LIANZHOU LANDFILL GAS POWER GENERATION PROJECT

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

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Work carried out by	Lead Auditor / Technical Expert: Doris Dai Technical Reviewer: Simon Shen

Summary:

LGAI Technological Center, S.A. (hereafter referred to as "Applus+ Certification") has been commissioned by Goldchina Consultancy International Co., Ltd. to perform the validation of project activity "Lianzhou Landfill Gas Power Generation Project" (hereafter referred to as "the project activity") and reported in the Project Description.

The project activity is a landfill gas recovery and power generation project located at Jiupo town, Lianzhou City, Qingyuan City, Guangdong Province, P. R. China, of which the main purpose is to use landfill gas for electricity generation. The total installed capacity of the project activity is 3 MW consisting of 5 sets of 600 kW generators. The project uses LFG from Lianzhou MSW landfill for power generation. During the first 7 years renewable crediting period, the power generated by the project is expected to be 109,379 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 Southern Power Grid (CSPG). Meanwhile by utilization the landfill gas recovered by project, the project activity avoids the emission of methane that would be generated under landfill condition. It's estimated that the project activity could achieve GHG emission reductions of 577,253 tCO_2e during the 1st renewable crediting period.

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

- ACM0001: Flaring or use of landfill gas, version 19.0
- Emissions from solid waste disposal sites, version 08.0
- 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
- Tool to calculate the emission factor for an electricity system, version 07.0
- Positive lists of technologies, version 04.0

The projects compliance with, the requirements of Article 12 of the Kyoto Protocol, the CDM Modalities and Procedures as agreed in the Marrakech Accords under decision 3/CMP.1, the annexes to this decision, subsequent decisions and guidance made by COP/MOP & CDM Executive Board and other relevant rules, including the Host Country legislation and sustainability criteria along with VCS guideline and standard version 4.4

- CDM Validation and Verification Standard for project activities version 03.0
- VCS standard version 4.4
- VCS guideline version 4.3

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

- A risk-based approach has been followed to perform this validation and verification activity. In the course of Validation, 1 Corrective Action requests (CARs), 0 Clarification Requests (CLs), and 0 Forward action request (FARs) were raised and successfully closed. The review of the project description and additional documents related to baseline and monitoring methodology; the subsequent background investigation, follow-up interviews and project owners have provided LGAI Technological Center S.A. (Applus+ Certification) with sufficient evidence to verify the fulfilment of the stated criteria of VCS.

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1 INTRODUCTION

1.1 Objective

LGAI Technological Center, S.A. (hereafter referred to as "Applus+ Certification") has been commissioned by Goldchina Consultancy International Co., Ltd. to perform the validation of project activity "Lianzhou Landfill Gas Power Generation Project" (hereafter referred to as "the project activity") and reported in the Project Description.

LGAI Technological Center, S.A. as the validation body of the project activity has been accredited as a DOE by UNFCCC and also meets the competence requirements as set out in ISO 14065:2020.

The objective of this validation is to ensure that reported information in the Project Description of "Lianzhou Landfill Gas Power Generation Project" is complete and accurate in accordance with applicable VCS standards and relevant UNFCCC requirements.

1.2 Scope and Criteria

The validation scope is defined as an independent and objective review of the project design (PD). The PD is reviewed against the criteria stated in Article 12 of the Kyoto Protocol, the CDM modalities and procedures as agreed in the Marrakech Accords and the relevant decisions by the CDM Executive Board, including the approved baseline and monitoring methodology ACM0001-version 19.0. The validation was based on the requirements in the CDM Validation and Verification standard for project activities version 03.0 and VCS guideline and standard version 4.4.

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

1.3 Reasonableness of Assumptions

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

The validation conclusion is assured a reasonable level of assumptions.

1.4 Summary Description of the Project

Project title	Lianzhou Landfill Gas Power Generation Project
Project Participants	Lianzhou Dongkang Renewable Energy Technology Co., Ltd. (Project owner, host country, P. R. China)
Location of the project	Jiupo town, Lianzhou City, Qingyuan City, Guangdong Province, P. R. China. Geographic coordinates: longitude of 112°20′09.20″ E and latitude of 24°44′27.74″ N
Project start date	01/06/2021, the commissioning start date
Applied Methodology/Version	ACM0001, Version 19.0
Scope/Technical Area	Scope 01: energy industries (renewable-/non-renewable sources) and sectoral scope 13: Waste handling and disposal

The project activity is a landfill gas recovery and power generation project located at Jiupo town, Lianzhou City, Qingyuan City, Guangdong Province, P. R. China, of which the main purpose is to use landfill gas for electricity generation. The total installed capacity of the project activity is 3 MW consisting of 5 sets of 600 kW generators. The project uses LFG from Lianzhou MSW landfill for power generation. During the first 7 years renewable crediting period, the power generated by the project is expected to be 109,379 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 Southern Power Grid (CSPG). Meanwhile by utilization the landfill gas recovered by project, the project activity avoids the emission of methane that would be generated under landfill condition. It's estimated that the project activity could achieve GHG emission reductions of 577,253 tCO_2e during the 1st renewable crediting period.

2 VALIDATION PROCESS

2.1 Method and Criteria

Validation was conducted using Applus+ Certification's procedures in line with the requirements specified in the VCS Standard version 4.4, CDM M&P, the latest version of the CDM Validation and Verification Standard, and relevant UNFCCC requirements and applying standard auditing techniques. No sampling was utilized during the site visit as well as validation for project activity.

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

- Project Details;

- Application of Methodology;

- Estimated GHG Emission Reduction and Removals;

- Monitoring;

- Safeguards etc.

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

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

Assessment team

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

- Leader Auditor (LA)

- Auditor (A)/ Auditor Trainee (AT)

- Technical Reviewer (TR)

- Technical Experts (TE)

Name	Qualification	Coverage of scope	Coverage of Technical Area	Host country experience
Doris Dai	*LA/TE*	*Y (1.1 and 13.1)*	*Y*	*Y*
Simon Shen	*TR*	*Y (1.1 and 13.1)*	*Y*	*Y*

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

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

2.2 Document Review

The VCS project design version 02 dated 02/11/2022, version 04 dated 30/03/2023 were assessed as part of the validation. Relevant documents were reviewed. A detailed documents reviewed are listed in Appendix 1 of the report.

2.3 Interviews

The key personnel interviewed are summarized in the table below:

Interviewed personnel	Role	Organization	Subject
Ms. Lu Yongjiao	General Manager	Lianzhou Dongkang Renewable Energy Technology Co., Ltd.	Status of the project (including PPs); Applicability of selected methodology;

Mr. Yin Jian	Operation Director	Lianzhou Dongkang Renewable Energy Technology Co., Ltd.	Baseline of the project and its updates; Emission factors and their updates; Monitoring plan; Stakeholder consultation process and its outcomes. The process and participation of the stakeholder consultation; The impact of the project activity; The complaint by local stakeholders and the implementation of the mitigation measures.
Mr. Zhao Keqiang	Staff	Lianzhou Dongkang Renewable Energy Technology Co., Ltd.	
Mr. Sun Zhiyong	Villager	Lianyi Village	
Mr. Zhao Guojing	Villager	Lianyi Village	
Dr. Zheng Zhaoning	Technical Director	Goldchina Consultancy International Co., Ltd.	Data collection and ER calculation.
Mr. Li Wenbing	Project Manager	Goldchina Consultancy International Co., Ltd.	

2.4 Site Visits

The assessment team performed the on-site validation (Jiupo town, Lianzhou City, Qingyuan City, Guangdong Province, P. R. China) on 16-17/01/2023. The interviewed personnel and objective are listed in above table.

2.5 Resolution of Findings

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

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

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

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

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

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

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

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

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

The final VCS PD Version 04 submitted by project developer on 30/03/2023 serves as the basis for the final assessment presented. Additional changes to the project during the validation and verification process are not considered to be significant with respect to the main CDM/VCS

objectives. The two CDM/VCS main objectives are the reduction of anthropogenic GHG emissions and the contribution of sustainable development to the host country.

Areas of validation and verification findings	No. of CL	No. of CAR	No. of FAR
Project design document and Monitoring report	00	00	00
Description of project activity	00	00	00
Application of selected baseline and monitoring methodology and selected standardized baseline			
- Applicability of methodology and standardized baseline	00	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	00	00
- Emission reductions	00	01	00
- Monitoring plan	00	00	00
-Stakeholders consultation process	00	00	00
- Public comments	00	00	00

Others (please specify)-Matter related to double counting- for validation	0 0	00	00
Total	0 0	01	00

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

2.5.1 Forward Action Requests

None FAR was raised during the validation process.

3 VALIDATION FINDINGS

3.1 Project Details

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

The project activity is a landfill gas recovery and power generation project of which the main purpose is to use landfill gas for electricity generation. The total installed capacity of the project activity is 3 MW consisting of 5 sets of 600 kW generators.

The project uses LFG from Lianzhou MSW landfill for power generation. During the first 7 years renewable crediting period, the power generated by the project is expected to be 109,379 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 Southern Power Grid (CSPG). Meanwhile by utilization the landfill gas recovered by project, the project activity avoids the emission of methane that would be generated under landfill condition. It's estimated that the project activity could achieve GHG emission reductions of 577,253 tCO_2e during this crediting period.

The project activity is located in Jiupo town, Lianzhou City, Qingyuan City, Guangdong Province, P. R. China. The project activity has been developed by Lianzhou Dongkang Renewable Energy Technology Co., Ltd. The geographic coordinates of the project activity is longitude of 112°20′09.20″ E and latitude of 24°44′27.74″ N which is confirmed by site visit.

The Project activity has been approved by Chinese government by checking the Project approval and Environmental Impact Assessment (EIA) approval. The project started construction on 02/06/2020 confirmed by checking construction order and commissioned on 01/06/2021 by checking operation log and site visit.

Project design, including eligibility criteria for grouped projects

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

Type	Gas-fired Engine and generator	
Manufacture	Shandong Chaji New Energy Technology Co., Ltd	Jinan Qi Neng Power Equipment Co., Ltd
Model	600GF-NK	600QF-NK
Units	2	3

Rated Voltage	400 V	400 V
Rated capacity	600 kW	600 kW
Lifetime	20 years	20 years

Theoretically, electricity generation system would operation continuously. In emergency case that electricity generation system is not operational, the LFG generated would be sent to a flare system for burning.

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

By checking project approval and site visit, assessment team confirmed the project has been designed to include a single installation of an activity.

Project proponent and other entities involved in the project

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

Organization name	Lianzhou Dongkang Renewable Energy Technology Co., Ltd.
Contact person	Tony You
Title	Vice General Manger
Address	Shop 09, First floor, Tianyinglijing Commercial Building, Lianzhou Town, Lianzhou City, Guangdong Province, China 513400
Telephone	86-13538080705
Email	190322962@qq.com

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

Organization name	Shenzhen Times Huanneng Technology Co., Ltd
Role in the project	Consultancy
Contact person	Tony You
Title	Manager
Address	Room 25J, Building 4, Songpingshan Phase III West, Xili Street, Nanshan District, Shenzhen, Guangdong Province, China 518052
Telephone	(86)-13538080705
Email	vcu.you@foxmail.com

Organization name	Goldchina Consultancy International Co., Ltd.
Role in the project	Technical support
Contact person	Dr. Zheng Zhaoning
Title	Technical Director
Address	Room 230, Unit B, Building 2, Tangning One, No. 16 of Zhongguancun East Road, Haidian District, Beijing, China 100083
Telephone	(86) 18010121386
Email	zzn@gcci-carbon.com

Project Ownership

Lianzhou Dongkang Renewable Energy Technology Co., Ltd. is the project owner of project activity and they have the legal right to control and operate the project activities.

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

Project Start Date

Start date of the project activity is 01/06/2021, which is the commissioning start date. Assessment team checked operation log to confirm the date.

Project crediting period Date

The project activity adopts 3*7 years renewable crediting period, the first crediting period is 7 years.

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

1st Crediting Period Start date: 01/06/2021

1st Crediting Period End date: 31/05/2028

Project Scale and Estimated GHG Emission Reductions or Removals

Assessment team confirms that the project is a large-scale project under CDM scheme. The total installed capacity of the project activity is 3 MW.

Project Scale	
Project	✓
Large project	

As the estimated annual average GHG emission reductions or removal per year is 82,464 tCO_2e which is less than 300,000 tonnes of CO_2e per year, thus the project falls in the category of Project.

Year	Estimated GHG emission reductions or removals (tCO_2e)
01/06/2021-31/12/2021	37,201
2022	68,980
2023	74,455
2024	79,951
2025	85,527
2026	91,227
2027	97,084
01/01/2028-31/05/2028	42,828
Total estimated ERs	577,253
Total number of crediting years	7
Average annual ERs	82,464

By checking FSR and site visit interview with staff from Lianzhou MSW landfill, it is confirmed that the landfill started operation in 2015 with an operational lifespan of 30 years, the operation of project would last which cover the whole crediting period.

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

Project location

The project activity is located in Jiupo town, Lianzhou City, Qingyuan City, Guangdong Province, P. R. China. The project activity has been developed by Lianzhou Dongkang Renewable Energy

Technology Co., Ltd. The project is located at longitude of 112°20′09.20″ E and latitude of 24°44′27.74″ 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 landfill gas combusted would be disposed in the landfill without utilization.

Project compliance with applicable laws, statutes and other regulatory frameworks

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

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

Participation under other GHG programs

Projects registered (or seeking registration) under other GHG program(s)

The project has neither been registered nor seeking registration under any other GHG programs. The project is seeking registration only in VCS program. Applus+ Certification checked the REC Mechanism database of China and found that the project activity is not accredited / registered under REC mechanism. Further, declaration for the same is checked and found correct by the assessment team. Also, assessment team checked the following registries to confirm the same. The details of the registries checked are as follows:

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

- http://www.irecstandard.org/

- http://cdm.unfccc.int/

- http://www.goldstandard.org/

Rejection by other GHG programs

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

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

- http://www.irecstandard.org/

- http://cdm.unfccc.int/

- http://www.goldstandard.org/

- http://verra.org/

Other forms of credit and supply chain (Scope 3) emissions

Emissions trading programs and other binding limits

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

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

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

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

Issuance of public statement(s) to help prevent scope 3 emissions double claiming

By site visit interview and checking website of the project owner, it is confirmed that the project does not involve in issuance of public statement to help prevent scope 3 emissions double claiming. Moreover, as an electricity generation project, the electricity generated would be supplied to the grid, no such scope 3 emissions occurs in China based on professional knowledge of assessment team as the project is not in a supply chain.

Email notification of the potential risk of Scope 3 emissions double claiming

The project is not in a supply chain; therefore, this is not applicable for the project.

Additional information relevant to the project

Leakage management for AFOLU projects

Not applicable to the project activity.

Commercially sensitive information

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

Sustainable development contributions

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

SDG 8 Economic Growth: The project creates direct and indirect employment opportunities during construction and operation phases. Therefore, the project contributes to SDG Target 8.5 "By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities and equal pay for work of equal value".

SDG 9 Infrastructure, Industrialization: SDG Target 9.4 requires "By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities". The project helps the Target 9.4 by implementing a clean, reliable and environmental-friendly infrastructure for clean energy production / up-to-date industrialization.

SDG 13 Climate Change: The project produces clean renewable energy by diminishing CO_2 emissions. Therefore, it contributes SDG Target 13.3 "Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning".

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

3.2 Safeguards

3.2.1 No Net Harm

The Environmental Impact Assessment (EIA) Report of the project activity was compiled by Shenzhen Dachuang Environmental Protection Technology Co., Ltd and approved by the Environmental Protection Bureau of Lianzhou City, Qingyuan City on 27/10/2020. The assessment team confirm all environmental impacts has been analyzed and no net harm was detected.

As all potential environmental and socio-economic impacts have been discussed in the EIA. The assessment team check the same and find there are no negative potential environmental and socio-economic impacts. Moreover, based on the professional experience of assessment team, and site visit, the assessment team confirm that there are no negative potential environmental and socio-economic impacts detected during the site visit.

3.2.2 Local Stakeholder Consultation

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

A local stakeholder consultation meeting was held on 17/07/2020 by the project owner. During the meeting, the project information and the continuous input / grievance mechanism have been introduced to the local stakeholders. The project information with contact information has also been posted on the bulletins at and nearby the project site.

During the meeting, a survey was carried out on the local residents and comments received from the survey are summarized as follows. The survey was conducted through distributing and collecting responses to a questionnaire. In total 10 out of 10 questionnaires were returned with a 100% response rate.

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

Moreover, grievance mechanism was also explained during the local stakeholder consultation meeting.

During project implementation phase, there is a public comments collection and feedback book for the power plant. The local stakeholders can leave their opinions, comments and concerns on the project and contact information in the public comments collection and feedback book at any time. The project owner will contact the local stakeholders to give feedback within one week.

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

3.2.3 Environmental Impact

By checking Environmental Impact Assessment (EIA) Report compiled by Shenzhen Dachuang Environmental Protection Technology Co., Ltd, the environmental impact has been presented as below:

Water Quality

The amount of wastewater which is produced by the project is very small. The condensate water during the process of landfill gas collection will be treated by the landfill leachate treatment system. The domestic wastewater from onsite employees will be treated in the septic tank and then treated by the landfill leachate treatment system.

Air Quality

This project uses LFG which is collected from Lianzhou landfill site to generate electricity, and it avoids uncontrolled releasing of LFG. Therefore, it reduces greenhouse gas and effluvium emitting to air, and mitigates the possible danger of fire or explosion.

The emission amount of NO_x, SO_2 and NH_3 for this project is less than the national emission standards, that is because prior to electricity generation, LFG has been pre-treated to remove its impurities and moisture. After that, LFG is sent to gas-fired engines. And the exhaust gas would be emitted to atmosphere which is far away from sensitive targets. Therefore, the emission of exhaust gas has little impact on surrounding environment.

Noise

The project is surrounded by landfill site and mountains, the only building which is next to the project is Lianzhou landfill site office building. The EIA has said that under the influence of distance attenuation, air absorption and trees blocking, the noise of the project has no impact on surrounding residential areas.

Solid Waste

This project produces small amounts of solid waste. The general industrial solid waste is dust. All solid waste will be sent to the landfill site, which could not only ensure the safety of disposal, but also has little impact on surrounding environment.

After the above measures are performed, the negative impacts on environment will be minimized below the requirements of laws and regulations during the construction and operational period. The environmental impacts during the construction and operation of the Project have been carefully and strictly assessed; measures have been taken to minimize the potential negative impacts and to ensure that there is no net harm.

3.2.4 Public Comments

Applus+ Certification noted that this project was open for public comment from 29/11/2022 to 29/12/2022. The detail was checked by the assessment team in the following web platform: https://registry.verra.org/app/projectDetail/VCS/3940.

During the period, no public comments were received.

3.2.5 AFOLU-Specific Safeguards

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

3.3 Application of Methodology

3.3.1 Title and Reference

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

Title: Flaring or use of landfill gas

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 82,464 tCO_2e which is larger than 60,000 tonnes of CO_2e per year.

Methodology: Flaring or use of landfill gas[1], ACM0001, Version 19.0

Type I: Energy industries (renewable / non-renewable sources)

Sectoral scope(s): 01 and 13

Category: Approved Consolidated Methodology

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

- Emissions from solid waste disposal sites, Version 08.0

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

- Tool to calculate the emission factor for an electricity system, Version 07.0

- Tool to determine the mass flow of a greenhouse gas in a gaseous stream, Version 03.0

- Positive lists of technologies, Version 04.0

3.3.2 Applicability

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

[1] https://cdm.unfccc.int/methodologies/DB/JPYB4DYQUXQPZLBDVPHA87479EMY9M

(a) Install a new LFG capture system in an existing or new (Greenfield) SWDS where no LFG capture system was or would have been installed prior to the implementation of the project activity; or

(b) Make an investment into an existing LFG capture system to increase the recovery rate or change the use of the captured LFG, provided that:

(i) The captured LFG was vented or flared and not used prior to the implementation of the project activity; and

(ii) In the case of an existing active LFG capture system for which the amount of LFG cannot be collected separately from the project system after the implementation of the project activity and its efficiency is not impacted on by the project system: historical data on the amount of LFG capture and flared is available;

(c) Flare the LFG and/or use the captured LFG in any (combination) of the following ways:

(i) Generating electricity;

(ii) Generating heat in a boiler, air heater or kiln (brick firing only) or glass melting furnace; and/or

(iii) Supplying the LFG to consumers through a natural gas distribution network;

(iv) Supplying compressed/liquefied LFG to consumers using trucks;

(v) Supplying the LFG to consumers through a dedicated pipeline;

(d) Do not reduce the amount of organic waste that would be recycled in the absence of the project activity

In the absence of the project, LFG from Lianzhou MSW landfill is emitted directly into atmosphere. The project activity Installs a new LFG capture system in an existing Lianzhou MSW landfill where no LFG capture system was or would have been installed prior to the implementation of the project activity. The project activity captures and uses LFG for power generation. Electricity generated by LFG will be exported to China Southern Power Grid (CSPG), which could replace a certain amount of electricity generated by fossil fuel fired power plants. The project does not reduce the amount of organic waste that would be recycled in the absence of the project activity. Therefore, the methodology is applicable.

The methodology is only applicable if the application of the procedure to identify the baseline scenario confirms that the most plausible baseline scenario is:

(a) Atmospheric release of the LFG or capture of LFG and destruction through flaring to comply with regulations or contractual requirements, to address safety and odour concerns, or for other reasons; and

(b) In the case that the LFG is used in the project activity for generating electricity and/or generating heat in a boiler, air heater, glass melting furnace or kiln:

(i) For electricity generation: that electricity would be generated in the grid or in captive fossil fuel fired power plants; and/or

(ii) For heat generation: that heat would be generated using fossil fuels in equipment located within the project boundary;

(c) In the case of LFG supplied to the end-user(s) through natural gas distribution network, trucks or the dedicated pipeline, the baseline scenario is assumed to be displacement of natural gas.

(d) In the case of LFG from a Greenfield SWDS, the identified baseline scenario is atmospheric release of the LFG or capture of LFG in a managed SWDS and destruction through flaring to comply with regulations or contractual requirements, to address safety and odour concerns, or for other reasons.

The most feasible baseline scenario of the project activity is:

- Atmospheric release of the LFG;

- and for electricity generation: that electricity would be generated in the grid.

This methodology is not applicable:

(a) In combination with other approved methodologies. For instance, ACM0001 cannot be used to claim emission reductions for the displacement of fossil fuels in a kiln or glass melting furnace, where the purpose of the CDM project activity is to implement energy efficiency measures at a kiln or glass melting furnace;

(b) If the management of the SWDS in the project activity is deliberately changed during the crediting in order to increase methane generation compared to the situation prior to the implementation of the project activity.

The project activity only applies ACM0001, and the management of the SWDS in the project activity will not be deliberately changed during the crediting in order to increase methane generation compared to the situation prior to the implementation of the project activity.

Applicability conditions of "Emissions from solid waste disposal sites"

(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 simplified approach detailed in 0 when calculating baseline emissions.

The project adopts Application A. The project activity mitigates methane emissions from Lianzhou MSW landfill site. Methane emissions are mitigated by capturing for power generation (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 project activity. The tool is only applied for an ex ante estimation of emissions in the project description. 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).

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.

Only MSW are disposed in Lianzhou MSW landfill site.

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

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.

Emissions are calculated for electricity consumption, Scenario A "Electricity consumption from the grid" 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;

(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 can be referred to in methodologies to provide procedures to monitor amount of electricity generated in the project scenario, Scenario I: "Electricity is supplied to the grid" applies to the recipient of the electricity generated.

This tool is not applicable in cases where captive renewable power generation technologies are installed to provide electricity in the project activity, in the baseline scenario or to sources of leakage. The tool only accounts for CO_2 emissions.

No captive renewable power generation technologies are installed to provide electricity in the project activity, in the baseline scenario or to sources of leakage.

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

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).

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.

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 country.

The project activity is located in P. R. China, not in any Annex I country.

Under this tool, the value applied to the CO_2 emission factor of biofuels is zero.

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

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 landfill gas for power plant. For ex post emission reduction estimation, this tool will be applied.

Methodologies where CO_2 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 CO_2.

The project activity adopts ACM0001, and CO_2 is not the particular or only gas of interest. Therefore, 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 N2).

The project activity adopts ACM0001:

(a) the amount of methane in the LFG which is used for electricity generation for the project activity in year y is determined using the tool;

(b) CH_4 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).

Applicability conditions in tool "Positive lists of technologies"

The use of this methodological tool is not mandatory for the project participants of a CDM project activity or CDM PoA for demonstrating their additionality.

The project activity adopts this methodological tool for demonstrating their additionality.

This methodological tool shall be applied in conjunction with a small-scale or large-scale methodology which refers to this tool.

This methodological tool is applied in conjunction with ACM0001 which refers to this tool.

The positive lists as contained in section 5 of this tool are valid up to 10/03/2025. Notwithstanding the provisions on the validity of new, revised and previous versions of methodologies and methodological tools in the "Procedure: Development, revision and clarification of baseline and monitoring methodologies and methodological tools", there will be no grace period for the application of this tool and the validity of the positive list after this date, including in cases where further technologies are added to the positive list through revisions of this tool before this date.

The positive lists as contained in section 5 "5.1.1. Landfill gas recovery and its gainful use" of this tool are valid up to 10/03/2025.

It is confirmed by the assessment team that the application of the baseline methodology is transparent and conservative and confirms that the chosen baseline and monitoring methodology i.e. ACM0001 version 19.0 is applicable to the project activity.

The project activity qualifies as Type I and Type III 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 82,464 tCO_2e, larger than 60,000 tonnes of CO_2e per year, which is applicable as per large scale project activities methodology ACM0001 version 19.0.

3.3.3 Project Boundary

As per ACM0001, the project boundary of the project activity shall include the site where the LFG is captured and, as applicable:

(a) Sites where the LFG is flared or used (e.g. flare, power plant, boiler, air heater, glass melting furnace, kiln, natural gas distribution network, dedicated pipeline or biogas processing facility);

(b) Captive power plant(s) (including emergency diesel generators) or power generation sources connected to the grid, which are supplying electricity to the project activity;

(c) Captive power plant(s) (including emergency diesel generators) or power generation sources connected to the grid, which are supplying electricity in the baseline that is displaced by electricity generated by captured LFG in the project activity;

(d) Heat generation equipment or sources which are supplying heat in the baseline that is displaced by heat generated by captured LFG in the project activity; and

(e) The transportation of the compressed/liquefied LFG from the biogas processing facility to consumers.

It is confirmed by the assessment team that the project boundary of the project activity includes the sites where the LFG is flared or used (e.g. power plant). The electricity used by the project activity is sourced from CSPG and electricity generated by LFG capturing of the project activity is connected to CSPG. Therefore, the project boundary includes the whole LFG related system (e.g. LFG collection, LFG pre-treatment system, LFG power generation system, flare system, etc.) and all grid-connected power plants in CSPG. According to China DNA[2], CSPG covers Guangdong Province, Guangxi Zhuang Autonomous Region, Yunnan Province, Guizhou Province and Hainan Province.

[2]http://www.mee.gov.cn/ywgz/ydqhbh/wsqtkz/202012/t20201229_815386.shtml

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

Source		Gas	Included?	Justification/Explanation
Baseline	Emissions from decomposition of waste at the SWDS site	CH_4	Yes	The major source of emissions in the baseline
		N_2O	No	N_2O emissions are small compared to CH_4 emissions from SWDS. This is conservative
		CO_2	No	CO_2 emissions from decomposition of organic waste are not accounted since the CO_2 is also released under the project activity
	Emissions from electricity generation	CO_2	Yes	Major emission source
		CH_4	No	Excluded for simplification. This is conservative
		N_2O	No	Excluded for simplification. This is conservative
	Emissions from heat generation	CO_2	No	No heat generation is included in the project activity.
		CH_4	No	Excluded for simplification. This is conservative
		N_2O	No	Excluded for simplification. This is conservative
	Emissions from the use of natural gas	CO_2	No	Excluded for simplification. This is conservative
		CH_4	No	No supply of LFG is included in the project.
		N_2O	No	Excluded for simplification. This is conservative
Project activity	Emissions from fossil fuel consumption for purposes other than electricity generation or transportation due to the project activity	CO_2	No	Excluded because there is no fossil fuel consumption.
		CH_4	No	Excluded because there is no fossil fuel consumption.
		N_2O	No	Excluded because there is no fossil fuel consumption.
	Emissions from electricity consumption due to the project activity	CO_2	Yes	Main emission source.
		CH_4	No	Excluded for simplification. This emission source is very small compared to CO_2 emissions.
		N_2O	No	Excluded for simplification. This emission source is very small compared to CO_2 emissions.
	Emissions from flaring	CO_2	No	Excluded because there is no flaring in the project.
		CH_4	No	Excluded because there is no flaring in the project.
		N_2O	No	Excluded because there is no flaring in the project.
	Emissions from distribution of LFG using trucks and dedicated pipelines	CO_2	No	No supply of LFG is included in the project.
		CH_4	No	No supply of LFG is included in the project.
		N_2O	No	No supply of LFG is included in the project.

3.3.4 Baseline Scenario

As per ACM0001, the baseline scenario for LFG is assumed to be the atmospheric release of the LFG or capture of LFG and destruction through flaring to comply with regulations or contractual requirements, to address safety and odour concerns, or for other reasons. If all or part of the electricity generated by the project activity is exported to the grid, the baseline scenario for all or the part of the electricity exported to the grid is assumed to be electricity generation in existing and/or new grid-connected power plants.

As per CDM Validation and Verification Standard for project activities version 03.0, "where the baseline scenario is not prescribed in the approved methodology, the DOE shall assess the list of identified credible alternatives to the project activity in the VCS PD selected to determine the

most realistic baseline scenario." As the selected large-scale methodology clearly mention the baseline scenario and the same has been opted in this project, therefore, no further analysis on baseline is required.

The assessment team, therefore, concludes that the VCS PD conforms to the guidance given by EB via CDM Validation and Verification Standard for project activities version 03.0 and VCS via VCS standard version 4.4.

The project activity captures LFG to produce electricity and supplies to the grid. According to GB50869-2013 has been implemented from 01/03/2014, Item 3.0.3, 4.0.2, 8.1.1, 10.1.1, 11.1.1, 11.6.1, 11.6.3, 11.6.4 and 15.0.5 are mandatory provisions and must be strictly implemented. But Item 11.1.3 is a voluntary provision, and it is a common practice in China that the LFG from landfill sites is vented to the atmosphere directly. And the assessment team confirmed that no regulatory surplus required for project activity.

The assessment team confirmed the baseline of the project is in the absence of the project, LFG from Lianzhou MSW landfill is emitted directly into atmosphere, the equivalent amount of power would have been supplied by CSPG, which is fed mainly by fossil fuel fired plants.

Applus+ Certification confirms that the Project has been approved by Chinese government by checking the Project approval and Environmental Impact Assessment (EIA) approval. By checking laws and regulation, it is confirmed that the project activity is in complicate with all laws and regulations in China.

3.3.5 Additionality

As per the Methodological Tool "Positive lists of technologies", the project activities at new or existing landfills (greenfield or brownfield) are deemed automatically additional, if it is demonstrated that prior to the implementation of the project activities the landfill gas (LFG) was only vented and/or flared (in the case of brownfield projects) or would have been only vented and/or flared (in the case of greenfield projects) but not utilized for energy generation, and that under the project activities any of the following conditions are met:

(a) The LFG is used to generate electricity in one or several power plants with a total nameplate capacity that equals or is below 10 MW;

(b) The LFG is used to generate heat for internal or external consumption;

(c) The LFG is flared.

The project activity uses LFG which is collected from Lianzhou MSW landfill to generate electricity. Prior to the implementation of the project activity, the LFG from Lianzhou MSW landfill was only vented, not utilized for energy generation. By interviewing local stakeholders, staff from local

government, staff from Lianzhou MSW landfill and checking website of local government, it is confirmed by the assessment team that only the project activity uses LFG from Lianzhou MSW landfill to generate electricity. By checking Project Approval and EIA Approval, the total installed capacity of the project activity is 3 MW, which is below 10 MW. Therefore, the project activity is deemed automatically additional.

3.3.6 Quantification of GHG Emission Reductions and Removals

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

Baseline emissions

Baseline emissions are determined according to the following equation and comprise the following sources:

(a) Methane emissions from the SWDS in the absence of the project activity;

(b) Electricity generation using fossil fuels or supplied by the grid in the absence of the project activity;

(c) Heat generation using fossil fuels in the absence of the project activity; and

(d) Natural gas used from the natural gas network in the absence of the project activity.

$BE_y = BE_{CH4,y} + BE_{EC,y} + BE_{HG,y} + BE_{NG,y}$

Where:

BE_y	Baseline emissions in year y (tCO_2e/yr)
$BE_{CH4,y}$	Baseline emissions of methane from the SWDS in year y (tCO_2e/yr)
BE	Baseline emissions associated with electricity generation in year y (tCO_2/yr)

$BE_{EC,y}$		
$BE_{HG,y}$		Baseline emissions associated with heat generation in year y (tCO_2/yr)
$BE_{NG,y}$		Baseline emissions associated with natural gas use in year y (tCO_2/yr)

The project activity does not associated with heat generation and natural gas use by checking EIA Report, thus, $BE_{HG,y} = 0$ and $BE_{NG,y} = 0$.

Therefore, for the project activity, $BE_y = BE_{CH4,y} + BE_{EC,y}$

Baseline emissions of methane from the SWDS ($BE_{CH4,y}$)

As per ACM0001, Baseline emissions of methane from the SWDS ($BE_{CH4,y}$) is determined as follows:

$$BE_{CH4} = \left((1\text{-}OX_{top\_layer}) \times F_{CH4,PJ,y} - F_{CH,BL,y} \right) \times GWP_{CH4}$$

Where:

$BE_{CH4,y}$	=	Baseline emissions of methane from the SWDS in year *y* (tCO_2e/yr)
OX_{top_layer}	=	Fraction of methane in the LFG that would be oxidized in the top layer of the SWDS in the baseline (dimensionless)
$F_{CH4,PJ,y}$	=	Amount of methane in the LFG which is flared and/or used in the project activity in year *y* (tCH_4/yr)

$F_{CH4,BL,y}$ = Amount of methane in the LFG that would be flared in the baseline in year *y* (tCH_4/yr)

GWP_{CH4} = Global warming potential of CH_4 (tCO_2e/tCH_4)

Ex post determination of $F_{CH4,PJ,y}$

During the crediting period, $F_{CH4,PJ,y}$ is determined as the sum of the quantities of methane flared and used in power plant(s), boiler(s), air heater(s), glass melting furnace(s), kiln(s) and natural gas distribution, as follows:

$$F_{CH4,PJ,y} = F_{CH4,flared,y} + F_{CH4,EL,y} + F_{CH4,HG,y} + F_{CH4,NG,y}$$

Where:

$F_{CH4,PJ,y}$ = Amount of methane in the LFG which is flared and/or used in the project activity in year *y* (tCH_4/yr)

$F_{CH4,flared,y}$ = Amount of methane in the LFG which is destroyed by flaring in year *y* (tCH_4/yr)

$F_{CH4,EL,y}$ = Amount of methane in the LFG which is used for electricity generation in year *y* (tCH_4/yr)

$F_{CH4,HG,y}$ = Amount of methane in the LFG which is used for heat generation in year *y* (tCH_4/yr)

$F_{CH4,NG,y}$ = Amount of methane in the LFG which is sent to the natural gas distribution network and/or dedicated pipeline and/or to the trucks in year *y* (tCH_4/yr)

The project activity does not associate with heat generation and natural gas use, $F_{CH4,HG,y}$ = 0 and $F_{CH4,NG,y}$ = 0.

For the project activity, the flare will not be used when the power plant is in normal operation. The emission reduction from the flare is not claimed, which is conservative. Therefore, for the project activity, $F_{CH4,PJ,y} = F_{CH4,EL,y}$.

$F_{CH4,EL,y}$ is determined using the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" and monitoring the working hours of the power plant(s), boiler(s), air heater(s), glass melting furnace(s) and kiln(s), so that no emission reduction are claimed for methane

destruction during non-working hours. This is taken into account by monitoring the hours that the equipment utilizing the LFG is operating in year y ($O_{pj,h,y}$).

The following requirements apply:

(a) As per the gaseous stream tool, if the LFG is used for multiple purposes (e.g. flaring or energy generation), and all methane destruction devices are verified to be operational (e.g. by means of flame detectors records, energy generated), a single flow meter may be used to record the flow into multiple destruction devices. The destruction efficiency of the least efficient among the destruction devices shall be used as the destruction efficiency for all destruction devices monitored by this flow meter. If there are any periods for which one or more destruction devices are not operational, paragraph (a) and (b) of the Appendix of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" tool shall be followed;

(b) CH_4 is the greenhouse gas for which the mass flow should be determined;

(c) The simplification offered for calculating the molecular mass of the gaseous stream is valid (equations (3) or (17) in the tool);

(d) The mass flow should be calculated on an hourly basis for each hour *h* in year *y*;

(e) The mass flow calculated for hour *h* is 0 if the equipment is not working in hour *h* ($Op_{j,h}$=not working), the hourly values are then summed to a yearly unit basis.

For the project activity, the flow of gaseous stream is Volume flow – dry basis, and the volumetric fraction is dry basis, thus, as per the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream", Option A will be applied.

The mass flow of greenhouse gas i ($F_{i,t}$) is determined as follows:

$$F_{i,t} = V_{t,db} \times v_{i,t,db} \times \rho_{i,t}$$

With:

$$\rho_{i,t} = \frac{P_t \times MM_i}{R_u \times T_t}$$

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 at normal conditions (m^3 dry gas/h)

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

All parameters about the LFG which is fed into the gas engines are converted automatically to normal conditions during the monitoring process. Therefore, P_t and T_t don't need to be monitored.

Ex ante estimation of $F_{CH4,PJ,y}$

An ex ante estimate of $F_{CH4,PJ,y}$ is required to estimate baseline emission of methane from the SWDS (according to equation (2) of ACM0001) in order to estimate the emission reductions of the proposed project activity in the VCS-PD. It is determined as follows:

$$F_{CH4,PJ,y} = \eta_{PJ} \times BE_{CH4,SWDS,y}/GWP_{CH4}$$

Where:

$F_{CH4,PJ,y}$	=	Amount of methane in the LFG which is flared and/or used in the project activity in year *y* (tCH_4/yr)
$BE_{CH4,SWDS,y}$	=	Amount of methane in the LFG that is generated from the SWDS in the baseline scenario in year *y* (tCO_2e/yr)
η_{PJ}	=	Efficiency of the LFG capture system that will be installed in the project activity
GWP_{CH4}	=	Global warming potential of CH_4 (tCO_2e/tCH_4)

$BE_{CH4,SWDS,y}$ is determined using the methodological tool "Emissions from solid waste disposal sites". The following guidance should be taken into account when applying the tool:

(a) f_y in the tool shall be assigned a value of 0 because the amount of LFG that would have been captured and destroyed is already accounted for in equation (2) of methodology ACM0001;

(b) In the tool, x begins with the year that the SWDS started receiving wastes (e.g. the first year of SWDS operation); and

(c) Sampling to determine the fractions of different waste types is not necessary because the waste composition can be obtained from previous studies.

For the project, the amount of methane generated from disposal of waste at the SWDS for year y ($BE_{CH4,SWDS,y}$) is calculated using first order decay (FOD) model as follows:

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

Where:

$BE_{CH4,SWDS,y}$	=	Baseline, project or leakage methane emissions occurring in year y generated from waste disposal at a SWDS during a time period ending in year y (tCO_2e/yr)
x	=	Years in the time period in which waste is disposed at the SWDS, extending from the first year in the time period (x = 1) to year y (x = y)
y	=	Year of the crediting period for which methane emissions are calculated (y is a consecutive period of 12 months)
$DOC_{f,y}$	=	Fraction of degradable organic carbon (DOC) that can decomposes under the specific conditions occurring in the SWDS for year y (weight fraction)
$W_{j,x}$	=	Amount of solid waste type j disposed or prevented from disposal in the SWDS in the year x (t)
φ_y	=	Model correction factor to account for model uncertainties for year y
f_y	=	Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere in year y
GWP_{CH4}	=	Global Warming Potential of methane

OX	=	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)
F	=	Fraction of methane in the SWDS gas (volume fraction)
MCF_y	=	Methane correction factor
DOC_j	=	Fraction of degradable organic carbon in the waste type j (weight fraction)
k_j	=	Decay rate for the waste type j (1 / yr)
j	=	Type of residual waste or types of waste in the MSW

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

Parameter	Application A	Justification
φ_y	0.75	Baseline emissions: default values
OX	0.1	Default value
F	0.5	Default value
$DOC_{f,y}$	0.5	Default value
MCF_y	1.0	Default values (based on SWDS type)
k_j	Refer to Section 3.3.8	Default values (based on waste type)
$W_{j,x}$	Refer to Section 3.3.8	Estimated once, with the waste composition obtained from EIA.
DOC_j	Refer to Section 3.3.8	Default values (based on waste type)
f_y	0	Requirement from ACM0001

Determination of $F_{CH4,BL,y}$

This section provides a procedure to determine the amount of methane that would have been captured and destroyed (by flaring) in the baseline due to regulatory or contractual requirements, to address safety and odour concerns, or for other reasons (collectively referred to as requirement in this section). The four cases in the following table are distinguished. The appropriate case should be identified, and the corresponding instructions followed.

Situation at the start of the project activity	Requirement to destroy methane	Existing LFG capture and destruction system
Case 1	No	No
Case 2	Yes	No

Situation at the start of the project activity	Requirement to destroy methane	Existing LFG capture and destruction system
Case 3	No	Yes
Case 4	Yes	Yes

Currently China has regulations in place to deal with the management of landfills and to encourage utilization of LFG. Those regulations are:

"Standard for Pollution Control on the Landfill Site of Municipal Solid Waste" (GB 16889-2008), which became effective in 2008, issued by the Environment Protection Administration.

"Technical Code for Municipal Solid Waste Sanitary Landfill" (GB 50869-2013), issued by the Ministry of Construction in 2013.

According to item 5.15 of GB16889-2008, if the designed landfill capacity is more than 2.5 million tons and the landfill thickness is more than 20m, methane utilization facilities or flare burning facilities shall be built to treat the landfill gas containing methane. For municipal solid waste landfills smaller than the above scale, technologies that can effectively reduce methane generation and emission shall be adopted or flare combustion facilities shall be used to treat methane containing landfill gas.

Item 11.1.1 of GB 50869-2013 stipulates that the landfill site must be equipped with effective landfill gas drainage facilities to prevent the natural accumulation and migration of landfill gas, causing fire and explosion. Item 11.1.3 stipulates that if the landfill does not have the conditions for landfill gas utilization, the flare method shall be adopted for combustion treatment, and the process that can effectively reduce the generation and emission of methane shall be adopted. The old landfills that are not safe and stable should be equipped with effective landfill gas drainage facilities. Among them, item 11.1.1 is mandatory and must be strictly implemented.

In fact, the LFG of Lianzhou landfill is emitted to atmosphere without LFG capture system prior the implementation of the project. Therefore, Case 2 listed in the table above is applicable for the project.

The requirements above don't specify any amount or percentage of LFG that should be destroyed. In this situation:

$$F_{CH4,BL,y} = F_{CH4,BL,R,y}$$

$$F_{CH4,BL,R,y} = 0.2 \times F_{CH4,PJ,capt,y}$$

Where:

$F_{CH4,BL,R,y}$	=	Amount of methane in the LFG which is flared in the baseline due to a requirement in year y (tCH_4/yr)
$F_{CH4,PJ,capt,y}$	=	Amount of methane in the LFG which is captured in the project activity in year y (tCH_4/yr)

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

The baseline emissions from electricity consumption in year y ($BE_{EC,y}$) shall be calculated using the "Methodological tool: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation". 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 ($EG_{PJ,y}$).

$$BE_{EC,y} = \sum_k EC_{BL,k,y} \times EF_{EF,k,y} \times (1+TDL_{k,y})$$

$BE_{EC,y}$	=	Baseline emissions from electricity consumption in year *y*(tCO_2/yr)
$EC_{BL,k,y}$	=	Quantity of electricity that would be consumed by the baseline electricity consumption source *k* in year *y* (MWh/yr)
$EF_{EF,k,y}$	=	Emission factor for electricity generation for source k in year y (tCO_2/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 ($EF_{EF,k,y}$)

The baseline scenario of the project is that the LFG from Lianzhou MSW landfill site was released directly into atmosphere and equivalent electricity generation by the project was supplied by CSPG, Scenario A of the "Methodological tool: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" applies. $EF_{EF,k,y}$ 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" ($EF_{EF,k,y} = EF_{grid,CM,y}$).

The grid emission factor is calculated as the weighted average of the operating margin (0.5) & 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. China DNA 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.

Emission factor (EF_y): $EF_y = EF_{grid,CM,y}$= 0.8042×0.5+0.2135×0.5= 0.50885 tCO_2/MWh.

This value is fixed ex-ante for the crediting period.

ID number	$F_{CH4,PJ,y}$	$OX_{top-layer}$	$F_{CH4,BL,y}$	$BE_{CH4,SWDS,y}$
Unit	tCH_4	Dimensionless	tCH_4	tCO_2e
01/06/2021-31/12/2021	1,662	0.1	332	33,507
2022	3,082	0.1	616	62,130
2023	3,326	0.1	665	67,061
2024	3,572	0.1	714	72,012
2025	3,821	0.1	764	77,034
2026	4,076	0.1	815	82,168
2027	4,337	0.1	867	87,443
01/01/2028-31/05/2028	1,913	0.1	383	38,575

ID number	$EG_{PJ,y}$	$EF_{grid,CM,y}$	$BE_{EC,y}$
Unit	MWh	tCO_2e/MWh	tCO_2e
01/06/2021-31/12/2021	7,049	0.50885	3,694
2022	13,070	0.50885	6,850
2023	14,108	0.50885	7,394
2024	15,149	0.50885	7,939
2025	16,206	0.50885	8,493
2026	17,286	0.50885	9,059
2027	18,396	0.50885	9,641
01/01/2028-31/05/2028	8,115	0.50885	4,253

Year	Emission Reduction by Methane recovery from the landfill in the absence of the project activity during the crediting period (tCO_2e) ($BE_{CH4,SWDS,y}$)	Emission Reduction from Electricity Generation (tCO_2e) ($BE_{EC,y}$)	Baseline Emissions (tCO_2e)
01/06/2021-31/12/2021	33,507	3,694	37,201
2022	62,130	6,850	68,980
2023	67,061	7,394	74,455
2024	72,012	7,939	79,951
2025	77,034	8,493	85,527
2026	82,168	9,059	91,227
2027	87,443	9,641	97,084
01/01/2028-31/05/2028	38,575	4,253	42,828
Total (tones of CO_2e)	**519,930**	**57,323**	**577,253**

Project emissions

As per ACM0001, Project emissions are calculated as follows:

$$PE_y = PE_{EC,y} + PE_{FC,y} + PE_{DT,y} + PE_{SP,y}$$

Where:

PE_y = Project emissions in year *y* (tCO_2/yr)

$PE_{EC,y}$ = Emissions from consumption of electricity due to the project activity in year *y* (tCO_2/yr)

$PE_{FC,y}$ = Emissions from consumption of fossil fuels due to the project activity, for purpose other than electricity generation, in year *y* (tCO_2/yr)

$PE_{DT,y}$ = Emissions from the distribution of compressed/liquefied LFG using trucks, in year *y* (tCO_2/yr)

$PE_{SP,y}$ = Emissions from the supply of LFG to consumers through a dedicated pipeline, in year y (tCO_2/yr)

By checking EIA Report, it is confirmed that there is no fossil fuel consumption in the project activity, and there is no distribution of compressed/liquefied LFG using trucks and no supply of LFG to consumers through a dedicated pipeline involved in the project activity, therefore, $PE_{FC,y}$ = 0, $PE_{DT,y}$ = 0 and $PE_{SP,y}$ = 0.

Hence, Project emissions are calculated as follows:

$$PE_y = PE_{EC,y}$$

The project emissions from consumption of electricity by the project activity ($PE_{EC,y}$) shall be calculated using the "Methodological tool: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation". When applying the tool:

(a) $EC_{PJ,k,y}$ in the tool is equivalent to the amount of electricity consumed by the project activity in year y ($EC_{PJ,y}$); and

(b) If in the baseline a proportion of LFG is destroyed ($F_{CH4,BL,y}$>0), then the electricity consumption in the tool ($EC_{PJ,j,y}$) should refer to the net quantity of electricity consumption (i.e. the increase due to the project activity). The determination of the amount of electricity consumed in the baseline shall be transparently documented in the VCS-PD.

Considering when electricity generators might be under regular maintenance and sometimes shut down, the electricity will be purchased from the CSPG during this period of time. For ex ante calculation, $EC_{PJ,y}$ = 0 as simplified consideration since it is estimated to be small amount in the project operation and it will be monitored during the crediting period. As per the "Methodological tool: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation", emissions from consumption of electricity due to the project activity in year y will be calculated as follows:

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

Where:

$PE_{EC,y}$ = Project emissions from electricity consumption in year *y*(tCO_2/yr)

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

$EF_{EF,j,y}$ = Emission factor for electricity generation for source *j* in year y (tCO_2/MWh)

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

j = Sources of electricity consumption in the project

For the determination of $EF_{EF,j,y}$, 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" ($EF_{EF,j,y} = EF_{grid,CM,y}$).

ID number	$EC_{PJ,y}$	$EF_{EF,j,y}$	$TDL_{j,y}$	$PE_{EC,y}$	PE_y
Unit	MWh	tCO_2e/MWh	%	tCO_2e	tCO_2e
01/06/2021-31/12/2021	0	0.50885	20	0	0
2022	0	0.50885	20	0	0
2023	0	0.50885	20	0	0
2024	0	0.50885	20	0	0
2025	0	0.50885	20	0	0
2026	0	0.50885	20	0	0
2027	0	0.50885	20	0	0
01/01/2028-31/05/2028	0	0.50885	20	0	0

Leakage

The project does not need to consider leakage. The validation team deems this consideration is correct and in line with methodology ACM0001, version 19.0.

Emission Reductions

According to ACM0001, Version 19.0, emission reductions are calculated as follows:

$ER_y = BE_y - PE_y$

Where:

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

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

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

Hence for the project activity, the estimated amount of GHG emission reductions (ER_y) is 577,253 tCO_2e during the crediting period from 01/06/2021 to 31/05/2028, resulting in estimated average annual emission reductions of 82,464 tCO_2e.

Year	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)
01/06/2021-31/12/2021	37,201	0	0	37,201
2022	68,980	0	0	68,980
2023	74,455	0	0	74,455
2024	79,951	0	0	79,951
2025	85,527	0	0	85,527
2026	91,227	0	0	91,227
2027	97,084	0	0	97,084
01/01/2028-31/05/2028	42,828	0	0	42,828
Total	**577,253**	**0**	**0**	**577,253**

3.3.7 Methodology Deviations

No methodology deviation is applied in the project.

3.3.8 Monitoring Plan

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

Parameters determined ex-ante

Data / Parameter:	OX_{top_layer}
Data unit:	/

Description:	Fraction of methane that would be oxidized in the top layer of the SWDS in the baseline
Source of data used:	Consistent with how oxidation is accounted for in the methodological tool "Emissions from solid waste disposal sites "
Value applied:	0.1

Data / Parameter:	GWP_{CH4}
Data unit:	$tCO_2e/t\ CH_4$
Description:	Global warming potential of CH_4
Source of data used:	IPCC
Value applied:	28

Data / Parameter:	ρ_{CH4}
Data unit:	t/m^3
Description:	Density of methane gas at Normal Conditions
Source of data used:	/
Value applied:	0.0007168 (Normal conditions: 0℃ and 101.325 kPa)

Data / Parameter:	η_{PJ}
Data unit:	Dimensionless
Description:	Efficiency of the LFG capture system that will be installed in the project activity
Source of data used:	Technical specifications of the LFG capture system to be installed
Value applied:	95%

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:	Consistent with an extensive review of published literature on this subject, including the IPCC2006 Guidelines for National Greenhouse Gas Inventories.
Value applied:	0.1

Data / Parameter:	φ_y
Data unit:	Dimensionless
Description:	The model correction factor to account for model uncertainties
Source of data used:	Default value of the tool "Emissions from solid waste disposal sites" (version 08.0)
Value applied:	0.75

Data / Parameter:	f_y
Data unit:	Dimensionless
Description:	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
Source of data used:	Default value of the tool "Emissions from solid waste disposal sites" (version 08.0)
Value applied:	0

Data / Parameter:	F
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:	1.0 Lianzhou MSW landfill site is an anaerobic managed solid waste disposal site.

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 j	DOC_j (% wet waste)
Wood and wood products	43
Pulp, paper and cardboard (other than sludge)	40
Food and food waste	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:	Default value of the tool "Emissions from solid waste disposal sites" (version 08.0)
Value applied:	Apply the following default values for the different waste types j:

Waste type j		k_j (MAT> 20°C, MAP/PET > 1)
Slowly degrading	Pulp, paper, cardboard (other than sludge)	0.07
	Wood, wood products and straw	0.035
Moderately degrading	Other (non-food) organic putrescible garden and park waste	0.17
Rapidly degrading	Food, food waste, sewage sludge, beverages and tabacco	0.40

As per FSR of the project, the climate data for the location of Lianzhou MSW landfill is:

Mean annual temperature (MAT): 20.1°C

Mean annual precipitation (MAP): 1,622 mm

Potential evapotranspiration (PET): 1,139 mm

Data / Parameter:	$W_{j,x}$
Data unit:	t
Description:	Amount of organic waste type j disposed/prevented from disposal in the SWDS in the year y

Source of data used:	Estimated once in the FSR
Value applied:	Apply the following default values for the different waste types j:

Year	W_j (waste amount) (t/x)
2015	99,280
2016	104,244
2017	106,329
2018	108,455
2019	113,878
2020	119,572
2021	125,551
2022	131,828
2023	138,420
2024	145,341
2025	152,608
2026	160,238
2027	168,250
2028	176,663
2029	185,496
2030	194,770
2031	204,509
2032	214,734
2033	225,471
2034	236,745
2035	248,582
2036	261,011

Waste type of Landfill site	Weight content（%）
W_1-Wood and wood products	8.00
W_2-Pulp, paper and cardboard	7.60
W_3-Food, food waste, beverages and tobacco	54.50
W_4-Textiles	12.70
W_5-Garden, yard and park waste	4.90
W_6-Glass, plastic, metal other inert	12.30

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:	$TDL_{j,y}$ and $TDL_{k,y}$
Data unit:	%
Description:	Average technical transmission and distribution losses for providing electricity to source j, k in year y
Source of data used:	Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation (version 03.0)
Value applied:	Use as default values of 20% for project consumption sources; Use as default values of 3% for baseline electricity consumption sources. i.e.: $TDL_{j,y}$ = 20%, $TDL_{k,y}$= 3%

Parameters determined ex-post

- Management of SWDS

Parameters title	Descriptions
Management of SWDS	Management of SWDS

Project participants would apply the original design of the landfill as the source of data to ensure that any practice to increase methane generation have been occurring prior to the implementation of the project activity.

Any change in the management of the SWDS after the implementation of the project activity should be justified by referring to technical or regulatory specifications.

- Policy requirement: $F_{CH4,BL,R,y}$, $P_{reg,y}$

Parameters title	Descriptions
$F_{CH4,BL,R,y}$	Amount of methane in the LFG which is flared due to a requirement in year y
$P_{reg,y}$	Fraction of LFG that is required to be flared due to a requirement in year y

$F_{CH4,BL,R,y}$ and $P_{reg,y}$ will be checked annually through information of the host country's regulatory requirements relating to LFG, contractual requirements, or requirements to address safety and odour concerns

- Electricity Generation: $EG_{PJ,y}$, $EG_{EC,y}$

Parameters title	Descriptions
$EG_{PJ,y}$	Amount of electricity generated using LFG by the project activity in year y
$EG_{EC,y}$	Amount of electricity consumed by the project activity in year y

$EG_{PJ,y}$ and $EG_{EC,y}$ will be continuous measured by electricity meters and monthly recorded. The electricity meters will be calibrated in accordance with national standards or other relevant requirements. The accuracy of electricity meters will be satisfied with relevant standards or requirements.

- LFG utilization: $V_{t,db}$, $V_{i,t,db}$ and $Op_{j,h}$

Parameters title	Descriptions
$V_{t,db}$	Volumetric flow of the gaseous stream in time interval t on a dry basis
$V_{i,t,db}$	Volumetric fraction of greenhouse gas I in a time interval t on dry basis
$Op_{j,h}$	Operation of the electricity generators that consume the LFG

$V_{t,db}$ will be monitored continuously by flow meter and hourly recorded. The flow meter will be calibrated periodically in accordance with manufacturer's specifications or relevant requirements. The accuracy of flow meter will be satisfied with manufacturer's specifications or relevant requirements. And the location of flow meter used to measure the LFG are after the flaring system installed, and just before the gas generator confirmed by site visit.

$V_{i,t,db}$ will be monitored continuously by gas analyzer. The gas analyzer will be calibrated periodically in accordance with manufacturer's specifications or relevant requirements. The accuracy of gas analyzer will be satisfied with manufacturer's specifications or relevant requirements.

$Op_{j,h}$ would be monitored by the project owner to ensure methane destruction is claimed for methane used in electricity plant when it is operational. $Op_{j,h}$ = 0 when: One of more temperature measurements are missing or below the minimum threshold in hour h (instantaneous measurements are made at least every minute); Flame is not detected continuously in hour h (instantaneous measurements are made at least every minute); No products are generated in the hour h. Otherwise, $Op_{j,h}$ = 1.

- Other parameters: CAPEX and OPEX, Tariff of electricity exported

Parameters title	Descriptions
CAPEX and OPEX	Total investment to implement the project and total cost to operate the project
Tariff of electricity exported	Tariff of the electricity exported

Since the project activity applies the simplified procedures to identify the baseline scenario and demonstrate additionality, the parameters CAPEX and OPEX and Tariff of electricity exported needs to be monitored. As per ACM0001, the parameters are monitored at the first issuance request after each phase of the project is fully implemented.

Based on the on-site visit and interviewed with the Manager of Lianzhou Dongkang Renewable Energy Technology Co., Ltd., the validation team confirmed that monitoring parameter has been correctly descried in the PD and in compliance with the methodology ACM0001 Version 19.0 and the guidance given by EB via CDM Validation and Verification Standard for project activities version 03.0 and VCS via VCS standard version 4.4.

3.4 Non-Permanence Risk Analysis

Not applicable for the present project activity.

4 VALIDATION OPINION

Applus+ Certification has been engaged by Goldchina Consultancy International Co., Ltd. to perform the validation of Lianzhou Landfill Gas Power Generation Project.

The management of the project proponent/owner is responsible for the preparation of the GHG emissions data and the reported/estimated GHG emissions reductions on the basis set out within the project's Monitoring Plan in the VCS PD and the approved methodology ACM0001 version 19.0.

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

The projects description compliance with, the requirements of Article 12 of the Kyoto Protocol, the CDM Modalities and Procedures as agreed in the Marrakech Accords under decision 3/CMP.1, the annexes to this decision, subsequent decisions and guidance made by COP/MOP & CDM Executive Board and other relevant rules, including the Host Country legislation and sustainability criteria along with VCS guideline and standard version 4.4.

The project's baseline and additionality is assessed against ACM0001 version 19.0 for large scale project.

The project's monitoring plan is assessed against ACM0001 version 19.0 for large scale project.

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

Validated GHG emission reductions and removals in the above period:

Year	Estimated GHG emission reductions or removals (tCO_2e)
01/06/2021-31/12/2021	37,201
01/01/2022-31/12/2022	68,980
01/01/2023-31/12/2023	74,455
01/01/2024-31/12/2024	79,951
01/01/2025-31/12/2025	85,527
01/01/2026-31/12/2026	91,227

01/01/2027-31/12/2027	97,084
01/01/2028-31/05/2028	42,828
Total estimated ERs	577,253
Total number of crediting years	7
Average annual ERs	82,464

APPENDIX I: < REFERENCE LIST >

1. VCS project design version 02 dated 02/11/2022, version 04 dated 30/03/2023

2. Estimated ER calculation spreadsheet

3 VCS standard version 4.4

4 VCS guideline version 4.3

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

6. Approved methodology ACM0001: Flaring or use of landfill gas, version 19.0

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

8. Emissions from solid waste disposal sites, version 08.0

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

10. Tool to determine the mass flow of a greenhouse gas in a gaseous stream, version 03.0

11. Positive lists of technologies, version 04.0

12. Business License

13. Project approval

14. Environmental Impact Assessment Report

15. Environmental Impact Assessment (EIA) approval

16. LFG generator contract

17. Operation Log

18. Nameplate of the equipment

19. 2019 Baseline Emission Factors for Regional Power Grids in China dated 29/12/2020

20. Questionnaires for stakeholder meeting

21. Cooperation agreement

22. Feasible Study Report

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

CAR ID	01	**Section no.**	3.3.6	**Date:** 18/01/2023
Description of CAR				
The monitoring plan of the project does not meet the requirement of ACM0001.				
Project proponent response				**Date:** 19/01/2023
The monitoring plan of the project has been corrected and in line with the requirement of ACM0001.				
Documentation provided by project proponent				
Updated VCS				
VVB assessment				**Date:** 20/01/2023
By checking updated PD, it is able to confirm the monitoring plan of the project has been corrected and in line with the requirement of ACM0001. CAR01 is closed out.				