



NANNING LANDFILL GAS POWER GENERATION PROJECT



Document Prepared by Swiss Carbon Value Ltd.

Contact Information s.yang@southpole.com

Project Title	Nanning Landfill Gas Power Generation Project
Version	Version 02
Report ID	-
Date of Issue	18-10-2023
Project ID	2464
Monitoring Period	01-10-2022 to 30-06-2023 (first and last days included)
Prepared By	Swiss Carbon Value Ltd.
Contact	Technoparkstrasse 1, 8005 Zurich, Switzerland, +41 43 501 35 50, s.yang@southpole.com , www.southpole.com

CONTENTS

1	PROJECT DETAILS.....	3
1.1	Summary Description of the Implementation Status of the Project.....	3
1.2	Sectoral Scope and Project Type	4
1.3	Project Proponent	4
1.4	Other Entities Involved in the Project	4
1.5	Project Start Date	4
1.6	Project Crediting Period	5
1.7	Project Location	5
1.8	Title and Reference of Methodology	6
1.9	Participation under other GHG Programs.....	6
1.10	Other Forms of Credit and Supply Chain (Scope 3) Emissions	6
1.11	Sustainable Development Contributions	7
2	SAFEGUARDS	10
2.1	No Net Harm.....	10
2.2	Local Stakeholder Consultation	10
2.3	AFOLU-Specific Safeguards	11
3	IMPLEMENTATION STATUS	11
3.1	Implementation Status of the Project Activity	11
3.2	Deviations	13
3.3	Grouped Projects.....	13
4	DATA AND PARAMETERS.....	13
4.1	Data and Parameters Available at Validation	13
4.2	Data and Parameters Monitored	17
4.3	Monitoring Plan	26
5	QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS.....	31
5.1	Baseline Emissions.....	31
5.2	Project Emissions.....	33
5.3	Leakage	34
5.4	Net GHG Emission Reductions and Removals.....	34
	APPENDIX: THE EMPLOYEE ROSTER.....	36

1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

Nanning Landfill Gas Power Generation Project (hereafter referred to as the project) is located at Pingli Landfill Site in Xingning District, Nanning City, Guangxi Zhuang Autonomous Region, P.R China. The Project is owned by Guangxi Ruirong 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. The electricity is supplied to the South China Power Grid (SCPG) to replace the electricity generated from coal-fired power plants of SCPG.

The purpose of the project is to utilize landfill gas (LFG) from the Pingli Landfill site, which consists mainly of methane, for electricity generation. The landfill handles an average of 1,135 tonnes MSW per day which is mainly from Nanning City. The project includes LFG collection system, LFG pre-treatment system, electricity generation system and flare system. LFG collected is used for electricity generation with internal combustion generators. Meanwhile, the flare is only involved when the electricity generation system is not in operation, hence, the project developer determined that VERs from flare are not claimed. VERs are only claimed from the methane destroyed by power generation system and the power displacement. The feed-in electricity is estimated to be 365,083 MWh during the fixed 10 years crediting period. The expected average annual emission reductions are 231,811 tCO₂e during the fixed 10 years crediting period. The total estimated emission reductions over the whole crediting period of the project will be 2,318,113 tCO₂e.

The project started construction on 30/09/2019 and started operation on 03/04/2020. This monitoring period is from 01/10/2022 to 30/06/2023. The total installed capacity is 5.8MW, consisting of 6 sets of 0.966MW generator. For this monitoring period, the net electricity generated using LFG were 27,646.60 MWh, and the net electricity delivered to SCPG were 27,645.00 MWh, and the total GHG emission reduction was 174,990 tCO₂e.

Audit Type	Period	Program	VVB Name	Number of years
Validation	28-04-2021 (date when FVR was finished)	VCS	LGAI Technological Center, S.A. (Applus+ Certification)	/
Verification	03-04-2020 – 30-06-2021	VCS	LGAI Technological Center, S.A. (Applus+ Certification)	1.24
Verification	01-07-2021 – 31-12-2021	VCS	CTI Certification Co., Ltd.	0.50

Verification	01-01-2022 30-09-2022	–	VCS	CTI Certification Co., Ltd.	0.75
Verification	01-10-2022 30-06-2023	–	VCS	CTI Certification Co., Ltd.	0.75
Total	03-04-2020 30-06-2023	–	VCS	/	3.24

1.2 Sectoral Scope and Project Type

Sector scope 1: energy industries and sector scope 13: Waste handling and disposal.

The project is not a grouped project.

1.3 Project Proponent

Organization name	Guangxi Ruirong Energy Technology Co., Ltd.
Contact person	Ouyang Yuewen
Title	Carbon Management Department Manager
Address	Xingning District, Nanning City, Guangxi Zhuang Autonomous Region, China
Telephone	+86 17707313599
Email	ouyangyuewen@chinawaterind.com

1.4 Other Entities Involved in the Project

Organization name	Swiss Carbon Value Ltd.
Role in the Project	Project developer
Contact person	Renat Heuberger
Title	CEO
Address	Technoparkstr. 1, 8005, Switzerland.
Telephone	+41 43 501 35 50
Email	registration@southpolecarbon.com

1.5 Project Start Date

03/04/2020, the commissioning start date

1.6 Project Crediting Period

This project adopts the fixed crediting period of 10 years, from 03/04/2020 to 02/04/2030 (the start and end dates included).

1.7 Project Location

The project is located at Pingli landfill site in Xingning District, Nanning City, Guangxi Zhuang Autonomous Region, P.R China. The geographical location of the project site is shown in Figure 1. The central coordinates of the project location are longitude of 108°38'11" E and latitude of 23°00'43" N.



Figure 1 The location of the project

1.8 Title and Reference of Methodology

ACM0001 Large-scale Consolidated Methodology: Flaring or use of landfill gas, Version 19.0

The methodology also refers to:

Emissions from solid waste disposal sites, Version 08.0;

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

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

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

Positive lists of technologies, Version 02.0.

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

<https://cdm.unfccc.int/methodologies/DB/JPYB4DYQUXQPZLBDVPHA87479EMY9MA>Applicability of Methodology

1.9 Participation under other GHG Programs

The project has not been registered or is seeking registration under any 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 certificates.

The project is an LFG power generation project. Its GHG emission reductions come from avoiding CO₂ emissions from those fossil fuel-based power plants connected to the grid and avoiding GHG emissions from releasing LFG into atmosphere at the landfill site. The GHG emission reductions don't occur in a supply chain, and thus the Supply Chain (Scope 3) Emissions are not applicable.

1.11 Sustainable Development Contributions

The project provides many benefits that helps achieve China's Sustainable Development Goals (SDG)¹, a set of 17 universal goals covering the thematic areas of environmental, economic and social development.



The project contributes to achieving sustainable development in following ways:

- Provide clean energy. The project makes use of landfill gas to generate electricity and supplies clean electricity to SCPG, which is dominated by fossil fuel fired electricity. During this monitoring period, 27,645.00 MWh of net electricity was delivered to SCPG. This helps diversify power structure of the SCPG and reduce the dependence on exhaustible fossil fuels for power generation. This contributes to one of the China's actions for promoting the sustainable developing, "By 2030, increase the share of non-fossil fuels in primary energy consumption to about 20 percent"; (SDG 7)
- Provide decent work. The project creates 12 employment opportunities related to the management, operation and maintenance of the power plant, which meets one of the China's action plans "Increase labor force participation rate through implementation of the classification policy. Vigorously enforce the Law on Promotion of Employment." (SDG 8)
- Reduce GHG emissions. The project utilizes and destroys landfill gas that would otherwise be released directly into the atmosphere, effectively reducing GHG emissions and air pollution. That means not only the project reduces GHG emissions to local environment, but also provide an environmentally sound solution to minimize explosion risks and odour at the landfill site, which improves the environment around landfills. During this monitoring period, the total GHG emission reduction was 174,990 tCO₂e. This contributes to achieving one of China's stated sustainable development priorities

¹ https://www.fmprc.gov.cn/mfa_eng/zxxx_662805/W020161014332600482185.pdf

“Actively adapt to climate change and strengthen resistance capacity to climate risks in agriculture, forestry, water resources and other key fields, as well as cities, coastal regions and ecologically vulnerable areas”; (SDG 13)

The project’s quantifiable contributions to specific targets and indicators of the Sustainable Development Goals (SDGs) for the monitoring period have been provided in table 1 below.

For SDG 8 contribution, the employee roster as evidence has been provided as appendix to this report. For SDG 7 and 13, please refer to this monitoring report and previous approved verification report² for data source.

² <https://registry.verra.org/app/projectDetail/VCS/2464>

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, 27,645.00 MWh of renewable electricity was delivered to SCPG.	From the operation start date of the project to the end of this monitoring period, 116,557.02 ³ MWh of renewable electricity was delivered to SCPG.
2)	8.5	Number of jobs created	Implemented activities to increase	No further changes this monitoring period	The project creates 12 long-term employment opportunities.
3)	13.0	Tonnes of greenhouse gas emissions avoided or removed	Implemented activities to increase	During this monitoring period, the total GHG emission reduction was 174,990 tCO ₂ e.	From the operation start date of the project to the end of this monitoring period, the total GHG emission reduction was 749,204 ⁴ tCO ₂ e.

³ 36,077.41+21682.20+31,152.41+27,645.00 = 116,557.02

⁴ 246,932+127,862+199,420+174,990 = 749,204

2 SAFEGUARDS

2.1 No Net Harm

The Environmental Impact Assessment (EIA) Report for the project was compiled by Guangxi Bohuan Environmental Consultancy Service Co., Ltd. The EIA Report for the project has been approved by Nanning City Xingning District Environmental Protection Bureau on 21/05/2019. According to the approval comments of the EIA Report by Nanning City Xingning District Environmental Protection Bureau, the environmental impacts likely to be caused by the project are considered insignificant and conforming to the laws and regulations. At the same time, the implementation of the project will improve local socio-economic development through creating employment opportunities. Therefore, there is no net harm.

2.2 Local Stakeholder Consultation

The project owner held a local stakeholder consultation meeting on 15/05/2020 in the company office. Before the stakeholder consultation meeting, the project description summary with the project owner contact information and the stakeholder meeting notice were published on the bulletins at the project site and village committee offices nearby on 15/04/2020. The local stakeholders were invited to get to know their opinions and/or suggestions about the implementation of the project and the design of the project.

During the meeting, the project owner first explained the purpose and procedure of the meeting and made a brief introduction of the project to the attendees. Then, a survey was carried out on the local residents to get their comments. The survey was conducted through distributing and collecting responses to questionnaires which include a brief summary description of the project above the questions box, describing the project design and key information in text to local stakeholders. In total 30 out of 30 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 no negative comments have been received.

During the meeting, the project information and the continuous input / grievance mechanism have been introduced to the local stakeholders. The project information with contact information has also been posted on the bulletins at the project site and nearby, which states that there is a grievance book at the project site, and everyone is welcome to give comments. The continuous input / grievance mechanism is as below.

Table 2 Continuous input / grievance mechanism

	Method Chosen (include all known details e.g. location of book, phone number)	Justification
Continuous Input / Grievance Expression Process Book	A grievance book is put at the project site.	The grievance book is kept at the project owner office. Anyone can go there to record their grievance or comment in the book. The project owner personnel will review and respond to the comments and record the response in the book as well.
Telephone access	+86 17707313599	Mr. Ouyang Yuewen, Guangxi Ruirong Energy Technology Co., Ltd.
	+10 59070872	Ms. Sui Yang, Swiss Carbon Value Ltd.
Email access	ouyangyuewen@chinawaterind.com	Mr. Ouyang Yuewen, Guangxi Ruirong Energy Technology Co., Ltd.
	s.yang@southpole.com	Ms. Sui Yang, Swiss Carbon Value Ltd.

During this monitoring period, there were no negative comments received for the project.

2.3 AFOLU-Specific Safeguards

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

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

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

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 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:

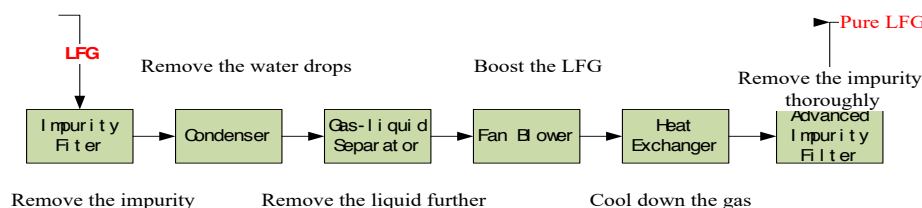


Figure 2 The flow chart of the LFG pre-treatment system

Power generation and grid connection system

A power plant is installed in order to generate electricity with the LFG captured. It adopts internal combustion engine generating sets. 6 sets with each capacity of 0.966MW have been installed for power generation. The electricity generated using LFG, except small portion for on-site usage, is exported to SCPG.

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 Key technical parameters of internal combustion engine generating set

Type	Gas-fired Engine and generator
Manufacturer	Jenbacher
Model	J320 GS
Rated Voltage	400 V
Rated capacity	966kW
Lifetime	15 years

Flaring system

The landfill gas would be sent to be burnt 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.

The project operates smoothly during this monitoring period. The net electricity export is 27,645.00 MWh. The operation time of each generator in this monitoring period is 6,345 h (generator 1#), 5,563 h (generator 2#), 4,481 h (generator 3#), 6,235 h (generator 4#), 5,904 h (generator 5#), 4,759 h (generator 6#).

3.2 Deviations

3.2.1 Methodology Deviations

There is no methodology deviation applied during this monitoring period.

3.2.2 Project Description Deviations

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

3.3 Grouped Projects

The project is not a grouped 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 activity ($BE_{CH_4,SWDS,y}$) is used for ex-ante estimation of relevant parameter $F_{CH_4,PJ,y}$. For $F_{CH_4,PJ,y}$, there is an ex post determination method. Thus, in this monitoring period, $BE_{CH_4,SWDS,y}$ and the relevant basic parameters (ϕ_y , OX, F, DOC_i , MCF_y , k_j , $W_{j,x}$, DOC_j , η_{PJ}) for calculation of $BE_{CH_4,SWDS,y}$ 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	Based on an extensive review of published literature on this subject, including the IPCC 2006 Guidelines for National Greenhouse Gas Inventories
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 ₂ e/tCH ₄
Description	Global warming potential of CH ₄
Source of data	IPCC Fifth Assessment Report (AR5)
Value applied	28
Justification of choice of data or description of measurement methods and procedures applied	-
Purpose of Data	Calculation of baseline emissions
Comments	Updated according to VCS Standard_v4.4

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	2019 Baseline Emission Factors for Regional Power Grids in China
Value applied	0.8042
Justification of choice of data or description of measurement methods and procedures applied	Official publication data from the Chinese DNA
Purpose of Data	Calculation of baseline emissions Calculation of project emissions
Comments	-

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	2019 Baseline Emission Factors for Regional Power Grids in China

Value applied	0.2135
Justification of choice of data or description of measurement methods and procedures applied	Official publication data from the Chinese DNA
Purpose of Data	Calculation of baseline emissions Calculation of project emissions
Comments	-

Data / Parameter	$EF_{grid,CM,y}$
Data unit	t CO ₂ /MWh
Description	Combined margin CO ₂ emission factor in year y
Source of data	Calculated following the "Tool to calculate the emission factor for an electricity system"
Value applied	0.50885
Justification of choice of data or description of measurement methods and procedures applied	Calculated following the "Tool to calculate the emission factor for an electricity system"
Purpose of Data	Calculation of baseline emissions Calculation of project emissions
Comments	-

Data / Parameter	R_u
Data unit	Pa.m ³ /kmol.K
Description	Universal ideal gases constant
Source of data	Value from "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 i
Source of data	Value from "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	Value from "Tool to determine the mass flow of a greenhouse gas in a gaseous stream"
Value applied	101,325
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	Value from "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	-

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	There is no change in the management of the SWDS after the implementation of the project activity.
Frequency of monitoring/recording	Annually
Value monitored	-
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of data	Calculation of baseline emissions
Calculation method	-
Comments	-

Data / Parameter	$Op_{j,h}$
Data unit	-
Description	Operation of the electricity generators that consume the LFG
Source of data	Project participants
Description of measurement methods and procedures to be applied	Products generated. $Op_{j,h}=0$ when: No products are generated in the hour h. Otherwise, $Op_{j,h}=1$
Frequency of monitoring/recording	Hourly
Value monitored	In this monitoring period, the operation hours of each generator are as follows: 6,345 h (generator 1#), 5,563 h (generator 2#), 4,481 h (generator 3#), 6,235 h (generator 4#), 5,904 h (generator 5#), 4,759 h (generator 6#)
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of 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	Monitor net electricity generation by the project activity using LFG

and procedures to be applied					
Frequency of monitoring/recording	Continuous measurement and monthly recording				
Value monitored	01/10/2022-31/12/2022: 10,715.06 01/01/2023-30/06/2023: 16,931.53				
Monitoring equipment	Bi-directional electricity meters at the transformer substation located at the project site				
	Model	Serial number	Accuracy class	Date of calibration	Validity
	DSSD718 (Main)	001700006603	0.5S	14/03/2022	13/03/2023
				13/03/2023	12/03/2024
	DSSD718 (Backup)	001700007636	0.5S	14/03/2022	13/03/2023
13/03/2023				12/03/2024	
QA/QC procedures to be applied	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	-				
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	TDL _{k,y}
Data unit	-
Description	Average technical transmission and distribution losses for providing electricity to source k in year y
Source of data	Default value from methodological tool "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation"
Description of measurement methods and procedures to be applied	-
Frequency of monitoring/recording	Annually
Value monitored	3%
Monitoring equipment	-
QA/QC procedures to be applied	The value will be updated as per latest version tool.
Purpose of data	Calculation of baseline emissions
Calculation method	-
Comments	-

Data / Parameter	EC _{PJ,y}
Data unit	MWh
Description	Amount of electricity consumed by the project activity in year y
Source of data	Electricity meter
Description of measurement methods and procedures to be applied	Sources of consumption include electricity consumed for the operation of the LFG capture system, for any processing and upgrading of the LFG, for transportation of the LFG to the flare or power generators, etc.
Frequency of monitoring/recording	Continuous measurement and monthly recording

Value monitored	01/10/2022-31/12/2022: 0.20 01/01/2023-30/06/2023: 1.40				
Monitoring equipment	Bi-directional electricity meters at the transformer substation located at the project site				
	Model	Serial number	Accuracy class	Date of calibration	Validity
	DSSD718 (Main)	001700006603	0.5S	14/03/2022	13/03/2023
				13/03/2023	12/03/2024
	DSSD718 (Backup)	001700007636	0.5S	14/03/2022	13/03/2023
13/03/2023				12/03/2024	
QA/QC procedures to be applied	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 project emissions				
Calculation method	-				
Comments	This parameter is required for calculating project emissions from electricity consumption due to an alternative waste treatment process (PE _{EC,y}) using the methodological tool "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation"				
Data / Parameter	TDL _{j,y}				
Data unit	-				

Description	Average technical transmission and distribution losses for providing electricity to source j in year y
Source of data	Default value from methodological tool "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation"
Description of measurement methods and procedures to be applied	-
Frequency of monitoring/recording	Annually
Value monitored	20%
Monitoring equipment	-
QA/QC procedures to be applied	The value will be updated as per latest version tool.
Purpose of data	Calculation of project 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 from SWDS
Description of measurement methods and procedures to be applied	-
Frequency of monitoring/recording	For application A: Once for the crediting period
Value monitored	0
Monitoring equipment	-

QA/QC procedures to be applied	-
Purpose of data	Calculation of baseline emissions
Calculation method	-
Comments	-

Data / Parameter	$V_{i,t,wb}$				
Data unit	m ³ gas i/m ³ wet gas				
Description	Volumetric fraction of greenhouse gas i in the gaseous stream in time interval t on a wet basis				
Source of data	Gas analyzer				
Description of measurement methods and procedures to be applied	Continuous in-situ analyzer				
Frequency of monitoring/recording	Continuous measurement and hourly recording				
Value monitored	46.86% (hourly average for this monitoring period)				
Monitoring equipment	Gas analyzer				
	Model	Serial number	Accuracy class	Date of calibration	Validity
	GTR 196	63523/5	2%	28/01/2022	27/01/2023
				20/01/2023	19/01/2024
QA/QC procedures to be applied	The calibration includes zero verification with an inert gas (N ₂) and one reading verification with a standard gas (calibration gas). All calibration gases have a certificate provided by the manufacturer and are under their validity period.				
Purpose of data	Calculation of baseline emissions				
Calculation method	-				
Comments	-				

Data / Parameter	$V_{t,wb}$
------------------	------------

Data unit	m³ wet gas/h				
Description	Volumetric flow of the gaseous stream in time interval t on a wet basis				
Source of data	Flow meter				
Description of measurement methods and procedures to be applied	Volumetric flow measurement should always refer to the actual pressure and temperature. Instruments with recordable electronic signal (analogical or digital) are required.				
Frequency of monitoring/recording	Continuous measurement and hourly recording				
Value monitored	2,886.65 (hourly average for this monitoring period at normal conditions)				
Monitoring equipment	Flow meter				
	Model	Serial number	Accuracy class	Date of calibration	Validity
	KZV	19122401	0.5%	07/12/2021	06/12/2022
				06/12/2022	05/12/2023
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 and frequency of calibration is according to manufacturer’s specifications.				
Purpose of data	Calculation of baseline emissions				
Calculation method	-				
Comments	For the project, $V_{t,wb}$ is automatically converted to $V_{t,wb,n}$ at normal conditions during the monitoring process, therefore, T_t and P_t are not included as separate parameters according to the registered Project Description. The monitoring equipment for T_t and P_t , temperature transducer and pressure transducer with recordable electronic signal, are calibrated periodically according to relevant national standards and regulations.				
	Temperature transducer				
	Model	Serial number	Accuracy class	Date of calibration	Validity
	KZW/P-240E	19120776	0.2	07/12/2021	06/12/2022
06/12/2022				05/12/2023	

	Pressure transducer				
	Model	Serial number	Accuracy class	Date of calibration	Validity
	KZY-KB-P	19120342	0.25	09/09/2022	08/10/2022
				09/10/2022	08/11/2022
				09/11/2022	08/12/2022
				09/12/2022	08/01/2023
				09/01/2023	08/02/2023
				09/02/2023	08/03/2023
				09/03/2023	08/04/2023
				09/04/2023	08/05/2023
				09/05/2023	08/06/2023
				09/06/2023	08/07/2023

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
Value monitored	CAPEX: 61 million OPEX: 11.2 million
Monitoring equipment	-
QA/QC procedures to be applied	Audited by professional, independent financial auditors. The VVB should only verify that the data provided corresponds to the data from independent financial auditors

Purpose of data	-
Calculation method	-
Comments	The information provided for CAPEX indicates the investment made: (i) in the collection and flaring 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 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	CNY/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
Value monitored	0.4207
Monitoring equipment	-
QA/QC procedures to be applied	Audited by professional, independent financial auditors. The VVB should only verify that the data provided corresponds to the data from independent financial auditors
Purpose of 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

Operational and Management Structure

The operational and management structure of the project is summarized as below.

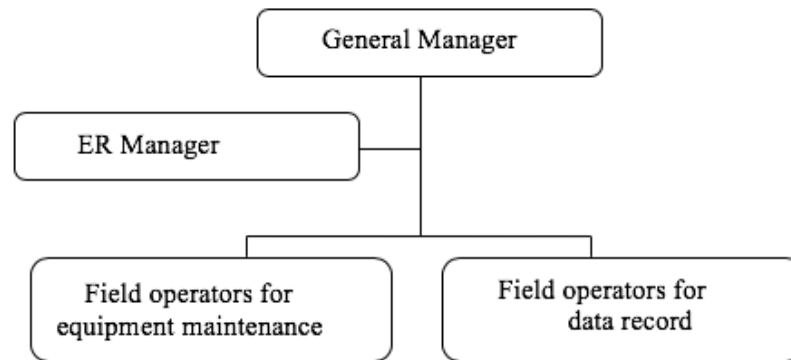


Figure 3 The management flow chart

The general manager of the power plant is the principal of the monitoring task, who sets out the responsibility of everyone in the monitoring system and establishing related documents. The principal should confirm that the staffs in the monitoring system have the ability to deal with the distributive tasks.

An ER Manager is appointed, specifically responsible for meter calibration, training, checking the daily operation, reporting and archiving. The ER 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 ER manager will inform the GM about the situation and work out relevant measures to be taken.

The ER manager is also responsible for aggregating the monitored data monthly and yearly, archiving and keeping data during the crediting period and two years after.

Field operators take turns to work in the control centre 24 hours a day. They are 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.

In addition, all the data will be reviewed by the project developer and VVB.

Monitoring Equipment and Data

The data sets relating to the monitoring parameters outlined in section 4.2. above are monitored and stored for the project. Installation and configuration of meters are shown as Figure 4. In order to ensure measurements with a low degree of uncertainty, the data metering equipment are calibrated and checked by an appropriately qualified third party according to an appropriate national standard. The calibration records are appropriately maintained and made available for review by VVB.

Monitoring equipment and data for the project are as below:

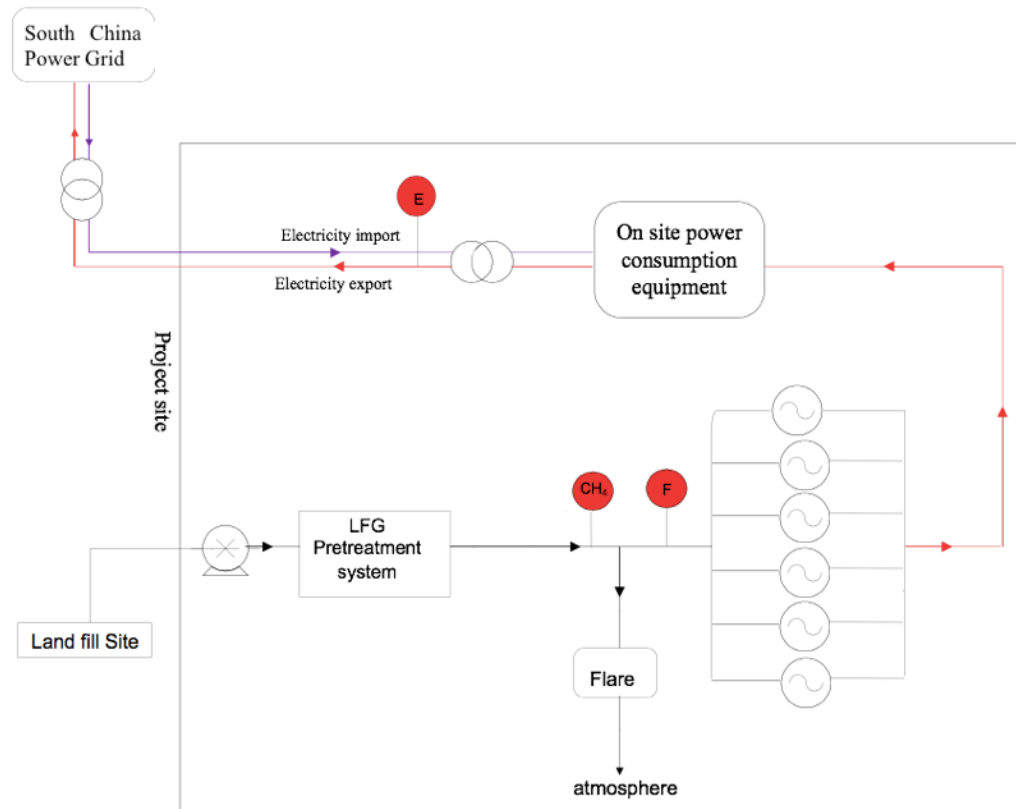


Figure 4 The monitoring flow chart

CH₄ - Gas analyzer to continuously measure methane fraction in LFG

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

E - Bi-directional electricity meters to continuously measure the net electricity exported to SCPG and electricity imported from SCPG (Main meter and Backup meter)

Flow of LFG fed to the Power Plant

The flow meter is installed at the LFG pipe inlet to gas engines to monitor the flow of landfill gas fed to the gas engines. The monitoring frequency should be Continuous. And the data are recorded and electronic archived once per one hour by computer automatically. The field operators check the data every day.

Methane fraction in the landfill gas

Install the Gas analyzer to monitor the concentration of CH₄. The Monitoring frequency should be Continuous. And the data are recorded and electronic archived once per one hour by computer automatically. The field operators check the data every day.

Net electricity exported to the grid

From the diagram above, the bi-directional electricity meters E include one main meter and one backup meter for monitoring the net amount of the electricity exported by project (EG_{PJ,y}).

E is installed by local grid company at the transformer substation located at the project site. E monitors the electricity exported to SCPG (after the voltage is increased in the transformer substation). 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.

Electricity imported from the grid

E is the bi-directional electricity meter, it could continuously measure the electricity imported from SCPG ($EC_{PJ,y}$) simultaneously, when the power plant is shut down and non-operation.

When the emergency occurred to the main meter, the measurement result of back-up meter will be used.

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.

For staffs involved in the project, necessary trainings are provided by the project owner. The training contents should be regard to the general and technical aspects of the project to the extent appropriate, as well as basic understandings of VCS Standard and climate change.

All the monitoring devices used (including flow meters, gas analyzer and electricity meter) are calibrated periodically according to relevant national standards and regulations. Flow meters, electricity meter and other critical project monitoring equipment are subject to regular maintenance and testing according to technical specifications from the manufactures to ensure accuracy and good performance. The calibration of meters, including the frequency of calibration, are done in accordance with national standards or requirements. The accuracy class of the meters are in accordance with the stipulation of the meter supplier and/or as per the requirements set by the grid operators or national requirements.

According to the Chinese national standard "Technical Management Code for Electricity Metering" (DL/T448-2020), the electricity meters were properly configured and checked by both the project owner and the grid company before the project is in operation.

And the calibration records are kept in the archives by the project owner and be kept at least for 2 years after the end of last the crediting period.

The ER Manager is appointed, specifically responsible for meter calibration, training, checking the daily operation, data recording and archiving. All data collected are recorded and regularly backed up. Internal audits are carried out to check compliance with operational procedures outlined in this monitoring plan. This internal audits also identify potential possible adjustments

for operational procedures to improve monitoring and reporting in future years. The ER 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 ER manager will inform the GM about the situation and work out relevant measures to be taken. In case such nonconformities are observed:

- An analysis of the nonconformity and its causes will be carried out immediately by the project owner, with the help of external experts if necessary.
- A corrective action plan should then be developed to eliminate the non-conformity and its causes to prevent its recurrence.
- Corrective actions are implemented and reported back to the ER Manager.
- Relative information will be included in the monitoring report and reported to VVB during the verification.

Data Management

- Specific staff are appointed by the project owner to take the overall responsibility for monitoring greenhouse gas 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 last the crediting period.
- Electronic data and documents are regularly copied and archived via hard disk and CD-ROM and will be kept at least two years after the end of the crediting period.
- Written data and documents, including electricity receipts for cross-checking, are copied and archived and will be kept at least two years after the end of the crediting period.

Procedure in case of failure

If during the data collection, one data exceeds the permissible range, or if an abnormal situation is detected, the ER manager should analyze the reason of the error as soon as possible and take action. The relevant errors and solutions should be archived and stored.

Once a meter (including flow meters, gas analyzer and electricity 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.

If the data record is missing or damaged during the monitoring periods, the following makeup process will be conducted:

- The general principle is that conservative value will be used for the missing or damaged data. This is most conservative approach. The monitoring personnel will be trained before the starting of the project operation to ensure that each team member is fully aware of and able to strictly

follow this conservative principle. During the monitoring process, the monitoring personnel will be required to strictly abide by the above conservative principle in data recording, i.e., use Conservative value for all the missing or damaged data.

-If this is due to the working error of the monitoring personnel, further train the person until he or she can perform the job properly. And in the meantime, use conservative value for the missing or damaged data;

-If this is due to the inability or attitude of a particular worker in monitoring team, dismiss such worker and re-hire those with proper ability and attitude. And in the meantime, use Conservative value for the missing or damaged data;

-If some data recorded are significantly higher than the normal range, the monitoring personnel should ask for the reason. If the measurement is high due to the damage of measurement equipment, Conservative value will be used for that day's data. And need to calibrate and maintain the measuring equipment immediately and avoid this situation in the future.

If the monitoring results are satisfactory in terms of correct reporting, data completeness and correct analysis, the data will be accepted for the monitoring report.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

The baseline emissions are calculated as follows:

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

Parameter	Description	01/10/2022-31/12/2022	01/01/2023-30/06/2023	Total	Unit
BE _y	Baseline emissions	67,110	107,882	174,992	tCO ₂ e
BE _{EC,y}	Baseline emissions associated with electricity generation	5,615	8,874	14,489	tCO ₂ e
BE _{CH4,y}	Baseline emissions of methane from the SWDS	61,495	99,008	160,503	tCO ₂ e

$$BE_{EC,y} = \sum_k EC_{BL,k,y} \times EF_{EL,k,y} \times (1 + TDL_{k,y}) \quad \text{Equation (2)}$$

Parameter	Description	01/10/2022-31/12/2022	01/01/2023-30/06/2023	Total	Unit
BE _{EC,y}	Baseline emissions associated with electricity generation	5,615	8,874	14,489	tCO ₂
EC _{BL,k,y}	Quantity of electricity that would be consumed by the baseline electricity consumption source k. In this project, the equivalent electricity is from SCPG.	10,715.06	16,931.53	27,646.60	MWh
EF _{EL,k,y}	Emission factor for electricity generation for source k (tCO ₂ /MWh). In this project, it is EF of SCPG. EF _{EL,k,y} =EF _{grid,CM,y}	0.50885	0.50885	0.50885	tCO ₂ /MWh
TDL _{k,y}	Average technical transmission and distribution losses for providing electricity to source k	3%	3%	3%	/

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

Parameter	Description	01/10/2022-31/12/2022	01/01/2023-30/06/2023	Total	Unit
BE _{CH₄,y}	Baseline emissions of methane from the SWDS	61,495	99,008	160,503	tCO ₂ e
OX _{top_layer}	Fraction of methane in the LFG that would be oxidized in the top layer of the SWDS in the baseline (dimensionless)	0.1	0.1	0.1	/
F _{CH₄,PJ,y}	Amount of methane in the LFG which is flared and/or used in the project activity	2,440	3,929	6,369	tCH ₄
F _{CH₄,BL,y}	Amount of methane in the LFG that would be flared in the baseline. No requirement in the baseline, therefore, it is 0.	0	0	0	tCH ₄

GWP _{CH4}	Global warming potential of CH ₄	28	28	28	tCO ₂ e/tCH ₄
--------------------	---	----	----	----	-------------------------------------

$$F_{CH4,PJ,y} = F_{CH4,EL,y}$$

Equation (4)

Parameter	Description	01/10/2022-31/12/2022	01/01/2023-30/06/2023	Total	Unit
F _{CH4,PJ,y}	Amount of methane in the LFG which is flared and/or used in the project activity	2,440	3,929	6,369	tCH ₄
F _{CH4,EL,y}	Amount of methane in the LFG which is used for electricity generation	2,440	3,929	6,369	tCH ₄

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

Equation (5)

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

Equation (6)

- $F_{i,t}$ = Mass flow of greenhouse gas i in the gaseous stream in time interval t (kg gas/h), calculated on an hourly basis
 $V_{t,wb,n}$ = Volumetric flow of the gaseous stream in time interval t on a wet basis at normal conditions (m³ wet gas/h)
 $v_{i,t,wb}$ = Volumetric fraction of greenhouse gas i in the gaseous stream in time interval t on a wet basis (m³ gas i/m³ wet gas)
 $\rho_{i,n}$ = Density of greenhouse gas i in the gaseous stream at normal conditions (kg gas i/m³ wet gas i)
 P_n = Absolute pressure at normal conditions (101,325 Pa)
 T_n = Temperature at normal conditions (273.15 K)
 MM_i = Molecular mass of greenhouse gas i (16.04 kg/kmol)
 R_u = Universal ideal gases constant (8,314 Pa.m³/kmol.K)

5.2 Project Emissions

Project emissions are calculated as follows:

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

Equation (7)

Parameter	Description	01/10/2022-31/12/2022	01/01/2023-30/06/2023	Total	Unit
PE _y	Project emissions	1	1	2	tCO ₂

$PE_{EC,y}$	Emissions from consumption of electricity due to the project activity	1	1	2	tCO ₂
-------------	---	---	---	---	------------------

$$PE_{EC,y} = \sum_j EC_{PJ,j,y} \times EF_{EL,j,y} \times (1 + TDL_{j,y}) \quad \text{Equation (8)}$$

Parameter	Description	01/10/2022-31/12/2022	01/01/2023-30/06/2023	Total	Unit
$PE_{EC,y}$	Emissions from consumption of electricity due to the project activity	1	1	2	tCO ₂
$EC_{PJ,j,y}$	Quantity of electricity consumed by the project electricity consumption source j	0.20	1.40	1.60	MWh
$EF_{EL,j,y}$	Emission factor for electricity generation for source j	0.50885	0.50885	0.50885	tCO ₂ /MWh
$TDL_{j,y}$	Average technical transmission and distribution losses for providing electricity to source j	20%	20%	20%	/

5.3 Leakage

According to ACM0001, no leakage effects need to be accounted.

5.4 Net GHG Emission Reductions and Removals

Emission reductions are calculated as follows:

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

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
------	---	--	--	--

Year 2022 (01-10-2022–31-12-2022)	67,110	1	0	67,109
Year 2023 (01-01-2023–30-06-2023)	107,882	1	0	107,881
Total	174,992	2	0	174,990

<u>Ex-ante emissions reductions/removals</u>	<u>Achieved emissions reductions/removals</u>	<u>Percent difference</u>	<u>Justification for the difference</u>
206,536 ⁵	174,990	-15.27%	The actual emission reductions of 174,990 tCO ₂ e achieved in this monitoring period is 15.27% lower than the estimated emission reductions of 206,536 tCO ₂ e in the registered PD, which is mainly due to the actual amount of CH ₄ generated from the waste is less than estimated.

⁵ The monitoring period covers from 01/10/2022 to 30/06/2023, with 92 days in year 2022, and 181 days in year 2023, and totally 273 days. Based on the registered VCS PD, the amount of estimated emission reductions for this monitoring period would be $268,582 \times 92/365 + 279,980 \times 181/365 = 206,536$ tCO₂e.

APPENDIX: THE EMPLOYEE ROSTER

广西睿荣能源科技有限公司在职员工花名册

序号	姓名	二级部门	职位
1	陈	综合部	总经理
2	陈	综合部	行政兼出纳
3	张	财务部	财务
4	莫	生产部	技术员
5	李	生产部	技术员
6	赵	生产部	技术员
7	方	生产部	维修组长
8	李	生产部	技术员
9	莫	生产部	技术员
10	韦	生产部	技术员
11	李	生产部	生产部长
12	韦	生产部	技术员