



NANCHANG ZHONGLAN HUANNENG TECHNICAL SERVICE CO. LTD. MAIYUAN LFG POWER GENERATION PROJECT



Document Prepared by Climate Bridge (Shanghai) Ltd.

Tel: +86 21 6246 2036; Fax: +86 21 2301 9950

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Prepared By	Climate Bridge (Shanghai) Ltd.
Contact	Physical address: Block B, Level 24, Jiangong Mansion, 33 Fushan Road, Pudong New Area, Shanghai, China 200120 Telephone: +86 21 6246 2036; Email: projects@climatebridge.com, gu.jiayi@climatebridge.com; http://www.climatebridge.com

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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

Nanchang Zhonglan Huanneng Technical Service Co. Ltd. Maiyuan LFG Power Generation Project (hereinafter referred to as the Project) is located at the Nanchang Maiyuan landfill in Shuangling village, Jiaoqiao town, Nanchang Economic and Technological Development Zone, Nanchang city, Jiangxi province, P.R China. The project is owned and implemented by Nanchang Zhonglan Huanneng Technical Service Co. Ltd.

Nanchang Maiyuan landfill owned by local City Management Bureau, the first phase began operation in 1997 and second phase operated in 2002, with an aggregate designed capacity of 17,930,000m³ and an operational lifespan of 31.5 years. It handles an average of 1,800 tonnes MSW per day which is mainly from the Nanchang City. The area used for waste disposal covers 655,000 m² and the average depth is 20~30m.

Before the implementation of the project activity, there was an existing landfill gas (LFG) power generation project named “Nanchang Maiyuan Landfill Gas Recovery and Utilisation Project” (hereinafter refers to as the existing LFG project) with the installed capacity of 3MW, which has been registered as a CDM project (reference number 1745). With the increasing amount of waste in landfills about 2,800 tonnes/day, the landfill gas in the landfill was greatly exceed the amount of the existing project demands. In this condition, the proposed VCS project is designed and constructed by the project owner to capture and utilized the landfill gas that the existing LFG project has not captured and emitted into the atmosphere directly for power generation. The electricity generated by the project is supplied to Central China Power Grid (CCPG). The new and independent gas extraction and utilization systems were installed by the project. Before the implementation of the project activity, the landfill gas that captured and utilized by the project was emitted into the atmosphere directly. The electricity is provided by Central China Power Grid (CCPG) which is dominated by coal-fired power stations. This is the scenario that existed prior to the implementation of the project activity and is also the baseline scenario.

Six sets of power generators have been installed with a total installed capacity of 6.402MW (6*1.067MW). The total amount of feed-in electricity is estimated to be 307,882 MWh during the fixed 10 years crediting period, with the annual average amount of feed-in electricity 30,788MWh. And the expected average annual emission reductions are 155,699 tCO₂e during the fixed 10 years crediting period.

The timeline of the project is shown below:

Start date of construction	14-Dec-2018
Start date of commissioning	01-Jan-2019

Start date of the crediting period	01-Jan-2019
1 st monitoring period	01-Jan-2019 ~28-Feb-2021

It is the 2nd monitoring period of the project, in this monitoring period from 1-March-2021 to 30-April-2022 (both days included), all equipment worked well and no error or accident occurred. There are no events or situation that may impact the applicability of the methodology. The actual emission reductions achieved in this monitoring period are 265,484 tCO_{2e}.

1.2 Sectoral Scope and Project Type

Sectoral Scope 1: Energy industries (renewable - / non-renewable sources)

Sectoral Scope 13: Waste handling and disposal.

The project is not a grouped project.

1.3 Project Proponent

Organization name	Nanchang Zhonglan Huanneng Technical Service Co. Ltd.
Contact person	Lai Xinjiang
Title	Deputy general manager
Address	Room 101, Nanchang Economic and Technological Development Zone Office Building, Nanchang City, Jiangxi Province, China
Telephone	+86 -2123019950
Email	3542346576@qq.com

1.4 Other Entities Involved in the Project

Organization name	Climate Bridge (Shanghai) Ltd.
Role in the Project	Consultancy
Contact person	Gao Zhiwen
Title	General Manager
Address	Block B, Level 24, Jiangong Mansion, 33 Fushan Road, Pudong New Area, Shanghai, China 200120
Telephone	+86-2162462036

Email gao.zhiwen@climatebridge.com

1.5 Project Start Date

01-Jan-2019 (operation start date).

1.6 Project Crediting Period

This project adopts fixed crediting periods of 10 years, 01-Jan-2019 to 31-Dec-2028 (both days included).

1.7 Project Location

The Project is located at the Nanchang Maiyuan landfill in Shuangling village, Jiaoqiao town, Nanchang Economic and Technological Development Zone, Nanchang city, Jiangxi province, P.R China. The geographical coordinates for the project site are east longitude 115° 46'49" and north latitude 28° 44'6".



Figure 1-1 Location of the project site

1.8 Title and Reference of Methodology

The applied baseline and monitoring methodology for the project:

The approved consolidated methodology applied in the project activity is ACM0001 – “Flaring or use of landfill gas” (version 19.0).

This methodology also refers to the latest approved version of the following tools:

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

“Tool to calculate the emission factor for an electricity system” (version 07.0);

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

“Tool to determine the mass flow of a greenhouse gas in a gaseous stream” (version 03.0).

“Positive lists of technologies” (version 02.0).

For more detail information about the methodology and tools, please reference to the following link: <https://cdm.unfccc.int/methodologies/DB/JPYB4DYQUXQPZLBDVPHA87479EMY9M>

1.9 Participation under other GHG Programs

The project has neither been registered nor seeking registration under any other GHG programs.

The project has been registered only under VCS program.

1.10 Other Forms of Credit

Emission Trading Programs and Other Binding Limits

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 CO₂e/year, not including renewable project. The project proponent Nanchang Zhonglan Huanneng Technical Service Co. Ltd. is not included in the compliance entity list by China national Emission Trading Scheme (ETS). Also, the project has not been registered as a CCER (Chinese Certified Emission Reductions) project in China, thus it is not eligible for emission reductions transaction under the China’s ETS. Therefore, the project is not involved in an emission trading program or any other mechanism that includes GHG allowance trading. Furthermore, as a voluntary emission reduction project, the GHG emission reductions and removals generated by the project will not be enforced to be used for compliance in China.

Other Forms of Environmental Credit

The project has not sought or received another form of GHG-related environmental credit, including renewable energy certificates, during this monitoring period.

1.11 Sustainable Development Contributions

The Project contributes to sustainable development in the following ways:



The project utilizes landfill gas to generate electricity and supplies 47,786.244 MWh renewable electricity to the power grid, which contributes to SDG 7. It also contributes to “Chinese Fourteenth-Five-Years-Plan 2021”. The Plan demonstrates that the China will enlarge the scale of clean energy¹.



The project provides 11 long-term job opportunities for local residents, which has a positive effect on the local economy and contributes to SDG 8. 5 of the 11 employees are women. This helps to promote women equality in China as described in “Chinese Fourteenth-Five-Years-Plan 2021”².



The renewable electricity generated by the project replaces electricity generation by fossil-fuel power plants of the power grid, which reduces 265,484 tCO₂e GHG emission in this monitoring period and contributes to SDG 13. It also contributes to “Chinese Fourteenth-Five-Years-Plan 2021”. The Plan demonstrates that China aims to achieve carbon balance by the end of 2060 by cutting the CO₂ emissions³.

¹ Section 3, Chapter 39: http://www.gov.cn/xinwen/2021-03/13/content_5592681.htm

² Section 1, Chapter 50: http://www.gov.cn/xinwen/2021-03/13/content_5592681.htm

³ Section 4, Chapter 38: http://www.gov.cn/xinwen/2021-03/13/content_5592681.htm

Table 1-1: Sustainable Development Contributions

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
1)	7.2	Amount of Renewable energy supplied to the power grid	Implemented activities to increase	47,786.244 MWh of electricity from renewable sources has been supplied to the power grid during the reporting period	An accumulated 141,475.844 MWh including 93,689.600 MWh in the 1 st monitoring period of electricity from renewable sources has been supplied to the power grid by end of the reporting period
2)	8.5	Numbers of job opportunities Provided by the project	Implemented activities to increase	11 people have been employed by the project as long-term employees, of which 4 women are employed.	11 people have been employed by the project as long-term employees by end of the reporting period, of which 4 women are employed.
3)	13.0	Tonnes of greenhouse gas emissions avoided or removed	Implemented activities to increase	The project has achieved a total GHG emission reduction of 265,484 tCO ₂ e during the reporting period	The project has achieved an accumulated GHG emission reduction of 733,155 tCO ₂ e including 467,671 in the 1 st monitoring period by end of the reporting period

2 SAFEGUARDS

2.1 No Net Harm

The Environmental Impact Assessment (EIA) Report for the project was compiled by Jiangxi Nanda Ronghui Environmental Technology Co. Ltd. The EIA Report for the Project has been approved by Nanchang Administrative Approval Bureau on 13-December-2018, with approval No. “Hongxingshenchengzi[2018] No.114”. Every aspect of environmental impact has been considered in the EIA report with corresponding measures during project development, and no net harm has been detected. Meanwhile, the implementation of the project improves local socio-economic development through creating career opportunities and paying taxes.

2.2 Local Stakeholder Consultation

Local Stakeholder Consultation during the project preparation stage:

The Project owner collected comments by local stakeholders on the project activity. Survey questionnaires were distributed to relevant personnel of the landfill site, local villagers and government officials by the Project owner on 20-Dec-2018. The survey questionnaire was designed to assess the project impacts on the local environment and social economic development.

Forty questionnaires were distributed to local stakeholders, and all questionnaires have been recollected.

In general, local stakeholders are supportive of the project construction. The survey shows that a majority of local stakeholders think the Project helps improve the life of local people and promote local economic development without much adverse environmental impact. The survey shows that almost all the stakeholders are supportive to the proposed project, believing that the Project will provide more employment opportunities, help local economic development, and increase local power supply. Therefore, the implementation of the Project is regarded as beneficial by most of the local stakeholders.

Local Stakeholder Consultation during the project implementation stage:

Communications with Local stakeholders are being carried out at periodic intervals as described in PD. During this monitoring period (01-March-2021 to 30-April-2022, the first and last days included), the project participant sent questionnaires once each year. During this monitoring period, totally 60 questionnaires were sent out on 15-Mar-2021 and 15-Mar-2022, each time 30 questionnaires respectively. 57 out of 60 questionnaires were given back. In general, there are no negative comments received for the project. In line with VCS requirements all the processes have been implemented to receive comments from local stakeholders as well as communicate with them at periodic intervals.

The following people are considered as the stakeholders of this project during the implementation stage.

- Residents of the nearby village.
- Staff of the project

The project owner designed a questionnaire to collect the comments of relevant stakeholders and the major question issues are shown as below:

1. How the implementation of the project influences your life?
2. Do you observe any wasted gas/wastewater/noise discharged by the project?
3. If you have other opinions, write down here please.

The representatives covered different gender, different ages, different occupations and different education levels. The detail information is shown as below:

Item		Percentage	
		March-2021	March-2022
Amount of stakeholders surveyed	Male	48.28%	50%
	Female	51.72%	50%
Age	<25	10.71%	10.34
	25-45	39.29%	34.48%
	45-55	39.29%	41.38%
	>55	10.71%	13.80
Education	Junior high school or below	50%	48.28%
	Senior high school	50%	51.72%
	College or above	0%	0%
Occupation	Worker	7.14%	6.90%
	Farmer	67.86%	68.97%
	Unspecified	25.00%	24.14%

In general, there are no negative comments received for the project. In line with VCS requirements all the processes have been implemented to receive comments from local stakeholders as well as communicate with them at periodic intervals.

2.3 AFOLU-Specific Safeguards

The project is a non-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. Six sets of LFG power generation units with a total capacity of 6.402 MW, have been built and started operation on 01-Jan-2019. In this monitoring period (from 01-Mar-2021 to 30-Apr-2022, first and last days included), the net electricity delivered to the grid was 47,786.244 MWh.

The timeline of the project is shown below:

Start date of construction	14-Dec-2018
Start date of commissioning	01-Jan-2019
Start date of the crediting period	01-Jan-2019
1 st monitoring period	01-Jan-2019-28-Feb-2021

In this monitoring period from 01-Mar-2021 to 30-Apr-2022, all equipment worked well and no error or accident occurred. There are no events or situation that may impact the applicability of the methodology.

The project activity installs a comprehensive system for LFG recovery and utilization on the existing landfill site independent to the existing LFG project. The system involves LFG collection, LFG pre-treatment and electricity generation. The key systems involved in the proposed project are as follows:

- Gas 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 was extracted by gas collection blower and transported by pipeline from gas collection wells.

- Gas pre-treatment system

Before electricity generation and flaring, the LFG was pre-treated to remove impurities and moisture etc., in order to prevent the corrosion of the electricity generation system. In addition, land fill gas should be continuously in a stable condition before it flows into gas

engine or flare. The pre-treatment consists of pre-filtration, dehumidification, dewatering, cooling and fine filtration.

- Electricity generation system

The electricity generated using LFG, except small portion for on-site usage, was predominantly sold to the CCPG through nearby distribution network. Six electricity generators with each capacity of 1.067MW, internal combustion engine generators, were installed by the project. The annual average running time is 7200 hours as determined by a certified design institute.

The technical process of the Project is shown in Figure 3-1. Table 3-1 shows the key technical specifications of CMM gas generators installed.

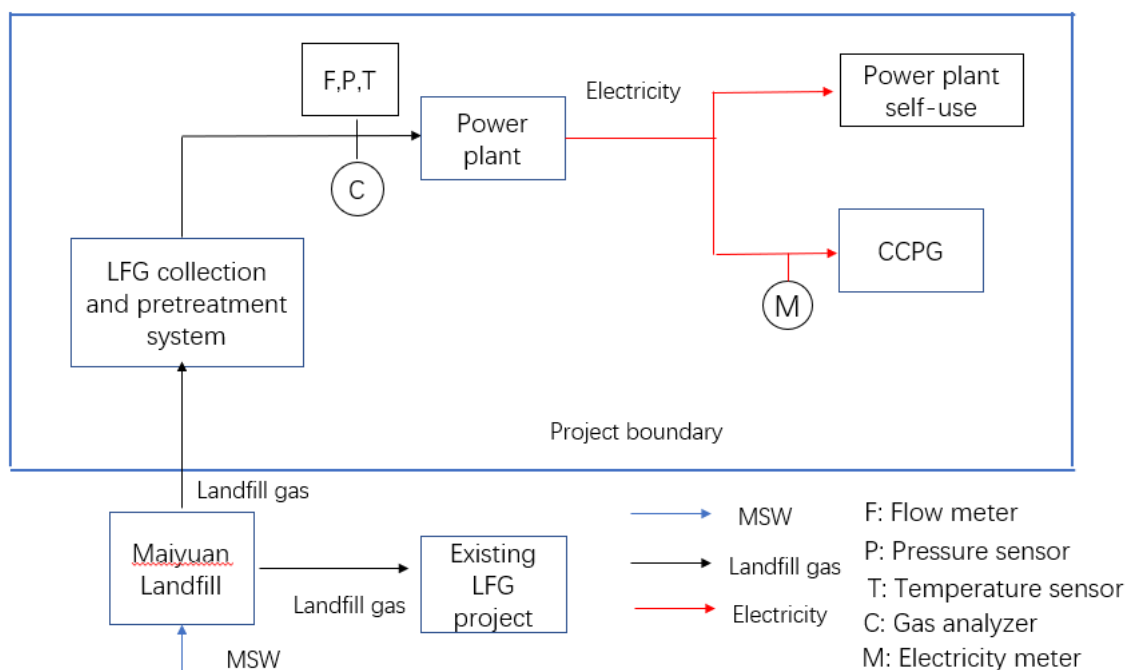


Figure 3-1 Diagram of the project boundary and flow

Table 3-1 Quantity & Capacity of power generators

Type	JGS 320GS-L.L
Quantity	6
Rated capacity	1.067 MW
Rated power factor	1
Rated frequency	50HZ

Rated Voltage	400V
Rated current	1540A

3.2 Deviations

3.2.1 Methodology Deviations

There is no methodology deviation applied to this monitoring period.

3.2.2 Project Description Deviations

There is a deviation regarding the parameter $\rho_{i,n}$ "density of greenhouse gas CH₄ in the gaseous stream at normal conditions". In the registered PD, the value of methane density at normal conditions was calculated as 0.71338 kg /m³, which was a typo. In this monitoring period, the value is corrected as 0.71566 kg /m³. As per equation (10) in "Tool to demonstrate the mass flow of a greenhouse gas in a gaseous stream", $\rho_{i,n}$ is calculated as follows:

$$\rho_{i,n} = \frac{P_i \times MM_i}{R_u \times T_i} = 101,325 Pa \times \frac{\frac{16.04 kg}{kmol}}{8314 Pa \cdot \frac{m^3}{kmol \cdot K} \times 273.15 K} = 0.71566 kg \text{ gas}_i / m^3 \text{ gas}_i$$

This change would not influence the additionality and conservation of the project because the parameter $\rho_{i,n}$ was not involved in the baseline emission calculation in registered PD. This deviation is made in order to increase the accuracy of the calculations in monitoring report.

3.3 Grouped Projects

There is no project description deviation applied to this monitoring period.

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

In this monitoring report, the data and parameters (η_{PJ} , ϕ_y , OX, F, DOC_{f,y}, MCF_y, W_{j,x}, DOC_j, and k_j) available at validation in the PD was not listed in the following part, the reason is that these parameters were used to ex ante estimate the F_{CH₄,PJ,y}, which will be ex post monitored.

Data / Parameter	OX _{top_layer}
Data unit	Dimensionless
Description	Fraction of methane that would be oxidized in the top layer of the SWDS in the baseline

Source of data	Consistent with how oxidation is accounted for in the methodological tool “Emissions from solid waste disposal sites”
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_{CH_4}
Data unit	t CO ₂ e/t CH ₄
Description	Global warming potential of CH ₄
Source of data	IPCC
Value applied	28
Justification of choice of data or description of measurement methods and procedures applied	Default value of 28 from IPCC Fifth Assessment Report (AR5). Shall be updated according to any future COP/MOP decisions. For emission reductions achieved in this report, the CH ₄ GWP of 28 is applied for conservative consideration.
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	NCV_{CH_4}
Data unit	TJ/t CH ₄
Description	Net calorific value of methane at reference conditions
Source of data	Technical literature
Value applied	0.0504
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	t CO ₂ /MWh
Description	Operating margin CO ₂ emission factor in year y
Source of data	“2017 Baseline Emission Factors for Regional Power Grids in China” published by DNA of China
Value applied	0.9014
Justification of choice of data or description of measurement methods and procedures applied	Official and authoritative statistic data.
Purpose of Data	Calculation of baseline emissions and project emissions
Comments	According to section 4.1, the ex-ante option is selected to calculate $EF_{grid, OM, y}$ and fixed in the crediting period.

Data / Parameter	$EF_{grid, BM, y}$
Data unit	t CO ₂ /MWh
Description	Build margin CO ₂ emission factor in year y
Source of data	“2017 Baseline Emission Factors for Regional Power Grids in China” published by DNA of China
Value applied	0.3112
Justification of choice of data or description of measurement methods and procedures applied	Official and authoritative statistic data.
Purpose of Data	Calculation of baseline emissions and project emissions
Comments	According to section 4.1, the ex-ante option is selected to calculate $EF_{grid, BM, y}$ and fixed in the crediting period.

Data / Parameter	$EF_{grid, CM, y}$
Data unit	t CO ₂ /MWh
Description	Combined margin emission factor for the grid in year y
Source of data	Calculated based on “Tool to calculate the emission factor for an electricity system”
Value applied	0.6063
Justification of choice of data or description of measurement methods and procedures applied	$EF_{grid, CM, y}$ is calculated based on $EF_{grid, OM, y}$ and $EF_{grid, BM, y}$ as per the latest version of “Tool to calculate the emission factor for an electricity system” (version 07.0).

Purpose of Data	Calculation of baseline emissions and project emissions
Comments	According to section 4.1, the ex-ante option is selected to calculate $EF_{grid, OM, y}$ and $EF_{grid, BM, y}$ and fixed in the crediting period, thus the $EF_{grid, CM, y}$ is fixed during the crediting period.

Data / Parameter	R_u
Data unit	Pa.m ³ /kmol.K
Description	Universal ideal gases constant
Source of data	"Tool to determine the mass flow of a greenhouse gas in a gaseous stream"
Value applied	8,314
Justification of choice of data or description of measurement methods and procedures applied	-
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	MM_i
Data unit	kg/kmol
Description	Molecular mass of greenhouse gas CH ₄
Source of data	"Tool to determine the mass flow of a greenhouse gas in a gaseous stream"
Value applied	16.04
Justification of choice of data or description of measurement methods and procedures applied	-
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	P_n
Data unit	Pa
Description	Total pressure at normal conditions
Source of data	"Tool to determine the mass flow of a greenhouse gas in a gaseous stream"

Value applied	101,325 Pa
Justification of choice of data or description of measurement methods and procedures applied	-
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	T_n
Data unit	K
Description	Temperature at normal conditions
Source of data	"Tool to determine the mass flow of a greenhouse gas in a gaseous stream"
Value applied	273.15
Justification of choice of data or description of measurement methods and procedures applied	-
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	$\rho_{i,n}$
Data unit	kg gas i/m ³ wet gas i
Description	Density of greenhouse gas CH ₄ in the gaseous stream at normal conditions
Source of data	Calculated based on the equation (7) in the PD as per the latest version of "Tool to determine the mass flow of a greenhouse gas in a gaseous stream"
Value applied	0.71566
Justification of choice of data or description of measurement methods and procedures applied	-
Purpose of Data	Calculation of baseline 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 or k in year y
Source of data	Methodological tool “Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation” (version 03.0)
Value applied	TDL _{j,y} : 20% TDL _{k,y} : 3%
Justification of choice of data or description of measurement methods and procedures applied	According to the tool “Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation” (version 03.0), the project belongs to the case of Scenario A, use as default values of 20% for project emission, and 3% for baseline emissions.
Purpose of Data	Calculation of baseline emissions and project emissions
Comments	-

4.2 Data and Parameters Monitored

Data / Parameter	Management of SWDS
Data unit	-
Description	Management of SWDS
Source of data	Original design of the landfill
Description of measurement methods and procedures to be applied	Project participants should refer to the original design of the landfill to ensure that any practice to increase methane generation have been occurring prior to the implementation of the project activity. Any change in the management of the SWDS after the implementation of the project activity should be justified by referring to technical or regulatory specifications
Frequency of monitoring/recording	Annually
Value monitored	Since the implementation of the project activity, no changes have taken place in the management of the landfill. In China, the regulations and standards currently issued and in force as below: -In July 2008, the State Environmental Protection Bureau and the State Administration of Quality Supervision and Quarantine jointly issued the "Standard for Pollution Control of Domestic Waste Landfills" (GB16889-2008) - In 2013, the ministry of construction released the technical specification for domestic waste sanitary landfill (GB50869-2013).

	GB16889-2008 and GB50869 -2013 are used to regulate the landfill site construction, management and operation, and encourage the use of landfill gas from a safety perspective with the installation of LFG capture system, but no clear requirements on the amount of landfill gas destroyed or percentage reaches a certain value. Due to financial and/or technical difficulties, these regulations have not been widely implemented in China. According to the "Overview of the Development of China's Municipal Solid Waste Treatment Industry in 2012"⁴, there were 648 landfill sites in China by the end of 2012. However, only 50 of the 648 landfill sites were equipped to utilize and collect or combust landfill gases. As "2019 Statistical Yearbook of Urban and Rural Construction" and "2020 China Biomass Power Generation Industry Development Report", As of 2019, there were 1,885 landfill sites in cities and counties across the country, and only 216 landfill sites were installed gas generators and connected to the power grid, with a coverage rate of less than 12%. By the end of the implementation of the project, the provisions on methane recovery and utilization have not changed in the current effective laws and standards in China, and it is a common phenomenon in China that methane is discharged into the atmosphere without any use without control. Meanwhile, according to the "Statement of Management Technical " of the landfill site, it is confirmed that after the implementation of the project activity, the management of the landfill site has not undergone any changes, and there has been no increase in methane production.
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of the data	Calculation of baseline emissions
Calculation method	-
Comments	-

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
Source of data	historic data on the amount captured from FSR
Description of measurement methods and procedures to be applied	-

⁴ <https://doc.mbalib.com/view/604143e8e7ecadf5b5410f95fee266fc.html>

Frequency of monitoring/recording	For application A: Once for the crediting period
Value monitored	0 (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)
Monitoring equipment	Not applicable as this parameter is confirmed in ways of paper documents and oral interviews.
QA/QC procedures to be applied	The parameter is cross-checked with interviews with the staff of the power plant.
Purpose of the data	Calculation of baseline emissions
Calculation method	-
Comments	-

Data / Parameter	F_{CH4,BL,R,y}	
Data unit	t CH ₄ /yr	
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 and odour concerns	
Description of measurement methods and procedures to be applied	-	
Frequency of monitoring/recording	Annually	
Value monitored	Monitoring period	Value
	01-Mar-2021~31-Dec-2021	1,902
	01-Jan-2022~30-Apr-2022	503
	Total	2,405
Monitoring equipment	Not applicable as this parameter is a calculated value.	
QA/QC procedures to be applied	The emission reduction (ER) calculation sheet will be checked by VVB	
Purpose of the data	Calculation of baseline emissions	
Calculation method	The data is calculated as annual methane destroyed multiplied by fraction of LFG that is required to be flared due to a requirement. $F_{CH4,BL,y} = \max \{F_{CH4,BL,R,y}; F_{CH4,BL,sys,y}\} = \rho_{reg,y} \times F_{CH4,PJ,y} = 0.2 \times F_{CH4,PJ,y}$	
Comments	Applicable to Case 2 of section 5.4.1.3	

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	According to the methodology ACM0001 (version 19.0), If the requirement does not specify any amount or percentage of LFG that should be destroyed, but requires the installation of a system to capture and flare the LFG, then a typical destruction rate of 20 per cent is assumed
Frequency of monitoring/recording	Annually
Value monitored	20%
Monitoring equipment	Not available as per the methodology
QA/QC procedures to be applied	This parameter value should be in accordance with the value determined in the applied methodology as well as the value described in PD.
Purpose of the data	Calculation of baseline emissions
Calculation method	-
Comments	Applicable to Case 2 of section 5.4.1.3

Data / Parameter	$V_{t,wb,n}$								
Data unit	m ³ wet gas/h								
Description	Volumetric flow of the gaseous stream in time interval t on a wet basis at normal conditions								
Source of data	Measured by a flow meter continuously and converted automatically by the recovery monitoring system								
Description of measurement methods and procedures to be applied	The parameters of $V_{t,wb}$ is measured by a flow meter continuously, which was converted automatically into standard value $V_{t,wb,n}$ (at the normal condition of 0 °C and 101,325 Pa) by the recovery monitoring system								
Frequency of monitoring/recording	Continuously. Recorded by the project participant every day.								
Value monitored	<table border="1"> <thead> <tr> <th>Monitoring period</th><th>Value</th></tr> </thead> <tbody> <tr> <td>01-Mar-2021~31-Dec-2021</td><td>3,998</td></tr> <tr> <td>01-Jan-2022~30- Apr-2022</td><td>3,060</td></tr> <tr> <td>Average</td><td>3,529</td></tr> </tbody> </table>	Monitoring period	Value	01-Mar-2021~31-Dec-2021	3,998	01-Jan-2022~30- Apr-2022	3,060	Average	3,529
Monitoring period	Value								
01-Mar-2021~31-Dec-2021	3,998								
01-Jan-2022~30- Apr-2022	3,060								
Average	3,529								

Monitoring equipment	Flow meter Calibration frequency: annually Accuracy: 0.5 The information of flow meter and calibration record please refers to Table 4-2.
QA/QC procedures to be applied	Periodic calibration against a primary device provided by an independent accredited laboratory is mandatory for all projects applying large scale methodology(ies). Calibration is carried out every year and the independent accredited laboratory issues verification certificates. Evidence will be saved two years after the crediting period.
Purpose of the data	Calculation of baseline emissions
Calculation method	-
Comments	This parameter was monitored in Options A

Data / Parameter	$V_{i,t,wb}$								
Data unit	m ³ gas CH ₄ /m ³ wet gas								
Description	Volumetric fraction of greenhouse gas CH ₄ in a time interval t on a wet basis								
Source of data	Measured by continuous gas analyzer								
Description of measurement methods and procedures to be applied	Continuous gas analyzer operating on wet basis. Volumetric flow measurement should always refer to the actual pressure and temperature.								
Frequency of monitoring/recording	Continuously. Recorded by the project participant everyday.								
Value monitored	<table border="1"> <thead> <tr> <th>Monitoring period</th><th>Value</th></tr> </thead> <tbody> <tr> <td>01-Mar-2021~31-Dec-2021</td><td>52.93%</td></tr> <tr> <td>01-Jan-2022~30-Apr-2022</td><td>47.77%</td></tr> <tr> <td>Average</td><td>50.35%</td></tr> </tbody> </table>	Monitoring period	Value	01-Mar-2021~31-Dec-2021	52.93%	01-Jan-2022~30-Apr-2022	47.77%	Average	50.35%
Monitoring period	Value								
01-Mar-2021~31-Dec-2021	52.93%								
01-Jan-2022~30-Apr-2022	47.77%								
Average	50.35%								
Monitoring equipment	Gas analyzer Calibration frequency: annually Accuracy: 2% The information of gas analyzer and calibration record please refers to Table 4-2.								
QA/QC procedures to be applied	Periodic calibration against a primary device provided by an independent accredited laboratory is mandatory for all projects applying large scale methodology(ies). Calibration is carried out every year and the independent accredited laboratory issues verification certificates. Evidence will be saved two years after the crediting period.-								
Purpose of the 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 participants								
Description of measurement methods and procedures to be applied	For each equipment unit j using the LFG monitor that the plant is operating in hour h by the monitoring any one or more of the following three parameters: (a) Temperature. Determine the location for temperature measurements and minimum operational temperature based on manufacturer's specifications of the burning equipment. Document and justify the location and minimum threshold in the PD; (b) Flame. Flame detection system is used to ensure that the equipment is in operation; (c) Products generated. Monitor the generation of steam for the case of boilers and air-heaters and glass for the case of glass melting furnaces. This option is not applicable to brick kilns. $Op_{j,h}=0$ when: (a) One of more temperature measurements are missing or below the minimum threshold in hour h (instantaneous measurements are made at least every minute); (b) Flame is not detected continuously in hour h (instantaneous measurements are made at least every minute); (c) No products are generated in the hour h. Otherwise, $Op_{j,h}=1$								
Frequency of monitoring/recording	Hourly								
Value monitored	<table border="1"> <thead> <tr> <th>Monitoring period</th><th>Value</th></tr> </thead> <tbody> <tr> <td>01-Mar-2021~31-Dec-2021</td><td>6,158</td></tr> <tr> <td>01-Jan-2022~30-Apr-2022</td><td>2,400</td></tr> <tr> <td>Total</td><td>8,558</td></tr> </tbody> </table>	Monitoring period	Value	01-Mar-2021~31-Dec-2021	6,158	01-Jan-2022~30-Apr-2022	2,400	Total	8,558
Monitoring period	Value								
01-Mar-2021~31-Dec-2021	6,158								
01-Jan-2022~30-Apr-2022	2,400								
Total	8,558								
Monitoring equipment	The on-line operation system								
QA/QC procedures to be applied	The staff of the power plant record the value of on-line operation system every day and exported the records of on-line operation system every month. The Daily Operation Report and Monthly Report will be saved two years after the crediting period.								
Purpose of the data	Calculation of baseline emissions.								
Calculation method	-								
Comments	-								

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	Electricity meter	
Description of measurement methods and procedures to be applied	The electricity generated by the project is recorded on 00:00 of the first day every month. The data electricity meter is confirmed by the project participant and the grid company⁵. All electronic data and paper documents will be archived for two years following the end of the crediting period.	
Frequency of monitoring/recording	Continuously and monthly recorded	
Value monitored	Monitoring period	Value
	01-Mar-2021~31-Dec-2021	36,702.244
	01-Jan-2022~30-Apr-2022	11,084.000
	Total	47,786.244
Monitoring equipment	Electricity meter Calibration frequency: annually Accuracy:0.5s The information of electricity meter and calibration record please refers to Table 4-2.	
QA/QC procedures to be applied	The data is cross checked with Electricity Transaction Note. The electricity meter is periodically checked and maintained. Calibration is carried out once a year to ensure normal operation.	
Purpose of the data	Calculation of baseline emissions.	
Calculation method	-	
Comments	This parameter is required for calculating baseline emissions associated with electricity generation (BE_{EC,y}) using the methodological tool “Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation”.	

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

⁵ As per the description in Page 5 of the Power Purchase Agreement (PPA).

Source of data	Electricity meter	
Description of measurement methods and procedures to be applied	Electricity meter(s) and monthly recorded. All electronic data and paper documents will be archived for two years following the end of the crediting period.	
Frequency of monitoring/recording	Continuously	
Value monitored	Monitoring period	Value
	01-Mar-2021~31-Dec-2021	2.714
	01-Jan-2022~30-Apr-2022	6.700
	Total	9.414
Monitoring equipment	Electricity meter Calibration frequency: annually Accuracy:0.5s The information of electricity meter and calibration record please refers to Table 4-2.	
QA/QC procedures to be applied	The data is cross checked with Electricity Transaction Note. The electricity meter is periodically checked and maintained. Calibration is carried out once a year to ensure normal operation.	
Purpose of the data	Calculation of project emissions.	
Calculation method	-	
Comments	This parameter is required for calculating project emissions from electricity consumption due to an alternative waste treatment process t (PE _{EC,y}) using the methodological tool "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation".	

Data / Parameter	CAPEX and OPEX	
Data unit	Currency (RMB)	
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	Once at the first verification	
Value monitored	Total investment of the project is 62,969,370.54 RMB; and total cost is 10,360,000 RMB, of which, O&M cost is 4,560,000 RMB.	
Monitoring equipment	-	

QA/QC procedures to be applied	Audited by professional, independent financial auditors. The DOE should only verify that the data provided corresponds to the data from independent financial auditors
Purpose of the data	-
Calculation method	-
Comments	The information provided for CAPEX shall indicate the investment made: (i) in the collection and flaring system; (ii) in the power plant and connection to the grid (if applicable); and (iii) in the purchase of the new boiler or refurbishment of the existing one and in the steam/hot air pipeline if steam/hot air is exported out of the project boundary (if applicable). The information supplied for OPEX shall indicate the costs for: (i) staff and maintenance involved in the operation of the collection and flaring 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	RMB/kwh
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 monitored	0.58 (including VAT)
Monitoring equipment	-
QA/QC procedures to be applied	Audited by professional, independent financial auditors. The DOE should only verify that the data provided correspond to the data from independent financial auditors.
Purpose of the data	-
Calculation method	-
Comments	The monitoring of this parameter is only required for projects applying the simplified procedures to identify the baseline scenario and demonstrate additionality.

4.3 Monitoring Plan

The monitoring plan presented in this PD 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 was implemented by the project owner during the project operation. The details of the monitoring plan are specified as follows:

(A) Data and parameters to be monitored

Data and parameters to be monitored are listed below shows the positions of the monitoring instruments and Table 4-1 lists the corresponding parameters monitored:

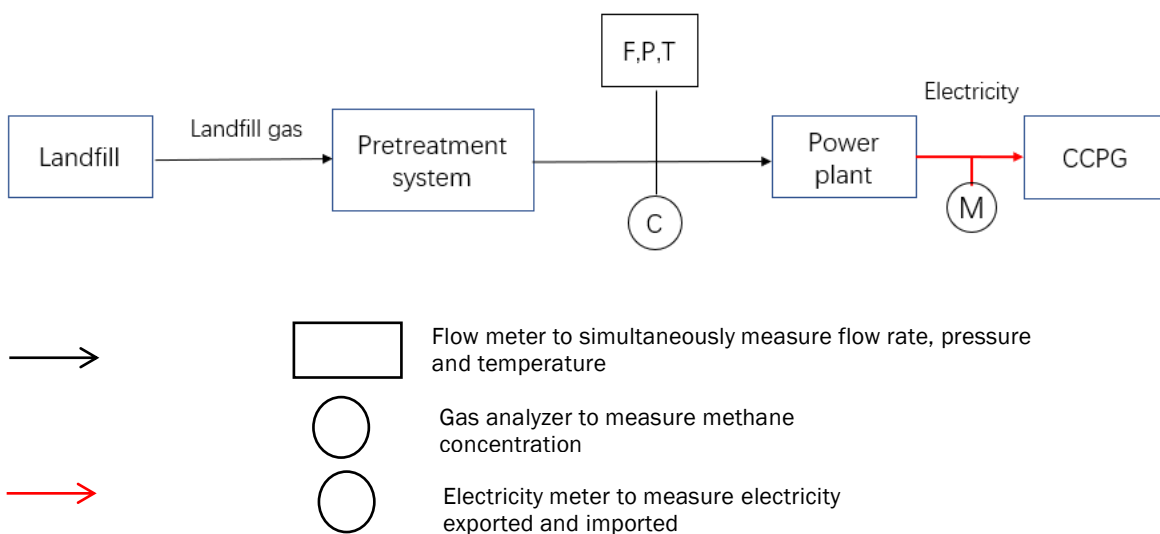


Figure 4-1 Project monitoring diagram

Table 4-1 Corresponding parameters monitored

Position	Parameter Monitored	Description
LFG Inflow Monitoring: Flow meter	$V_{t,wb,n}$	Volumetric flow of the gaseous stream ($V_{t,wb}$), pressure and temperature are monitored on-site by flow meter, which was converted automatically into standard value $V_{t,wb,n}$ (at the normal condition of 0°C and 101,325 Pa) by the recovery monitoring system. The monitoring frequency is continuous. And the data was recorded and electronic archived once per one hour by computer automatically. The operators checks the data every day and totalize the amount of LFG destroyed every month.

LFG Inflow Monitoring: Gas analyzer	$V_{i,t,wb}$	Volumetric fraction of greenhouse gas CH ₄ is monitored on-site by gas analyzer. The Monitoring frequency is continuous. And the data was recorded and electronic archived once per one hour by computer automatically. The operators checks the data every day and average the data every month.
Electricity Monitoring: Electricity meter	$EG_{PJ,y}$, $EG_{EC,y}$	Amount of electricity generated using LFG by the project activity and electricity consumed by the project activity are continuously monitored by bi-directional electricity meter installed by local grid company at 10kV Xiangzhang line with the accuracy of no less than 0.5s.

Table 4-2 Information of monitoring equipment installed

Equipment	Model	Serial No.	Accuracy	Date of calibration	Validity	Parameter monitored
Flow meter	RVM-VS14IJJF63 N2	18081001	0.5	18-Dec-2020 18-Dec-2021	17-Dec-2021 17-Dec-2022	$V_{t,wb,n}$
Gas analyzer	GFA800-MOH	1803020	2%	18-Dec-2020 18-Dec-2021	17-Dec-2021 17-Dec-2022	$V_{i,t,wb}$
Electricity meter	DTZ1296	363000120 180001093 6364	0.5S	01-Feb-2021 01-Feb-2022	31-Jan-2022 31-Jan-2023	$EG_{PJ,y}$, $EG_{EC,y}$

(B) Management Structure

The Project owner organizes a specific VCS team in project development department to be responsible for data collection, supervision and witness the whole process of data measuring and recording. A VCS manager is appointed to take full responsibility for the overall monitoring of the project. The monitoring and measurement of extracted gas, electricity generation and consumption etc. are carried out by a few designated monitoring officers. In addition, the Project developer appoints internal verifiers who is responsible for internal check of the measurement, collection of relevant receipts and invoices, and the calculation of the emission reductions. A monitoring and management manual of the project that identifies detailed duties and responsibilities of the relevant parties is developed and served as the basis of the project monitoring. Figure 4-2 shows the operation and management structure of the Project.

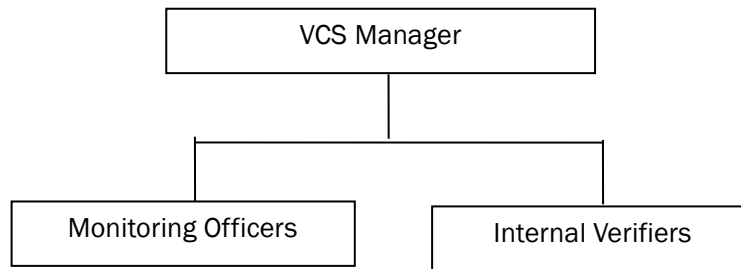


Figure 4-2 Operation and management structure of the project

(C) Data collection

Monitoring officers are responsible for data collection. Designated teams read and collect the monitored data regularly. The computer system automatically monitors and records relevant meter data. Automatic records will serve as the main data source for emission reductions calculation. All data files, relevant purchase invoices and sales receipts will be collected by a designated monitoring officer, who prepares backup in time and archive all documents properly.

(D) Quality assurance

All metering equipment for monitoring was chosen in accordance with VCS requirements and was calibrated regularly for accuracy by qualified party according to the national regulations. To assist in future verifications, the Project owner preserves the calibration records, along with the data files of project monitoring.

Error check routines is established on site and at the point of data storage to detect data measuring/transmission failures as well as malfunctions. In the case of malfunction of the meters, the meter supplier provides technical support to engage the problem promptly and emission reductions during the corresponding period is calculated conservatively.

The installation of the electricity metering equipment fulfills the requirements of “DL/T448-2016 Technical Administrative Code of Electric Energy Metering”⁶. The accuracy should not be less than 0.5S. The installation of flow meters and gas analyzers fulfills the national standard (MT448-2008 and JJG 1138-2017). All the meters were checked and maintained periodically.

(E) Data file management

All monitoring data will be electronically filed by the end of each month and the electronic data files will be archived in both disk copy and printed hard copy. Other documents in paper e.g. maps, forms and environment assessment reports will be preserved as well. All data collected as part of monitoring will be archived electronically and be kept at least for 2 years after the end of the crediting period. The Project owner will provide original records and documents if necessary.

⁶ <https://wenku.baidu.com/view/c8ad0b432379168884868762caaedd3383c4b59e.html>

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

According to the methodology ACM0001 (V19.0), baseline emissions are determined according to equation (1) and comprise the following sources:

$$BE_y = BE_{CH_4,y} + BE_{EC,y} + BE_{HG,y} + BE_{NG,y} \quad (1)$$

Where:

BE_y	=	Baseline emissions in year y (t CO ₂ e/yr)
$BE_{CH_4,y}$	=	Baseline emissions of methane from the SWDS in year y (t CO ₂ e/yr)
$BE_{EC,y}$	=	Baseline emissions associated with electricity generation in year y (t CO ₂ /yr)
$BE_{HG,y}$	=	Baseline emissions associated with heat generation in year y (t CO ₂ /yr)
$BE_{NG,y}$	=	Baseline emissions associated with natural gas use in year y (t CO ₂ /yr)

The project is not involved in heat generation and natural gas use, thus, the baseline emissions is calculated as follows:

$$BE_y = BE_{CH_4,y} + BE_{EC,y} \quad (2)$$

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

Baseline emissions of methane from the SWDS are determined as follows, based on the amount of methane that is captured under the project activity and the amount that would be captured and destroyed in the baseline (such as due to regulations). In addition, the effect of methane oxidation that is present in the baseline and absent in the project is taken into account:

$$BE_{CH_4,y} = \left((1 - OX_{top_layer}) \times F_{CH_4,PJ,y} - F_{CH_4,BL,y} \right) \times GWP_{CH_4} \quad (3)$$

Where:

$BE_{CH_4,y}$	=	Baseline emissions of methane from the SWDS in year y (t CO 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 (t CH ₄ /yr)
$F_{CH_4,BL,y}$	=	Amount of methane in the LFG that would be flared in the baseline in year y (t CH ₄ /yr)
GWP_{CH_4}	=	Global warming potential of CH ₄ (t CO ₂ e/t CH ₄)

Ex post determination of $F_{CH_4,PJ,y}$

During the crediting period, $F_{CH_4,PJ,y}$ is determined as the sum of the quantities of methane flared and used in power plant(s), boiler(s), air heater(s), glass melting furnace(s), kiln(s) and natural gas distribution, as follows:

$$F_{CH_4,PJ,y} = F_{CH_4,flared,y} + F_{CH_4,EL,y} + F_{CH_4,HG,y} + F_{CH_4,NG,y} \quad (4)$$

Where:

$F_{CH_4,PJ,y}$	=	Amount of methane in the LFG which is flared and/or used in the project activity in year y (t CH ₄ /yr)
$F_{CH_4,flared,y}$	=	Amount of methane in the LFG which is destroyed by flaring in year y (t CH ₄ /yr)
$F_{CH_4,EL,y}$	=	Amount of methane in the LFG which is used for electricity generation in year y (t CH ₄ /yr)
$F_{CH_4,HG,y}$	=	Amount of methane in the LFG which is used for heat generation in year y (t CH ₄ /yr)
$F_{CH_4,NG,y}$	=	Amount of methane in the LFG which is sent to the natural gas distribution network and/or dedicated pipeline and/or to the trucks in year y (t CH ₄ /yr)

The flare will not be used when the power plant is in normal operation, thus, the PD decides not to claim the emission reduction from the flare, even if any methane is destroyed by flare during the crediting period.

Meanwhile, the project is not involved in heat generation and natural gas use, thus,

$$F_{CH_4,PJ,y} = F_{CH_4,EL,y} \quad (5)$$

$F_{CH_4,EL,y}$ is determined using the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" and monitoring the working hours of the power plant(s), boiler(s), air heater(s), glass melting furnace(s) and kiln(s), so that no emission reduction are claimed for methane destruction during non-working hours. This is taken into account by monitoring the hours that the equipment utilizing the LFG is operating in year y ($O_{pj,h,y}$).

For the project, the flow of gaseous stream is volume flow-wet basis, and the volumetric fraction is wet basis, thus, as per the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 03.0), Option C is applied to determine the parameter of $F_{CH_4,EL,y}$.

Option C

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

$$F_{i,t} = V_{t,wb,n} \times v_{i,t,wb} \times \rho_{i,n} \quad (6)$$

With:

$$\rho_{i,n} = \frac{P_n \times MM_i}{R_u \times T_n} \quad (7)$$

Where:

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

The following equation should be used to convert the volumetric flow of the gaseous stream from actual conditions to normal conditions of temperature and pressure:

$$V_{t,wb,n} = V_{t,wb} \times \left[\left(T_n / T_t \right) \times \left(P_t / P_n \right) \right] \quad (8)$$

Where:

$V_{t,wb,n}$	=	Volumetric flow of the gaseous stream in a time interval t on a wet basis at normal conditions (m ³ wet gas/h)
$V_{t,wb}$	=	Volumetric flow of the gaseous stream in time interval t on a wet basis (m ³ wet gas/h)
P_t	=	Pressure of the gaseous stream in time interval t (Pa)
T_t	=	Temperature of the gaseous stream in time interval t (K)
P_n	=	Absolute pressure at normal conditions (Pa)
T_n	=	Temperature at normal conditions (K)

The calculation process of $BE_{CH_4,y}$ are as follows:

$$F_{CH_4,PJ,y} = V_{t,wb,n} \times V_{i,t,wb} \times Op_{j,h,y} \times \rho_{i,n}^7$$

$$F_{CH_4,BL,y} = \rho_{reg,y} \times F_{CH_4,BL,y}^8$$

Calculation results of $F_{CH_4,PJ,y}$ and $F_{CH_4,BL,y}$ are shown in **table 5-1**.

Table 5-1 Calculation results of $F_{CH_4,PJ,y}$ and $F_{CH_4,BL,y}$

Monitoring period		$V_{t,wb,n}$	$V_{i,t,wb}$	$Op_{j,h,y}$	$F_{CH_4,PJ,y}$	$F_{CH_4,BL,y}$
		m ³ wet gas/h	m ³ CH ₄ /m ³ wet gas	h	t CH ₄	t CH ₄
01/03/2021	31/03/2021	2,268	44.17%	588	422	84.4
01/04/2021	30/04/2021	3,721	53.18%	614	870	174
01/05/2021	31/05/2021	4,738	54.02%	628	1150	230
01/06/2021	30/06/2021	5,077	55.08%	630	1261	252.2
01/07/2021	31/07/2021	5,232	57.46%	632	1360	272
01/08/2021	31/08/2021	4,418	56.84%	624	1121	224.2
01/09/2021	30/09/2021	4,124	56.03%	620	1025	205
01/10/2021	31/10/2021	3,500	51.02%	610	780	156
01/11/2021	30/11/2021	3,518	51.38%	610	789	157.8
01/12/2021	31/12/2021	3,384	50.15%	602	731	146.2
Average/Subtotal 2021		3,998	52.93%	6,158	9,509	1,902
01/01/2022	31/01/2022	3,310	49.03%	608	706	141.2
01/02/2022	28/02/2022	3,072	47.52%	598	625	125
01/03/2022	31/03/2022	2,909	47.38%	598	590	118
01/04/2022	30/04/2022	2,948	47.15%	596	593	118.6
Average/Subtotal 2022		3,060	47.77%	2,400	2,514	503
Average/Total		3,529	50.35%	8,558	12,023	2,405

$$BE_{CH_4,y} = (1 - OX_{top,layer}) \times F_{CH_4,PJ,y} - F_{CH_4,BL,y}) \times GWP_{CH_4}^9$$

The calculation result of $BE_{CH_4,y}$ is as the following **table 5-2**.

Table 5-2 Calculation of $BE_{CH_4,y}$

Monitoring period	$OX_{top,layer}$	$F_{CH_4,PJ,y}$ (t CH ₄)	$F_{CH_4,BL,y}$ (t CH ₄)	GWP_{CH_4} (tCO ₂ e/tCH ₄)	$BE_{CH_4,y}$ (t CO ₂ e)
01/03/2021~31/12/2021	0.1	9,509	1,902	28	186,376
01/01/2022~30/04/2022	0.1	2,514	503	28	49,274

⁷ $\rho_{i,n} = 0.71566$ kg gas i/m³ wet gas I, for details please see section 4.1. The other values are monitored by the project participant.

⁸ $\rho_{reg,y} = 0.2$, for details please see section 4.1. The other values are monitored by the project participant.

⁹ $OX_{top,layer} = 0.1$, $GWP_{CH_4} = 28$ tCO₂e/tCH₄, for details please see section 4.1. The other values are monitored by the project participant.

Total		12,023	2,405		235,650
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2. Baseline emissions associated with electricity generation ($BE_{EC,y}$)

According to methodological tool "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (version 03.0),

$$BE_{EC,y} = \sum_k EC_{BL,k,y} \times EF_{EL,k,y} \times (1 + TDL_{k,y}) \quad (9)$$

Where:

- $BE_{EC,y}$ = Baseline emissions from electricity consumption in year y (t CO₂ / yr)
- $EC_{BL,k,y}$ = Quantity of electricity that would be consumed by the baseline electricity consumer k in year y (MWh/yr)
- $EF_{EL,k,y}$ = Emission factor for electricity generation for source k in year y (t CO₂/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

Values of monitored parameter $EG_{PJ,y}$ ($=EC_{BL,k,y}$) are presented in **table 5-3**.

Table 5-3. Monitored values of quantity of electricity that consumed by the baseline electricity consumer

Monitoring Period		$EG_{PJ,y}=EC_{BL,k,y}$ (MWh)		
		Monthly report	ETN Data	Data for Calculation
01/03/2021	31/03/2021	1,735.800	1,735.800	1,735.800
01/04/2021	30/04/2021	3,369.744	3,369.744	3,369.744
01/05/2021	31/05/2021	4,339.000	4,339.000	4,339.000
01/06/2021	30/06/2021	4,762.000	4,762.000	4,762.000
01/07/2021	31/07/2021	4,927.400	4,927.400	4,927.400
01/08/2021	31/08/2021	4,205.200	4,205.200	4,205.200
01/09/2021	30/09/2021	3,908.400	3,908.400	3,908.400
01/10/2021	31/10/2021	3,136.400	3,136.400	3,136.400
01/11/2021	30/11/2021	3,195.600	3,195.600	3,195.600
01/12/2021	31/12/2021	3,122.700	3,122.700	3,122.700
Subtotal 2021		36,702.244	36,702.244	36,702.244
01/01/2022	31/01/2022	3,069.700	3,069.700	3,069.700
01/02/2022	28/02/2022	2,709.000	2,709.000	2,709.000
01/03/2022	31/03/2022	2,667.600	2,667.600	2,667.600
01/04/2022	30/04/2022	2,637.700	2,637.700	2,637.700
Subtotal 2022		11,084.000	11,084.000	11,084.000
Total		47,786.244	47,786.244	47,786.244

Thus, the calculation result of $BE_{EC,y}$ is as the following **table 5-4**.

Table 5-4 Calculation of $BE_{EC,y}$

Year	$EG_{PJ,y}=EC_{BL,k,y}$	$EF_{EL,k,y}$	$TDL_{k,y}$	$BE_{EC,y}$
	MWh	tCO ₂ e/MWh	%	tCO ₂
01-Mar-2021~31-Dec-2021	36,702.244	0.6063	3	22,920
01-Jan-2022~30-Apr-2022	11,084.000	0.6063	3	6,921
Total	47,786.244			29,841

As a summary, the baseline emission is as **table 5-5**.

Table 5-5 Summary of baseline emission

Monitoring period	$BE_{CH_4,y}$	$BE_{EC,y}$	BE_y
	tCO ₂	tCO ₂	tCO ₂
01-Mar-2021~31-Dec-2021	186,376	22,920	209,296
01-Jan-2022~30-Apr-2022	49,274	6,921	56,195
Total	235,650	29,841	265,491

5.2 Project Emissions

Project emissions are calculated as follows:

$$PE_y = PE_{EC,y} + PE_{FC,y} + PE_{DT,y} + PE_{SP,y} \quad (10)$$

Where:

- PE_y = Project emissions in year y (t CO₂/yr)
- $PE_{EC,y}$ = Emissions from consumption of electricity due to the project activity in year y (t CO₂/yr)
- $PE_{FC,y}$ = Emissions from consumption of fossil fuels due to the project activity, for purpose other than electricity generation, in year y (t CO₂/yr)
- $PE_{DT,y}$ = Emissions from the distribution of compressed/liquefied LFG using trucks, in year y (t CO₂/yr)

$PE_{SP,y}$ = Emissions from the supply of LFG to consumers through a dedicated pipeline, in year y (t CO₂/yr)

The project is only included the emissions from consumption of electricity, not involved in the emissions from consumption of fossil fuels, the distribution of compressed/liquefied LFG using trucks and the supply of LFG to consumers through a dedicated pipeline, thus,

$$PE_y = PE_{EC,y} \quad (11)$$

According to the PD,

$$PE_{EC,y} = \sum_j EC_{PJ,j,y} \times EF_{EL,j,y} \times (1 + TDL_{j,y}) \quad (12)$$

Where:

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

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

$EF_{EL,j,y}$ = Emission factor for electricity generation for source j in year y (t CO₂/MWh)

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

j = Sources of electricity consumption in the project

Values of monitored parameter $EG_{EC,y}$ ($=EC_{PJ,j,y}$) are shown in **table 5-6**.

Table 5-6. Monitored values of quantity of electricity consumed by the project electricity consumption source

Monitoring period		EG _{EC,y} =EC _{PJ,j,y} (MWh)		
		Monthly report	ETN Data	Data for Calculation
01/03/2021	31/03/2021	1.414	1.414	1.414
01/04/2021	30/04/2021	0.000	0.000	0.000
01/05/2021	31/05/2021	0.000	0.000	0.000
01/06/2021	30/06/2021	0.100	0.100	0.100
01/07/2021	31/07/2021	0.400	0.400	0.400
01/08/2021	31/08/2021	0.100	0.100	0.100
01/09/2021	30/09/2021	0.300	0.300	0.300
01/10/2021	31/10/2021	0.300	0.300	0.300
01/11/2021	30/11/2021	0.000	0.000	0.000
01/12/2021	31/12/2021	0.100	0.100	0.100
Subtotal 2021		2.714	2.714	2.714
01/01/2022	31/01/2022	0.000	0.000	0.000
01/02/2022	28/02/2022	0.100	0.100	0.100
01/03/2022	31/03/2022	0.300	0.300	0.300
01/04/2022	30/04/2022	6.300	6.300	6.300
Subtotal 2022		6.700	6.700	6.700

Total	9.414	9.414	9.414
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The calculation result of $PE_{EC,y}$ is as **table 5-7**.

Table 5-7 Calculation of $PE_{EC,y}$

Monitoring period	$EC_{PJ,j,y}$	$EF_{EL,j,y}(EF_{grid,CM,y})$	$TDL_{j,y}$	$PE_{EC,y}$	PE_y
	MWh	tCO ₂ /MWh	%	tCO ₂	tCO ₂
01-Mar-2021~31-Dec-2021	2.714	0.6063	20	2	2
01-Jan-2022~30-Apr-2022	6.700	0.6063	20	5	5
Total	9.414				7

5.3 Leakage

No leakage effects are accounted for under this methodology.

5.4 Net GHG Emission Reductions and Removals

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
01-Mar-2021~31-Dec-2021	209,296	2	0	209,294
01-Jan-2022~30-Apr-2022	56,195	5	0	56,190
Total	265,491	7	0	265,484

Comparison of actual emission reductions with estimates during validation:

The actual emission reductions 265,484 tCO₂e achieved in this monitoring period is 11.06%¹⁰ higher than the estimated emission reductions 239,051 tCO₂e¹¹ which is calculated in line with the PD. The main reason is because GWP_{CH₄} is changed from 25 tCO₂e/tCH₄ to 28 tCO₂e/tCH₄. When 25 tCO₂e/tCH₄ is applied in this monitoring period, the emission reductions will be 240,236 tCO₂e, 0.5%¹² higher than that estimated in the registered VCS PD, which is in normal fluctuation.

Please see the table below to check details.

Table 5-5: Comparison of emission reductions using different GWP_{CH₄} values

	BE _{CH₄,y} (t CO ₂ e)	BE _{EC,y} (t CO ₂ e)	BE _y (t CO ₂ e)	PE _y (tCO ₂ e)	ER _y (tCO ₂ e)
Calculation using GWP _{CH₄} =28	235,650	29,841	265,491	7	265,484
Calculation using GWP _{CH₄} =25	210,402	29,841	240,243	7	240,236

APPENDIX X: <TITLE OF APPENDIX>

Evidence for SDG Target 7.2 and 13.0: Please refer to verified Monitoring report for the reporting period and validated Project Description: <https://registry.terra.org/app/projectDetail/VCS/2358> ;

Evidence for SDG Target 8.5: The payment record of corporate social insurance of the project proponent, have been submitted as a separate document to VVB due to confidentiality requirement of the project proponent.

¹⁰ $(265,484 - 239,051) / 239,051 \text{ tCO}_2\text{e} = 11.06\%$

¹¹ As per the PD, the annual emission reduction in 2021 and 2022 is respectively 209,723 tCO₂e and 192,321 tCO₂e, and it covers 306 days from 01-Mar-2021 to 31-Dec-2021, 120 days from 01-Jan-2022 to 30-Apr-2022, thus the estimated emission reduction in the monitoring period is 239,051 tCO₂e, ie. $239,051 \text{ tCO}_2\text{e} = 209,723 \text{ tCO}_2\text{e} / 365 * 306 + 192,321 \text{ tCO}_2\text{e} / 365 \text{ days} * 120$.

¹² $(240,236 - 239,051) / 239,051 \text{ tCO}_2\text{e} = 0.50\%$