LIANZHOU LANDFILL GAS POWER GENERATION PROJECT

Document Prepared by Goldchina Consultancy International Co., Ltd.

Project Title	**Lianzhou Landfill Gas Power Generation Project**
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Monitoring Period	01/06/2021 to 30/04/2023 (first and last days included)
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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

Lianzhou Landfill Gas Power Generation Project (hereafter referred to as the project) is invested and owned by Lianzhou Dongkang Renewable Energy Technology Co., Ltd (hereafter referred to as the project owner). The project captures the landfill gas that would have been released to the atmosphere in the absence of the project and generates electricity with the landfill gas (LFG). Lianzhou landfill site is located in Jiupo town, Lianzhou City, Qingyuan City, Guangdong Province, P. R. China. The climate condition of Lianzhou is that the average temperature is 20.1℃, mean annual precipitation 1,622 mm and potential evapotranspiration 1,139 mm. The landfill site started operation in 2015 with an operational lifespan of 30 years. The landfill handles about 330 tonnes Municipal Solid Waste (MSW) per day which is mainly from the Lianzhou city.

The purpose of the project is to use LFG, which consists mainly of methane, for electricity generation. It includes LFG collection system, LFG pre-treatment system and electricity generation system. The total installed capacity of the project is 3MW which consists of 5 sets of 600kW generators. LFG collected is used for electricity generation with internal combustion generators to generate about 109,379MWh supplying to CSPG during the first 7 years crediting period. The expected average annual emission reductions are 82,464 tCO_2e and the total emission reductions are 577,253 tCO_2e during the first 7-year crediting period.

The project started construction on 02/06/2020. 5 sets of 600kW generators were operated on 01/06/2021. For this monitoring period, the net electricity delivered to CSPG were 17,914.020 MWh, and the total GHG emission reduction was 132,655 tCO_2e.

Audit Type	Period	Program	VVB Name	Number of years
Validation	30/03/2023	VCS	APPLUS+ LGAI TECHNOLOGICAL CENTER S.A.	7
Verification	01/06/2021--30/04/2023	VCS	APPLUS+ LGAI TECHNOLOGICAL CENTER S.A.	1 year and 334 days
Total	01/06/2021--30/04/2023	VCS	APPLUS+ LGAI TECHNOLOGICAL CENTER S.A.	1 year and 334 days

1.2 Sectoral Scope and Project Type

Sectoral scope 1: energy industries and sectoral scope 13: Waste handling and disposal.

The project is not a grouped project.

1.3 Project Proponent

Organization name	**Lianzhou Dongkang Renewable Energy Technology Co., Ltd.**
Contact person	Tony You
Title	Manager
Address	Shop 09, First floor, Tianyinglijing Commercial Building, Lianzhou Town, Lianzhou City, Guangdong Province, China 513400
Telephone	(86)-13538080705
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1.4 Other Entities Involved in the Project

Organization name	**Shenzhen Times Huanneng Technology Co., Ltd**
Role in the project	Consultancy
Contact person	Tao You
Title	Manager
Address	Room 25J, Building 4, Songpingshan Phase III West, Xili Street, Nanshan District, Shenzhen, Guangdong Province, China 518052
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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
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1.5 Project Start Date

01/06/2021 (commercial operation started date)

1.6 Project Crediting Period

7 years *3 renewable crediting period is adopted by the project activity.

The first 7 years VCS project crediting period started on 01/06/2021 and will be expired on 31/05/2028 (the start and end dates included).

1.7 Project Location

The project is located in Jiupo Town, Lianzhou City, Qingyuan City Guangdong Province, P.R. China. The geographical location of the project site is shown in Figure 1.1. The central coordinates of the project location are longitude of 112°20′09.20″E and latitude of 24°44′27.74″ N.

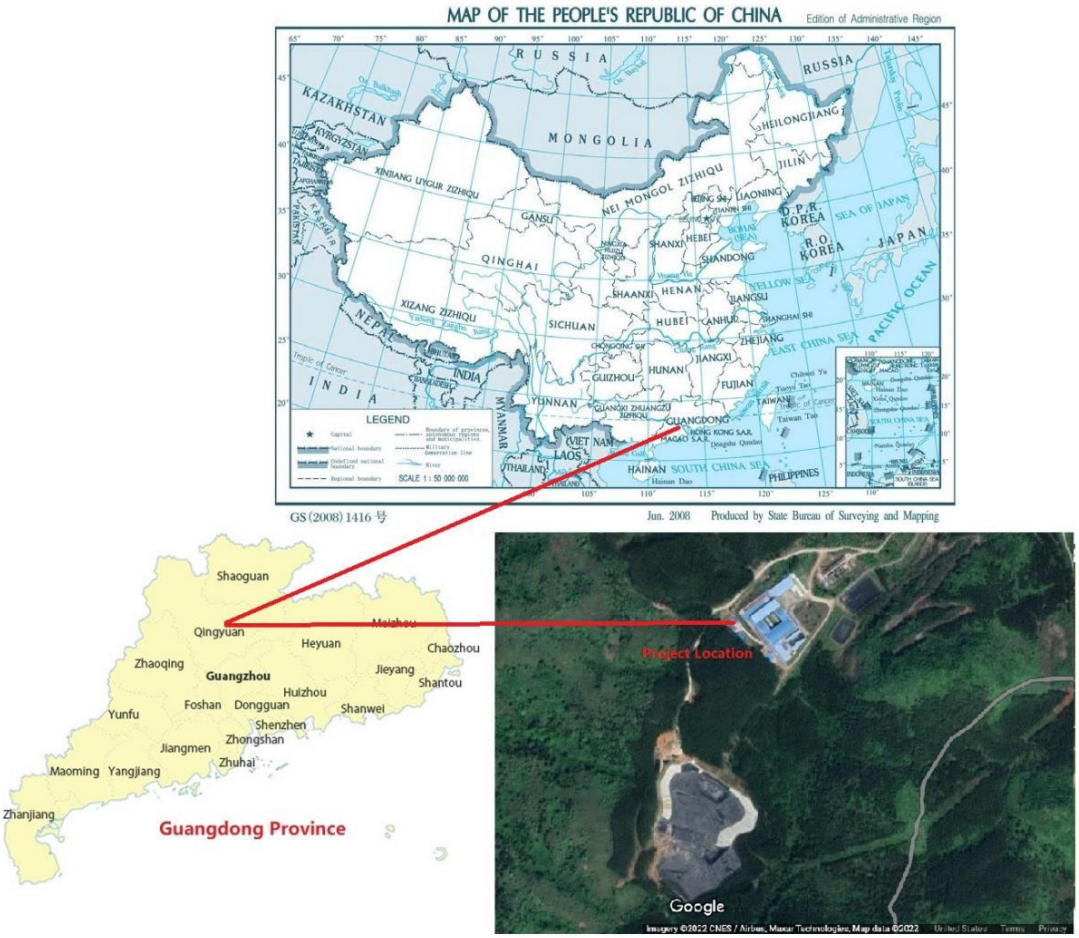

Figure 1.1 The location of the project

1.8 Title and Reference of Methodology

Title: ACM0001 Flaring or use of landfill gas --- Version 19.0

Reference: https://cdm.unfccc.int/methodologies/PAmethodologies/approved

The methodology also refers to the latest approved versions of the following tools:

“Combined tool to identify the baseline scenario and demonstrate additionality” (Version 07.0);

“Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation” (Version 03.0);

“Emissions from solid waste disposal sites” (Version 08.0);

“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).

For more detail information about the tools, please reference to the following link:

https://cdm.unfccc.int/methodologies/PAmethodologies/tools.

1.9 Participation under other GHG Programs

The project has not been registered/or is seeking registration under other GHG Program(s).

The project has not been rejected by other GHG programs.

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

The project does not reduce GHG emissions from activities that are included in an emissions trading program or any other mechanism that includes GHG allowance trading.

The project has not sought or received another form of GHG-related environmental credit or renewable energy certificate. The project is not part of any emission trading program. The net GHG emission reductions from the project will not be used for compliance with emission trading programs or to meet binding limits on GHG emissions. The project activity has not participated in any other GHG programs.

China has a national emissions trading scheme only cover the high-emission industries, such as thermal power generation, petrochemical, chemical, building materials, iron and steel, non-ferrous, paper, aviation and other key emission industries that emitted at least 26,000 tons of CO_2e/year. And the project activity is not included the mandatory emission control scheme and there is no emission cap enforced for the project owner according to the enforced company list in public information. Hence, it is confirmed that the emission reductions will not be double counted. The project will not seek to generate or has received any form of environmental credits, and the GHG emission removals generated by the project will not be used for compliance under such programs or mechanisms.

The project does not involve specific goods procurement supply chain emissions, so supply Chain (Scope 3) Emissions section is not applicable.

1.11 Sustainable Development Contributions

Landfill safety

If methane concentration in the air is in the range of 5-15% in volume within the confined space of a building, the risk of explosion is very high. With the project, a modern gas extraction system has been installed to ensure the effective collection of LFG, and also minimize the risk of landfill explosions.

Odour reduction

Odour from landfill negatively impacts on residents around the landfill. Implementation of the project will reduce odour through LFG collection and will thus mitigate the impact of landfill odour on people's daily lives.

Energy potential

The project makes use of LFG to generate electricity, which will supplement the energy supply of Qingyuan city.

Provide employment

The project was designed and technically supported by experts. Temporary job opportunities were created during the construction period and 12 permanent jobs during the operation time.

As a whole, the project will contribute to the sustainable development, not only by mitigating global warming, but also increasing the availability of electricity from renewable sources. It will also minimize the explosion risk at the landfill site and will increase job availability through the management, operation and maintenance of the LFG capture system and the power units.

Table 1: Sustainable Development Contributions

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
1)	7.2	MWh of renewable energy generated	Implemented activities to increase	During this monitoring period, 17,914.020 MWh of renewable electricity was delivered to CSPG.	From the operation start date of the project to the end of this monitoring period, 17,914.020 MWh of renewable electricity was delivered to CSPG.
2)	8.5	Number of jobs created	Implemented activities to increase	The project creates 12 long-term employment opportunities.	The project creates 12 long-term employment opportunities.
3)	13.0	Tonnes of greenhouse gas emissions avoided or removed	Implemented activities to increase	The project has prevented the release of 132,655 tonnes of CO_2e into the atmosphere during this monitoring period	Prevented the release of 132,655 tonnes CO_2e into the atmosphere during this monitoring period.

2 SAFEGUARDS

2.1 No Net Harm

The Environmental Impact Assessment (EIA) Report for the project was compiled by Shenzhen Dachuang Environmental Protection Technology Co., Ltd, which is a grade A environment impact assessment entity certified by the Ministry of Ecology and Environment, China. The EIA Report for the Project has been approved by the Environmental Protection Bureau of Lianzhou City, Qingyuan City on 27/10/2020, with approval No. "Qinghuan Lianzhou [2020] No.34". 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.

During the monitoring period, the measures taken to control any negative environmental impacts possibly caused by the project are in place and are analyzed as follows:

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 is treated by the landfill leachate treatment system. The domestic wastewater from onsite employees is 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 NOx, 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 is sent to the landfill site, which could not only ensure the safety of disposal, but also has little impact on surrounding environment.

As mentioned above, the project was not considered that it would bring out negative environmental impacts. On the Contrary, this project promotes local environment by reducing emission of greenhouse gas. At the same time, the implementation of the project improves local socio-economic development through creating employment opportunities. Therefore, there is no net harm.

2.2 Local Stakeholder Consultation

Local stakeholder consultation before the Project construction

On 17/07/2020, the project owner carried out a survey 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.

The following questions are from the questionnaires:

1. What do you know about the LFG power station?

2. What is your attitude to the construction of this LFG power station?

3. Do you think the implementation of the project will cause positive effect on living of local residents?

4. Do you think the implementation of the project will cause negative effect?

5. As a whole, what is your opinion on this LFG power station to the living of local residents?

The project is away from the residence, so, only 15 families live around the project and the landfill site. Each family was distributed a questionnaire. In total 15 out of 15 questionnaires were returned with a 100% response rate. The survey shows the stakeholders believe that the project will have positive impacts on the local ecology and employment. All stakeholders expressed their support to the project and were pleased with the development of the project, and no negative comments have been received. The project would actually facilitate the development of the local economy and increase the income of local residents.

Local stakeholder consultation during the project operation

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. So far, no public comments about potential negative impacts during project implementation have been received by the project owner.

2.3 AFOLU-Specific Safeguards

The project is not an AFOLU project.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

The project is implemented in accordance with the description of the PD.

The timeline of the project is shown below:

Start date of construction	02/06/2020
Start date of commissioning	01/06/2021
Start date of the crediting period	01/06/2021

The project uses LFG for electricity generation. It includes an LFG collection system, an LFG pre-treatment system, a flare system, an electricity generation plant, and grid connection system. The electricity generated is exported to CSPG to replace equivalent amount of electricity from those fossil fuel power plants connected to CSPG.

LFG collection system

The landfill gas collecting system is a gas pipeline network, consisting of gas collecting wells, gas collecting pipelines, and gas collection blower. LFG is extracted by gas collection blower and transported by pipeline from gas collection wells.

LFG pre-treatment system

Prior to electricity generation, LFG must be pre-treated to remove its impurities and moisture, etc., to prevent corrosion in the generators. According to the EIA, the pre-treatment system consists of six types of equipment:

1) Impurity Filter to remove the impurity in LFG primarily;
2) Condenser to remove the water in LFG;
3) Gas-liquid Separator to remove the liquid in LFG further;
4) Fan Blower to boost the LFG;
5) Heat Exchanger to cool down the gas;
6) Advanced Impurity Filter to remove the impurity thoroughly.

The LFG pre-treatment procedure and the main equipment are shown as the following chart:

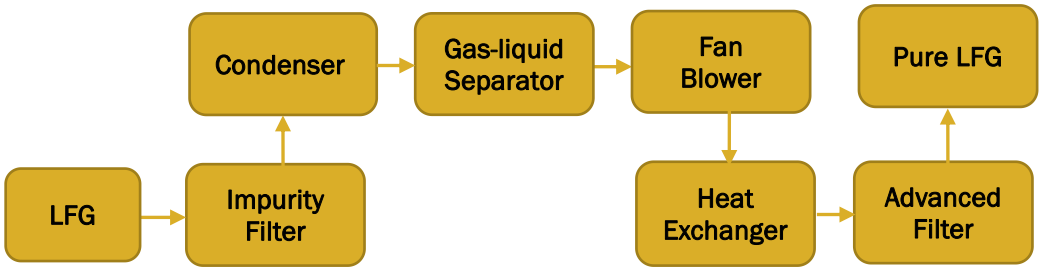

Figure 3.1 The flow chart of the LFG pre-treatment system

A flare system

The landfill gas would be sent to be burned in the flare device when the plant totally stopped. An enclosed flare is installed in the project. Meanwhile, the flare will only be involved when the electricity generation system is not in operation, hence, the project developer determined that VERs from flare will not be claimed, even if any methane is destroyed by flare during the crediting period.

Power generation and grid connection system

A power plant is installed to generate electricity with the LFG captured. It adopts internal combustion engine generating sets. In the project, 5 sets each with capacity of 600kW has been installed for power generation and started commissioning on 01/06/2021. The electricity generated using LFG, except small portion for on-site usage, is exported to CSPG.

This is a well-known and high reliable technology for biogas utilization. Furthermore, internal combustion engine generating sets have modular design and are available in many different sizes permitting the installation of power plant step by step as the LFG flow increases. High performance and reliability are guaranteed for the equipment. The detailed information about the technology of the project is shown in the table below.

Table 3.1 Key technical parameters of internal combustion engine generating set

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	400V	400V
Rated capacity	600kW	600kW

Lifetime	20 years	20 years

In this monitoring period from 01/06/2021 to 30/04/2023, the project operated smoothly. All equipment worked well and no error or accident occurred. There were no events or situation that may impact the applicability of the methodology. The net electricity exported to the CSPG is 17,914.020 MWh.

3.2 Deviations

3.2.1 Methodology Deviations

There is no methodology deviation applied during this monitoring period.

3.2.2 Project Description Deviations

In order to monitor the generated electricity by LFG, extra electricity meter was added to the monitoring system. So there are electricity meter numbers description deviation applied during this monitoring period. The deviation does not affect the net electricity exported to the CSPG and total GHG emission reduction. As a whole, the project description deviations bring out on difference in the net GHG emission reduction during this monitoring period.

3.3 Grouped Projects

The project is not a group project.

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

The parameter of methane generation from the landfill in the absence of the project ($BE_{CH4,SWDS,y}$) is used for ex ante estimation of relevant parameter $F_{CH4,PJ,y}$. For $F_{CH4,PJ,y}$, there is an ex post determination method. Thus, in this monitoring period, $BE_{CH4,SWDS,y}$ and the relevant basic parameters (φ_y, OX, F, DOC_f, MCF_f, K_j, $W_{j,x}$, DOC_j, f_y, η_{PJ}) for calculation of $BE_{CH4,SWDS,y}$ are not included here.

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	“Emission from the solid waste disposal sites” (version 8.0)

Value applied	0.1
Justification of choice of data or description of measurement methods and procedures applied	-
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	GWP_{CH4}
Data unit	tCO_2e/tCH_4
Description	Global warming potential of CH_4
Source of data	IPCC Fifth Assessment Report
Value applied	Default value of 28. Shall be updated according to any future COP/CMP decisions
Justification of choice of data or description of measurement methods and procedures applied	As per VCS Standard v4.3, for GHG emission reductions occurring on or after 01/01/2021, all ex-ante estimates and ex-post calculations shall be converted to CO_2e using GWP values from the IPCC Fifth Assessment Report (AR5); The Project applies value from AR5 for both ex ante estimates and ex post calculations and for GHG emission reductions occurring both before and after 01/01/2021. According to AR5, the 100-year GWP of methane is 28 tCO_2e/CH_4.
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	ρ_{CH4}
Data unit	t/m^3
Description	Density of methane gas at Normal Conditions
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value applied	0.0007168 (Normal Conditions: 0℃ and 101.325kPa)

Justification of choice of data or description of measurement methods and procedures applied	-
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	$EF_{grid,OM,y}$
Data unit	tCO_2/MWh
Description	Operation margin emission factor of CSPG
Source of data	2019 China baseline emission factor of regional power grid.
Value applied	0.8042
Justification of choice of data or description of measurement methods and procedures applied	The value is published by Ministry of Ecology and Environment of the People's Republic of China on 29/12/2020, which is the latest available source in China.
Purpose of Data	Calculation of baseline emissions Calculation of project emissions
Comments	-

Data / Parameter	$EF_{grid,BM,y}$
Data unit	tCO_2/MWh
Description	Build margin emission factor of CSPG
Source of data	2019 China baseline emission factor of regional power grid.
Value applied	0.2135
Justification of choice of data or description of measurement methods and procedures applied	The value is published by Ministry of Ecology and Environment of the People's Republic of China on 29/12/2020, which is the latest available source in China.

Purpose of Data	Calculation of baseline emissions Calculation of project emissions
Comments	-

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	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%
Justification of choice of data or description of measurement methods and procedures applied	The Project is applicable to Scenario A defined in TOOL05 (version 03.0), which requires the default value of 20% for project emissions, and 3% for baseline emissions.
Purpose of Data	Calculation of baseline emissions Calculation of project emissions
Comments	The parameter will be updated according to the latest version of TOOL05.

4.2 Data and Parameters Monitored

Data / Parameter	$F_{CH4,BL,R,y}$
Data unit	tCH_4/y
Description	Amount of methane in the LFG which is flared due to a requirement in year y
Source of data	Information of the host country's regulatory requirements relating to LFG, contractual requirements, or requirements to address safety

<table>
<tr><td></td><td>and odour concerns.</td></tr>
<tr><td>Description of measurement methods and procedures to be applied</td><td>-</td></tr>
<tr><td>Frequency of monitoring/recording</td><td>Annually</td></tr>
<tr><td>Value applied</td><td>
<table>
<tr><td>Monitor period</td><td>$F_{CH4,BL,R,y}$ (tCH_4)</td></tr>
<tr><td>01/06/2021-31/12/2021</td><td>327.04</td></tr>
<tr><td>01/01/2022-31/12/2022</td><td>672.98</td></tr>
<tr><td>01/01/2023-30/04/2023</td><td>222.90</td></tr>
<tr><td>Total</td><td>1222.92</td></tr>
</table>
</td></tr>
<tr><td>Monitoring equipment</td><td>Flow meter
<table>
<tr><td>-Model</td><td>Serial number</td><td>Accuracy class</td><td>Date of calibration</td><td>Validity</td></tr>
<tr><td rowspan="2">LUGB-2/2/200/Z/DV/E/N (SZ)</td><td rowspan="2">V200160 10004</td><td rowspan="2">1.5</td><td>27/05/2021</td><td>26/05/2022</td></tr>
<tr><td>26/05/2022</td><td>25/05/2023</td></tr>
</table>
</td></tr>
<tr><td>QA/QC procedures to be applied</td><td>Flow meter should be subject to a regular maintenance and testing regime to ensure accuracy -</td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Calculation method</td><td>-</td></tr>
<tr><td>Comments</td><td>Applicable to Case 2 of section 5.4.1.3 of ACM0001“Flaring or use of landfill gas” (version 19.0)</td></tr>
</table>

Data / Parameter	$P_{reg,y}$
Data unit	Dimensionless
Description	Fraction of LFG that is required to be flared due to a requirement

	in year y
Source of data	Information of the host country's regulatory requirements relating to LFG, contractual requirements, or requirements to address safety and odour concerns.
Description of measurement methods and procedures to be applied	-
Frequency of monitoring/recording	Annually
Value applied	20%
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of data	Calculation of baseline emissions
Calculation method	-
Comments	Applicable to Case 2 of section 5.4.1.3 of ACM0001"Flaring or use of landfill gas" (version 19.0)

Data / Parameter	$EG_{PJ,y}$
Data unit	MWh
Description	Amount of electricity generated using LFG by the project activity in year y
Source of data	Project participant
Description of measurement methods and procedures to be applied	Measured continuously by electricity meter(bi-directional) installed at the project site. All data will be monitored and archived electronically. Double check by receipt of electricity sales.
Frequency of monitoring/recording	The recording frequency will be hourly measured and record, and monthly aggregated.
Value applied	17,914.020 MWh

Monitor period	Electricity generated by landfill gas (MWh)
01/06/2021-30/06/2021	491.460
01/07/2021-31/07/2021	548.640
01/08/2021-31/08/2021	551.400
01/09/2021-30/09/2021	521.280
01/10/2021-31/10/2021	593.280
01/11/2021-30/11/2021	530.280
01/12/2021-31/12/2021	556.200
01/01/2022-31/01/2022	782.820
01/02/2022-28/02/2022	688.140
01/03/2022-31/03/2022	815.220
01/04/2022-30/04/2022	857.100
01/05/2022-31/05/2022	923.160
01/06/2022-30/06/2022	932.040
01/07/2022-31/07/2022	899.340
01/08/2022-31/08/2022	981.720
01/09/2022-30/09/2022	997.620
01/10/2022-31/10/2022	972.600
01/11/2022-30/11/2022	1,023.420
01/12/2022-31/12/2022	1,006.620
01/01/2023-31/01/2023	891.960
01/02/2023-28/02/2023	745.620
01/03/2023-31/03/2023	800.640
01/04/2023-30/04/2023	3,241.680
Total	17,914.020

Monitoring equipment	Electricity meter E1 shown in the monitoring system as below.

Model	Serial number	Accuracy class	Date of calibration	Validity
DSSD718 (Main)	03001SG0 00003117 00028553	0.5S	27/05/2021	26/05/2022
			26/05/2022	25/05/2023
DSSD718 (Backup)	03001SG0 00003117 00028554	0.5S	27/05/2021	26/05/2022
			26/05/2022	25/05/2023

QA/QC procedures to be applied	The calibration should be done once a year by a qualified third party. Data from the main electricity meter are recorded remotely and digitally by the grid company with the cut-off time of 24:00 o'clock on the last day of every month. The grid company incorporates the downloaded electric data into the monthly Electricity Transaction Notes (ETN) and sends to the project owner for confirmation on the electricity amount. The project owner confirms the electricity amount on the ETNs with the monthly reading records and keeps the ETNs. When the emergency occurred to the main meter, the measurement result of back-up meter will be used. The meters are calibrated and maintained by the grid company. The calibration of meters, including the frequency of calibration, is done in accordance with national standards or requirements set by the meter supplier or requirements set by the grid operators. The accuracy class of the meters is in accordance with the stipulation of the meter supplier and/or as per the requirements set by the grid operators or national requirements.
Purpose of data	Calculation of baseline emissions
Calculation method	Monthly aggregated.
Comments	-

Data / Parameter	$EG_{EC,y}$
Data unit	MWh
Description	Amount of electricity consumed by the project activity in year y
Source of data	Project participant

Description of measurement methods and procedures to be applied	Measured continuously by electricity meter(bi-directional) installed at the project site. All data will be monitored and archived electronically. Double check by receipt of electricity sales.
Frequency of monitoring/recording	The recording frequency will be hourly measured and record, and monthly aggregated.
Value applied	2.700 MWh during this monitoring period

Monitor period	Electricity consumed by the project activity (MWh)
01/06/2021-30/06/2021	0.120
01/07/2021-31/07/2021	0.060
01/08/2021-31/08/2021	0.060
01/09/2021-30/09/2021	0.480
01/10/2021-31/10/2021	0.000
01/11/2021-30/11/2021	0.000
01/12/2021-31/12/2021	0.120
01/01/2022-31/01/2022	0.060
01/02/2022-28/02/2022	0.120
01/03/2022-31/03/2022	0.060
01/04/2022-30/04/2022	0.060
01/05/2022-31/05/2022	0.000
01/06/2022-30/06/2022	0.060
01/07/2022-31/07/2022	0.060
01/08/2022-31/08/2022	0.180
01/09/2022-30/09/2022	0.000
01/10/2022-31/10/2022	0.000
01/11/2022-30/11/2022	0.000
01/12/2022-31/12/2022	0.000

	01/01/2023-31/01/2023 | 0.000 01/02/2023-28/02/2023 | 0.060 01/03/2023-31/03/2023 | 0.120 01/04/2023-30/04/2023 | 0.120 Total | 2.700
Monitoring equipment	Electricity meter E2 shown in the monitoring system as below. Model: DSSD718 (Main); Serial number: 03001SG000003117 00028555; Accuracy class: 0.5S; Date of calibration: 27/05/2021; Validity: 26/05/2022 Date of calibration: 26/05/2022; Validity: 25/05/2023 Model: DSSD718 (Backup); Serial number: 03001SG000003117 00028556; Accuracy class: 0.5S; Date of calibration: 27/05/2021; Validity: 26/05/2022 Date of calibration: 26/05/2022; Validity: 25/05/2023
QA/QC procedures to be applied	The calibration should be done once a year by a qualified third party.
Purpose of data	Calculation of baseline emissions
Calculation method	Monthly aggregated.
Comments	-

Data / Parameter	$V_{t,db}$
Data unit	m^3 dry gas/h
Description	Volumetric flow of the gaseous stream in time interval t on a dry basis
Source of data	Monitored by project participant
Description of measurement methods and procedures to be applied	Volume flow measurement always refer to the actual pressure and temperature.
Frequency of monitoring/recording	Measured continuously by a flow meter F (average hourly value should be used in the calculations of baseline emission reductions).

<table>
<tr><td></td><td>Data to be aggregated monthly.</td></tr>
<tr><td>Value applied</td><td>974.66 (hourly average for this monitoring period at normal conditions)</td></tr>
<tr><td>Monitoring equipment</td><td>Flow meter
<table>
<tr><th>Model</th><th>Serial number</th><th>Accuracy class</th><th>Date of calibration</th><th>Validity</th></tr>
<tr><td rowspan="2">LUGB-2/2/200/Z/DV/E/N(SZ)</td><td rowspan="2">V20016010004</td><td rowspan="2">1.5</td><td>27/05/2021</td><td>26/05/2022</td></tr>
<tr><td>26/05/2022</td><td>25/05/2023</td></tr>
</table></td></tr>
<tr><td>QA/QC procedures to be applied</td><td>Flow meter should be subject to a regular maintenance and testing regime to ensure accuracy</td></tr>
<tr><td>Purpose of data</td><td>Calculation of project emissions</td></tr>
<tr><td>Calculation method</td><td>-</td></tr>
<tr><td>Comments</td><td>-</td></tr>
</table>

Data / Parameter	$V_{i,t,db}$
Data unit	m^3 gas CH_4/m^3 dry gas
Description	Volumetric fraction of greenhouse gas I in a time interval t on dry basis
Source of data	Monitored by project participant
Description of measurement methods and procedures to be applied	Continuous gas analyzer operating in operating in dry-basis. Volumetric flow measurement should always refer to the actual pressure and temperature.
Frequency of monitoring/recording	Continuous if not specified in the underlying methodology
Value applied	52.17% (hourly average for this monitoring period)

<table>
<tr><td>Monitoring equipment</td><td>Gas analyzer
<table>
<tr><th>Model</th><th>Serial number</th><th>Accuracy class</th><th>Date of calibration</th><th>Validity</th></tr>
<tr><td rowspan="2">SGA-501-CH4</td><td rowspan="2">201114001</td><td rowspan="2">±5%</td><td>27/05/2021</td><td>26/05/2022</td></tr>
<tr><td>26/05/2022</td><td>25/05/2023</td></tr>
</table></td></tr>
<tr><td>QA/QC procedures to be applied</td><td>Gas analyzer should be subject to a regular maintenance and testing regime to ensure accuracy.</td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Calculation method</td><td>Hourly average for this monitoring period</td></tr>
<tr><td>Comments</td><td>-</td></tr>
</table>

Data / Parameter	Management of SWDS
Data unit	-
Description	Management of SWDS
Source of data	Use different sources of data: (a) Original design of the landfill; (b) Technical specifications for the management of the SWDS; (c) Local or national regulations
Description of measurement methods and procedures to be applied	There is no change in the management of the SWDS after the implementation of the project activity.
Frequency of monitoring/recording	Annually
Value applied	-
Monitoring equipment	-
QA/QC procedures to be applied	Management of SWDS is under the control of the local government.
Purpose of data	Calculation of baseline emissions
Calculation method	

Comments	-

Data / Parameter	$Op_{j,h}$
Data unit	-
Description	Operation of the equipment that consumes the LFG
Source of data	Project participant
Description of measurement methods and procedures to be applied	The captured LFG is consumed by gas generators. Operation of the gas generators is automatically monitored and recorded in the daily records.
Frequency of monitoring/recording	Hourly
Value applied	7,481.0 h (generator 1#) 5,985.0 h (generator 2#) 6,763.5 h (generator 3#) 6,577.0 h (generator 4#) 6,339.0 h (generator 5#)
Monitoring equipment	Flow meter
QA/QC procedures to be applied	Flow meter should be subject to a regular maintenance and testing regime to ensure accuracy
Purpose of data	Calculation of baseline emissions
Calculation method	-
Comments	For the project, operation of the gas generators is automatically monitored and recorded in the daily records.

Model	Serial number	Accuracy class	Date of calibration	Validity
LUGB-2/2/200/Z/DV/E/N(SZ)	V20016010004	1.5	27/05/2021	26/05/2022
			26/05/2022	25/05/2023

Data / Parameter	CAPEX and OPEX
Data unit	CNY
Description	Total investment to implement the project and total cost to operate the project
Source of data	Engineering, procurement and construction contracts; and maintenance contracts
Description of measurement methods and procedures to be applied	-
Frequency of monitoring/recording	At the first issuance request after each phase of the project is fully implemented
Value applied	CAPEX: 23,619,367 OPEX: 6,013,300
Monitoring equipment	-
QA/QC procedures to be applied	Audited by professional, independent financial auditors. The Designated Operational Entity (DOE) should only verify that the data provided corresponds to the data from independent financial auditors
Purpose of data	The monitoring of this parameter is only required for projects applying the simplified procedures to identify the baseline scenario and demonstrate additionality
Calculation method	
Comments	The information provided for CAPEX indicates the investment made: (i) in the collection system; (ii) in the power plant and connection to the grid. The information supplied for OPEX indicates the costs for: (i) staff and maintenance involved in the operation of the collection system; and (ii) staff and maintenance involved in the operation of the collection and power generation system. The monitoring of this parameter is only required for projects applying the simplified procedures to identify the baseline scenario and demonstrate additionality

Data / Parameter	Tariff of electricity exported
Data unit	CNY

Description	Tariff of the electricity exported
Source of data	Power purchase agreement
Description of measurement methods and procedures to be applied	-
Frequency of monitoring/recording	At the first issuance request after each phase of the project is fully implemented
Value applied	0.689
Monitoring equipment	-
QA/QC procedures to be applied	Audited by professional, independent financial auditors. The Designated Operational Entity (DOE) should only verify that the data provided corresponds to the data from independent financial auditors.
Purpose of data	Identify the baseline scenario and demonstrate additionality
Calculation method	-
Comments	This parameter is sourced from Power purchase agreement of the project

4.3 Monitoring Plan

The monitoring plan presented in this MR assures that real, measurable, long term GHG emission reductions can be monitored, recorded and reported. It is a crucial procedure to identify the final VCUs of the project. This monitoring plan will be implemented by the project owner during the project operation. A Monitoring Manual will be provided to each member of the monitoring team with a specific explanation to make sure they fully understand all the monitoring process and issues concerned. The monitoring activities will be arranged before each verification and the detailed plan for the certain monitoring activities and the draft monitoring results will be reviewed by the experts who come from Goldchina Consultancy International Co., Ltd., to make sure the monitoring activity is implemented in line with monitoring plan. If there are non-conformances founded, expert group will ask the monitoring team to take necessary compensation measures (redo some of the monitoring activities or calculation) until all the non-conformances been corrected. If the registered monitoring plan is unable to be implemented, or the monitoring would permanently deviate from the applied methodologies, the applied standardized baselines, or the other applied methodological regulatory documents, the project participants shall describe the nature and extent of the non-

conforming monitoring in a revised monitoring plan and submitted to Verra to request a change of the monitoring plan.
The details of the monitoring plan are specified as follows:

1. The requirement of monitoring plan

According to the "Monitoring Methodology ACM0001(Version 19.0)", the project participants will monitor the emission reductions (ERs) by methods, indicators, and frequency to ensure project ERs are measurable and real. The monitoring methodology is based on direct measurement of the amount of LFG captured and destroyed by the project and electricity generating units.

2. Responsibilities of operational and management structure

The project participant will implement this monitoring plan. The plan could be revised according to suggestions from Designated Operational Entity (DOE) and the practical circumstances, in order to keep it consistent, transparent and conservative during the monitoring process.

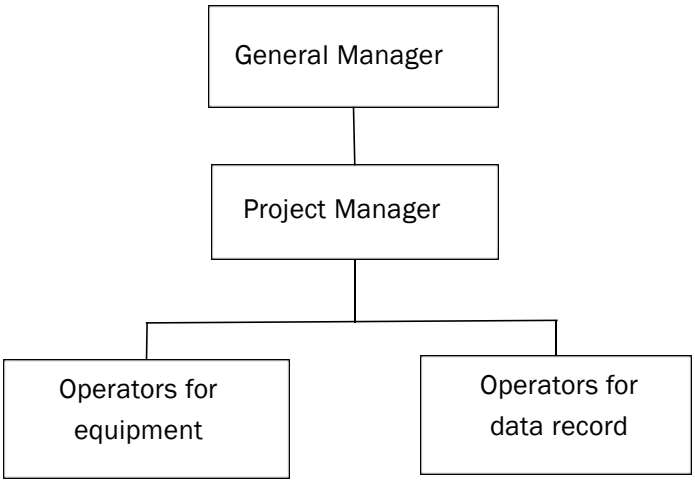

Figure 4.1 Operational and management structure

(1) Principal of the monitoring procedure

The general manager of the project is the leader of the monitoring tasks who sets out the responsibility of everyone in the monitoring system and establishes the related documents. The general manager ensures that staffs in the monitoring system has the ability to deal with the assigned tasks.

The project manager will be responsible for aggregating the monitored data monthly and yearly, archiving and keeping data during the crediting period and two years after.

Operators will be in charge of data supervision, checking and inspecting the system. If necessary, they will have the responsibility for executing the emergency plan and drafting emergency situation reports.

(2) Executive person of the monitoring procedure

Project Manager: A Project Manager is appointed who is specifically responsible for training, checking the daily operation, reporting forms and archiving emergency situation reports. The Project Manager reports monthly to the General Manager (GM) about the project performance and monitored data. In the event that non-conformance in the performance to the mentioned procedures and/or functioning problems of the monitoring equipment are identified, the Project manager will inform the GM about the situation and work out relevant measures to be taken. The Project manager will also be responsible for aggregating the monitored data monthly and yearly, archiving and keeping data during the crediting period and two years after.

(3) Operators of the monitoring procedure

Operators will take turns to work in the control center 24 hours a day, 7 days a week. They will be in charge of data supervision, filling operation report forms and, checking and inspecting the system. If necessary, they will have the responsibility for executing the emergency plan and drafting emergency situation reports.

3. Monitoring system

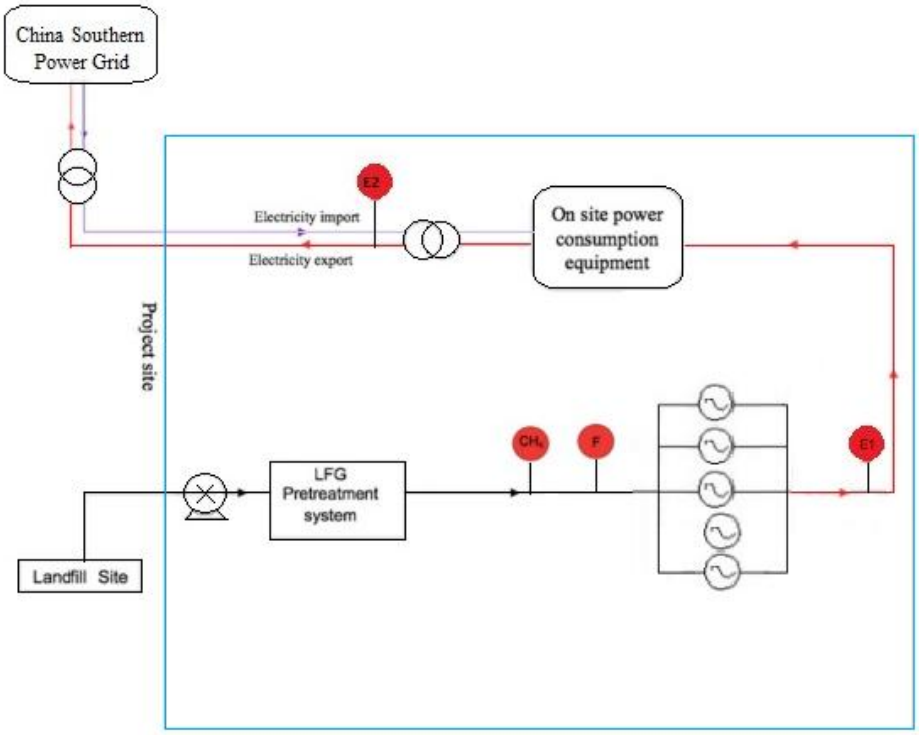

Figure 4.2 The monitoring flow chart

CH_4 - Gas analyzer to continuously measure methane fraction in LFG fed to the power plant

F - Flow meter to continuously measure flow of LFG fed to the Power Plant

E1 - Electricity meter to continuously measure the electricity produced by generators

E2 - Bi-directional electricity meter to continuously measure the net electricity exported to CSPG and electricity imported from CSPG

4. Data collection procedures

The data are fully recorded and archived by DCS automatically and shown in the control system. The data are recorded once per hour. DCS of a historian database, primarily to provide data backup to the sheet of excel. Ultimately it forms the Monitoring Operating Record. All data are kept 2 years after the end of the crediting period.

5. QA/QC

In order to ensure monitoring plan with high quality, QA/QC measures are carried out in monitoring data recording and checking, equipment calibrating and staff training.

All the monitoring devices listed above (flow meter, gas analyzer and electricity meter) will be chosen in accordance with VCS requirements and will be calibrated regularly for accuracy by qualified party according to the national regulations.

Data recording: all data collected are recorded in electronic files which are regularly backed up. The data are checked by the specific staff every day and reported to General Manger by Project manager monthly.

Equipment calibration and maintenance: Flow meters, gas analyzer, other critical project equipment are subject to regular maintenance and testing according to technical specifications from the manufactures to ensure accuracy and good performance.

According to the Chinese national standard (Technical Management Code for Electricity Metering, DL/T448-2016), the electricity meter was properly configured and checked by both the project owner and the grid company before the project is in operation. The accuracy should not be less than 0.5S. The installation of flow meters and gas analyzers will fulfill the national standard (JJG1029-2007 and JJG693-2011).

To assist in future verification, the calibration records, along with the data files of project monitoring will be kept in the archives by the project owner, and checked by Project Manager. When the data is not available from the main monitoring devices, the data measured by the back-up devices will be used.

6. Data Management

Specific staff will be appointed by the project owner to take the overall responsibility for monitoring GHG emission reductions and keeping all monitored data collected as part of monitoring archived electronically and be kept at least for 2 years after the end of the last crediting period.

Electronic data and documents will be regularly copied and archived via hard disk, and kept at least two years after the end of the last crediting period.

All written data and documents, including electricity receipts for cross-checking, will be copied and archived and kept at least two years after the end of the last crediting period.

7. Procedure in case of failure

In the case of a meter in fault, it shall be immediately repaired or replaced with another calibrated meter by a professional engineer, and the LFG or electricity generated during the period of erroneous measurement and replacement of the fault meter shall not be accounted for conservative consideration.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

The baseline emissions are calculated as follows:

$$BE_y = BE_{CH4,y} + BE_{EC,y} \quad \text{Equation (1)}$$

Where:

BE_y = Baseline emissions in year *y* (t CO_2e/yr)

$BE_{CH4,y}$ = Baseline emissions of methane from the SWDS in year *y* (t CO_2e/yr)

$BE_{EC,y}$ = Baseline emissions associated with electricity generation in year *y* (t CO_2/yr)

Monitor period	$BE_{CH4,y}$ (tCO_2e)	$BE_{EC,y}$ (tCO_2e)	BE_y (tCO_2e)
01/06/2021 - 31/12/2021	32,965.6	1,987.7	34,953
01/01/2022 - 31/12/2022	67,836.3	5,702.2	73,538

01/01/2023 - 30/04/2023	22,468.3	1,699.0	24,167
Total	123,270.2	9,388.9	132,658

$$BE_{EC,y} = \sum_{k} EC_{BL,k,y} \times EF_{EF,k,y} \times \left(1 + TDL_{k,y}\right)$$ Equation (2)

Where:

$BE_{EC,y}$ = Baseline emission from electricity generation in year y (tCO_2/yr)

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

$EF_{EF,k,y}$ = Emission factor for electricity generation for source k in year y (t CO_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

Monitor period	$EC_{PJ,y}$ (MWh)	$EF_{grid,CM,y}$ (tCO_2/MWh)	$TD_{Lk,y}$ (%)	$BE_{EC,y}$ (tCO_2e)
01/06/2021 - 31/12/2021	3,792.540	0.50885	3	1,987.7
01/01/2022 - 31/12/2022	10,879.800	0.50885	3	5,702.2
01/01/2023 - 30/04/2023	3,241.680	0.50885	3	1,699.0
Total	17,914.020	/	/	9,388.9

$$BE_{CH4,y} = \left(\left(1 - OX_{top\_layer}\right) \times F_{CH4,PJ,y} - F_{CH4,BL,y}\right) \times GWP_{CH4}$$ Equation (3)

Where:

$BE_{CH4,y}$ = Baseline emissions of methane from the SWDS in year *y* (t CO_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* (t CH_4/yr)

$F_{CH4,\,BL,y}$ = Amount of methane in the LFG that would be flared in the baseline in year *y* (t CH_4/yr)

GWP_{CH4} = Global warming potential of CH_4 (t CO_2e/t CH_4)

Monitor period	$F_{CH4,PJ,y}$ (tCH_4)	$OX_{top\text{-}layer}$ (Dimensionless)	$F_{CH4,BL,y}$ (tCH_4)	$BE_{CH4,y}$ (tCO_2e)
01/06/2021 - 31/12/2021	1,635.20	0.1	327.04	32,965.6
01/01/2022 - 31/12/2022	3,364.90	0.1	672.98	67,836.3
01/01/2023 - 30/04/2023	1,114.50	0.1	222.90	22,468.3
Total	6,114.60	/	1222.92	123,270.2

$$F_{CH4,\,PJ,y} = F_{CH4,\,EL,\,y}$$ Equation (4)

Parameter	Description	01/06/2021-31/12/2021	01/01/2022 - 31/12/2022	01/01/2023-30/04/2023	Total
$F_{CH4,PJ,y}$ (tCH_4)	Amount of methane in the LFG which is flared and/or used in the project activity	1,635.20	3,364.90	1,114.50	6,114.60
$F_{CH4,EL,y}$ (tCH_4)	Amount of methane in the LFG which is used for electricity generation	1,635.20	3,364.90	1,114.50	6,114.60

$$F_{i,\,t} = V_{t,\,db} \times \nu_{i,\,t,\,db} \times \rho_{i,\,t}$$ Equation (5)

$$\rho_{i,t} = \frac{P_t \times MM_i}{R_u \times T_t}$$ Equation (6)

Where:

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

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

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

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

P_t = Absolute pressure of the gaseous stream in time interval t (101,325 Pa)

MM_i = Molecular mass of greenhouse gas i (16.04 kg/kmol)

R_u = Universal ideal gases constant (8,314 Pa.m^3/kmol.k)

T_t = Temperature of the gaseous stream in time interval t (273.15K)

5.2 Project Emissions

Project emissions PE_y are calculated as follows:

$$PE_y = PE_{EC,y}$$ Equation (7)

$$PE_{EC,y} = \sum_j EC_{PJ,j,y} \times EF_{EF,j,y} \times \left(1 + TDL_{j,y}\right)$$ Equation (8)

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)

$EF_{EFj,y}$ = 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

Monitor period	$EC_{PJ,j,y}$ (MWh)	$EF_{grid,CM,y}$ (tCO_2/MWh)	$TDL_{j,y}$ (%)	PE_y (tCO_2e)
01/06/2021 - 31/12/2021	0.840	0.50885	20	1
01/01/2022 - 31/12/2022	1.560	0.50885	20	1
01/01/2023 - 30/04/2023	0.300	0.50885	20	1
Total	2.700	/	/	3

5.3 Leakage

No leakage effects are accounted for under this methodology.

5.4 Net GHG Emission Reductions and Removals

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \quad \text{Equation (9)}$$

Monitor period	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
01/06/2021-31/12/2021	34,953	1	0	34,952
01/01/2022 - 31/12/2022	73,538	1	0	73,537
01/01/2023 - 30/04/2023	24,167	1	0	24,166
Total	132,658	3	0	132,655

Comparison of actual emission reductions with estimates during validation:

The monitoring period covers from 01/06/2021 to 30/04/2023, with totally 699 days. Based on the registered VCS PD, From 01/01/2023 to 30/04/2023, there are 120 days. the amount of estimated emission reductions for this monitoring period would be 37,201 + 68,980+74,455*120/365=130,659.36 tCO_2e. The actual emission reductions in this monitoring period are 132,655 tCO_2e, which is 1.53% more than the estimation in the registered VCS PD and in the normal range of fluctuation. Therefore, the net GHG emission reduction during this monitoring period is considered to be reasonable and acceptable for LFG power project.

Monitor period	Ex-ante emissions reductions/ removals (tCO_2e)	Achieved emissions reductions/ removals (tCO_2e)	Percent difference	Justification for the difference
01/06/2021-31/12/2021	37,201	34,952	-6.05%	The difference is in the normal range of fluctuation
01/01/2022 - 31/12/2022	68,980	73,537	6.61%	The difference is in the normal range of fluctuation
01/01/2023 - 30/04/2023	24,478	24,166	-1.28%	The difference is in the normal range of fluctuation
Total	130,659	132,655	1.53%	The difference is in the normal range of fluctuation

APPENDIX: THE EMPLOYEE ROSTER

连州市东康再生能源科技有限公司员工花名册

序号	姓名	部门	职位
1	陆永娇	项目部	负责人
2	陆云聪	项目部	监测员
3	李书峰	项目部	监测员
4	何海霞	财务部	会计
5	陆景华	财务部	出纳
6	于晓飞	生产部	技术员
7	贺展	生产部	技术员
8	黄俊霖	生产部	技术员
9	张启胜	生产部	技术员
10	张辉高	生产部	技术员
11	李志明	生产部	技术员
12	赵克强	生产部	技术员

特此说明！

连州市东康再生能源科技有限公司

电话：（86）-13689590950

时间：2023年6月7日