an enclosed flare, the biogas collected from the digester is stored in the gas tank which is installed at the back end of desulfurization and dehydration process. The biogas will be deliver to generators for generating electricity and the remaining biogas will be flaring if the gas tank malfunctions or its storage capacity is full. And monitored flow rate and methane content of the residual gas are all on a dry basis, therefore, **Option A** in the "Tool to determine the mass

flow of a greenhouse gas in a gaseous stream" (version 03.0) is applied to determine the parameter of $F_{CH_4, RG, m}$.

As per the **Option A** in the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 03.0) and when under normal conditions ($P_n=101,325$ Pa and $T_n= 273.15K$), the calculation equation is listed as follows,

$$F_{CH_4, RG, m} = V_{RG, t, db} \times v_{RG, t, db} \times \rho_{RG, n} \times \frac{h}{1000} \quad \text{Equation (12)}$$

With:

$$\rho_{RG, n} = \frac{P_n \times MM_i}{R_u \times T_n} \quad \text{Equation (13)}$$

Where:

$F_{CH_4, RG, m}$ = Mass flow of greenhouse gas i in the in the residual gaseous stream in time interval t (kg gas/m)

$V_{RG, t, db}$ = Volumetric flow of the gaseous stream (residue gas) in time interval t on a dry basis (m^3 dry gas/h)

$v_{RG, t, db}$ = Volumetric fraction of greenhouse gas i in the gaseous stream in a time interval t on a dry basis (m^3 gas i/ m^3 dry gas), i = Residual gas (RG),
 $v_{RG, t, db} = v_{i, t, db}$

$\rho_{RG, n}$ = Density of greenhouse gas i in the gaseous stream in time interval t (kg gas i/ m^3 gas i), i =Residual gas (RG)

P_n = Absolute pressure of the gaseous stream in time interval t (Pa)

MM_i = Molecular mass of greenhouse gas i (kg/kmol) , i =Residual gas (RG)

R_u = Universal ideal gases constant ($Pa.m^3 /kmol.K$)

T_n = Temperature of the gaseous stream in time interval t (K)

h = The total operation hours of the flare (hours)

$F_{CH_4, RG, m}$ is ex ante determined based on the parameters $BE_{CH_4, SWDS, y}$ minus theoretical methane destroyed by generators which is calculated by theoretical and actual installed capacity and has justified above and $F_{CH_4, RG, m}$ will be monitored ex post.

Step 5.2: Determination of flare efficiency

By checking FSR /28/ and through site inspection, it is confirmed that the project activity installs an enclosed flare. As per "TOOL06: Project emissions from flaring", in the case of enclosed flares, project participants may choose between the following two options to

determine the flare efficiency for minute m ($\eta_{flare,m}$) and shall document which option is selected:

- (a) Option A: Apply a default value for flare efficiency;
- (b) Option B: Measure the flare efficiency.

By checking the joint PD&MR, it is confirmed that Option A: Apply a default value for flare efficiency is chosen by PP.

Option A: Default value

The flare efficiency for the minute m ($\eta_{flare,m}$) is 90% when the following two conditions are met to demonstrate that the flare is operating:

- (a) The temperature of the flare ($T_{EG,m}$) and the flow rate of the residual gas to the flare ($F_{RG,m}$) is within the manufacturer's specification for the flare ($SPEC_{flare}$) in minute m ; and
- (b) The flame is detected in minute m ($Flame_m$).

By checking Technical Agreement of the enclosed flare of the project activity /46/, it is confirmed the temperature of the flare ($T_{EG,m}$) and the flow rate of the residual gas to the flare ($F_{RG,m}$) is within the manufacturer's specification for the flare ($SPEC_{flare}$) and the flame is detected in minute, thus, **Option A**: Apply a default value for flare efficiency is applicable. Thus, $\eta_{flare,m} = 90\%$

Step 5.3: Calculation of project emissions from flaring

As per "TOOL06: Project emissions from flaring", project emissions from flaring are calculated as the sum of emissions for each minute m in year y , based on the methane mass flow in the residual gas ($F_{CH4,RG,m}$) and the flare efficiency ($\eta_{flare,m}$), as follows:

$$PE_{flare,y} = GWP_{CH4} \times \sum_{m=1}^{525600} F_{CH4,RG,m} \times (1 - \eta_{flare,m}) \times 10^{-3} \quad \text{Equation (14)}$$

Where:

- $PE_{flare,y}$ = Project emissions from flaring of the residual gas in year y (tCO₂e)
- GWP_{CH4} = Global warming potential of methane valid for the commitment period (tCO₂e/tCH₄)
- $F_{CH4,RG,m}$ = Mass flow of methane in the residual gas in the minute m (kg)
- $\eta_{flare,m}$ = Flare efficiency in minute m

A theoretical calculation of methane destroyed by capacity of 10.34MW is ex-ante estimated using parameters from FSR /28/, including designed annual operating hours (7,920 hours), the power generation efficiency (42%), plant self-consumption rate (20%), methane calorific

value (0.0504 TJ/tCH₄). it is estimated that methane destroyed is 13,927 tCH₄/year for the capacity of 10.34 MW. The biogas will be deliver to generators for generating electricity and the remaining biogas will be flaring if the gas tank malfunctions or its storage capacity is full. The detailed calculation process in the ER calculation spreadsheet /2/ has been confirmed by the assessment team to be correct as follows:

Year	BE _{CH₄} , SWDS, y = BE _{CH₄} , y (CO ₂ e)	Q _{CH₄} , y (t)	Theoretical installed capacity (MW)	Actual installed capacity (MW)	Electricity generation (MWh)	F _{CH₄} , RG, m (t)
01/04/2020~31/12/2020	113,279	4,046	3.99	10.34	23,809	0
01/01/2021~31/12/2021	227,822	8,137	6.71	10.34	47,831	0
01/01/2022~31/12/2022	306,541	10,948	8.59	10.34	64,361	0
01/01/2023~31/12/2023	361,118	12,897	9.9	10.34	75,850	0
01/01/2024~31/12/2024	399,394	14,264	10.82	10.34	81,034	484
01/01/2025~31/12/2025	426,632	15,237	11.47	10.34	81,893	1,310
01/01/2026~31/12/2026	446,367	15,942	11.95	10.34	81,893	2,015
01/01/2027~31/03/2027	111,162	3,970	11.95	10.34	20,193	536
Total	111,162	85,440	/	10.34	476,863	4,344

Year	F _{CH₄} , RG, m (t)	η _{flare, h}	GWP _{CH₄}	PE _{flare, y} (tCO ₂ e)
01/04/2020~31/12/2020	0	90%	28	0
01/01/2021~31/12/2021	0	90%	28	0
01/01/2022~31/12/2022	0	90%	28	0
01/01/2023~31/12/2023	0	90%	28	0
01/01/2024~31/12/2024	484	90%	28	1,355
01/01/2025~31/12/2025	1,310	90%	28	3,667
01/01/2026~31/12/2026	2,015	90%	28	5,642
01/01/2027~31/03/2027	536	90%	28	1,501
Total				12,165

Based on the above justification and equations, PE_y of the project activity is calculated as:

Year	PE _{EC, y} (tCO ₂ e)	PE _{CH₄} , y (tCO ₂ e)	PE _{flare, y} (tCO ₂ e)	PE _y (tCO ₂ e)
01/04/2020~31/12/2020	0	3,173	0	3,173
01/01/2021~31/12/2021	0	6,379	0	6,379

01/01/2022~31/12/2022	0	8,584	0	8,584
01/01/2023~31/12/2023	0	10,112	0	10,112
01/01/2024~31/12/2024	0	11,184	1,355	12,538
01/01/2025~31/12/2025	0	11,946	3,667	15,613
01/01/2026~31/12/2026	0	12,499	5,642	18,141
01/01/2027~31/03/2027	0	3,113	1,501	4,614
Total	0	66,989	12,165	79,154

Leakage

As per ACM0022, Version 03.0, leakage emissions are associated with composting/co-composting, anaerobic digestion and the use of RDF/SB that is exported outside the project boundary. For the case that waste by-products of the alternative waste treatment process are:

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

Leakage emissions are determined as follows:

$$LE_y = LE_{COMP,y} + LE_{AD,y} + LE_{RDF_SB,y} \quad \text{Equation (15)}$$

Where:

LE_y = Leakage emissions in the year y (t CO₂e)

$LE_{COMP,y}$ = Leakage emissions from composting or co-composting in year y (t CO₂e)

$LE_{AD,y}$ = Leakage emissions from anaerobic digester in year y (t CO₂e)

$LE_{RDF_SB,y}$ = Leakage emissions associated with RDF/SB in year y (t CO₂e)

The project activity does not involve composting or co-composting, or RDF/SB, therefore,

$$LE_y = LE_{AD,y}$$

As per ACM0022, Version 03.0, leakage emissions associated with anaerobic digestion of waste ($LE_{AD,y}$) are calculated according to "Project and leakage emissions from anaerobic digesters" (version 02.0). The leakage emissions associated with the anaerobic digester ($LE_{AD,y}$) depend on how the digestate is managed. They include emissions associated with storage and composting of the digestate and are determined as follows:

$$LE_{AD,y} = LE_{storage,y} + LE_{comp,y} \quad \text{Equation (16)}$$

Where:

$LE_{AD,y}$ = Leakage emissions associated with the anaerobic digester in year y (t CO₂e)

$LE_{storage,y}$ = Leakage emissions associated with storage of digestate in year y (t CO₂e)

$LE_{comp,y}$ = Leakage emissions associated with composting digestate in year y (t CO₂e)

Step 1: Determination of leakage emissions associated with storage of digestate ($LE_{storage,y}$)

This step applies in the case that the digestate is stored under the following anaerobic conditions:

- (a) In an un-aerated lagoon that has a depth of more than one meter; or
- (b) In a SWDS, including stockpiles that are considered a SWDS as per the definitions section.

By checking FSR /28/ and through site visit, it is confirmed that the solid digestate will be outward transported and incinerated directly in thermal power plant and will not be stored under anaerobic conditions. This step is not applicable and $LE_{storage,y}=0$.

Step 2: Determination of leakage emissions associate with composting digestate ($LE_{comp,y}$)

By checking FSR /28/ and through site visit, it is confirmed that the solid digestate will be outward transported and incinerated directly in thermal power plant and will not be composted. Therefore, this step is not applicable and $LE_{comp,y}=0$.

Emission Reductions

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

$$ER_y = BE_y - PE_y$$

Where:

ER_y = Emission reductions in year y (t CO₂e/yr)

BE_y = Baseline emissions in year y (t CO₂e/yr)

PE_y = Project emissions in year y (t CO₂e/yr)

Hence for the project activity, the estimated total amount of GHG emission reductions (ER_y) is 2,513,097 tCO₂e during the crediting period from 01/04/2020 to 31/03/2027, resulting in estimated average annual emission reductions of 359,014 tCO₂e.

Year	BE _y (tCO ₂ e)	PE _y (tCO ₂ e)	LE _y (tCO ₂ e)	ER _y (tCO ₂ e)
01/04/2020~31/12/2020	123,262	3,173	0	120,089
01/01/2021~31/12/2021	247,876	6,379	0	241,497
01/01/2022~31/12/2022	333,526	8,584	0	324,942
01/01/2023~31/12/2023	392,920	10,112	0	382,808
01/01/2024~31/12/2024	433,369	12,538	0	420,831
01/01/2025~31/12/2025	460,967	15,613	0	445,354
01/01/2026~31/12/2026	480,703	18,141	0	462,562
01/01/2027~31/03/2027	119,628	4,614	0	115,015
Total	2,592,251	79,154	0	2,513,097
Average annual ERs	370,322	11,308	0	359,014

The assessment team confirms that all data sources and assumptions are appropriate and calculations are correct, applicable to the project activity and will result in a conservative estimate of the emission reductions. In general, the assessment team is able to confirm the following:

- All assumptions and data used by the project participants are listed in the joint PD & MR (version 2.1 dated 14/07/2022) and/or supporting documents, including their references and sources;
- All documentation used by the project participants as the basis for assumptions and source of data is correctly quoted and interpreted in the joint PD & MR (version 2.1 dated 14/07/2022);
- All values used in joint PD & MR (version 2.1 dated 14/07/2022) are considered reasonable in the context of the project activity;
- The baseline methodology has been applied correctly to calculate project emissions, baseline emissions, and leakage emissions;
- All estimates of the baseline, project and leakage emissions can be replicated using the data and parameter values provided in joint PD & MR (version 2.1 dated 14/07/2022).

3.4.7 Methodology Deviations

As plant specific fuel consumption and electricity generation data are not publicly available in China, the Guidance caused by DNV's request for deviation of Chinese project activities for the CDM baseline methodology AM0005 has been applied for calculating the build margin (BM) emission factor of this project activity. The deviation has no impact on conservativeness of the quantification of GHG emission reductions or removals.

Except this, no methodology deviation is applied in the project.

3.4.8 Monitoring Plan

The project applies the approved monitoring methodology ACM0022: Alternative waste treatment processes, Version 03.0. The selected monitoring methodology is applicable for the project. The monitoring plan is in accordance with the monitoring methodologies. The monitoring plan will give opportunity for real measurements of achieved emission reductions and contains principles and concepts on which it is based, operational and monitoring obligations of the project owner like resources involved in the monitoring process, training, support activities, calibration and data collection, quality assurance procedures, data management, electronic support tools.

Parameters determined ex-ante

Data / Parameter:	GWP_{CH4}
Data unit:	/
Description:	Global warming potential of CH ₄
Source of data used:	IPCC Fifth Assessment Report (AR5)
Value applied:	28

Data / Parameter:	NCV_{CH4}
Data unit:	TJ/t CH ₄
Description:	Global warming potential of CH ₄
Source of data used:	ACM0001 version 19.0
Value applied:	0.0504

Data / Parameter:	$\eta_{P\text{flare},m}$
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Data unit:	Dimensionless
Description:	Flare efficiency in minute m
Source of data used:	Project emissions from flaring v04.0
Value applied:	90%

Data / Parameter:	Φ_y										
Data unit:	Dimensionless										
Description:	Model correction factor to account for model uncertainties for year y										
Source of data used:	Emissions from solid waste disposal sites (version 08.0)										
Value applied:	0.85 <table border="1"> <thead> <tr> <th></th><th>Humid/wet conditions</th><th>Dry conditions</th></tr> </thead> <tbody> <tr> <td>Application A</td><td>0.75</td><td>0.75</td></tr> <tr> <td>Application B</td><td>0.85</td><td>0.80</td></tr> </tbody> </table> Default values from "Emissions from solid waste disposal sites" Application B. By checking FSR, it is confirmed the climate is wet conditions with an average temperature of 23 °C and annual mean precipitation of 1,722mm in Guangzhou City, thus 0.85 is chosen by PP .			Humid/wet conditions	Dry conditions	Application A	0.75	0.75	Application B	0.85	0.80
	Humid/wet conditions	Dry conditions									
Application A	0.75	0.75									
Application B	0.85	0.80									

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:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value applied:	0.1 By checking public information and through site interview, the assessment team confirmed that landfill sites in China are commonly covered with plastic film or soil, therefore, 0.1 was chosen for conservative.

Data / Parameter:	F
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Data unit:	/
Description:	Fraction of methane in the SWDS gas (volume fraction)
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value applied:	0.5

Data / Parameter:	DOC_{f,y}
Data unit:	Weight fraction
Description:	Default value for the fraction of degradable organic carbon (DOC) in MSW that decomposes in the SWDS
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value applied:	0.5

Data / Parameter:	MCF_y
Data unit:	/
Description:	Methane correction factor
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value applied:	By checking public information and through site interview, the nearly landfill of the project is controlled, including the following activities: (i) cover material; (ii) mechanical compacting; (iii) levelling of the waste. As per IPCC 2006 Guidelines for National Greenhouse Gas Inventories, MCF _y = 1.0

Data / Parameter:	DOC_j
Data unit:	/
Description:	Fraction of degradable organic carbon in the waste type j (weight fraction)
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adopted from Volume 5, Tables 2.4 and 2.5)
Value applied:	For MSW, the following values for the different waste types j should be applied:

Waste type <i>j</i>		DOC _j (% wet waste)
Wood and wood products		43
Pulp, paper and cardboard (other than sludge)		40
Food, food waste, beverages and tobacco (other than sludge)		15
Textiles		24
Garden, yard and park waste		20
Glass, plastic, metal, other inert waste		0

Data / Parameter:	k_j																																						
Data unit:	1/yr																																						
Description:	Decay rate for the waste type j																																						
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adopted from Volume 5, Table 3.3)																																						
Value applied:	Apply the following default values for the different waste types j: <table><thead><tr><th colspan="2" rowspan="2">Waste type j</th><th colspan="2">Boreal and Temperate (MAT≤20°C)</th><th colspan="2">Tropical (MAT>20°C)</th></tr><tr><th>Dry (MAP/PET <1)</th><th>Wet (MAP/PET >1)</th><th>Dry (MAP< 1000m m)</th><th>Wet (MAP > 1000 mm)</th></tr></thead><tbody><tr><td rowspan="2">Slowly degrading</td><td>Pulp, paper, cardboard (other than sludge), textiles</td><td>0.04</td><td>0.06</td><td>0.045</td><td>0.07</td></tr><tr><td>Wood, wood products and straw</td><td>0.02</td><td>0.03</td><td>0.025</td><td>0.035</td></tr><tr><td>Moderately degrading</td><td>Other (non-food) organic putrescible garden and park waste</td><td>0.05</td><td>0.10</td><td>0.065</td><td>0.17</td></tr><tr><td>Rapidly degrading</td><td>Food, food waste, sewage sludge, beverages and tobacco</td><td>0.06</td><td>0.185</td><td>0.085</td><td>0.40</td></tr></tbody></table> As per FSR, the climate data for the location of the project activity is: MAT – Mean annual temperature: 23°C MAP – Mean annual precipitation: 1,722 mm Therefore, the value of k_j under tropical (MAT > 20 °C), wet (MAP > 1000m) is applied for the project activity.						Waste type j		Boreal and Temperate (MAT≤20°C)		Tropical (MAT>20°C)		Dry (MAP/PET <1)	Wet (MAP/PET >1)	Dry (MAP< 1000m m)	Wet (MAP > 1000 mm)	Slowly degrading	Pulp, paper, cardboard (other than sludge), textiles	0.04	0.06	0.045	0.07	Wood, wood products and straw	0.02	0.03	0.025	0.035	Moderately degrading	Other (non-food) organic putrescible garden and park waste	0.05	0.10	0.065	0.17	Rapidly degrading	Food, food waste, sewage sludge, beverages and tobacco	0.06	0.185	0.085	0.40
Waste type j		Boreal and Temperate (MAT≤20°C)		Tropical (MAT>20°C)																																			
		Dry (MAP/PET <1)	Wet (MAP/PET >1)	Dry (MAP< 1000m m)	Wet (MAP > 1000 mm)																																		
Slowly degrading	Pulp, paper, cardboard (other than sludge), textiles	0.04	0.06	0.045	0.07																																		
	Wood, wood products and straw	0.02	0.03	0.025	0.035																																		
Moderately degrading	Other (non-food) organic putrescible garden and park waste	0.05	0.10	0.065	0.17																																		
Rapidly degrading	Food, food waste, sewage sludge, beverages and tobacco	0.06	0.185	0.085	0.40																																		

Data / Parameter:	EF_{grid,OM,y}
Data unit:	tCO ₂ /MWh
Description:	Operating margin CO ₂ emission factor in year y
Source of data used:	2019 Baseline Emission Factors for Regional Power Grids in China dated 29/12/2020 published by China DNA
Value applied:	0.8042

Data / Parameter:	EF_{grid,BM,y}
Data unit:	tCO ₂ /MWh
Description:	Build margin CO ₂ emission factor in year y
Source of data used:	2019 Baseline Emission Factors for Regional Power Grids in China dated 29/12/2020 published by China DNA
Value applied:	0.2135

Data / Parameter:	EF_{grid,CM,y}
Data unit:	tCO ₂ /MWh
Description:	Combined margin CO ₂ emission factor in year y
Source of data used:	Calculated as per "Tool to calculate the emission factor for an electricity system" Version 07.0
Value applied:	0.50885

Data / Parameter:	EF_{CH4,default}
Data unit:	t CH ₄ leaked / t CH ₄ produced
Description:	Default emission factor for the fraction of CH ₄ produced that leaks from the anaerobic digester
Source of data used:	As per "Project and leakage emissions from anaerobic digesters" (version 02.0), data source of this parameter is "Flesch et al. (2011)"

	and Kurup (2003)".
Value applied:	0.028 Digesters with steel or lined concrete or fiberglass digesters and a gas holding system (egg shaped digesters) and monolithic construction.

Data / Parameter:	$f_{CH_4, default}$
Data unit:	$m^3 CH_4 / m^3$ biogas corrected to reference conditions
Description:	Default value for the fraction of methane in the biogas
Source of data used:	As per "Project and leakage emissions from anaerobic digesters" (version 02.0), this default value was derived based on reported values from registered projects and research papers (Davidsson, 2007).
Value applied:	0.6

Data / Parameter:	R_u
Data unit:	$Pa \cdot m^3 / kmol \cdot K$
Description:	Universal ideal gases constant
Source of data used:	Tool to determine the mass flow of a greenhouse gas in a gaseous stream
Value applied:	8,314

Data / Parameter:	MM_i
Data unit:	$kg / kmol$
Description:	Molecular mass of greenhouse gas CH_4
Source of data used:	Tool to determine the mass flow of a greenhouse gas in a gaseous stream
Value applied:	16.04

Data / Parameter:	P_n
Data unit:	Pa
Description:	Total pressure at normal conditions
Source of data used:	Tool to determine the mass flow of a greenhouse gas in a gaseous stream
Value applied:	101,325

Data / Parameter:	T_n
Data unit:	K
Description:	Temperature at normal conditions
Source of data used:	Tool to determine the mass flow of a greenhouse gas in a gaseous stream
Value applied:	273.15

Data / Parameter:	$\rho_{i,n}$ and $\rho_{RG,n}$
Data unit:	kg gas i/m ³ wet gas i
Description:	Density of greenhouse gas i in the gaseous stream at normal conditions
Source of data used:	Calculated based on equation in "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 03.0)
Value applied:	0.71566, which is calculated based on equation: $\rho_{i,n} (\rho_{RG,n}) = (P_n * MM_i) / (R_u * T_n)$. The values and data sources of parameters in this equation, including P_t , T_t , MM_i , R_u , have been demonstrated in tables above.

Data / Parameter:	$TDL_{j,y}$ and $TDL_{k,y}$
Data unit:	/
Description:	Average technical transmission and distribution losses for providing electricity to source j or k in year y

Source of data used:	Methodological tool "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (version 03.0)
Value applied:	TDL_{j,y}: 3% TDL_{k,y}: 3% By checking tool "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (version 03.0), the assessment team confirmed that the project belongs to the case of Scenario A. Since electricity consumption by all project electricity consumption sources is smaller than the electricity consumption of all baseline electricity consumption sources, default values of 3% for both baseline emissions and project emissions are adopted.

Data / Parameter:	RATE _{compliance,t,y}
Data unit:	Fraction
Description:	Rate of compliance with a regulatory requirement to implement the alternative waste treatment t implemented in the project activity
Source of data used:	As per ACM0022, data source of this parameter is Official studies, reports and certification from municipal authorities.
Value applied:	0 Calculated based on the number of instances of compliance identified at the time of the investment decision and updated once for every subsequent crediting period

Parameters determined ex-post

Parameter	Description	Monitoring procedure
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	f_y is historic data from FSR /28/ which is determined annually. By checking public information, it is confirmed that in China, the requirement does not specify any amount or percentage of LFG that should be destroyed but require the installation of a system to capture and flare the LFG. As per "Technical code for municipal solid waste

		sanitary landfill" (CJJ17-2004) /43/, landfills are required to be equipped with effective landfill gas from a safety perspective and shall take the initiative to adopt flaring treatment method. However, due to financial and/or technical difficulties, these regulations have not been widely implemented in China. As per the Development Overview of China's Urban Domestic Waste Treatment Industry in 2014 /44/, by the end of 2013, China had a total of 942 waste landfills, but only about 50 of them collected and utilized landfill gas or burned it by torch. As per published Article "Gas generation and collection and utilization in landfill" in 2015 /45/, most landfills in China are not equipped with gas collection devices, and the technology level is low, thus a large amount of gas is discharged in disorder. For conservativeness, it is assumed $f_y = 0.2$ as per ACM0022.
W_x	Total amount of waste disposed in a SWDS in year x	The parameter is continuously measured by weightbridge on wet basis, and aggregated at least annually. The weightbridge will be calibrated annually as per relevant regulations, such as .Verification Regulation for Digital Indication Weighing Instruments (JJG539).
$P_{n,j,x}$	Weight fraction of the waste type j in the sample n collected during the year x	Waste composition, using the waste types j, as provided in the table for DOC_j and k_j will be sampled. Each waste fraction will be measured on wet basis. Minimum three samples of waste were weighed every three months. The samples will be measured as per relevant standard.
Z_x	Number of samples collected during the year x	Minimum three samples of waste were weighed every three months. The number of samples were monitored continuously and aggregated annually. The samples will be measured as per relevant standard.
$EC_{BL,k,y}$	Quantity of electricity that would be consumed by the baseline electricity consumption source k in year y	The parameter will be continuously measured by two bidirectional electricity meters (main meter M1 and backup meter M2) and monthly recorded. The electricity meters were installed in the high voltage switch room of the project site with the accuracy of 0.5S and will be calibrated annually in accordance with national standards or other relevant requirements, such as Verification Regulation of Electrical Meters for Measuring Alternating-current Electrical Energy (JJG596), Technical Administrative Code of Electric Energy Metering (DL/T448). The

		accuracy of electricity meter will satisfy the relevant standards or requirements. The parameter is equivalent to $EG_{t,y}$ in ACM0022, which means the net amount of electricity generated by the alternative waste treatment process t and exported to the grid or displacing fossil fuel fired captive energy plant in year y, and is equivalent to the electricity exported by the project activity
$EC_{PJ,j,y}$	Quantity of electricity consumed by the project electricity consumption source j in year y	The parameter will be continuously measured by two bidirectional electricity meters (main meter M1 and backup meter M2) and monthly recorded. The electricity meters were installed in the high voltage switch room of the project site with the accuracy of 0.5S and will be calibrated annually in accordance with national standards or other relevant requirements, such as Verification Regulation of Electrical Meters for Measuring Alternating-current Electrical Energy (JJG596), Technical Administrative Code of Electric Energy Metering (DL/T448). The accuracy of electricity meter will satisfy the relevant standards or requirements.
$Q_{CH_4,y}$	Quantity of methane produced in the digester in year y	The ex ante estimation of this parameter has been justified above. For ex post calculation, the parameter is monitored through parameters $V_{t,db,n}$, $V_{i,t,db}$, $\rho_{i,n}$ and operation hours. The monitoring of parameters $V_{t,db,n}$, $V_{i,t,db}$ and operation hours are justified below. The parameter $\rho_{i,n}$ is ex ante determined as $0.71566t\ CH_4 / m^3\ CH_4$ at normal condition.
$V_{t,db,n}$	Volumetric flow of the gaseous stream in time interval t on a dry basis at normal conditions	$V_{t,db,n}$ will be monitored continuously by flow meter continuously and converted automatically into standard value at the normal condition of $0^\circ C$ and $101,325\ Pa$. The data will be continuously monitored and recorded monthly. The flow meter will be calibrated every two years by an independent accredited laboratory in accordance with manufacturer's specifications and national regulation, such as Verification Regulation of Thermal Mass Gas Flowmeters (JJG 1132).
$F_{CH_4,RG,m}$	Mass flow of methane in the residual gas in the minute m (kg)	The ex ante estimation of this parameter has been justified above. For ex post calculation, the parameter is monitored through parameters $V_{RG,t,db}$, $V_{RG,t,db}$, $\rho_{RG,n}$ and operation hours.

		The monitoring of parameters $V_{RG,t,db}$, $v_{RG,t,db}$ and operation hours are justified below. The parameter $\rho_{RG,n}$ is ex ante determined as $0.71566t\text{ CH}_4 / m^3\text{ CH}_4$ at normal condition.
$V_{RG,t,db}$	Volumetric flow of the gaseous stream (residue gas) in time interval t on a dry basis at normal conditions	$V_{RG,t,db}$ will be monitored continuously by flow meter continuously and converted automatically into standard value at the normal condition of 0°C and $101,325\text{ Pa}$. The data will be continuously monitored and recorded monthly. The flow meter will be calibrated every two years by an independent accredited laboratory in accordance with manufacturer's specifications and national regulation, such as Verification Regulation of Thermal Mass Gas Flowmeters (JJG 1132).
$v_{i,t,db}$ (Same as $V_{RG,t,db}$)	Volumetric fraction of greenhouse gas CH_4 in a time interval t on a dry basis	$v_{i,t,db}$ will be monitored continuously by gas analyzer operating on wet basis. The data will be continuously monitored and recorded monthly. The gas analyzer will be calibrated annually by an independent accredited laboratory in accordance with manufacturer's specifications, such as Verification Regulation of Alarmer Detectors of Combustible Gas (JJG693).
Operation hours (to calculate $Q_{CH_4,y}$) Operation hours (to calculate $F_{CH_4,RG,m}$)	The total operation hours of the project (to calculate $Q_{CH_4,y}$) The total operation hours of the flare (to calculate $F_{CH_4,RG,m}$)	The ex ante estimation of this parameter has been justified above. This parameter would be hourly monitored and monthly recorded by the project participant.

Based on the on-site visit and interviewed with staff from Guangzhou LEO-KING Environmental Technology Co., Ltd., The assessment team confirmed that monitoring parameter has been correctly described in the joint PD & MR (version 2.1 dated 14/07/2022) and in compliance with the methodology ACM0022 Version 03.0, CDM Validation and Verification Standard for project activities version 03.0, and VCS standard version 4.2.

3.5 Non-Permanence Risk Analysis

Not applicable for the present project activity.

4 VERIFICATION FINDINGS

4.1 Accuracy of GHG Emission Reduction and Removal Calculations

4.1.1 Project Implementation Status

The selected monitoring period 01/04/2020 to 31/12/2021 is the 1st monitoring period of the project, which is within the crediting period 01/04/2020 to 31/03/2027.

The control system at the project site is automated and assures continuous operation, including monitoring on malfunction of equipment. By checking the daily operation and maintenance records and interview with staff from project owner, CTI can confirm that no serious malfunction happened and the project site was under a normal operation as expected in this monitoring period.

On-site training for the related procedures including monitoring, recording and reporting was verified to be in place and their implementation was confirmed by interview with the key operators and observing the operation.

Through visual inspection and document review through site visit, CTI was able to confirm that:

- the project implementation is in accordance with the project description contained in the Joint PD & MR (version 2.1 dated 14/07/2022) and monitoring plan.
- all physical features of the proposed project activity including data collection systems and storage systems have been implemented in accordance with the Joint PD & MR (version 2.1 dated 14/07/2022) and monitoring plan.
- the monitoring plan in the Joint PD & MR (version 2.1 dated 14/07/2022) is in accordance with the approved methodology applied by the project activity, i.e. ACM0022 (Version 03.0).
- The monitoring has been carried out in accordance with the monitoring plan contained in the Joint PD & MR (version 2.1 dated 14/07/2022).
- all parameters stated in the monitoring plan are monitored and reported appropriately.

All parameters required to be monitored by the monitoring plan as per the monitoring methodology ACM0022 (Version 03.0) and the management system were assessed during the site visit. The joint PD & MR lists each parameter required by the monitoring plan and the information flow (i.e. from data generation, aggregation, recording, calculation and reporting) for these parameters is provided. The information flow for each parameter is further verified in the following sections.

4.1.2 Parameters monitored ex post

The parameters that included in the joint PD&MR (version 2.1 dated 14/07/2022) were monitored in the period from 01/04/2020 to 31/12/2021 and were justified as follows:

■ **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 (f_y)**

By checking public information, it is confirmed that in China (also in Guangdong Province where the project is located), the requirement does not specify any amount or percentage of LFG that should be destroyed but require the installation of a system to capture and flare the LFG.

As per "Technical code for municipal solid waste sanitary landfill" (CJJ17-2004) /43/, landfills are required to be equipped with effective landfill gas from a safety perspective and shall take the initiative to adopt flaring treatment method. However, due to financial and/or technical difficulties, these regulations have not been widely implemented in China. As per the Development Overview of China's Urban Domestic Waste Treatment Industry in 2014 /44/, by the end of 2013, China had a total of 942 waste landfills, but only about 50 of them collected and utilized landfill gas or burned it by torch. As per published Article "Gas generation and collection and utilization in landfill" in 2015 /45/, most landfills in China are not equipped with gas collection devices, and the technology level is low, thus a large amount of gas is discharged in disorder.

For conservativeness, f_y is determined as 0.2 as per ACM0022.

■ **Total amount of waste disposed in a SWDS in year x (W_x)**

This parameter was monitored by weightbridge during this monitoring period. Through site visit, it is confirmed that the weightbridge was installed at the project site /65/. By checking Summary Table of quantity and fraction of treated fresh waste /63/, it is confirmed that the readings of weight bridge was continuously monitored and aggregated monthly. Therefore, the assessment team confirmed that the monitoring of this parameter is in compliance with the monitoring plan and the methodology.

W_x was sourced from Summary Table of quantity and fraction of treated fresh waste /63/ covering this monitoring period. By checking the same, the assessment team confirmed that total amount of waste disposed in a SWDS in year X in this monitoring period were:

Year	Value (t)
01/04/2020~31/12/2020	482,551.85
01/01/2021~31/12/2021	654,072.84

■ **Weight fraction of the waste type j in the sample n collected during the year x ($P_{n,j,x}$)**

Weight fraction of the waste was sampled and measured by the project owner during this monitoring period. Each waste fraction was measured on wet basis as per relevant standard. The assessment team confirmed that the monitoring of this parameter is in compliance with the monitoring plan and the methodology.

$P_{n,j,x}$ was sourced from Waste Fraction Testing Report /64/ covering this monitoring period. By checking the same, the assessment team confirmed that Weight fraction of the waste type j in the sample n collected during this monitoring period were:

waste type j	2020	2021
Food	77.63%	77.80%
Paper	6.28%	5.89%
Garden and park waste	0.00%	0.00%
Wood	0.00%	0.00%
Others (Glass, plastic, metal, etc)	12.77%	12.70%
Textile	3.32%	3.61%

■ **Number of samples collected during the year x (Z_x)**

The number of samples were monitored continuously and aggregated monthly during this monitoring period. Minimum three samples of waste were weighed every three months. Therefore, the assessment team confirmed that the monitoring of this parameter is in compliance with the monitoring plan and the methodology.

Z_x was sourced from Waste Fraction Testing Report /64/ covering this monitoring period. By checking the same, the assessment team confirmed that number of samples collected during this monitoring period were:

Year	Value
01/04/2020~31/12/2020	16
01/01/2021~31/12/2021	17

■ **Quantity of electricity that would be consumed by the baseline electricity consumption source k in year y ($EC_{BL,k,y}$)**

The parameter is equivalent to $EG_{t,y}$ in ACM0022, which means the net amount of electricity generated by the alternative waste treatment process t and exported to the grid or displacing fossil fuel fired captive energy plant in year y , and is equivalent to the electricity exported by the project activity.

The parameter will be continuously measured by two bidirectional electricity meters (main meter M1 and backup meter M2) and monthly recorded. The electricity meters were installed in the high voltage switch room of the project site with the accuracy of 0.5S. At 24:00 of the last day of each month, the staff from project owner will record the electricity meter readings and generate Statistic of production data covering this monitoring period /66/. At the same cut-off time, meter readings will be recorded remotely and digitally by local power grid company. Based on the recorded data, local power grid company will issue the ETNs /55/.

EC_{BL,k,y} was sourced from Statistic of production data covering this monitoring period /66/ and ETNs of electricity exported by the project activity /55/ issued by the power grid company covering monitoring period. By checking the same, the assessment team confirmed that the amount of electricity exported by the project activity in this monitoring period were;

Year	Value (MWh)
01/04/2020~31/12/2020	16,077.60
01/01/2021~31/12/2021	23,276.00

■ **Quantity of electricity consumed by the project electricity consumption source j in year y (EC_{Pj,j,y})**

The parameter will be continuously measured by two bidirectional electricity meters (main meter M1 and backup meter M2) and monthly recorded. The electricity meters were installed in the high voltage switch room of the project site with the accuracy of 0.5S. At 24:00 of the last day of each month, the staff from project owner will record the electricity meter readings and generate Statistic of production data covering this monitoring period /66/. At the same cut-off time, meter readings will be recorded remotely and digitally by local power grid company. Based on the recorded data, local power grid company will issue the electricity invoices /56/.

EC_{BL,k,y} was sourced from Statistic of production data covering this monitoring period /66/ and electricity invoices of electricity consumed by the project electricity /56/ issued by the power grid company covering monitoring period. By checking the same, the assessment team confirmed that the amount of electricity exported by the project activity in this monitoring period were:

Year	Value (MWh)
01/04/2020~31/12/2020	378.282
01/01/2021~31/12/2021	2,574.692

■ **Quantity of methane produced in the digester in year y (Q_{CH4,y})**

The parameter is calculated as:

$$Q_{CH4,y} = \frac{V_{t,db} \times v_{i,t,db} \times \rho_{i,n} \times h}{1000}$$

The monitoring of parameters $V_{t,db,n}$, $v_{i,t,db}$ and operation hours are justified below. The parameter $\rho_{i,n}$ is ex ante determined as 0.71566t CH₄ / m³ CH₄ at normal condition. $V_{t,db,n}$, $v_{i,t,db}$ and operation hours are sourced from Statistic of production data covering this monitoring period /66/, by checking the same, it is confirmed Quantity of methane produced in the digester of this monitoring period is calculated to be:

Year	Value (t)
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01/04/2020~31/12/2020	8,534
01/01/2021~31/12/2021	9,842

- **Volumetric flow of the gaseous stream in time interval t on a dry basis at normal conditions ($V_{t,db,n}$)**

The volumetric flow of methane in the gaseous stream was measured by a continuous flow meter with temperature sensor and pressure sensor installed at the inlet of the gas tank. By checking recovery monitoring system Display Screen /65/ during site visit, the assessment team confirmed that the readings of the flow meter with temperature sensor and pressure sensor was continuously monitored and recorded automatically by Online Recovery Monitoring System through recordable electronic signal and was recorded manually by PP monthly. By checking Monitor System Display Screen during site visit, the assessment team confirmed that the parameter $V_{t,db}$ have been converted automatically into normal condition (0°C and 101,325Pa) during the monitoring process.

$V_{t,db,n}$ was sourced from Statistic of production data covering this monitoring period /66/, by checking the same, it is confirmed the hourly average volumetric flow of the gaseous stream on a dry basis at normal conditions of this monitoring period was:

Period	Value (m ³ dry gas/h)
01/04/2020~30/04/2020	2,695
01/05/2020~31/05/2020	3,333
01/06/2020~30/06/2020	3,542
01/07/2020~31/07/2020	3,417
01/08/2020~31/08/2020	3,417
01/09/2020~30/09/2020	2,193
01/10/2020~31/10/2020	2,286
01/11/2020~30/11/2020	2,917
01/12/2020~31/12/2020	2,580
01/01/2021~31/01/2021	2,500
01/02/2021~28/02/2021	2,871
01/03/2021~31/03/2021	2,649
01/04/2021~30/04/2021	2,417

01/05/2021~31/05/2021	1,917
01/06/2021~30/06/2021	2,375
01/07/2021~31/07/2021	3,231
01/08/2021~31/08/2021	3,083
01/09/2021~30/09/2021	2,661
01/10/2021~31/10/2021	2,610
01/11/2021~30/11/2021	2,292
01/12/2021~31/12/2021	1,789

- **Mass flow of greenhouse gas i in the residual gaseous stream in time interval t ($F_{CH_4,RG,m}$)**

The parameter is calculated as:

$$F_{CH_4,RG,m} = V_{RG,t,db} \times v_{RG,t,db} \times \rho_{RG,n} \times \frac{h}{1000}$$

The monitoring of parameters $V_{RG,t,db}$, $v_{RG,t,db}$ and operation hours are justified below. The parameter $\rho_{RG,n}$ is the same as $\rho_{i,n}$ and ex ante determined as 0.71566t CH₄ / m³ CH₄ at normal condition. $V_{RG,t,db}$, $v_{RG,t,db}$ and operation hours are sourced from Statistic of production data covering this monitoring period /66/, by checking the same, it is confirmed mass flow of greenhouse gas i in the residual gaseous stream in time interval t of this monitoring period is calculated to be:

Year	Value (t)
01/04/2020~31/12/2020	3,119
01/01/2021~31/12/2021	1,271

- **Volumetric flow of the gaseous stream (residue gas) in time interval t on a dry basis at normal conditions ($V_{RG,t,db}$)**

The volumetric flow of methane in the gaseous stream (residue gas) was measured by a continuous flow meter with temperature sensor and pressure sensor installed at the inlet of the flare. By checking recovery monitoring system Display Screen /65/ during site visit, the assessment team confirmed that the readings of the flow meter with temperature sensor and pressure sensor was continuously monitored and recorded automatically by Online Recovery Monitoring System through recordable electronic signal and was recorded manually by PP monthly. By checking Monitor System Display Screen during site visit, the assessment team confirmed that the parameter $V_{RG,t,db}$ have been converted automatically into normal condition (0°C and 101,325Pa) during the monitoring process.

$V_{RG,t,db}$ was sourced from Statistic of production data covering this monitoring period /66/, by checking the same, it is confirmed the hourly average volumetric flow of the gaseous stream (residue gas) on a dry basis at normal conditions of this monitoring period was:

Period	Value (m ³ dry gas/h)
01/04/2020~30/04/2020	2,003
01/05/2020~31/05/2020	1,688
01/06/2020~30/06/2020	2,001
01/07/2020~31/07/2020	2,001
01/08/2020~31/08/2020	2,000
01/09/2020~30/09/2020	2,108
01/10/2020~31/10/2020	1,621
01/11/2020~30/11/2020	2,202
01/12/2020~31/12/2020	2,001
01/01/2021~31/01/2021	1,528
01/02/2021~28/02/2021	1,621
01/03/2021~31/03/2021	1,625
01/04/2021~30/04/2021	1,620
01/05/2021~31/05/2021	2,108
01/06/2021~30/06/2021	2,100
01/07/2021~31/07/2021	1,765
01/08/2021~31/08/2021	2,098
01/09/2021~30/09/2021	1,688
01/10/2021~31/10/2021	1,766
01/11/2021~30/11/2021	2,000
01/12/2021~31/12/2021	2,100

- Volumetric fraction of greenhouse gas CH₄ in a time interval t on a dry basis ($v_{i,t,db} / v_{RG,t,db}$)

The volumetric fraction of methane in the gaseous stream was measured by gas analyzer which is installed at the inlet of gas tank. By checking Recovery Monitor System Display Screen during site visit, the assessment team confirmed that the readings of the gas analyzer were continuously monitored and automatically recorded by Online Recovery Monitoring System through recordable electronic signal and was manually recorded monthly by PP.

$v_{i,t,db} / v_{RG,t,db}$ was sourced from Statistic of production data covering this monitoring period /66/, by checking the same, it is confirmed the monthly average volumetric fraction of greenhouse gas CH₄ during this monitoring period were:

Period	Value (m ³ gas CH ₄ /m ³ dry gas)
01/04/2020~30/04/2020	63.69
01/05/2020~31/05/2020	62.14
01/06/2020~30/06/2020	61.54
01/07/2020~31/07/2020	59.47
01/08/2020~31/08/2020	61.87
01/09/2020~30/09/2020	60.75
01/10/2020~31/10/2020	59.88
01/11/2020~30/11/2020	63.51
01/12/2020~31/12/2020	61.56
01/01/2021~31/01/2021	59.41
01/02/2021~28/02/2021	61.37
01/03/2021~31/03/2021	60.75
01/04/2021~30/04/2021	59.41
01/05/2021~31/05/2021	60.87
01/06/2021~30/06/2021	59.75
01/07/2021~31/07/2021	60.14
01/08/2021~31/08/2021	61.54
01/09/2021~30/09/2021	59.47
01/10/2021~31/10/2021	63.52
01/11/2021~30/11/2021	61.57
01/12/2021~31/12/2021	59.42

However, by checking the calibration reports, CTI found the gas analyzer was calibrated on 02/02/2020 and 30/12/2021, which means the calibration period is longer than one year during this monitoring period, not in line with the monitoring plan of the joint PD&MR which stated that the monitoring frequency is annually. As confirmed with PP and by checking manufacturer's specifications, it was verified that the calibration frequency of gas analyzer is recommended to be once every two years by manufacturer. Even through the calibration frequency of gas analyzer was considered to be delayed since Verification Regulation of Alarmer Detectors of Combustible Gas (JJG693) regulated that was the calibration frequency of such instruments should be **not longer than one year**.

As per para 366 and 367 of CDM Validation and Verification Standard for project activities version 03.0, it is stated that the DOE may conclude its verification, provided the conservative approach is adopted in the calculation of GHG emission reductions or net anthropogenic GHG removals: applying the maximum permissible error of the instrument to the measured values taken during the period between the scheduled date of calibration and the actual date of calibration, if the results of the delayed calibration do not show any errors in the measuring equipment, or if the error is smaller than the maximum permissible error. The DOE shall confirm that the error has been applied: In a conservative manner, such that the adjusted measured values of the delayed calibration shall result in fewer claimed GHG emission reductions or net anthropogenic GHG removals.

For the project activity, gas analyzer is out of calibration from 02/02/2021 to 29/12/2021 in this monitoring period. According to CDM VVS, PP applied conservative method to calculate the value of $v_{i,t,db} / v_{RG,t,db}$ for the period from 01/02/2021 to 31/12/2021 by applying the accuracy (2.5%) as the maximum permissible error of the gas analyzer to the measured values, i.e. the adjusted value = measured value $\times (1+2.5\%)$. By checking the same, it is confirmed the adjusted monthly average volumetric fraction of greenhouse gas CH₄ during this monitoring period were:

Period	Value (m ³ gas CH ₄ /m ³ dry gas)
01/04/2020~30/04/2020	63.69
01/05/2020~31/05/2020	62.14
01/06/2020~30/06/2020	61.54
01/07/2020~31/07/2020	59.47
01/08/2020~31/08/2020	61.87
01/09/2020~30/09/2020	60.75
01/10/2020~31/10/2020	59.88
01/11/2020~30/11/2020	63.51
01/12/2020~31/12/2020	61.56
01/01/2021~31/01/2021	59.41
01/02/2021~28/02/2021	62.90
01/03/2021~31/03/2021	62.27
01/04/2021~30/04/2021	60.90
01/05/2021~31/05/2021	62.39
01/06/2021~30/06/2021	61.24
01/07/2021~31/07/2021	61.64
01/08/2021~31/08/2021	63.08

01/09/2021~30/09/2021	60.96
01/10/2021~31/10/2021	65.11
01/11/2021~30/11/2021	63.11
01/12/2021~31/12/2021	60.91

■ **Operation hours (to calculate $Q_{CH_4,y}$) / Operation hours (to calculate $F_{CH_4,RG,m}$)**

The project activity was in normal operational condition during this monitoring period, while the operation hours of generators were monitored by the project owner.

By checking Statistic of production data covering this monitoring period /66/ issued by the project owner, the assessment team confirmed the operational hours of generators in this monitoring period were:

Item	2020 (h)	2021 (h)
Operation hours (to calculate $Q_{CH_4,y}$)	6600	8760
Operation hours (to calculate $F_{CH_4,RG,m}$)	3614	1501

CTI has on-site checked the location of the monitoring equipment against the diagram of monitoring system and found them to be consistent. The data reported in the monitoring report and ERs calculation spreadsheet has been verified by the assessment team. Supporting references and data required to determine the parameters for calculating emission reductions are found to be complete and transparent.

Monitoring equipment and calibration

The monitoring equipments /65/ have been calibrated periodically as per the relevant industrial standard by the qualified third party to ensure the monitoring equipments' accuracy and in good conditions. The relevant information of monitoring equipments' calibration /57/-/62/ is listed as below.

Monitoring parameter	Monitoring equipment	Serial Number	Type	Accuracy Class	Calibration Date	Validity	Calibration Party
W_x	Weighbridge	21050314BD	SCS-100/D2008	III	09/02/2020	08/02/2021	Guangzhou Institute of Measurement and Testing Technology /57/
					02/02/2021	01/02/2022	
$EC_{BL,k,y}$ $EC_{PJ,j,y}$	Electricity meter	001800010302	DSSD71	0.5S	05/02/2020	04/02/2021	South China National Centre of Metrology/Guangdong Institute of Metrology /57/
					02/02/2021	01/02/2022	
		001800010306	DSSD71	0.5S	05/02/2020	04/02/2021	
					02/02/2021	01/02/2022	
$v_{i,t,db}$ $v_{RG,t,db}$	Gas analyzer	62387/2	UE50	$\pm 2.5\%$	02/02/2020 30/12/2021	01/02/2022 29/12/2022	South China National Centre of Metrology/Guangdong Institute of Metrology /57/
$V_{t,db,n}$	Flow meter	2106L3546001	ZD7200MT5HEX	$\pm 1.5\%$	02/02/2020	01/02/2022	South China National Centre of Metrology/Guangdong Institute of Metrology /57/
$V_{RG,t,db}$	Flow meter	18101502	JF63N2	0.5	02/02/2020	01/02/2022	South China National Centre of Metrology/Guangdong Institute of Metrology /57/

The weighbridge was calibrated by a qualified third party, Guangzhou Institute of Measurement and Testing Technology. Calibration records and accreditation certificates /62//58/ have been verified by the assessment team. All calibration gases have been certified and were under their validity period. In the monitoring plan of the joint PD&MR, it stated that the weighbridge will be calibrated and checked for accuracy. By checking the calibration reports, CTI found the calibration frequency of the weighbridge is annual, which is in line with the monitoring plan of the joint PD&MR and the calibrations of meters are verified to be valid for the whole reporting period.

The electricity meters were calibrated by a qualified third party, South China National Centre of Metrology/Guangdong Institute of Metrology. Calibration records and accreditation certificates /61/ /57/ have been verified by the assessment team. The accuracy of meters complies with that in the monitoring plan. By checking the industrial metering configuration standard “Technical Administrative Code of Electric Energy Metering (DL/T 448-2016)” /67/, CTI can confirm that the accuracy level of all meters meet the requirement stipulated in this standard. CTI can thus confirm that the accuracy of the meters is in line with the monitoring plan and relevant industry standard. In the monitoring plan of the joint PD&MR, it stated that the meters will be calibrated and checked for accuracy. By checking the calibration reports, CTI found the calibration frequency of these meters is annual, which is in line with the calibrating standard “Technical Administrative Code of Electric Energy Metering (DL/T 448-2016)” /67/. Hence, CTI can confirm that the meters’ calibration frequency is in line with the monitoring plan of the joint PD&MR and relevant industry standard, and the calibrations of meters are verified to be valid for the whole reporting period.

The gas analyzer was calibrated by a qualified third party, South China National Centre of Metrology/Guangdong Institute of Metrology. Calibration records and accreditation certificates /60//57/ have been verified by the assessment team. All calibration gases have been certified and were under their validity period. In the monitoring plan of the joint PD&MR, it stated that the gas analyzer will be calibrated and checked for accuracy. However, by checking the calibration reports, CTI found the calibration period of the gas analyzer is longer than one year, not in line with the monitoring plan of the joint PD&MR which stated that the monitoring frequency is annually. Therefore, a conservative emission reduction calculation method has been applied and the details have been justified above and in section 4.2 of this report.

The flow meters were calibrated by a qualified third party, South China National Centre of Metrology/Guangdong Institute of Metrology. Calibration records and accreditation certificates /59//57/ have been verified by the assessment team. In the monitoring plan of the joint PD&MR, it stated that these monitoring instruments will be calibrated and checked for accuracy. By checking the calibration reports, CTI found the calibration frequency of the flow meter is every two years which is in line with the monitoring plan of the joint PD&MR and the calibrations of these monitoring instruments are verified to be valid for the whole reporting period.

Data management and control

The project owner is responsible for operation and routine maintenance of power plant under the project activity. The quality assurance and quality control procedures have been addressed in the VER project management and monitoring manual /68/, including the organization structure with the responsibilities, personnel competencies, monitoring procedures and monitoring management. By interview with the staff /67/ and check records /24/ during on-site visit, it can be confirmed that the monitoring management system is implemented following the project management and monitoring manual.

All monitoring devices have been calibrated and maintained periodically to ensure the accuracy of measurement. Calibration records of instruments used in measurements were made available during the verification visit and found to be valid for the entire period of the verification. Competence and training records of in-plant personnel engaged in measurement of plant parameters were presented during verification and found to be in order.

In conclusion, CTI confirms that appropriate methods and formulae for calculating baseline emissions, project emissions and leakage have been followed, and the assumptions, emission factors and default values that are applied in the calculation have been justified.

4.1.3 Emission reductions calculation

Baseline emissions

- Baseline emissions of methane from the SWDS ($BE_{CH_4,y}$)

By checking data sources listed in section 4.1.1 of this report and based on equations, parameters justified in section 3.4.6 of this report, the assessment team confirmed the value of $BE_{CH_4,y}$ of this monitoring period were as follows:

Period	$BE_{CH_4,y}$ (t CO ₂ e)
01/04/2020~31/12/2020	111,980
01/01/2021~31/12/2021	215,921
Total	327,901

- Baseline emissions associated with electricity generation ($BE_{EN,t,y}$)

By checking data sources listed in section 4.1.1 of this report and based on equations, parameters justified in section 3.4.6 of this report, the assessment team confirmed the value of $BE_{EN,t,y}$ of this monitoring period were as follows:

Period	$EC_{BL,k,y}$ (MWh)	$EF_{EL,k,y}$ (tCO ₂ /MWh)	$TDL_{k,y}$	$BE_{EN,t,y}$ (t CO ₂ e)
01/04/2020~31/12/2020	16,077.600	0.50885	3%	8,426
01/01/2021~31/12/2021	23,276.000	0.50885	3%	12,199

Total	39,353.600	/	/	20,625
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Therefore, baseline emission of this project activity during this monitoring period is calculated as:

Period	$BE_{EN,t,y}$ ($BE_{EC,y}$) (t CO ₂ e)	$BE_{CH_4,y}$ (t CO ₂ e)	BE_y (t CO ₂ e)
01/04/2020~31/12/2020	8,426	111,980	120,406
01/01/2021~31/12/2021	12,199	215,921	228,120
Total	20,625	327,901	348,526

Project emissions

By checking data sources listed in section 4.1.1 of this report and based on equations, parameters justified in section 3.4.6 of this report, the assessment team confirmed the value of $PE_{EC,y}$ of this monitoring period were as follows:

Period	$EC_{PJ,y}$ (MWh)	$EF_{EL,j,y} = EF_{grid,CM,y}$ (tCO ₂ /MWh)	$TDL_{j,y}$	$PE_{EC,y}$ (t CO ₂ e)
01/04/2020~31/12/2020	378.282	0.50885	3%	199
01/01/2021~31/12/2021	2,575.892	0.50885	3%	1,350
Total	2,954.174	0.50885	3%	1,549

By checking data sources listed in section 4.1.1 of this report and based on equations, parameters justified in section 3.4.6 of this report, the assessment team confirmed the value of $PE_{CH_4,y}$ and $PE_{flare,y}$ of this monitoring period were as follows:

Period	$Q_{CH_4,y}$ (t CH ₄)	$EF_{CH_4,default}$ (t CH ₄ leaked / t CH ₄ produced)	GWP_{CH_4} (tCO ₂ /tCH ₄)	$PE_{CH_4,y}$ (t CO ₂ e)
01/04/2020~31/12/2020	8,534	0.028	28	6,691
01/01/2020~31/12/2021	9,842	0.028	28	7,717
Total	18,376	/	/	14,408

Period	$F_{CH_4,RG,m}$ (t CH ₄)	$\eta_{flare,m}$ (%)	GWP_{CH_4} (tCO ₂ /tCH ₄)	$PE_{flare,y}$ (t CO ₂ e)
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01/04/2020~31/12/2020	3,119	90	28	9
01/01/2020~31/12/2021	1,271	90	28	4
Total	4,390	/	/	13

Therefore, project emission of this project activity during this monitoring period is calculated as:

Period	PE _{EC,y} (t CO ₂ e)	PE _{flare,y} (t CO ₂ e)	PE _{CH₄,y} (t CO ₂ e)	PE _y (t CO ₂ e)
01/04/2020~31/12/2020	199	9	6,691	6,899
01/01/2021~31/12/2021	1,350	4	7,717	9,071
Total	1,549	13	14,408	15,970

Leakage

As per ACM0022, Version 03.0, the project does not need to consider leakage. Therefore, LE = 0

As justified in section 3.4.6 of this report, the solid digestate will be outward transported and incinerated directly in thermal power plant and will not be stored under anaerobic conditions or be composted. Hence, $LE_{storage,y}=0$ and $LE_{comp,y}=0$.

Therefore, LE_y = 0.

Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates ex-ante

The emission reductions claimed are 332,556 tCO₂e in this monitoring period. Compared with estimated emission reductions of this monitoring period calculated ex-ante, which is 361,586 tCO₂e, the reported emission reductions are 8.03% lower than that expected, which is considered to be in the reasonable variation range.

Verified GHG emission reductions and removals from 01/04/2020 to 31/12/2021:

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
01/04/2020~31/12/2020	120,406	6,899	0	113,507
01/01/2021~31/12/2021	228,120	9,071	0	219,049
Total	348,526	15,970	0	332,556

CTI is able to confirm that the actual emission reductions reported in this monitoring period are reasonable and appropriate. CTI verified the input data for calculating emission reductions and the calculating process, and confirmed the result were complete and transparent. And CTI is able to confirm that GHG emission reductions and removals have been quantified correctly in accordance with the monitoring plan and applied methodology for this verification period.

4.2 Quality of Evidence to Determine GHG Emission Reductions and Removals

As a result of verification of the ER calculation process, the assessment team confirmed that all the parameters required for the determination of the emission reductions have been included in the joint PD & MR /1/ and ER Calculation Spreadsheet /3/ of this monitoring period and are consistent with the applied methodology ACM0022: Alternative waste treatment processes Version 03.0 and the monitoring plan contained in the joint PD & MR. The parameters are complete in this monitoring period.

After verifying the reported figures with the raw data sources, it's confirmed that the values of the parameters from the raw data sources are consistent with those quoted in the ER Calculation Spreadsheet of this monitoring period and joint PD & MR. the verification process for the same has been clearly described above in section 4 of the report.

All necessary documentations are collected, referenced and aggregated, which is easily accessible in hard-copy or electronic format. Measurements are performed by calibrated equipment, and the key data can also be cross-checked via other sources, such as records, receipts and inventory data. No assumptions are used that have any material influence on reported emission reductions.

CTI concludes that during this monitoring period, the evidences for determination of emission reductions are sufficient and reasonable, and the calculation of emission reductions is reliable.

5 VALIDATION AND VERIFICATION CONCLUSION

Shenzhen CTI International Certification Co., Ltd (CTI) has performed the joint validation and verification of the project activity "Guangzhou Eastern Solid Resource Recycling Center MSW Integrated Treatment Plant Project" in China (VCS Project ID: 2746) for the monitoring period 01/04/2020 to 31/12/2021 within the first crediting period 01/04/2020 to 31/03/2027.

The review of the project design documentation and the subsequent follow-up interviews have provided CTI with sufficient evidence to determine the fulfilment of stated criteria.

In the course of the validation and verification, 4 Corrective Action Requests (CARs) were raised and successfully closed. No Clarification Requests (CLs) or Forwarded Action Requests (FARs) was raised.

The review of the project design documentation and additional documents related to baseline and monitoring methodology and subsequent background investigation have provided the CTI with sufficient evidence to validate the fulfilment of the stated criteria. In detail the conclusions can be summarized as follows:

- the baseline scenario is correctly defined as per the applied methodology and relate tools;
- the project is additional;
- all data and information used for ex-ante calculation of emission reductions is of projected and/or hypothetical nature;
- a reasonable level of assurance has been applied.
- the monitoring plan in the validated joint PD&MR is as per the applied methodology ACM0022 Version 03.0;
- the project has been implemented and operated as per the joint PD & MR;
- the project complies with the validation criteria for projects set out in VCS Version 4.2;
- The calculation of the ex ante emission reductions is carried out in a transparent and conservative manner, so that the calculated emission reductions of 2,513,097 tCO₂e are most likely to be achieved within the first crediting period started from 01/04/2020.

It is CTI's responsibility to provide an independent validation statement on the Project's compliance with the VCS Program requirements as set out in the VCS Program Rules. The conclusions of this report show that the project, as it was described in the project description contained in the joint PD & MR, is in line with all criteria applicable for the validation against the VCS standard version 4.2 without any qualifications or limitations.

The verification is based on the baseline and monitoring methodology ACM0022 Version 03.0, and the joint PD & MR (version 2.1 dated 14/07/2022). The project proponents are responsible for the collection, calculation and determination of the GHG data in accordance with the monitoring plan and the reporting of GHG emission reductions on the basis set out within the joint PD & MR. Our verification approach was based on the requirements as defined under the applicable VCS Version 4.2 and relevant UNFCCC requirements. Our approach is risk-based, drawing on an understanding of the risks associated with reporting GHG emissions data and the controls in place to mitigate these. The verification can confirm that:

- the monitoring plan in joint PD & MR is as per the applied methodology;
- the monitoring complies with the monitoring plan in the joint PD & MR;
- the joint PD & MR and other supporting documents provided are complete and verifiable and in accordance with the applicable VCS Version 4.2 and CDM requirements;

- the installed equipment being essential for generating emission reduction runs reliably and is calibrated appropriately;
- the monitoring system is in place and generates GHG emission reductions data;
- the GHG emission reductions are calculated without material misstatements.

It is CTI's responsibility to provide an independent verification statement on the reported GHG emission reductions for the project. Based on an understanding of the risks associated with reporting of GHG emission data and the controls in place to mitigate these, CTI planned and performed our work to obtain the information and explanations that we considered necessary to provide reasonable assurance that reported GHG emission reductions are fairly stated.

CTI does not assume any responsibility towards the issuance and utilization of the VCU's hereby verified and certified. Request for issuance of VCU's shall be made by the project proponent to an approved VCS Program Registry based on the requirements set out under the most recent version of the VCS Program Guidelines clause on VCS Registration.

The verification of reported emission reductions is based on the information made available to CTI and the engagement conditions detailed in this report. CTI cannot be held liable by any party for decisions made or not made based on this report.

In CTI's opinion the GHG emissions reductions of the "Guangzhou Eastern Solid Resource Recycling Center MSW Integrated Treatment Plant Project" for the monitoring period 01/04/2020 to 31/12/2021 are fairly stated in the joint PD & MR (version 2.1 dated 14/07/2022). The GHG emission reductions were calculated correctly on the basis of the approved methodology ACM0022 Version 03.0 and the monitoring plan contained in the joint PD & MR (version 2.1 dated 14/07/2022).

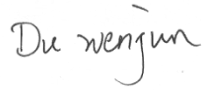
CTI can confirm that the GHG emission reductions are calculated without material misstatements. Based on the evidence and information that are considered necessary to guarantee that GHG emission reductions are appropriately calculated, CTI confirms the following statement:

Verification period: From 01/04/2020 to 31/12/2021

Verified GHG emission reductions and removals in the above verification period:

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
01/04/2020~31/12/2020	120,406	6,899	0	113,507
01/01/2021~31/12/2021	228,120	9,071	0	219,049

Total	348,526	15,970	0	332,556
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Mr. Du Wenjun
Team Leader
15/07/2022



Mr. Zhang Lei
Technical Reviewer
15/07/2022

APPENDIX 1: ABBREVIATIONS

Abbreviations	Full texts
AFOLU	Agriculture, Forestry, and Other Land Use
BM	Build Margin
CDM	Clean Development Mechanism
CME	Coordinating/managing entity
CER	Certified Emission Reduction
CM	Combined Margin
CO ₂	Carbon dioxide
CO ₂ e	Carbon dioxide equivalent
DNA	Designated National Authority
EB	Executive Board
GHG	Greenhouse gas(es)
GS	Gold Standard
EIA	Environmental Impact Assessment
ER	Emission Reduction
ETNs	Electricity Transaction Notes
ETS	Emission Trading Scheme
FAR	Forward Action Request
GHG	Greenhouse gas(es)
IPCC	Intergovernmental Panel on Climate Change
MP	Monitoring Plan
PA	Project Activity
PD	Project Description
PP	Project Proponent
PPA	Power Purchase Agreement

QA/QC	Quality Assurance / Quality Control
UNFCCC	United Nations Framework Convention on Climate Change
VVS	Validation and Verification Standard
VCS	Verified Carbon Standard
VCSA	Verified Carbon Standard Association
VCU	Verified Carbon Unit
VVB	Validation/Verification Body

APPENDIX 2: <COMPETENCE OF TEAM MEMBERS AND TECHNICAL REVIEWERS>

Mr. Wenjun DU

Satisfies the requirements of competence management system of CTI Certification, and is hereby appointed as:

Qualification						
Status	GHG Auditor	Validator	Verifier	Team Leader	Technical Reviewer	Technical Expert
Date	√	√	√	√	-	√

Scope	Technical Area
SS 1: Energy industries (renewable/non-renewable sources)	TA 1.2: Energy generation from renewable energy sources
SS 13: Waste handling and disposal	TA 13.1: Solid waste and wastewater
	TA 13.2: Manure

This appointment is valid for 3 years from its date of approval below and is bound by internal requirements of management system of the Certification Body of CTI.

Approved by: *Wu Lin*

Wu LIN

Technical Competent Manager

Shenzhen, 01/01/2021

Mr. Lei ZHANG

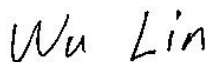
Satisfies the requirements of competence management system of CTI Certification, and is hereby appointed as:

Qualification						
Status	GHG Auditor	Validator	Verifier	Team Leader	Technical Reviewer	Technical Expert
Date	√	√	√	√	√	√

Scope	Technical Area
SS 1: Energy industries (renewable/non-renewable sources)	TA 1.1: Thermal energy generation
	TA 1.2: Energy generation from renewable energy sources
SS 4: Manufacturing industries	TA 4.1: Cement and lime production
SS 13: Waste handling and disposal	TA 13.1: Solid waste and wastewater

This appointment is valid for 3 years from its date of approval below and is bound by internal requirements of management system of the Certification Body of CTI.

Approved by:



Wu LIN

Technical Competent Manager

Shenzhen, 01/01/2021

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Satisfies the requirements of competence management system of CTI Certification, and is hereby appointed as:

Qualification						
Status	GHG Auditor	Validator	Verifier	Team Leader	Technical Reviewer	Technical Expert
Date	√	√	√	√	√	√

Scope	Technical Area
SS 1: Energy industries (renewable/non-renewable sources)	TA 1.1: Thermal energy generation
	TA 1.2: Energy generation from renewable energy sources
SS 2: Energy distribution	TA 2.1: Electricity distribution
SS 3: Energy demand	TA 3.1: Energy demand
SS 4: Manufacturing industries	TA 4.1: Cement and lime production
SS 5: Chemical industry	TA 5.1: Chemical industry
	TA 5.2: Caprolactam, nitric and adipic acid
SS 10: Fugitive emissions from fuels (solid, oil and gas)	TA 10.1: Fugitive emissions from oil and gas
SS 11: Fugitive emissions from production and consumption of halocarbons and sulphur hexafluoride	TA 11.1: Emissions of fluorinated gases
	TA 11.2: Refrigerant gas production
SS 12: Solvents use	TA 12.1: Chemical industry
SS 13: Waste handling and disposal	TA 13.1: Solid waste and wastewater
	TA 13.2: Manure

This appointment is valid for 3 years from its date of approval below and is bound by internal requirements of management system of the Certification Body of CTI.

Approved by:

A handwritten signature in black ink, appearing to read 'Zhou', written in a cursive style.

Lu ZHOU

General Manager

Shenzhen, 01/01/2021

APPENDIX 3: <REFERENCE LIST>

1. Joint project design and monitoring report, version 1.0 dated 07/01/2022, version 2.1 dated 14/07/2022
2. ER calculation spreadsheet for ex-ante estimation
3. ER calculation spreadsheet for monitoring period from 01/04/2020 to 31/12/2021
4. VCS Standard version 4.2, issued on 19/09/2019, updated on 22/04/2021
5. VCS Programme Guideline v4.1, issued on 19/09/2019
6. CDM Validation and Verification Standard for project activities version 03.0
7. CDM Project Standard for project activities version 03.0
8. CDM project cycle procedure for project activities version 03.0
9. Approved methodology ACM0022: Alternative waste treatment processes, Version 03.0
10. Combined tool to identify the baseline scenario and demonstrate additionality (version 07.0)
11. Common practice (version 03.1)
12. Investment analysis (version 11.0)
13. Emissions from solid waste disposal sites (version 08.0)
14. Project and leakage emissions from anaerobic digesters (version 02.0)
15. Tool to calculate the emission factor for an electricity system (version 07.0)
16. Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation (version 03.0)
17. Tool to determine the mass flow of a greenhouse gas in a gaseous stream (version 03.0)
18. Project emissions from flaring (version 04.0)
19. list of contracts of the project activity
20. Nameplate of the equipment
21. General Construction contract signed between the project owner and Shenzhen Luculent Environmental Protection Co., Ltd. on 12/10/2017
22. 2019 Baseline Emission Factors for Regional Power Grids in China dated 29/12/2020
23. Power Purchase Agreement signed between Guangzhou LEO-KING Environmental Technology Co., Ltd. and local Power Grid Company
24. Operation Logs (including evidence of the operation start date)
Business License of Guangzhou LEO-KING Environmental Technology Co., Ltd.
25. Notice on Approval of Registration Change issued by Guangzhou Huangpu District Market Supervision Administration on 27/07/2020
26. Project approval of the project activity issued by Guangzhou City Development and Reform Commission on 02/12/2016
27. Environmental Impact Assessment Report of the project activity
28. Feasibility study report (FSR) compiled by China Light Industry Guangzhou Academy of Engineering in Nov 2016
VAT refund policies issued by China State Taxation Administration
29. <http://www.chinatax.gov.cn/n810219/n810744/n3439465/n3439475/n3439554/c3448550/content.html>

30. Chinese power regulation: http://www.gov.cn/gongbao/content/2002/content_61480.htm
31. Environmental Impact Assessment (EIA) approval issued by Guangzhou City Environment Bureau on 02/05/2017
32. BOT franchise agreement signed between the project owner and Guangzhou City Administration Commission
33. Economic Evaluation Measurement and Parameters of Constructive Projects, version 03 issued by NDRC and the Ministry of Construction
34. Interim Rules on Additional Tax for City Development
35. Provisional Regulations of the People's Republic of China on Education tax
36. Enforcement Regulation of Income Tax Law of the People's Republic of China for Enterprises issued by State Council on 06/12/2007
37. Interim Regulation of VAT of the People's Republic of China issued by State Council
38. Formula of economic evaluation of construction project
39. 2017 Guangzhou Statistic Yearbook
https://lwzb.gzstats.gov.cn:20001/datav/admin/home/www_nj/
40. Compilation method of municipal engineering investment estimation issued by Ministry of Construction of China
<http://www.doc88.com/p-0337217900825.html>
41. the literature "Project Economic Evaluation" public available at
<http://wenku.baidu.com/view/fe5f34d676a20029bd642de7.html>
42. the publication "Financial Evaluation Practice and Analysis of Difficult Problems-Feasibility study and evaluation of Bank loan projects" issued by China Planning Press
43. Technical code for municipal solid waste sanitary landfill (CJJ17-2004)
<https://wenku.baidu.com/view/512fb0727c1cfad6185fa74e.html>
44. Development Overview of China's Urban Domestic Waste Treatment Industry in 2014
<https://wenku.baidu.com/view/3aebdca9360cba1aa911da12.html>
45. published Article "Gas generation and collection and utilization in landfill" in 2015
<https://jz.docin.com/p-1652165491.html>
46. Technical Agreement of the enclosed flare of the project activity
47. Wind resource situation in Guangdong Province:
<https://news.bjx.com.cn/html/20151015/671884.shtml>
48. Solar resource situation in Guangdong Province:
https://www.sohu.com/a/293922336_468672
49. Biomass resource situation in China:
https://wenku.baidu.com/view/475ac276940590c69ec3d5bbfd0a79563d1ed413.html?fixfr=OoXDKEm%252BwPnIIMw3W%252FQ%252F2A%253D%253D&fr=income4-wk_app_search_ctrX-search
50. Geothermal resource situation in China:
<http://news.bjx.com.cn/html/20120313/347598.shtml>
51. Equipment Purchase Contract signed between the project owner and Shenzhen Luculent Environmental Protection Co., Ltd. on 15/08/2017
52. Biodiesel Sales Statistic covering this monitoring period

53. Sample of Biodiesel Purchase Agreement
54. Local stakeholder consultation questionnaire
55. ETNs for electricity export issued by local power grid company covering the monitoring period.
56. Electricity invoices of electricity consumed by the project electricity issued by local power grid company covering the monitoring period.
57. Qualification of South China National Centre of Metrology, Guangdong Institute of Metrology, issued by General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China issued on 01/11/2017, valid till 31/10/2022
58. Qualification of Guangzhou Institute of Measurement and Testing Technology, issued by Guangdong Provincial Market Supervision and Management Bureau on 02/08/2019, valid till 01/08/2024
59. Calibration Certificate of flow meter issued by South China National Centre of Metrology, Guangdong Institute of Metrology covering this monitoring period
60. Calibration Certificate of Gas analyzer issued by South China National Centre of Metrology, Guangdong Institute of Metrology covering this monitoring period
61. Calibration Certificate of electricity meters issued by South China National Centre of Metrology, Guangdong Institute of Metrology covering this monitoring period
62. Calibration Certificate of weighbridge issued by Guangzhou Institute of Measurement and Testing Technology covering this monitoring period
63. Summary Table of quantity and fraction of treated fresh waste covering this monitoring period
64. Waste Fraction Testing Report covering this monitoring period
65. Photos of recovery monitoring system Display Screen, flow meter, electricity meters, weighbridge, gas analyzer
66. Statistic of production data covering this monitoring period
67. Technical Administrative Code of Electric Energy Metering (DL/T 448-2016)
68. VER project management and monitoring manual
69. Completion acceptance report issued by the project owner, Dongguan Geological Engineering Investigation Institute, Guangdong Province, China Aviation Planning and Design Research Institute Co., Ltd. etc.
70. Attendance List of CTI auditing meeting
71. Wind resource situation in Guangdong Province:
<http://swj.gz.gov.cn/>
72. 2021 Financial Cost Statement
73. Policies issued by China National Energy Bureau
http://www.nea.gov.cn/2021-09/27/c_1310212584.htm
74. staff roster
75. "Notice on Strengthening Enterprise Greenhouse Gas Emission Report Management" issued by National Development and Reform Committee of P.R.China
76. "List of key emissions in the national carbon emissions transaction quota management in 2019-2020" issued by Ministry of Ecology and Environment of P.R.China

APPENDIX 4: <CLARIFICATION REQUESTS, CORRECTIVE ACTION REQUESTS, FORWARD ACTION REQUESTS (CAR/CL/FAR)>

CAR ID	01	Section no.	3.4.5	Date: 17/01/2022
Description of CAR				
For Additionality of the project activity, please: 1. Provide evidence to demonstrate the rationality of annual material fee, Waste treatment fee and annual other cost; 2. Supplement the parameter “income tax” in Table 3-3 Main parameters for financial analysis calculation; 3. Compared with electricity revenue, biodiesel revenue and subsidy revenue, please conduct sensitivity analysis based on financial parameters directly from Table 3-3 Main parameters for financial analysis calculation, i.e. annual electricity generation and electricity tariff, biodiesel quantity and biodiesel price, MSW quantity and subsidy price.				
Project proponent response				Date: 23/03/2022
1. The rationality of annual material fee, Waste treatment fee and annual other cost has been provided in the revised joint PD&MR. 2. The parameter “income tax” in Table 3-3 Main parameters does not involve the financial analysis calculation due to that the benchmark project IRR of Petroleum Processing and Petroleum Products Manufacturing is before tax. 3. The sensitivity analysis based on financial parameters directly from Table 3-3 Main parameters for financial analysis calculation, i.e. annual electricity generation and electricity tariff, biodiesel quantity and biodiesel price, MSW quantity and subsidy price has been added in the revised joint PD&MR.				
Documentation provided by project proponent				
Updated joint PD&MR and relevant evidences, i.e. 2021 Financial Cost Statement, Policies issued by China National Energy Bureau, staff roster, list of contracts of the project activity, etc.				
DOE assessment				Date: 23/03/2022
By checking the updated joint PD&MR and relevant evidences as justified in section 3.4.5 of this report, it is confirmed that: 1. Evidences have been provided by PP to demonstrate the rationality of annual material fee, waste treatment treatment fee and annual other cost;				

2. The parameter “income tax” has been supplemented in Table 3-3 Main parameters for financial analysis calculation of the updated joint PD&MR, and confirmed by the assessment team to be correct;

The sensitivity analysis has been conducted based on parameters annual electricity generation and electricity tariff, biodiesel quantity and biodiesel price, MSW quantity and subsidy price, and confirmed by the assessment team to be reasonable and correct.

Therefore, CAR 01 was closed.

CAR ID	02	Section no.	3.4.6	Date: 17/01/2022
Description of CAR				
By checking 2019 Baseline Emission Factors for Regional Power Grids in China dated 29/12/2020, it is confirmed $EF_{grid,OMsimple,y}$ is 0.8042 tCO ₂ /MWh and $EF_{grid,BM,y}$ is 0.2135 tCO ₂ /MWh. Therefore, $EF_{grid,CM,y}$ is calculated to be 0.50885 tCO ₂ /MWh. However, in the joint PD&MR (version 1.0 dated 07/01/2022), $EF_{grid,CM,y}$ is 0.50885 tCO ₂ /MWh, which is not conservative. Please update $EF_{grid,CM,y}$ accordingly and recalculate emission reductions in the joint PD&MR.				
Project proponent response				Date: 23/03/2022
$EF_{grid,CM,y}$ has been corrected in the revised joint PD&MR.				
Documentation provided by project proponent				
Updated joint PD&MR				
DOE assessment				Date: 23/03/2022
By checking Updated joint PD&MR and ER calculation sheet, it is confirmed that the $EF_{grid,CM,y}$ applied as 0.50885 tCO ₂ /MWh and emission reductions has been recalculated and confirmed by the assessment team to be correct.				
Therefore, CAR 02 was closed.				

CAR ID	03	Section no.	4.1.1	Date: 17/01/2022
Description of CAR				
For monitoring parameters for this monitoring period, please:				
1. Supplement the location of measurement instruments, i.e. weighbridge, flow meter, electricity meters and gas analyzer, and the monitoring and recording frequency;				
2. The calibration date and valid date of electricity meters listed for parameter $EC_{PJ,j,y}$ is not consistent with the calibration certificates, please update accordingly;				
3. The value of $EC_{PJ,j,y}$ from 01/01/2021~31/12/2021 are not consistent with Statistic of production data covering this monitoring period.				
Project proponent response				Date: 23/03/2022

1. The location of measurement instruments, i.e. weighbridge, flow meter, electricity meters and gas analyzer, and the monitoring and recording frequency has been provided in the revised joint PD&MR.
2. The calibration date and valid date of electricity meters listed for parameter ECP_{j,y} has been corrected in the revised joint PD&MR.
3. The value of EC_{Pj,y} from 01/01/2021~31/12/2021 has been corrected in the revised joint PD&MR.

Documentation provided by project proponent

Updated joint PD&MR

DOE assessment

Date: 23/03/2022

By checking the updated joint PD&MR, it is confirmed that the location of measurement instruments, i.e. weighbridge, flow meter, electricity meters and gas analyzer, and the monitoring and recording frequency has been supplemented in the updated joint PD&MR, and confirmed by the assessment team to be correct.

Therefore, CAR 03 was closed.

CAR ID	04	Section no.	4.1.2	Date:	17/01/2022
Description of CAR					
Please provide detailed calculation process of $BE_{CH4,y}$, $PE_{flare,y}$ and $PE_{CH4,y}$ in the joint PD&MR.					
Project proponent response				Date:	23/03/2022
The detailed calculation process of $BE_{CH4,y}$, $PE_{flare,y}$ and $PE_{CH4,y}$ has been Please provided in the revised joint PD&MR.					
Documentation provided by project proponent					
Updated joint PD&MR					
DOE assessment				Date:	23/03/2022
The detailed calculation process of $BE_{CH4,y}$, $PE_{flare,y}$ and $PE_{CH4,y}$ has been supplemented in the updated joint PD&MR and confirmed by the assessment team to be correct and consistent with that in the ER calculation sheet.					
Therefore, CAR 04 was closed.					