



HAICHENG LANDFILL GAS POWER GENERATION PROJECT



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

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Summary:

LGAI Technological Center, S.A. (hereafter referred to as “Applus+ Certification”) has been commissioned by Swiss Carbon Value Ltd. to perform the verification of greenhouse gas emission reductions of the project activity “Haicheng Landfill Gas Power Generation Project” (VCS Ref. No. 2455, hereafter referred to as “the project activity”) reported in the monitoring report /1/ for the monitoring period 26/07/2021 to 25/12/2022 to review and determine the monitored reductions in GHG emissions that have occurred as a result of the project activity. These emission reductions are claimed as Verified Carbon Units (VCU) under the Verified Carbon Standard (VCS) version 4.4.

The project activity has been validated by Applus+ Certification which is available at <https://registry.terra.org/app/projectDetail/VCS/2455>.

The project activity is a landfill gas recovery and power generation project located at Haicheng Landfill Site in Laojianshan, Yushu Village, Xiangtang Management District, Haicheng City, Liaoning Province, P.R China which is to use landfill gas for electricity generation. The total installed capacity of the project activity is 2.134MW, consisting of 2 sets with each capacity of 1.067MW. The landfill where the project located will process 700 tons of MSW each day. The feed-in electricity is estimated to be 137,554 MWh during the fixed 10 years crediting period. The Project can reduce GHG emissions by replacing the electricity generated by fossil fuel fired power plants of Northeast China Power Grid (NEPG). Meanwhile by utilization the recovered landfill gas, the project activity avoids the emission of methane that would be generated under landfill condition. It's estimated that the proposed project could achieve GHG emission reductions of 81,914 tCO₂e annually in this crediting period.

The purpose and scope of this verification is to ensure that reported emission reductions are complete and accurate in accordance with applicable VCS standards and relevant UNFCCC requirements in order to be certified. A desk review and a site visit have been conducted to verify the data submitted in the monitoring report /1/. Applus+ Certification confirms the following has been reviewed:

- Monitoring plan included in the registered VCS PD /3/, version 02.1 dated 23/07/2021;
- Validation report No. CTINB-2021-0310 /4/, completed on 23/07/2021 by Shenzhen CTI International Certification Co., Ltd (CTI Certification);

- Monitoring report of 1st monitoring period /5/, version 01.1 dated 18/08/2021;
- Verification report No. CTINB-2021-0809 /6/, completed on 20/08/2021 by Shenzhen CTI International Certification Co., Ltd (CTI Certification);
- Approved methodology, ACM0001: Flaring or use of landfill gas /7/, Version 19.0, dated 14/06/2019;
- VCS standards version 4.4 and VCS Program Guide version 4.3, as well as relevant UNFCCC requirements;
- All information and references relevant to the project activity's resulting in emission reductions.

During this verification, 1 CAR, no CL or FAR was identified related to the monitoring, implementation or operations of the project activity in relation to relevant VCS standards, guidance and UNFCCC requirements and relevant host party criteria and the applied baseline and monitoring methodology etc.

Applus+ Certification confirms that the project is implemented in accordance with the registered PD /3/. The monitoring plan complies with the applied methodology ACM0001: Flaring or use of landfill gas /7/ Version 19.0 and the monitoring has been carried out in accordance with the monitoring plan in the registered PD /3/. The monitoring system is in place and the emission reductions are calculated without material misstatements. The level of assurance of the verification is reasonable. Our opinion relates to the projects GHG emissions and the resulting GHG emission reductions reported and related to the valid and registered project baseline and monitoring and its associated documents. Based on the information reviewed and evaluated Applus+ Certification confirms that the implementation of the project has resulted in 108,962 tCO₂e emission reductions during period 26/07/2021 to 25/12/2022.

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1 INTRODUCTION

1.1 Objective

LGAI Technological Center, S.A. (Applus+ Certification) has been commissioned by Swiss Carbon Value Ltd. to perform the verification of greenhouse gas emission reductions of the project activity “Haicheng Landfill Gas Power Generation Project” (VCS Ref. No. 2455) reported in the Monitoring Report /1/ during monitoring period 26/07/2021 to 25/12/2022.

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

The objective of verification is to have an independent review and ex post determination by a Validation and Verification Body (VVB) of the monitored reductions in GHG emissions that have occurred as a result of the registration of VCS project. Certification is the written assurance by the VVB that, during a specific time period, a proposed VCS project activity achieved the reductions in anthropogenic emissions by sources of GHGs as verified.

The objective of this verification/certification is to verify and certify emission reductions, reported for the “Haicheng Landfill Gas Power Generation Project” in China for the period 26/07/2021 to 25/12/2022.

1.2 Scope and Criteria

The verification scope is defined as an independent and objective review of the registered PD, the Project’s baseline study and Monitoring Report (MR) and other relevant documents. The information in these documents is reviewed against VCS version 4 requirements, UNFCCC rules and associated interpretations.

The verification is not meant to provide any consulting towards the client. However, stated requests for forward actions and/or corrective actions may provide input for improvement of the Project monitoring towards reductions in the GHG emissions.

1.3 Level of Assurance

The verification report is based on the VCS-PD, the VCS Monitoring Report (MR), supporting evidences made available to the verifier and information collected through performing interviews and during the on-site assessment.

The verification conclusion is assured a reasonable level of assurance.

1.4 Summary Description of the Project

Project title	Haicheng Landfill Gas Power Generation Project
VCS reference number	2455
Project Participants	Haicheng Xinzhongshui Environmental Protection Technology Co., Ltd. (Project Owner, host country, P. R. China)
Location of the project	Haicheng Landfill Site in Laojianshan, Yushu Village, Xiangtang Management District, Haicheng City, Liaoning Province, P.R China Geographic coordinates: Longitude: 122°47'59" E Latitude: 40°50'4" N
Project start date	Construction date: 12/11/2018 Operation start date: 09/09/2019
Version of VCS PD	version 02.1 dated 23/07/2021
Monitoring period	26/07/2021 to 25/12/2022
First monitoring report	Version 01 dated 16/01/2023
Final monitoring report	version 02.1 dated 03/04/2023
Applied Methodology/Version	ACM0001: Flaring or use of landfill gas, Version 19.0, dated 14/06/2019
Scope/Technical Area	1/1.1 13/13.1

The project activity is a landfill gas recovery and power generation project located at Haicheng Landfill Site in Laojianshan, Yushu Village, Xiangtang Management District, Haicheng City, Liaoning Province, P.R China which is to use landfill gas for electricity generation. The total installed capacity of the project activity is 2.134MW, consisting of 2 sets with each capacity of 1.067 MW. The landfill where the project located will process 700 tons of MSW each day. The feed-in electricity is estimated to be 137,554 MWh during the fixed 10 years crediting period. The Project can reduce GHG emissions by replacing the electricity generated by fossil fuel fired power plants of Northeast China Power Grid (NEPG). Meanwhile by utilization the recovered landfill gas, the project activity avoids the emission of methane that would be generated under landfill condition. It's estimated that the proposed project could achieve GHG emission reductions of 81,914 tCO₂e annually in this crediting period.

The project activity has been validated by Applus+ Certification which is available at <https://registry.verra.org/app/projectDetail/VCS/2455>.

2 VERIFICATION PROCESS

2.1 Method and Criteria

Verification was conducted using Applus+ Certification's procedures in line with the requirements specified in the VCS Standard version 4.4, the latest version of the CDM Validation and Verification Standard, and relevant UNFCCC requirements and applying standard auditing techniques.

Applus+ Certification completed a strategic review and risk assessment of the projects activities and processes in order to gain a full understanding of:

- Activities associated with all the sources contributing to the project emissions and emission reductions, including leakage if relevant;
- Protocols used to estimate or measure GHG emissions from these sources;
- Collection and handling of data;
- Controls on the collection and handling of data;
- Means of verifying reported data; and
- Compilation of the monitoring report.

Applus+ Certification verified the implementation of the monitoring plan and the data presented in the Monitoring Report /1/ for the period in question. This involved a site visit and a desk review of the Monitoring Report. This Verification Report describes the findings of this assessment.

The information of the assessment team is included in below:

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 (AiT)
- 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 monitoring report /1/ Version 01 dated 16/01/2023, Version 02 dated 01/02/2023, version 02.1 dated 03/04/2023 and the emission reduction calculations spreadsheet /2/, were assessed as part of the verification. In addition, the registered PD /3/ version 02.1 dated 23/07/2021 in particular the baseline estimations and the monitoring plan, the validation report /4/ version 02.0 dated 23/07/2021, as well as relevant documents, were reviewed. A detailed documents reviewed are listed in Appendix 1 of the report.

2.3 Interviews

The key personnel interviewed are summarized in the table below:

Interviewed personnel	Role	Organization	Subject
Mr. Lu Zhiyong	General Manager	Haicheng Xinzhongshui Environmental Protection Technology Co., Ltd.	Operation of the project activity; Implementation of the monitoring plan of the project activity;
Mr. Yang Chuanfeng	Administrative Staff		Data collection and data achievement;
Mr. Gao Feng	Production Staff		Calibration of meters and equipment maintenance; The impact of the project activity during the monitoring period; SDG Contributions of the project activity.
Mr. Zhang Huanxu	Director	Haicheng Landfill site	Status of Haicheng Landfill site; Management of Haicheng Landfill site.
Ms. Zhang Xiaoqing	Staff	Local Environmental Protection Bureau	The impact of the project activity during the monitoring period; The comments by local stakeholders during the monitoring period; SDG Contributions of the project activity.
Ms. Lin Jing	Local resident	Luoxiang Village	
Mr. Lin Guorui	Local resident	Xiangtang District	
Ms. Yang Sui	Project Manager	Swiss Carbon Value Ltd.	Data collection and ER calculation.

2.4 Site Inspections

The assessment team performed the on-site verification (Haicheng Landfill Site in Laojianshan, Yushu Village, Xiangtang Management District, Haicheng City, Liaoning Province, P.R China) during 30/01/2023 - 31/01/2023. The interviewed personnel and objective are listed in above table, which were:

- ✓ Operation of the project activity;
- ✓ Implementation of the monitoring plan of the project activity;
- ✓ Data collection and data achievement;
- ✓ Calibration of meters and equipment maintenance;
- ✓ Status of Haicheng Landfill site;
- ✓ Management of Haicheng Landfill site;
- ✓ The impact of the project activity during the monitoring period;
- ✓ The comments by local stakeholders during the monitoring period;
- ✓ SDG Contributions of the project activity;
- ✓ Data collection and ER calculation.

2.5 Resolution of Findings

As an outcome of the verification 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 requirements have been met.

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

There are 1 CAR and no CL raised for this monitoring period for the project.

2.5.1 Forward Action Requests

No FAR was raised during the verification process. Also there are no remaining from former verification and validation.

2.6 Eligibility for Validation Activities

Not applicable as Applus+ Certification holds the accreditation for the validation and verification for projects under scope 1 and 13.

Besides, as per 4.1.23 of VCS Standard version 4.4, Validation (including project crediting period renewal validation) and the first verification of a project (in a given project crediting period) may be undertaken by the same validation/verification body and a validation/verification body shall not verify more than six consecutive years of a project's GHG emission reductions or removals. Applus+ Certification only conducted verification (with monitoring period from 26/07/2021 to 25/12/2022, less than 6 years) of the project activity and therefore it is confirmed that 4.1.23 of VCS Standard version 4.4 have been met.

3 VALIDATION FINDINGS

3.1 Participation under Other GHG Programs

Through reviewing the registered PD /3/ and validation report /4/, it was validated that the project has been registered as VCS project which is available at <https://registry.verra.org/app/projectDetail/VCS/2455>. The project does not participate in the other emissions trading program by checking public information on Internet, interviewing with project owner and statement issued by project owner.

Therefore, Applus+ Certification consider the project is eligible to participate under the VCS Program as there is no double counting for the emission reduction during any period.

3.2 Methodology Deviations

Not applicable as not deviation for methodology.

3.3 Project Description Deviations

Not applicable as not deviation for project description.

3.4 Grouped Project

Not applicable as not a grouped project.

4 VERIFICATION FINDINGS

4.1 Project Implementation Status

Project Implementation in accordance with the registered project design document

By means of on-site visit, the assessment team confirms that all physical features of the project activity proposed in the registered VCS PD /3/ are in place and the PP has operated the project as per registered VCS PD /3/. The total installed capacity of the project activity is 2.134MW, consisting of 2 sets with each capacity of 1.067 MW. The landfill where the project located will process 700 tons of MSW each day. The electricity generated is transmitted to the local Power Grid via a transformer station, which was then exported to the NEPG. The feed-in electricity is estimated to be 137,554 MWh during the fixed 10 years crediting period. The construction of the project started on 12/11/2018, the project started operation on 09/09/2019 verified by checking Operation and Maintenance Log /27/. There are no changes on the key equipment and technology since the validation of the project. No special event which would affect the monitoring of the project has been observed during the monitoring period.

The technical parameters have been verified with the nameplates of the generators /35/ as below:

Technical parameters of the generators

Type	Gas-fired Engine and generator
Manufacturer	Jenbacher
Model	J320 GS-D121
Rated Voltage	400 V
Rated capacity	1067kW
Lifetime	15 years

The purpose of the project is to utilize landfill gas (LFG), which consists mainly of methane, for electricity generation. It includes LFG collection system, LFG pre-treatment system, electricity generation system and flare system. LFG collected will be used for electricity generation with internal combustion generators. The flaring system will only be involved when the electricity generation system is not in operation,

By checking the registered PD /3/, validation report /4/ and interviewing with Project Developer during site visit, it is confirmed by the assessment team that the project developer determined that VCUs from flare will not be claimed, even if any methane is destroyed by flare during the crediting

period. VCUs will only be claimed from the methane destroyed by power generation system and the power displacement.

The assessment team confirmed that there is no proposed or actual change to the project design during this monitoring period. All required equipments and procedures are available and implemented in an appropriate manner. All necessary monitoring instruments are installed. All required instruments including standby and operating procedures for the same have been implemented in an appropriate manner. The project is completely operational and the same has been confirmed on-site. Neither mistakes nor malfunction on electricity meter have been observed during this monitoring period.

Participation or any rejection under any other GHG programs

Applus+ Certification checked public information from the UNFCCC website, REC Mechanism database of China, Chinese Emission Trading System, Gold Standard Registry and interviewed with project owner during site visit, it is confirmed that except VCS scheme, the project has not been participated or been rejected under any other GHG programs since validation. The same has been confirmed through interviewing with project owner and statement issued by project owner.

Other Forms of Credit and Supply Chain (Scope 3) Emissions

- Emission Trading Programs and Other Binding Limits: The verification team checked the REC Mechanism database of China, Chinese Emission Trading System (Chinese ETS) and Chinese Certified Emission Reduction Mechanism, and found that the project activity is not accredited / registered under REC mechanism, Chinese ETS, or CCER mechanism. Also, CCER mechanism is currently suspended by Chinese government, the project activity will not and is not allowed to registered under CCER mechanism. Thus, the assessment team concluded that the project activity not involved on other emissions trading programs and other binding limits.

- Other Forms of Environmental Credit: The verification team checked the REC Mechanism database of China, I-REC database and confirmed that there are no other forms of environmental credits applied or issued for the project activity. The emission reduction resulted from the project during this monitoring period would only apply for VCUs.

- Supply Chain (Scope 3) Emissions: The Project can reduce GHG emissions by utilization the recovered landfill gas, avoiding the emission of methane that would be generated under landfill condition; and by replacing the electricity generated by fossil fuel fired power plants of Northeast China Power Grid (NEPG). For LFG power generation projects, the GHG emission reductions come from avoiding CO₂ emissions from those fossil fuel-based power plants connected to the grid and avoiding GHG emissions from releasing LFG into atmosphere at the landfill site, and does not happen in a supply chain. Therefore, it is confirmed that the Supply Chain (Scope 3) Emissions are not applicable for the project activity.

In conclusion, the verification team confirmed that the project only applies VCUs under VCS, and no rejection from VCS occurs, there are no other forms of environmental credits applied or issued for the project activity, the emission reduction resulted from the project during this monitoring

period would only apply for VCUs.

SD contributions resulted by implementation of the project activity

By checking EIA Report /31/, Staff roster /11/, China's National Plan on Implementation of the 2030 Agenda for Sustainable Development and 17 SDGs defined by UNDP, interviewing stakeholders during site visit, the assessment team confirmed that the project activity would contribute sustainable development in the region and China's Sustainable Development Goals (SDGs). The specific sustainable development goals that the project activity could achieve have been listed as follows:

- SDG13 "Take urgent action to combat climate change and its impacts": the project will utilize and destroy landfill gas that would otherwise be released directly into the atmosphere, effectively reducing GHG emissions and air pollution in the surrounding area and decreasing odour nuisance and minimizing health risks of local residents. Meanwhile, the project activity is able to increase the safety on the landfill through Proper extraction and utilization of the landfill gas, which minimizes the potential for LFG migration on site and reduce the explosion risks of landfill gas. This contributes to achieve one of China's stated sustainable development priorities "Actively adapt to climate change and strengthen resistance capacity to climate risks in agriculture, forestry, water resources and other key fields, as well as cities, coastal regions and ecologically vulnerable areas". During this monitoring period, total GHG emission reduction was 108,962 tCO₂e. By checking emission reductions of previous monitoring period from VERRA website, it is confirmed that the cumulative emission reductions were 219,446 tCO₂e since the project start date.

- SDG7 "Ensure access to affordable, reliable, sustainable and modern energy for all": the project activity will provide clean and renewable energy source through making use of landfill gas, displacing the power generation of fossil fuel power plants by using renewable energy sources, reducing fossil fuel consumption in NEPG. This contributes to one of the China's actions for promoting sustainable developing, "By 2030, increase the share of non-fossil fuels in primary energy consumption to about 20 percent". During this monitoring period, 17,732.26 MWh of renewable electricity was delivered to NEPG. By checking net electricity delivered to NEPG of previous monitoring period from VERRA website, it is confirmed that the cumulative renewable electricity delivered to NEPG was 35,876.92 MWh since operation of the project activity.

- SDG 8 "Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all": the project activity increases 10 long term employment opportunities for the management, operation and maintenance of the power plant. This contributes to one of the China's actions for promoting sustainable developing, "Increase labor force participation rate through implementation of the classification policy. Vigorously enforce the Law on Promotion of Employment".

4.2 Safeguards

4.2.1 No Net Harm

By checking the EIA summary and conclusion provided in the registered PD, it is confirmed that the impact caused by LFG power generation on the surrounding ecosystem and residents, water, and atmosphere etc. is very little, there would be no net harm caused due to the project activity. Also, the EIA of the project are approved by the government.

For environmental impacts during this monitoring period, the assessment team made the following assessment:

Water Quality

As verified during site visit and via interview with project owner, it is confirmed the domestic wastewater from onsite employees have been treated by the landfill site wastewater treatment system. Therefore, the project does not produce wastewater during the operation period.

Air Quality

This project uses LFG which is collected from Haicheng Landfill Site to generate electricity, avoiding uncontrolled releasing of LFG. Therefore, it is confirmed the project activity reduces greenhouse gas and effluvia emitting to air, and mitigates the possible danger of fire or explosion.

By checking EIA Report /31/, it is confirmed the emission of NO_x, SO₂ and NH₃ for this project is less than the 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. The same has been verified during site visit. Therefore, it is confirmed the emission of exhaust gas has little impact on surrounding environment.

Noise

As verified during site visit, the project is surrounded by the landfill site and mountains, the only building which is next to the project is Haicheng Landfill Site office building. As per the EIA Report /31/ and verified during site visit, it is confirmed the noise of the project has no impact on surrounding residential areas under the influence of distance attenuation, air absorption and trees blocking.

Solid Waste

By checking EIA Report /31/ and as verified during site visit, it is confirmed this project produces small amounts of solid waste during operational period, which have been sent to the landfill site, not only ensuring the safety of disposal, but also having little impact on surrounding environment.

After the above measures are performed, it is confirmed the negative impacts on environment have been minimized and met the requirements of laws and regulations during the operational period.

Also, no potential environment or social economic matter was found during the site visit. The project is LFG power generation project and thus no net harm observed in air or water quality on-site. Furthermore, by checking Staff Roster /11/, interviewing stakeholders during site visit, The assessment team confirmed that the implementation of the project activity could increase employment opportunities in the local area.

4.2.2 Local Stakeholder Consultation

By checking the attendance list /43/, the assessment team confirmed a local stakeholder consultation meeting was held on 13/03/2020 by the project owner. Before the stakeholder consultation meeting, the project information with contact information and the stakeholder meeting notice were published on the bulletins at and nearby the project site on 13/02/2020 to invite Local stakeholders.

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

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

The opinions expressed by the stakeholders were recorded and are available on request. The stakeholder meeting and the survey showed that the project receives no negative comments on its the construction.

All such conclusion has been verified through site visit and check registered PD.

By checking the filled questionnaires from local stakeholders /33/, it is confirmed by the assessment team that communications with local stakeholders was being carried out in 13/03/2020 by the project owner. There are no negative comments received for the project.

A grievance book has been put in the project office and the local stakeholders can provide feedbacks on the grievance book. Through interviewing with stakeholders and checking grievance book /32/ during site visit, it is confirmed that a grievance book has been put at the project owner office and no negative comments were identified from the grievance book. Via interviewing with staff from local environmental protection bureau and local residents during the site visit, it is confirmed by the assessment team that during the implementation stage of this monitoring period, local authority has conducted spot checks on the implementation of the project periodically as per the request from the local governments' regulations.

Therefore, it was able to confirmed that there were no negative comments and issues from the local stakeholders during this monitoring period and the project passed all the periodic spot checks by local government.

4.3 AFOLU-Specific Safeguards

Not applicable as non-AFOLU project.

4.4 Accuracy of GHG Emission Reduction and Removal Calculations

The monitoring has been carried out in accordance with the monitoring plan contained in the registered PD /3/.

Data and Parameters Available at Validation

The parameter $BE_{CH_4,SWDS,y}$ - methane generation from the landfill in the absence of the project activity, is only used for ex-ante estimation the parameter $F_{CH_4,PJ,y}$. In this monitoring period, the parameter $F_{CH_4,PJ,y}$ was ex post determined through monitoring parameters, which is consistent with the approved methodology ACM0001. Thus, the parameters, including ϕ_y , OX , F , DOC_f , MCF_y , k_i , $W_{j,x}$, DOC_j , η_{PJ} , which determined $BE_{CH_4,SWDS}$ and $F_{CH_4,PJ,y}$ ex-ante are not included in this report. Below data has been verified against the data sources and the registered PD.

Parameter title	Description	Data	Unit	Source
OX_{top_layer}	Fraction of methane that would be oxidized in the top layer of the SWDS in the baseline	0.1	/	Consistent with how oxidation is accounted for in the methodological tool "Emissions from solid waste disposal sites"
GWP_{CH_4}	Global warming potential of CH_4	28	/	IPCC Fifth Assessment Report (AR5)
$EF_{grid,OM,y}$	Operating margin CO_2 emission factor in year y	1.0826	t CO_2 /MWh	2019 Baseline Emission Factors for Regional Power Grids in China dated 29/12/2020 published by China DNA /15/.
$EF_{grid,BM,y}$	Build margin CO_2 emission factor in year y	0.2399	t CO_2 /MWh	2019 Baseline Emission Factors for Regional Power Grids in China dated 29/12/2020 published by China DNA /15/.
$EF_{grid,CM,y}$	Combined margin CO_2 emission factor in year y	0.66125	t CO_2 /MWh	Calculated as per "Tool to calculate the emission factor for an electricity system"
R_u	Universal ideal gases constant	8,314	Pa.m ³ /kmol.K	Tool to determine the mass flow of a greenhouse gas in a gaseous stream
MM_i	Molecular mass of greenhouse gas i	16.04	kg/kmol	Tool to determine the mass flow of a greenhouse gas in a gaseous stream
P_n	Total pressure at normal conditions	101,325	Pa	Tool to determine the mass flow of a greenhouse gas in a gaseous stream

T_n	Temperature at normal conditions	273.15	K	Tool to determine the mass flow of a greenhouse gas in a gaseous stream
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Data and Parameters Monitored

By checking Monitor System Display Screen during site visit /16/, it is confirm by the assessment team that the parameter $V_{t,wb}$ have been converted automatically into normal condition (0 °C and 101,325 Pa) during the monitoring process. Therefore, P_t and T_t are not included as separate parameters according to the registered PD.

For all rest parameters, including Management of SWDS, $Op_{j,h}$, $EG_{PJ,y}$, $TDL_{k,y}$, $EC_{PJ,y}$, $TDL_{j,y}$, f_y , $V_{i,t,wb}$, $V_{t,wb}$, CAPEX and OPEX, Tariff of electricity exported were monitored and determined as per the monitoring plan which is listed in below table.

Data / Parameter:	Management of SWDS
Data unit:	/
Description:	Management of SWDS
Purpose of the data:	Calculation of baseline emissions
Parameter value:	/
Source of data used:	Original design of the landfill
Information flow:	/
Monitoring method, frequency and equipments:	This parameter was monitored annually by the project owner through following up with any changes in the management of Haicheng Landfill Site. Through interview with staff from Haicheng Landfill Site and by checking the Operation Management Manual of Haicheng Landfill site /10/, the assessment team confirmed that there was no changes in the management of the SWDS after the implementation of the project activity, which is consistent with that in the registered PD and MR.
Calibration:	/
QA/QC procedure:	/
Means of verification:	Staff from Haicheng Landfill Site was interviewed, the Operation Management Manual of Haicheng Landfill site was checked, and on-site inspection was conducted by the assessment team, all monitoring method and frequency meets the description in the PD.

Data / Parameter:	Op _{j,h}				
Data unit:	/				
Description:	Operation of the electricity generators that consume the LFG				
Purpose of the data:	Calculation of baseline emissions				
Parameter value:	The methane was destructed through using for electricity generation. The project activity was in normal operational condition, while the operation hours of generators were monitored by the project owner. The operational hours of generators in this monitoring period were: <table border="1"> <tr> <td>generator 1#</td><td>10,282 h</td></tr> <tr> <td>generator 2#</td><td>10,390 h</td></tr> </table>	generator 1#	10,282 h	generator 2#	10,390 h
generator 1#	10,282 h				
generator 2#	10,390 h				
Source of data used:	The operational hours are all sourced from Monthly Statistic Report of Generator Unit Operation Hours /17/ issued by the project owner.				
Information flow:	By checking Monitor System Display Screen during site visit /16/, the assessment team confirmed that the operating hours of each gas engine are automatically monitored and recorded every hour by an integrated monitoring device in the engine system, which is consistent with methodology and registered PD. Generator Unit Operation Hours were daily recorded by the project owner in Power Generation Data Statistic Report /14/ and monthly aggregated in Monthly Statistic Report of Generator Unit Operation Hours /17/. Monthly cumulative data in Power Generation Data Statistic Report /14/ were used to cross check with that in Monthly Statistic Report of Generator Unit Operation Hours /17/. The data from Power Generation Data Statistic Report and Monthly Statistic Report of Generator Unit Operation Hours has been sent to the project participants for reporting of GHG emission reduction.				
Monitoring method, frequency and equipments:	The parameter was monitored continuously by an integrated monitoring device in the engine system, recorded every hour automatically.				
Calibration:	/				
QA/QC procedure:	/				

Means of verification:	Information flow was verified by checking the Monthly Statistic Report of Generator Unit Operation Hours /17/, and all information are consistent; Information flow was verified by checking Power Generation Data Statistic Report and Monthly Statistic Report of Generator Unit Operation Hours, and all information are consistent; Monitoring method was verified by site visit, checking the relevant records, all monitoring method meets the description in the PD; Calibration was verified by checking calibration certificate, all calibration of monitoring equipment meets the requirement indicated in the PD.
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Data / Parameter:	EG _{PJ,y}
Data unit:	MWh
Description:	Amount of electricity generated using LFG by the project activity in year y
Purpose of the data:	Calculation of baseline emissions
Parameter value:	17,733.96
Source of data used:	Monthly Electricity Meter Reading Records /18/ and Electricity Transaction Notes (ETNs) /24/ covering monitoring period.
Information flow:	One bi-directional electricity meter installed in transformer substation located at the project site was used to monitor continuously and the meter reading was recorded monthly. At 24:00 hr of the 25th day of each month, the meter readings will be recorded remotely and digitally by local power grid company and the data will be downloaded and transcribed into Electricity Transaction Notes (ETNs) /24/. At the same cut-off time, the staff from project owner will record the electricity meter readings and generate Monthly Electricity Meter Reading Records. After confirmation of transacted data from the grid company, the project owner will issue the electricity invoices /35/. The data from Monthly Electricity Meter Reading Records and ETNs has been sent to the project participant for reporting of GHG emission reduction. The conservative one would be used for ER calculation.
Monitoring method, frequency and equipments:	The parameter was monitor continuously, recorded monthly by the electricity meter installed in transformer substation located at the project site. See below for the information of the electricity meter verified by site visit and checking calibration certificates /12/:

	Meter	Model	Serial Number	Accuracy
	Electricity meter	DSZ331	2130001220000001170828	0.5S
	The model, serial number and accuracy have been confirmed by site visit /30/.			
Calibration:	The calibration information is shown as below /12/:			
	Meter	Calibration date	Valid until	
	Electricity meter	11/08/2020	10/08/2021	
		09/08/2021	08/08/2022	
		05/08/2022	04/08/2023	
	The calibration was conducted by a qualified third party, State Grid Liaoning Electric Power Co., Ltd. Marketing Service Center /13/.			
QA/QC procedure:	Data record will be archived for a period of 2 years after the crediting period to which the records pertain.			
Means of verification:	Data of the parameter was verified by checking Monthly Electricity Meter Reading Records, ETNs and electricity invoices of electricity generated using LFG. All data is consistent with that in Monthly Electricity Meter Reading Records, ETNs and electricity invoices; Information flow was verified by checking Monthly Electricity Meter Reading Records, ETNs and electricity invoices, and all information are consistent; Monitoring method was verified by site visit, checking calibration certificates, all monitoring method meets the description in the PD; Calibration was verified by checking calibration certificate, all calibration of monitoring equipment meets the requirement indicated in the PD.			

Data / Parameter:	TDL _{k,y}
Data unit:	-
Description:	Average technical transmission and distribution losses for providing electricity to source k in year y
Purpose of the data:	Calculation of baseline emissions
Parameter value:	3%

Source of data used:	Default value from methodological tool "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation"
Information flow:	/
Monitoring method, frequency and equipments:	The default value from latest version methodological tool "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" was monitored annually and adopted to calculate the baseline emissions.
Calibration:	/
QA/QC procedure:	/
Means of verification:	The default value from latest version methodological tool "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" was monitored annually and adopted to calculate the baseline emissions, which is consistent with the registered PD.

Data / Parameter:	EC _{PJ,y}
Data unit:	MWh
Description:	Amount of electricity consumed by the project activity in year y
Purpose of the data:	Calculation of project emissions
Parameter value:	1.70
Source of data used:	Monthly Electricity Meter Reading Records /18/, electricity invoices /35/ of electricity consumed from the grid issued by the power grid company covering monitoring period.
Information flow:	One bi-directional electricity meter installed in transformer substation located at the project site was used to monitor continuously and the meter reading was recorded monthly. At 24:00 hr of the 25th day of each month, the meter readings will be recorded remotely and digitally by local power grid company and the data will be downloaded. At the same cut-off time, the staff from project owner will record the electricity meter readings and generate Monthly Electricity Meter Reading Records. After confirmation of transacted data by the project owner, the grid company will issue Electricity Transaction Notes (ETNs) /24/. The data from Monthly Electricity Meter Reading Records and ETNs has been sent to the project participant for reporting of GHG

	emission reduction. The conservative one would be used for ER calculation.										
Monitoring method, frequency and equipments:	The parameter was monitor continuously, recorded monthly by the electricity meter installed in transformer substation located at the project site. See below for the information of the electricity meter verified by site visit and checking calibration certificates /12/: <table><tr><th>Meter</th><th>Model</th><th>Serial Number</th><th>Accuracy</th></tr><tr><td>Electricity meter</td><td>DSZ331</td><td>2130001220000001170828</td><td>0.5S</td></tr></table> The model, serial number and accuracy have been confirmed by site visit /30/.	Meter	Model	Serial Number	Accuracy	Electricity meter	DSZ331	2130001220000001170828	0.5S		
Meter	Model	Serial Number	Accuracy								
Electricity meter	DSZ331	2130001220000001170828	0.5S								
Calibration:	The calibration information is shown as below /12/: <table><tr><th>Meter</th><th>Calibration date</th><th>Valid until</th></tr><tr><td rowspan="3">Electricity meter</td><td>11/08/2020</td><td>10/08/2021</td></tr><tr><td>09/08/2021</td><td>08/08/2022</td></tr><tr><td>05/08/2022</td><td>04/08/2023</td></tr></table> The calibration was conducted by a qualified third party, State Grid Liaoning Electric Power Co., Ltd. Marketing Service Center /13/.	Meter	Calibration date	Valid until	Electricity meter	11/08/2020	10/08/2021	09/08/2021	08/08/2022	05/08/2022	04/08/2023
Meter	Calibration date	Valid until									
Electricity meter	11/08/2020	10/08/2021									
	09/08/2021	08/08/2022									
	05/08/2022	04/08/2023									
QA/QC procedure:	Data record will be archived for a period of 2 years after the crediting period to which the records pertain.										
Means of verification:	Data of the parameter was verified by checking Monthly Electricity Meter Reading Records and ETNs of Electricity consumed from the grid. All data is consistent with Monthly Electricity Meter Reading Records and ETNs; Information flow was verified by checking Monthly Electricity Meter Reading Records and ETNs, and all information are consistent; Monitoring method was verified by site visit, checking calibration certificates, all monitoring method meets the description in the PD; Calibration was verified by checking calibration certificate, all calibration of monitoring equipment meets the requirement indicated in the PD.										

Data / Parameter:	TDL _{j,y}
Data unit:	/

Description:	Average technical transmission and distribution losses for providing electricity to source j in year y
Purpose of the data:	Calculation of project emissions
Parameter value:	20%
Source of data used:	Default value from methodological tool "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation"
Information flow:	/
Monitoring method, frequency and equipments:	The default value from latest version methodological tool "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" was monitored annually and adopted to calculate the project emissions.
Calibration:	/
QA/QC procedure:	/
Means of verification:	The default value from latest version methodological tool "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" was monitored annually and adopted to calculate the project emissions, which is consistent with the registered PD.

Data / Parameter:	f_y
Data unit:	/
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
Purpose of the data:	Calculation of baseline emissions
Parameter value:	0
Source of data used:	Historic data from SWDS
Information flow:	/
Monitoring method, frequency and equipments:	The parameter was followed up by the project owner and was determined once for the crediting period. In the absence of the project, LFG from Haicheng Landfill site is emitted directly into atmosphere. Through interview with staff

	from Haicheng Landfill Site and by checking the Operation Management Manual of Haicheng Landfill site /10/, the assessment team confirmed that the methane was not captured at SWDS or not flare, combusted. And no other measures that prevents the emissions of methane to the atmosphere are taken.
Calibration:	/
QA/QC procedure:	/
Means of verification:	By interviewing with staff from Haicheng Landfill Site, the assessment team confirmed that in the absence of the project, the methane was not captured at SWDS or not flare, combusted. And no other measures that prevents the emissions of methane to the atmosphere are taken. The baseline scenario or monitoring plan will not change accordingly.

Data / Parameter:	$V_{i,t,wb}$
Data unit:	m ³ gas i/m ³ wet gas
Description:	Volumetric fraction of greenhouse gas i in the gaseous stream in time interval t on a wet basis
Purpose of the data:	Calculation of baseline emissions
Parameter value:	48.19% (hourly average value for this monitoring period)
Source of data used:	Pretreatment Monitoring Records /19/ issued by the project owner
Information flow:	The volumetric fraction of methane in the gaseous stream was measured by an continuous in-situ gas analyzer. By checking Monitor System Display Screen during site visit /16/, the assessment team confirmed that the readings of the gas analyzer was continuously monitored and hourly recorded /19/ by Online Monitoring System through recordable electronic signal, which is in compliance with methodology and registered PD. The volumetric fraction of methane in the gaseous stream was manually recorded in Parameter Recording Table of Pretreatment control system /29/ by project owner. Raw data in Pretreatment Monitoring Records /19/ has been crosschecked with that in Parameter Recording Table of Pretreatment control system /29/. Data from Pretreatment Monitoring Records and Parameter Recording Table of Pretreatment control system has been sent

	to the project participants for reporting of GHG emission reduction.										
Monitoring method, frequency and equipments:	The parameter was monitored continuously and recorded hourly automatically by Online Monitoring System through recordable electronic signal. <table><tr><th>Equipment</th><th>Model</th><th>Serial Number</th><th>Accuracy</th></tr><tr><td>Gas analyzer</td><td>Gasboard-3500</td><td>2190 5061 3618 2000 0001</td><td>2%</td></tr></table> The model, serial number and accuracy have been confirmed by site visit /30/.	Equipment	Model	Serial Number	Accuracy	Gas analyzer	Gasboard-3500	2190 5061 3618 2000 0001	2%		
Equipment	Model	Serial Number	Accuracy								
Gas analyzer	Gasboard-3500	2190 5061 3618 2000 0001	2%								
Calibration:	The calibration information is shown as below /21/: <table><tr><th>Equipment</th><th>Calibration date</th><th>Valid until</th></tr><tr><td rowspan="3">Gas analyzer</td><td>04/08/2020</td><td>03/08/2021</td></tr><tr><td>02/08/2021</td><td>01/08/2022</td></tr><tr><td>29/07/2022</td><td>28/07/2023</td></tr></table> The calibration was conducted by a qualified third party, Shenzhen Academy of Metrology and Quality Inspection/22/. As per the calibration certificate /21/, the zero verification with an inert gas (N₂) and one reading verification with a standard gas (single calibration gas, CH₄) was included. All calibration gases have been certified and were under their validity period.	Equipment	Calibration date	Valid until	Gas analyzer	04/08/2020	03/08/2021	02/08/2021	01/08/2022	29/07/2022	28/07/2023
Equipment	Calibration date	Valid until									
Gas analyzer	04/08/2020	03/08/2021									
	02/08/2021	01/08/2022									
	29/07/2022	28/07/2023									
QA/QC procedure:	Data record will be archived for a period of 2 years after the crediting period to which the records pertain.										

Means of verification:	Information flow was verified by checking Pretreatment Monitoring Records /19/, and all information are consistent; Data recorded in Pretreatment Monitoring Records /19/ was crosschecked with Parameter Recording Table of Pretreatment control system. It is confirmed by the assessment team that all information are consistent; Monitoring method was verified by site visit, checking calibration certificates, all monitoring method meets the description in the PD; Calibration was verified by checking calibration certificate, all calibration of monitoring equipment meets the requirement indicated in the PD.
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Data / Parameter:	$V_{t,wb}$
Data unit:	m ³ wet gas/h
Description:	Volumetric flow of the gaseous stream in time interval t on a wet basis
Purpose of the data:	Calculation of baseline emissions
Parameter value:	913.04 (average value for this monitoring period at normal conditions)
Source of data used:	Pretreatment Monitoring Records /19/ issued by the project owner
Information flow:	The volumetric flow of methane in the gaseous stream was measured by a continuous flow meter. By checking Monitor System Display Screen during site visit /16/, the assessment team confirmed that the readings of the flow meter was continuously monitored and hourly recorded /19/ by Online Monitoring System through recordable electronic signal, which is consistent with the registered PD. The volumetric flow of methane in the gaseous stream was manually recorded in Parameter Recording Table of Pretreatment control system /29/ by project owner. Raw data in Pretreatment Monitoring Records /19/ has been crosschecked with that in Parameter Recording Table of Pretreatment control system /29/. Data from Pretreatment Monitoring Records and Parameter Recording Table of Pretreatment control system has been sent to the project participants for reporting of GHG emission reduction.

Monitoring method, frequency and equipments:	The parameter was monitored continuously and recorded hourly automatically by Online Monitoring System through recordable electronic signal.					
	Equipment		Model		Serial Number	Accuracy
	Flow meter		3051DP1A62A1AB4K8M5HR5		03380891	0.04%
	The model, serial number and accuracy have been confirmed by site visit /30/.					
Calibration:	The calibration information is shown as below /23/:					
	Equipment		Calibration date		Valid until	
	Flow meter		03/06/2021		02/06/2022	
			01/06/2022		31/05/2023	
	The calibration was conducted by a qualified third party, Shanghai Inspection and Testing Institute of Instruments and Automation System Co., Ltd /26/.					
	By checking Monitor System Display Screen during site visit /16/, It is confirm by the assessment team that the parameter $V_{t,wb}$ have been converted automatically into normal condition (0 °C and 101,325Pa) during the monitoring process. The readings of temperature transducer and pressure transducer measuring T_t and P_t was monitored automatically by Online Monitoring System through recordable electronic signal. The calibration information of Temperature transducer and Pressure transducer is shown below:					
	Equipment	Model	Serial number	Accuracy	Calibration date	Valid until
	Temperature transducer	KZWS/G	18101256	0.5	03/06/2021	02/06/2022
					01/06/2022	31/05/2023
Equipment	Model	Serial number	Accuracy	Calibration date	Valid until	
Pressure transducer	SY-2088	19061003	0.5	05/07/2021	04/08/2021	
				05/08/2021	04/09/2021	

					05/09/2021 1	04/10/2021
					05/10/2021 1	04/11/2021
					05/11/2021 1	04/12/2021
					05/12/2021 1	04/01/2022
					05/01/2022 2	04/02/2022
					05/02/2022 2	04/03/2022
					05/03/2022 2	04/04/2022
					05/04/2022 2	04/05/2022
					05/05/2022 2	04/06/2022
					05/06/2022 2	04/07/2022
					05/07/2022 2	04/08/2022
					05/08/2022 2	04/09/2022
					05/09/2022 2	04/10/2022
					05/10/2022 2	04/11/2022
					05/11/2022 2	04/12/2022
					05/12/2022 2	04/01/2023
The model, serial number and accuracy have been confirmed by site visit /30/. The calibration of Temperature transducer and Pressure transducer /25/ was conducted by a qualified third party, Shanghai Inspection and Testing Institute of Instruments and Automation System Co., Ltd. /26/.						
QA/QC procedure:	Data record will be archived for a period of 2 years after the crediting period to which the records pertain.					
Means of verification:	Information flow was verified by checking Pretreatment Monitoring Records /19/, and all information are consistent;					

	Raw data in Pretreatment Monitoring Records /19/ has been crosschecked with that in Parameter Recording Table of Pretreatment control system /29/. It is confirmed by the assessment team that all information are consistent; Monitoring method was verified by site visit, checking calibration certificates, all monitoring method meets the description in the PD; Calibration was verified by checking calibration certificate, all calibration of monitoring equipment meets the requirement indicated in the PD.
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Data / Parameter:	CAPEX and OPEX
Data unit:	CNY
Description:	Total investment to implement the project and total cost to operate the project
Purpose of the data:	For projects applying the simplified procedures to identify the baseline scenario and demonstrate additionality
Parameter value:	CAPEX: 24.6 million OPEX: 3.82 million
Source of data used:	Engineering, procurement and construction contracts; and maintenance contracts
Information flow:	/
Monitoring method, frequency and equipments:	As the project activity applied the simplified procedures to identify the baseline scenario and demonstrate additionality in the registration stage, the monitoring of this parameter is required as per ACM0001. By checking registered VCS PD and ACM 0001, this parameter was monitored at the first issuance request after each phase of the project is fully implemented.
Calibration:	/
QA/QC procedure:	Data record will be archived for a period of 2 years after the crediting period to which the records pertain.
Means of verification:	By checking validation report /4/, Operation and Maintenance Log /27/, as well as checking through site visit, it is confirmed all 2 gas-fired Engine / generators of the project activity put into operation on 09/09/2019 and the project activity does not involve any other phases, i.e. the project activity was fully implemented since 09/09/2019. Furthermore, by checking the monitoring report and verification report of previous monitoring period (the first issuance request) /5/ /6/, it is confirmed that

	this parameter has been justified at the first issuance request after full implementation and thereby consistent with the registered VCS PD and ACM 0001.
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Data / Parameter:	Tariff of electricity exported
Data unit:	CNY/kWh
Description:	Tariff of the electricity exported
Purpose of the data:	For projects applying the simplified procedures to identify the baseline scenario and demonstrate additionality
Parameter value:	0.5513
Source of data used:	Power purchase agreement /20/
Information flow:	/
Monitoring frequency, method, and equipments:	As the project activity applied the simplified procedures to identify the baseline scenario and demonstrate additionality in the registration stage, the monitoring of this parameter is required as per ACM0001. By checking registered VCS PD and ACM 0001, this parameter was monitored at the first issuance request after each phase of the project is fully implemented.
Calibration:	/
QA/QC procedure:	Data record will be archived for a period of 2 years after the crediting period to which the records pertain.
Means of verification:	By checking validation report /4/, Operation and Maintenance Log /27/, as well as checking through site visit, it is confirmed all 2 gas-fired Engine / generators of the project activity put into operation on 09/09/2019 and the project activity does not involve any other phases, i.e. the project activity was fully implemented since 09/09/2019. Furthermore, by checking the monitoring report and verification report of previous monitoring period (the first issuance request) /5/ /6/, it is confirmed that this parameter has been justified at the first issuance request after full implementation and thereby consistent with the registered VCS PD and ACM 0001.

Quantification of GHG Emission Reductions and Removals

The assessment team confirms that appropriate methods and formulae for calculating baseline

emissions, project emissions and leakage have been followed, and the assumptions, emission factors and default values that are applied in the calculation have been justified.

Baseline emissions

As per registered VCS PD, baseline reductions are determined as:

$$BE_y = BE_{CH_4,y} + BE_{EC,y}$$

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

As per registered VCS PD and ACM0001, Baseline emissions of methane from the SWDS ($BE_{CH_4,y}$) is determined as follows:

$$BE_{CH_4} = \left((1 - OX_{top_layer}) \times F_{CH_4,PJ,y} - F_{CH_4,BL,y} \right) \times GWP_{CH_4}$$

Where:

$BE_{CH_4,y}$	=	Baseline emissions of methane from the SWDS in year y (tCO ₂ e/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)
$F_{CH_4,PJ,y}$	=	Amount of methane in the LFG which is flared and/or used in the project activity in year y (tCH ₄ /yr)
$F_{CH_4,BL,y}$	=	Amount of methane in the LFG that would be flared in the baseline in year y (tCH ₄ /yr)
GWP_{CH_4}	=	Global warming potential of CH ₄ (tCO ₂ e/t CH ₄)

The requirements set out in provision 5.15 of “Standard for Pollution Control on the Landfill Site of Municipal Solid Waste” (GB 16889 – 2008, issued by the Environment Protection Administration) /36/ and provisions 11.1.1 - 11.1.4 “Technical Code for Municipal Solid Waste Sanitary Landfill” (GB 50869-2013, issued by the Ministry of Housing and Urban-Rural Development of the People's Republic of China in 2013) /37/ have been checked for parameter $F_{CH_4,BL,y}$.

As per Announcement from Ministry of Housing and Urban-Rural Development of the People's Republic of China on the issuance of GB 50869-2013 /38/ and explanation in Annex section of GB 50869-2013 (page 131) /37/, among para 11.1.1 - 11.1.4, only 11.1.1 is the mandatory provision, 11.1.2 - 11.1.4 are voluntary provisions.

By checking Operation Management Manual of Haicheng Landfill site /10/ and onsite interview and investigation, it is confirmed that Haicheng landfill site has been equipped with effective landfill gas discharge facilities, i.e. gas discharging gabion, to prevent fire and explosion. Therefore, the assessment team deemed that para 11.1.1 are satisfied.

Since both para 5.15 of GB16889-2008 and para 11.1.2 of GB50869-2013 states that for landfill site with the designed landfill volume more than 2.5 million tons and the landfill depth more than 20 meters, methane utilization facility or flaring facility should be built to treat the methane-containing landfill gas. The assessment team made the following justifications:

By checking the EIA Report /31/ of the project, approved by Haicheng City Environmental Protection Bureau on 26/09/2018, it was verified that the depth of the landfill site where the project located is only 16 meters, less than 20 meters as specified by para 5.15 of GB16889-2008 and para 11.1.2 of GB50869-2013. Therefore, it is confirmed that para 5.15 of GB16889-2008 and para 11.1.2 of GB50869-2013 are not applicable to the project.

Therefore, it is confirmed that the project is satisfied with the situation Case 1 in Section 5.4.1.3 of ACM0001, v.19, i.e. No requirement to destroy methane exists and no existing LFG capture system. Upon this selection (case 1), $F_{CH_4,BL,y} = 0$ and the selection is considered applicable and in compliance with the legal requirements.

The calculation process has been included in the ER calculation spreadsheet and confirmed by the assessment team to be correct. The value of parameters in the equation are listed as follows:

Parameter	Description	2021	2022	Total
OX_{top_layer}	Fraction of methane in the LFG that would be oxidized in the top layer of the SWDS in the baseline (dimensionless)	0.1	0.1	0.1
$F_{CH_4,PJ,y}$ (tCH ₄)	Amount of methane in the LFG which is flared and/or used in the project activity	1,196	2,649	3,845

$F_{CH_4,BL,y}$ (tCH ₄)	Amount of methane in the LFG that would be flared in the baseline. No requirement in the baseline, therefore, it is 0.	0	0	0
GWP_{CH_4} (tCO _{2e} /tCH ₄)	Global warming potential of CH ₄	28	28	28
$BE_{CH_4,y}$ (tCO _{2e})	Baseline emissions of methane from the SWDS	30,139	66,748	96,887

As per registered VCS PD, for the project activity, the mass flow of greenhouse gas *i* ($F_{i,t}$) is determined as follows:

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

With:

$$\rho_{i,n} = \frac{P_n \times MM_i}{R_u \times T_n}$$

Where:

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

The detailed calculation process of $F_{CH_4,PJ,y}$ has been included in the ER calculation spreadsheet and confirmed by the assessment team to be correct. The value of $F_{CH_4,PJ,y}$ during this monitoring period are as follows:

Parameter	Description	2021	2022	Total
$F_{CH_4,PJ,y}$ (tCH ₄)	Amount of methane in the LFG which is flared and/or used in the project activity	1,196	2,649	3,845
$F_{CH_4,EL,y}$ (tCH ₄)	Amount of methane in the LFG which is used for electricity generation	1,196	2,649	3,845

● **Baseline emissions associated with electricity generation ($BE_{EC,y}$)**

As per registered VCS PD, this parameter is calculated as:

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

The detailed calculation process of $BE_{EC,y}$ has been included in the ER calculation spreadsheet and confirmed by the assessment team to be correct. The parameters determining $BE_{EC,y}$ during this monitoring period are as follows:

Parameter	Description	2021	2022	Total
$EC_{BL,k,y}$ (MWh)	Quantity of electricity that would be consumed by the baseline electricity consumption source k. In this project, the equivalent electricity is from NEPG.	5,303.84	12,430.12	17,733.96
$EF_{EL,k,y}$ (tCO ₂ /MWh)	Emission factor for electricity generation for source k (tCO ₂ /MWh). In this project, it is EF of NEPG. $EF_{EL,k,y} = EF_{grid,CM,y}$	0.66125	0.66125	0.66125
$TDL_{k,y}$	Average technical transmission and distribution losses for providing electricity to source k	3%	3%	3%
$BE_{EC,y}$ (tCO ₂)	Baseline emissions associated with electricity generation	3,612	8,465	12,077

Hence, the corresponding baseline emission reductions are calculated as:

Parameter	Description	2021	2022	Total
$BE_{EC,y}$ (tCO ₂ e)	Baseline emissions associated with electricity generation	3,612	8,465	12,077
$BE_{CH_4,y}$ (tCO ₂ e)	Baseline emissions of methane from the SWDS	30,139	66,748	96,887
BE_y (tCO ₂ e)	Baseline emissions	33,751	75,213	108,964

Project emissions

As per the registered VCS PD, Project emissions are calculated as follows:

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

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

In which

The detailed calculation process of $PE_{EC,y}$ has been included in the ER calculation spreadsheet and confirmed by the assessment team to be correct. The parameters determining $PE_{EC,y}$ during this monitoring period are as follows:

Parameter	Description	2021	2022	Total
$EC_{PJ,j,y}$ (MWh)	Quantity of electricity consumed by the project electricity consumption source j	0.64	1.06	1.70
$EF_{EL,j,y}$ (tCO ₂ /MWh)	Emission factor for electricity generation for source j	0.66125	0.66125	0.66125
$TDL_{j,y}$	Average technical transmission and distribution losses for providing electricity to source j	20%	20%	20%
$PE_{EC,y}$ (tCO ₂ e)	Emissions from consumption of electricity due to the project activity	1	1	2

Hence, the corresponding project emissions are calculated as:

Parameter	Description	2021	2022	Total
PE _y (tCO _{2e})	Project emissions	1	1	2
PE _{EC,y} (tCO _{2e})	Emissions from consumption of electricity due to the project activity	1	1	2

Leakages

Leakage does not need to be accounted for this project as per the VCS PD.

Emission reductions

The emission reductions for this monitoring period was calculated as:

Year	Baseline emissions or removals (tCO _{2e})	Project emissions or removals (tCO _{2e})	Leakage emissions (tCO _{2e})	Net GHG emission reductions or removals (tCO _{2e})
Year 2021 (26/07/2021 - 31/12/2021)	33,751	1	0	33,750
Year 2022 (01/01/2022 - 25/12/2022)	75,213	1	0	75,212
Total	108,964	2	0	108,962

For electricity generated using LFG and electricity consumed by the project activity, since the transaction date was the 25th day of each month during this monitoring period. The value of these 2 parameters from 26/12/2021 to 25/01/2022 (31 days) was divided into 26/12/2021 to 31/12/2021 (6 days) and 01/01/2022 to 25/01/2022 (25 days), which was calculated based on the number of days of the divided periods (6 days and 25 days). It is confirmed the calculation method will not lead to over estimation of the emission reductions of this monitoring period and thereby verified by the assessment team to be reasonable.

Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in validated VCS PD

Year	Ex-ante emissions reductions /removals	Achieved emissions reductions/removals	Percent difference	Justification for the difference
26/07/2021 - 25/12/2022	116,250	108,962	-6.27%	By checking ER spreadsheet /2/ and via interviewing with PP, it is confirmed that the main reason of the difference is that the actual amount of CH ₄ generated from the waste is less than estimated.

The emission reductions claimed are 108,962 tCO₂e in this monitoring period (i.e. 518 days). Compared with yearly expected emission reductions 116,250 tCO₂e (calculated to be 81,914*518/365) in the VCS PD, the reported emission reductions in this monitoring period are 6.27% less than that estimated in the registered VCS PD, not leading to overestimation of VCUs.

Therefore, the assessment team is able to confirm that the emission reductions reported in this monitoring period are reasonable and appropriate. the assessment team verified the input data for calculating emission reductions and the calculating process, and confirmed the result were complete and transparent.

4.5 Quality of Evidence to Determine GHG Emission Reductions and Removals

The monitoring has been carried out in accordance with the monitoring plan contained in the registered PD /3/ version 02.1 dated 23/07/2021.

As a result of verification of the ER calculation process, the assessment team confirmed that all the parameters required for the determination of the emission reductions have been included in the Monitoring Report /1/ and ER Calculation Spreadsheet /2/ and are consistent with the applied methodology ACM0001: Flaring or use of landfill gas Version 19.0 and the monitoring plan contained in the registered PD. The parameters are complete in this monitoring period.

After verifying the reported figures with the raw data sources, it's confirmed that the values of the parameters from the raw data sources are consistent with those quoted in the ER Calculation Spreadsheet and the MR Report. The verification process for the same has been clearly described above in section 4.4 of the report.

4.6 Non-Permanence Risk Analysis

Not applicable as a renewable project.

5 VERIFICATION OPINION

Applus+ Certification has been commissioned by Swiss Carbon Value Ltd. to perform the verification of greenhouse gas emission reductions of the project activity “Haicheng Landfill Gas Power Generation Project” (VCS Ref. No. 2455).

The management of Haicheng Xinzhongshui Environmental Protection Technology Co., Ltd. is responsible for the preparation of the GHG emissions data and the reported GHG emissions reductions on the basis set out within the project’s Monitoring Plan in the registered PD (version 02.1 dated 23/07/2021) /3/.

Our verification approach was based on the requirements as defined under the applicable VCS standards and relevant UNFCCC requirements. Our approach is risk-based, drawing on an understanding of the risks associated with reporting GHG emissions data and the controls in place to mitigate these. The verification can confirm that:

- the project is implemented and operated as per the registered PD;
- the monitoring plan in registered PD is as per the applied methodology;
- the monitoring complies with the monitoring plan in the registered PD;
- the monitoring report and other supporting documents provided are complete and verifiable and in accordance with the applicable VCS and CDM requirements;
- the installed equipment being essential for generating emission reduction runs reliably and is calibrated appropriately;
- the monitoring system is in place and generates GHG emission reductions data;
- the GHG emission reductions are calculated without material misstatements.

In our opinion, the GHG emission reductions for “Haicheng Landfill Gas Power Generation Project” during the monitoring period 26/07/2021 to 25/12/2022 as reported in Monitoring Report, prepared on the basis of the project’s Monitoring Plan are fairly stated. Based on the information we have seen and evaluated, we confirm the following statement:

Verification period: From 26/07/2021 to 25/12/2022 (divided into 2 vintage periods).

Verified GHG emission reductions or removals in the above reporting period:

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
Year 2021 (26/07/2021 - 31/12/2021)	33,751	1	0	33,750
Year 2022 (01/01/2022 - 25/12/2022)	75,213	1	0	75,212
Total	108,964	2	0	108,962

APPENDIX 1: REFERENCE LIST

1. Monitoring report, Version 01 dated 16/01/2023; Version 02 dated 01/02/2023; Version 02.1 dated 03/04/2023
2. ER calculation spreadsheet
3. Registered VCS PD, version 02.1 dated 23/07/2021
4. Validation report, Version 02.0, completed on 23/07/2021 by Shenzhen CTI International Certification Co., Ltd (CTI Certification)
5. Monitoring report of 1st VCS monitoring period, version 01.1 dated 18/08/2021
6. Verification report of 1st VCS monitoring period, version 01, completed on 20/08/2021 by Shenzhen CTI International Certification Co., Ltd (CTI Certification)
7. Approved methodology ACM0001: Flaring or use of landfill gas, Version 19.0, dated 14/06/2019
8. VCS Standard version 4.4, dated on 17/01/2023
9. VCS Program Guide version 4.3, issued on 17/01/2023
10. Operation Management Manual of Haicheng Landfill site, issued on 01/01/2021 and 01/01/2022
11. Staff roster provided by the project owner
12. Calibration certificates of electricity meter covering the whole monitoring period issued by State Grid Liaoning Electric Power Co., Ltd. Marketing Service Center
13. Metrological Authorization Certification of State Grid Liaoning Electric Power Co., Ltd. Marketing Service Center, issued by General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China, valid from 07/08/2017 till 06/08/2022
14. Power Generation Data Statistic Report covering the monitoring period, issued by the project owner
15. 2019 Baseline Emission Factors for Regional Power Grids in China dated 29/12/2020 published by China DNA
16. Photo of Monitoring System Display Screen
17. Monthly Statistic Report of Generator Unit Operation Hours covering the monitoring period, issued by the project owner
18. Monthly Electricity Meter Reading Records covering the monitoring period
19. Pretreatment Monitoring Records covering the monitoring period, issued by the project owner
20. Power purchase agreement (PPA), signed between the power grid company and the project owner

21. Calibration certificates of gas analyzer covering the whole monitoring period issued by Shenzhen Academy of Metrology and Quality Inspection
22. Metrological Authorization Certification of Shenzhen Academy of Metrology and Quality Inspection, issued by Guangdong Provincial Market Supervision Administration, valid from 30/07/2019 to 29/07/2024
23. Calibration certificates of flow meter covering the whole monitoring period issued by Shanghai Inspection and Testing Institute of Instruments and Automation System Co., Ltd.
24. Electricity Transaction Notes (ETNs) of electricity generated using LFG by the project activity, issued by power grid company and covering the whole monitoring period.
25. Calibration certificates of Temperature transducer and Pressure transducer covering the whole monitoring period issued by Shanghai Inspection and Testing Institute of Instruments and Automation System Co., Ltd.
26. Metrological Authorization Certification of Shanghai Inspection and Testing Institute of Instruments and Automation System Co., Ltd, valid from 28/04/2020 till 28/04/2025
27. Operation and Maintenance Record covering this monitoring period
28. Attendance list of stakeholder consultation meeting
29. Parameter Recording Table of Pretreatment control system covering this monitoring period
30. Photos of electricity meter, gas analyzer, flow meter, Temperature transducer and Pressure transducer
31. Environmental Impact Assessment Report compiled by Zhongye Jiaonai Engineering Technology Co., Ltd. and approved by Haicheng City Environmental Protection Bureau on 26/09/2018
32. Photo of grievance book
33. Questionnaires from local stakeholders
34. VCS Monitoring procedure
35. Nameplate of the generators
36. "Standard for pollution control on the landfill site of municipal solid waste" (GB16889-2008) issued by Ministry of Environmental Protection and General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China on 02/04/2008 and effective since 01/07/2008.
<https://www.antpedia.com/standard/5640072-1.html>
37. "Technical code for municipal solid waste sanitary landfill" (GB 50869-2013) issued by Ministry of Housing and Urban-Rural Development of the People's Republic of China and General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China on 08/08/2013 and effective since 01/03/2014.

<https://www.antpedia.com/standard/6777386-1.html>

38. Announcement from Ministry of Housing and Urban-Rural Development of the People's Republic of China on the issuance of the national standard "Technical code for municipal solid waste sanitary landfill" (GB 50869-2013) on 08/08/2013

https://www.mohurd.gov.cn/gongkai/fdzdgknr/tzgg/201308/20130820_224784.html

APPENDIX 2: <CLARIFICATION REQUESTS, CORRECTIVE ACTION REQUESTS, FORWARD ACTION REQUESTS (CAR/CL/FAR)>

Table 1. Remaining FAR from validation and/or previous verifications

FAR ID	NA	Section no.	NA	Date: NA
Description of FAR				
NA				
Project participant response				Date: NA
NA				
Documentation provided by project participant				
NA				
VVB assessment				Date: NA
NA				

Table 2. CL from this verification

CL ID	NA	Section no.	NA	Date: NA
Description of CL				
NA				
Project participant response				Date: NA
NA				
Documentation provided by project participant				
NA				

VVB assessment	Date: NA
NA	

Table 3. CAR from this verification

CAR ID	01	Section no.	4.1	Date: 31/01/2023
Description of CAR				
Please supplement the reasons of difference between estimated and actual emission reductions of this monitoring period.				
Project participant response				Date: 01/02/2023
The actual emission reductions of 108,962 tCO ₂ e achieved in this monitoring period is 6.27% lower than the estimated emission reductions of 116,250 tCO ₂ e in the registered PD, which is in the normal range of fluctuation since the actual amount of CH ₄ generated from the waste is affected by various reasons, such as the climate situation at the landfill site, the organic material proportion in the waste, and the amount of the waste in the landfill site, etc.				
Documentation provided by project participant				
MR (version 02.1 dated 03/04/2023)				
VVB assessment				Date: 03/04/2023
By checking MR (version 02.1 dated 03/04/2023), it is confirmed that the reasons of difference between estimated and actual emission reductions of this monitoring period has been supplemented. As verified, the main reason of the difference is because the actual amount of CH ₄ generated from the waste is less than estimated, which will not cause over estimation of the emission reductions. Therefore, CAR 01 was closed.				

CAR ID	NA	Section no.	NA	Date: NA
Description of CAR				
NA				
Project participant response				Date:
NA				

Documentation provided by project participant	
NA	
VVB assessment	Date:
NA	

Table 4. FAR from this verification

FAR ID	NA	Section No.	NA	Date: NA
Description of FAR				
NA				
Project participant response				Date: NA
NA				
Documentation provided by project participant				
NA				
VVB assessment				Date: NA
NA				