



GUIZHOU PANJIANG LOW CONCENTRATION COAL MINE METHANE POWER GENERATION PROJECT PHASE 3



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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	5
1.5	Project Start Date	5
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.....	7
1.10	Other Forms of Credit.....	7
1.11	Sustainable Development.....	7
2	SAFEGUARDS	8
2.3	AFOLU-Specific Safeguards	13
3	IMPLEMENTATION STATUS	14
3.1	Implementation Status of the Project Activity	14
3.2	Deviations	16
3.3	Grouped Projects	16
4	DATA AND PARAMETERS.....	16
4.1	Data and Parameters Available at Validation	16
4.2	Data and Parameters Monitored.....	19
4.3	Monitoring Plan.....	24
5	QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS	30
5.1	Baseline Emissions	30
5.2	Project Emissions	37
5.3	Leakage.....	40
5.4	Net GHG Emission Reductions and Removals.....	41

1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

Guizhou Panjiang Low Concentration Coal Mine Methane Power Generation Project Phase 3 (hereinafter referred to as the Project) utilizes the low concentration coal mine methane (CMM), that otherwise would be vented into the atmosphere directly, for power generation to supply electricity to the coal mines where the Project is located, replacing the electricity that would otherwise have been supplied by the China Southern Power Grid (CSPG) and the captive power plants. The waste heat from the generators is recovered by waste heat boilers to provide free hot water to the coal mines, which was provided by coal-fired boilers before the implementation of the Project. However, to be conservative, emission reductions for this part are not claimed.

The low concentration CMM is delivered through methane extraction pumps to pre-treatment system for safety treatment, and then goes into the gas engines for power generation. The Project includes three coalmines (Tucheng, Laowuji and Songhe) with five mining areas (Tucheng 13, Tucheng 14, Laowuji Nanyi, Songhe Cai'er, and Songhe Caisan) with total methane resource of 9.8 billion m³ and extractable resources of 3.5 billion m³. 38 CMM power generation units with total capacity of 22.8 MW are involved and 36.3 million m³ of methane is utilized by the project annually. The project is expected to achieve 589,187 tCO₂e of emission reduction annually.

The timeline of the project is shown below:

Start date of construction	15-March-2011
Start date of commissioning	26-May-2011
Registration date	06-December-2012
Start date of the crediting period	
VCS registration date	01-September-2020

The GHG emission reductions of 305,485 tCO₂ generated from 26-May-2011 to 05-December-2012 by the project has been issued as CCER used for Chinese allowance trading, while 1,680,035 tCO₂ in the period of 06-December-2012 to 25-February-2018 issued as CER under CDM program. And 553,049 tCO₂ have been issued for the first VCS monitoring period from 26-February-2018 to 25-December-2019 under VCS program.

This monitoring period covers the period from 26-December-2019 to 25-May-2021 (actually from 08:00 25-December-2019 to 24:00 25-May-2021¹, both days included). The actual emission reductions achieved in this monitoring period are 553,049 tCO₂e.

During this monitoring period, the power plant Laowuji Nanyi stopped operation during the entire monitoring period, and Songhe Cai'er stopped operation during the period of 26-December-2019 to 25-February-2021 as the concentration of CH₄ in CMM gas from the two power plants was below 6% since their stoppage and can't meet the demand of CMM generators. All the rest three power plants run continuously during this monitoring period. No events or situations, which may impact the applicability of the applied methodology, occurred during this monitoring period.

1.2 Sectoral Scope and Project Type

Sectoral Scope 01: Energy industries (renewable/non-renewable sources)

Sectoral Scope 08: Mining/mineral production²

The project is not a grouped project.

1.3 Project Proponent

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¹ This monitoring period starts from 08:00 of 25-December-2019 as last monitoring period (1st VCS) ended at 08:00 of 25 -December-2019. The emission reductions achieved from 08:00 to 24:00 of 25-December-2019 are claimed in this monitoring period. The crediting period ends at 24:00 of 25-May-2021, so the ending time of this monitoring period is 24:00 of 25-May-2021. The emission reductions achieved from 08:00 to 24:00 of 25-May-2021 are claimed in this monitoring period.

² The project was implemented to generate electricity using low concentration coal mine methane (CMM) from coal mine and replace the electricity which would otherwise be generated by grid connected power plants. Therefore, the sectoral scope is scope 08: Mining/mineral production as per the UNFCCC Standard "Applicability of sectoral scopes version 01.0". The scope is confirmed as correct and consistent with previous VCS verification report.

1.4 Other Entities Involved in the Project

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Role in the project	Consultancy
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1.5 Project Start Date

26-May-2011 (*operation start date*).

1.6 Project Crediting Period

The crediting period under CDM started on 06-December-2012 and expires on 05-December-2022 with 10 years fixed.

The crediting period under CCER started on 26-May-2011 and expires on 05-December-2012.

The VCS crediting period of the Project is from 26-May-2011 to 25-May-2021 (both days included) totally 10 years.

1.7 Project Location

The project is located in the Panjiang Mining District, Pan County, Liupanshui City, Guizhou Province, P.R. China. The geographic coordinates of the involved power stations are listed in the table below:

Coal mine	Power station	Decimal Longitude	Decimal Latitude
Tucheng	Tucheng 13	104.5466E	26.0644N
	Tucheng 14	104.5667E	26.0593N
Laowuji	Nanyi	104.4908E	25.8661N
Songhe	Cai'er	104.6421E	25.0321N
	Caisan	104.6404E	25.0335N

The geographic locations of the involved coal mines are shown in Figure 1-1.



Figure 1-1 Location of the project

1.8 Title and Reference of Methodology

The applied baseline and monitoring methodology for the project:

ACM0008 "Consolidated methodology for coal bed methane, coal mine methane and ventilation air methane capture and use for power (electrical or motive) and heat and/or destruction through flaring or flameless oxidation"(version 07),

<http://cdm.unfccc.int/methodologies/DB/YSD3FQ5WR3VPC9Q64CDTLXHLFVKKKU>

Tools applied for the project:

"Tool to calculate the emission factor for an electricity system" (version 02.2.1),

<http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.2.1.pdf>

1.9 Participation under other GHG Programs

The project has been registered as a CDM project in UNFCCC on 06-December-2012 (UNFCCC Ref. 6957). The crediting period started on 06-December-2012 and expires on 05-December-2022. Please refer to the following link for details: <https://cdm.unfccc.int/Projects/DB/RINA1344516913.29/view>

The project has been registered as a CCER project on 26-May-2014 (Ref. 012). The crediting period started on 26-May-2011 and expires on 05-December-2012. Please refer to the following link for details:

<http://cdm.ccchina.org.cn/zybDetail.aspx?Id=26>

The GHG emission reductions of 305,485 tCO₂ generated from 26-May-2011 to 05-December-2012 by the project has been issued as CCER used for Chinese allowance trading, while 1,680,035 tCO₂ in the period of 06-December-2012 to 25-February-2018 issued as CER under CDM program. And 553,049 tCO₂ have been issued for the first VCS monitoring period from 26-February-2018 to 25-December-2019 under VCS program.

Except for CDM and CCER, the project did not register under any other GHG program.

1.10 Other Forms of Credit

The GHG emission reductions generated by the project from 26-December-2019 to 25-May-2021 will not be used for compliance with emission trading programs or to meet binding limits on GHG emissions.

All credits from 26-December-2019 to 25-May-2021 will be claimed under VCS program as VCUs for the project to avoid double counting.

The project hasn't sought or received another form of environmental credits.

1.11 Sustainable Development

The Project will contribute to sustainable development in the following ways:

- SDG 8.3 Create job opportunities by implementation of the project

Provided 23 employment positions for local villagers. No further changes in this reporting period.

- SDG 11.6 Annual mean levels of fine particulate matter (e.g. PM_{2.5} and PM₁₀) in cities (population weighted)

As known, fossil fuel consumption is a significant source of PM_{2.5} and PM₁₀ emission in the cities. Since the project reduces the use of fossil fuels, PM_{2.5} and PM₁₀ formation will be reduced accordingly;

- SDG 13.0 Tonnes of greenhouse gas emissions avoided or removed

The project achieved a GHG emission reduction of 553,049 tCO₂e during the reporting period;

2 SAFEGUARDS

2.1 No Net Harm

The Environmental Impact Assessment (EIA) of the project has been approved by Guizhou Province Environmental Protection Bureau on 26-December-2011. According to the approval comments of the EIA Report by the Guizhou Province Environmental Protection Bureau, the environmental impacts likely to be caused by the project are analyzed. The environmental impacts of the project in construction period and in operation period are summarized as follows.

1. Construction Phase

1.1 Air pollution

The major air pollutants during construction are dust, tail gas emitted by transport vehicles and construction machinery, and smoke emitted by coal combustion for cooking. The construction site is enclosed to prevent the spread of dust. The storage of sand and cement has been planned to minimize the air pollution caused by transportation. During the processes of surface digging, concrete mixing and vehicle transportation, water is sprayed within the project construction area and along the project construction roads to settle dust. Smoke abatement equipment has been installed to minimize tail gas from construction machinery. Therefore, the ambient air of the project construction area is ensured to satisfy Level 2 standard of “Ambient air quality standard” (GB3095-1996).

1.2 Wastewater

Wastewater in the construction period consists of construction wastewater, equipment washing wastewater and domestic wastewater, all prohibited to be discharged outwards. The wastewater generated in the construction processes is recycled for reuse in ground construction and dust settling. Domestic wastewater discharged from living activities of construction personnel is collected and treated by the sewage disposal plant of Panjiang Coal Mine. The surface water of the environmental evaluation area is ensured to satisfy Category III of “Environmental quality standards for surface water” (GB38382002), and the ground water is ensured to satisfy Category III of “Quality standards for ground water” (GB/T14848-93).

1.3 Noise

Noise in the construction period is mainly generated by construction machinery and transport vehicles. There are few noise sensitive points around the project construction area. To minimize

noise pollution, low-noise equipment is employed as much as possible and high-noise equipment is strictly prohibited to work during the night. Noise is controlled to satisfy “Noise limits for construction site” (GB12523-90).

1.4 Solid waste

Solid waste consists of construction waste and domestic trash, with little environmental impact. Construction waste is collected and transported to the coal-gangue wasteland of Panjiang Coal Mine for appropriate disposal. Domestic trash is collected and treated along with that of Panjiang Coal Mine according to the requirements of sanitation and hygiene department.

1.5 Impact on the ecosystem

The area of the construction site is not large, and the area does not contain protected species of plant or animal. To minimize water and soil loss, the construction site is strictly limited and enclosed, and construction period is planned to avoid being exposed to heavy rain and strong wind. The responsibility for water and soil conservation has been clarified, and construction management is strengthened accordingly. After the construction finishes, woods and bushes will be planted in time to ensure the minimum impact caused on the stability and completeness of the surrounding ecosystem.

2. Operation Phase

2.1 Air pollution

The air pollutants during operation are mainly from the tail gas emitted by waste heat boilers. H₂S concentration in CMM is extremely low, thus very little SO₂ will be emitted after the combustion in CMM generators. The low-concentration CMM generators are designed with low-nitrogen combustion technology to control the formation of NO₂. Therefore, the tail gas from CMM generators has little environmental impact, and complies with the standard requirements of Period IV of the regulation “Limits and measurement methods for exhaust pollutants from compression ignition and gas fuelled positive ignition engines of vehicles (III, IV, V)” (GB17691-2005).

2.2 Wastewater

Wastewater during operation consists of condensate water, equipment discharge, water and domestic wastewater. Condensate water and equipment discharge water contain no pollutant, thus discharged into the drainage ditch. Domestic wastewater is prohibited to be discharged outwards, but collected and then treated by the sewage disposal plant of Panjiang Coal Mine to satisfy Level 1 requirements of “Integrated Wastewater Discharge Standard” (GB8978-1996). The surface water of the environmental evaluation area is ensured to satisfy Category III of “Environmental quality standards for surface water” (GB3838-2002), and the ground water is ensured to satisfy Category III of “Quality standards for ground water” (GB/T14848-93).

2.3 Noise

Noise during operation is generated by the low-concentration CMM generators, waste heat boilers, circulating cooling tower and pumps. The plant buildings that contain machinery are all built from reinforced concrete, with soundproof materials installed inside, atop and at the openings. Mufflers and vibration damper bases have been designed for machinery. There are few noise sensitive points around the project site. To minimize noise pollution to the only one residential settlement near the project site, green belt with woods and bushes have been designed. Noise emission from the project operation complies with the standard requirements of Category 2 of “Emission standard for industrial enterprise noise at boundary” (GB12348-2008), and the environmental noise at the residential settlement satisfies Category 2 of “Environmental quality standard for noise” (GB3096-2008).

2.4 Solid waste

The project operation does not produce solid waste except domestic trash. Working personnel of the project live outside the project site. Their domestic trash is collected and treated together with that of Panjiang Coal Mine, according to the requirements of sanitation and hygiene department. In conclusion, the environmental impact during the project construction will be temporary and not significant, and the environmental impact during the project operation will be minor. The proposed project can reduce greenhouse gas emissions and environmental pollution caused by methane release and coal-fired power generation. The project owner takes appropriate measures to minimize adverse environmental impacts.

In this monitoring period, no negative environmental impacts are expected to result from the project activity. In fact, the implementation of the project turns harm into treasure and safeguard coal mine safety, save energy, fulfill reductions of greenhouse gas emission and protect the ecological environment.

Meanwhile, the implementation of the project improves local socio-economic development through creating career opportunities and paying taxes. Thus there are no negative environmental and/or socio-economic impacts due to the project.

2.2 Local Stakeholder Consultation

Local Stakeholder Consultation during the project preparation stage:

The Project owner collected comments by local stakeholders on the proposed project. The Project owner posted the announcement of the stakeholder meeting on the notice board of Pan County on 11-April-2011 informing the time and location of the stakeholder meeting, as well as the questionnaire distribution.

In general, local stakeholders are supportive of the project construction. The survey shows that a majority of local stakeholders think the Project will help improve the life of local people and promote local economic development without much adverse environmental impact. The survey shows that almost all of the stakeholders are supportive to the 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 were carried out from 26-December-2019 to 31-May-2021 at periodic intervals. Key implementation schedules or changes of the project was communicated to the local authority, who would inform the neighbourhood committee and the local residents, the comments and suggestions from residents were collected by the local authority meanwhile. And the local government agencies and competent authorities conduct spot checks on the implementation of the project from time to time, and give suggestions on the involved rectification problems. 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.

In this monitoring period, the project owner carried out questionnaire survey to collect the relevant comments and suggestions in May 2020. Survey questionnaires were distributed to relevant personnel of Panjiang Coal Mine, local villagers and government officials by the Project owner from 18-May-2020 and recollected by 22-May-2020. The survey questionnaire was designed to assess the project impacts on the local environment and social economic development. The structure of the survey respondents is listed in Table 2-1 below.

Table 2-1 Structure of stakeholders surveyed

Item		Distribution	Quantity	Percentage
Amount of stakeholders surveyed	Male		24	60.00%
	Female		16	40.00%
Age	<25		5	12.50%
	25-45		19	47.50%
	45-55		12	30.00%
	>55		4	10.00%
Education	Junior high school or below		24	60.00%
	Senior high school		10	25.00%
	College or above		6	15.00%

Occupation	Worker	10	25.00%
	Peasant	18	45.00%
	Management personnel	3	7.50%
	Civil servant	3	7.50%
	Unspecified	6	15.00%

Forty questionnaires were distributed to local stakeholders, and all questionnaires have been recollected. Comments from these questionnaires are summarized in Table 2-2 below:

Table 2-2 Summary of stakeholders' comments

No.	Questions	Attitude or Opinion	Amount	Percentage
1	Do you know about the project?	Quite much	31	77.50%
		Heard of	9	22.50%
		Nothing	0	0.00%
2	What is the most probable environmental impact do you think by the project? (multiple choice)	None	30	75.00%
		Air pollution	0	0.00%
		Water pollution	2	5.00%
		Noise pollution	3	7.50%
		Harm to indigenous animals and plants	0	0.00%
		No idea	5	12.50%
3	What influence do you think the project bring about to you and your family?	Positive	30	75.00%
		None	10	25.00%

			Negative	0	0.00%
4	Do you think the project operation would affect the production safety of the coal mine?		Positive effect	34	85.00%
			None	6	15.00%
			Negative effect	0	0.00%
5	What impact do you think the project would bring to local community? (multiple choice)	Employment	Increase	32	80.00%
			Decrease	0	0.00%
			No change	8	20.00%
		Economy	Rise	29	72.50%
			Fall	0	0.00%
			No change	11	27.50%

The survey shows that the Project is well known by local residents. All respondents know or hear about the Project. Seventy five percent of the respondents believe that the Project will not have any environmental impact, but there are a few respondents who show their concern about the potential noise pollution and water pollution caused by the Project. Then the Project Owner explained about this in the stakeholder meeting and brought up with corresponding approaches to minimize the impact of the Project on the environment.

Seventy five percent of the respondents recognize the positive impact of the Project on individuals and families. They think the Project will improve the local employment and increasing the residential income, thus greatly reducing family burden. No one thinks that the Project will have a negative impact on the local life. In the aspect of coal mine production safety, 15% of the respondents believe the Project will not have any impact on coal mine safety, and 85% of the respondents consider the Project improve the operational safety of the coal mines to some extent.

There are no negative comments received for the project.

2.3 AFOLU-Specific Safeguards

Not applicable since the project is 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 registered CDM PDD (version 05). All five power plants have started operation prior to the start date of this monitoring period. However, only six sets of CMM power generators (unit capacity: 600kW) have been installed in power plant Songhe cai'er while the registered PDD states that 10 sets of CMM power generator with unit capacity of 600kW are to be installed in power plant Songhe cai'er. This is because the CMM gas extracted from the coal mine can only meet the demand of six sets of CMM power generator. The rest four sets of CMM power generator will be installed in power plant Songhe cai'er when the CMM gas stream can meet the demand of 10 sets of CMM power generator in the future.

The commissioning date of the five power plants is listed in the table below.

Table 3-1 Commission date of the project

Power plant	Construction date	Commissioning date
Tucheng 14	15-March-2011	26-May-2011
Tucheng 13	10-April-2011	26-July-2011
Songhe Caisan	10-May-2011	18-January-2012
Laowuji nanyi	04-March-2013	24-July-2013
Songhe Cai'er	08-August-2013	18-January-2014

During this monitoring period, the power plant Laowuji Nanyi stopped operation during the entire monitoring period, and Songhe Cai'er stopped operation during the period of 26-December-2019 to 25-February-2021 as the concentration of CH₄ in CMM gas from the two power plants was below 6% since their stoppage and can't meet the demand of CMM generators. All the rest three power plants run continuously during this monitoring period. No events or situations, which may impact the applicability of the applied methodology, occurred during this monitoring period.

The technical process of the Project is shown in Figure 3-1. The low concentration CMM is delivered through methane extraction pumps to pre-treatment system for safety treatment, and then goes into the gas engines for power generation. The generated electricity is for internal coal mine consumption. The waste heat from the generators is recovered by the waste heat boilers and supplied to coal mines. Table 3-2, 3-3 shows the key technical specifications of CMM gas generators and waste heat boilers installed.

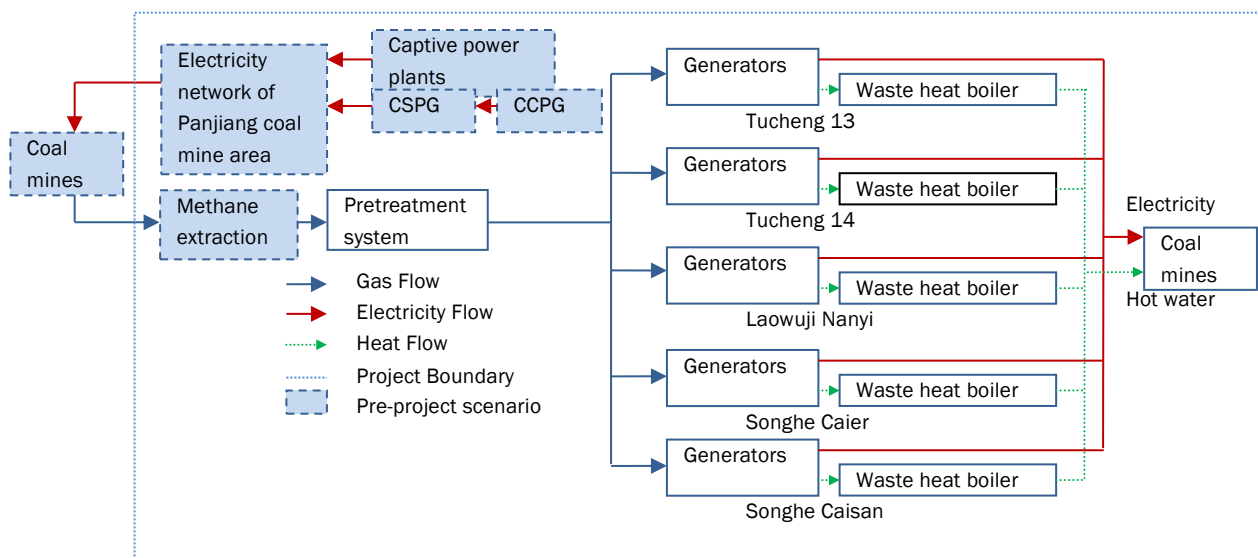


Figure 3-1 Diagram of the project boundary and flow

Table 3-2 Quantity & Capacity of power generators and waste heat boilers

Coal mine/mining area		Quantity	Capacity (kw)
Tucheng	Tucheng 13	8×600 (600GF ₁ -1RW _D)	4,800
	Tucheng 14	4×600 (600GJZ ₁ -1PWW _D)	2,400
Laowuji	Nanyi	4×600 (600GJZ ₁ -1PWW _D)	2,400
Songhe	Cai'er ³	6×600 (600GJZ ₁ -1PWW _D)	3,600
	Caisan	12×600 (600GF ₁ -1RW _D)	7,200
Total		34 installed (38 planned)	20,400 installed (22,800 planned)

Table 3-3 Specifications of generators installed

Type	600GJZ ₁ -1PWW _D	600GF ₁ -1RW _D
Supplier	Shangdong Oil Field Shengli Power Machinery Group CO. Ltd.	
Rated power (kw)	600	600
Continuous power (kW)	480	480
Rated current (A)	1,083	1,083
Rated voltage (V)	400	400
Rated speed (r/min)	1,000	1,000
Frequency (Hz)	50	50
Life time (year)	10	10

³ Only six sets of CMM power generator with unit capacity of 600kW have been installed in power plant songhe cai'er as the CMM gas extracted from the coal mine can only meet the demand of six sets of CMM power generator. The rest four sets of CMM power generator will be installed in power plant songhe cai'er when the CMM gas stream can meet the demand of 10 sets of CMM power generator in the future.

3.2 Deviations

2.3.1 Methodology Deviations

There is no methodology deviation applied to this monitoring period.

2.3.2 Project Description Deviations

There is no project description deviation applied to 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

Data / Parameter	$CMM_{BL,i,y}$
Data unit	tCH ₄
Description	Pre-mining CMM that would have been captured, sent to and destroyed by use <i>i</i> in the baseline scenario in year <i>y</i> .
Source of data	Data provided by the project owner
Value applied	0
Justification of choice of data or description of measurement methods and procedures applied	The captured CMM is released into the atmosphere unused under the baseline scenario. Hence, $CMM_{BL,i,y}$ is 0.
Purpose of Data	Baseline emission calculation
Comments	-

Data / Parameter	$PMM_{BL,i,y}$
Data unit	tCH ₄
Description	Post-mining CMM that would have been captured, sent to and destroyed by use <i>i</i> in the baseline scenario in year <i>y</i> .
Source of data	Data provided by the project owner
Value applied	0
Justification of choice of data or description of	The captured PMM is released into the atmosphere unused under the baseline scenario. Hence, $PMM_{BL,i,y}$ is 0.

measurement methods and procedures applied	
Purpose of Data	Baseline emission calculation
Comments	-

Data / Parameter	Eff _{ELEC}
Data unit	%
Description	Efficiency of methane destruction in power plant
Source of data	ACM0008 (Version 07)
Value applied	99.5
Justification of choice of data or description of measurement methods and procedures applied	IPCC reference
Purpose of Data	Project emission calculation
Comments	-

Data / Parameter	CEF _{CH4}
Data unit	tCO ₂ e/ tCH ₄
Description	Carbon emission factor for combusted methane
Source of data	ACM0008 (Version 07)
Value applied	2.75
Justification of choice of data or description of measurement methods and procedures applied	ACM0008 (Version 07) default value
Purpose of Data	Baseline emission calculation
Comments	44/16 = 2.75tCO ₂ e/tCH ₄

Data / Parameter	D _{CH4}
Data unit	kg/m ³
Description	Density of methane under normal conditions of temperature and pressure
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied	0.67

Justification of choice of data or description of measurement methods and procedures applied	IPCC reference
Purpose of Data	Baseline emission and project emission calculation
Comments	Applies at atmospheric pressure and 20 °C

Data / Parameter	GWP _{CH4}
Data unit	tCO ₂ e/ tCH ₄
Description	Global warming potential of methane
Source of data	IPCC Fifth Assessment Report: Climate Change 2013 (AR5) ⁴
Value applied	28
Justification of choice of data or description of measurement methods and procedures applied	IPCC Fifth Assessment Report: Climate Change 2013 (AR5)
Purpose of Data	Baseline emission and project emission calculation
Comments	-

Data / Parameter	EF _{ELEC}
Data unit	tCO ₂ /MWh
Description	CO ₂ emission factor of the grid (CSPG)
Source of data	DNA of China
Value applied	0.6323
Justification of choice of data or description of measurement methods and procedures applied	Calculated as per “Tool to calculate the emission factor for an electricity system”
Purpose of Data	Baseline emission calculation
Comments	-

⁴ As per Section 3.14.4 of VCS Standard 4.1, for GHG emission reductions occurring on or after 1 January 2021, all ex-ante estimates and ex-post calculations shall be converted to CO₂e using GWP values from the IPCC Fifth Assessment Report (AR5). For GHG emission reductions occurring on or before 31 December 2020, all ex-ante estimates and ex-post calculations may be converted to CO₂e using either the GWP values from the IPCC Fourth Assessment Report (AR4) or those from AR5.

4.2 Data and Parameters Monitored

Data / Parameter	MM _{ELEC}										
Data unit	t CH ₄										
Description	Methane sent to the power generators										
Source of data	Calculated from the monitored data										
Description of measurement methods and procedures to be applied	MM _{ELEC} is calculated by the gas flow rate, pressure, temperature, and CH ₄ concentration of CMM, which was continuously measured by flow meters and gas analyzers. The computer system automatically monitors and records relevant meters data. The concentration (in mass) of methane in extracted gas (PC _{CH4}) is monitored by gas analysers. The methane sent to the power generators (MM _{ELEC}) is calculated based on gas flow rate, pressure, temperature measured by flow meters and methane concentration of CMM measured by gas analysers. The monitored hourly data of gas flow rate, pressure, temperature and CH ₄ concentration are automatically collected and recorded by the DCS system. The DCS system then converts the monitored pressure and temperature to reference conditions (1 atm and 20°C) and calculates the hourly value of MM _{ELEC} .										
Frequency of monitoring/recording	Measuring continuously and recording hourly										
Value monitored	<table border="1"> <thead> <tr> <th>Year</th><th>Value</th></tr> </thead> <tbody> <tr> <td>26-December-2019~31-December-2019</td><td>333.58</td></tr> <tr> <td>01-January-2020~31-December-2020</td><td>12,914.96</td></tr> <tr> <td>01-January-2021~25-May-2021</td><td>6,558.95</td></tr> <tr> <td>Total</td><td>19,807.49</td></tr> </tbody> </table> Please refer to ER spreadsheet for monthly values.	Year	Value	26-December-2019~31-December-2019	333.58	01-January-2020~31-December-2020	12,914.96	01-January-2021~25-May-2021	6,558.95	Total	19,807.49
Year	Value										
26-December-2019~31-December-2019	333.58										
01-January-2020~31-December-2020	12,914.96										
01-January-2021~25-May-2021	6,558.95										
Total	19,807.49										
Monitoring equipment	Flow meters, Pressure Transmitters, Temperature Transmitters and Gas Analyzers Calibration frequency: annual The information of meters please refers to Table 4-1.										
QA/QC procedures to be applied	The flow meters, temperature and pressure transducer are calibrated annually according to the relevant standard "Verification regulation of different pressure type flow meter										

	(JJG640-2016)". All electronic data and paper documents will be archived for two years following the end of the crediting period.
Purpose of the data	Calculation of baseline emission from methane released into atmosphere; project emission from use of captured methane and from un-combusted methane from project activity.
Calculation method	-
Comments	-

Data / Parameter	CONSELEC,PJ										
Data unit	MWh										
Description	Additional electricity consumption for capture and use or destruction of methane, which is imported electricity from the coal mine electricity network										
Source of data	From the electricity meters installed at project site										
Description of measurement methods and procedures to be applied	The additional electricity consumption at the power plant site was continuously measured by electricity meter and monthly recorded.										
Frequency of monitoring/recording	Measuring continuously and recording monthly										
Value monitored	<table border="1"> <thead> <tr> <th>Year</th><th>Value</th></tr> </thead> <tbody> <tr> <td>26-December-2019~31-December-2019</td><td>1.416</td></tr> <tr> <td>01-January-2020~31-December-2020</td><td>136.600</td></tr> <tr> <td>01-January-2021~25-May-2021</td><td>40.760</td></tr> <tr> <td>Total</td><td>178.776</td></tr> </tbody> </table> Please refer to ER spreadsheet for monthly values.	Year	Value	26-December-2019~31-December-2019	1.416	01-January-2020~31-December-2020	136.600	01-January-2021~25-May-2021	40.760	Total	178.776
Year	Value										
26-December-2019~31-December-2019	1.416										
01-January-2020~31-December-2020	136.600										
01-January-2021~25-May-2021	40.760										
Total	178.776										
Monitoring equipment	The monitoring meters are bidirectional electricity meters. Calibration frequency: annual Please refer to Table 4-1 for details of meters.										
QA/QC procedures to be applied	The electricity meters are calibrated according to the industrial standard "Technical administrative code of electric energy metering (DL/T448-2016)". Electricity transaction notes (ETNs) have been provided for crosscheck.										

Purpose of the data	Project emissions from combustion emission from additional energy required for CMM capture and use.
Calculation method	-
Comments	-

Data / Parameter	GEN _y										
Data unit	MWh										
Description	Electricity generation by the project activity in year y										
Source of data	From the electricity meters installed at project site										
Description of measurement methods and procedures to be applied	Electricity generated in the Project was continuously measured by electricity meter and monthly recorded.										
Frequency of monitoring/recording	Measuring continuously and recording monthly										
Value monitored	<table border="1"> <thead> <tr> <th>Year</th><th>Value</th></tr> </thead> <tbody> <tr> <td>26-December-2019~31-December-2019</td><td>1,567.272</td></tr> <tr> <td>01-January-2020~31-December-2020</td><td>57,115.616</td></tr> <tr> <td>01-January-2021~25-May-2021</td><td>29,138.848</td></tr> <tr> <td>Total</td><td>87,821.736</td></tr> </tbody> </table> Please refer to ER spreadsheet for monthly values.	Year	Value	26-December-2019~31-December-2019	1,567.272	01-January-2020~31-December-2020	57,115.616	01-January-2021~25-May-2021	29,138.848	Total	87,821.736
Year	Value										
26-December-2019~31-December-2019	1,567.272										
01-January-2020~31-December-2020	57,115.616										
01-January-2021~25-May-2021	29,138.848										
Total	87,821.736										
Monitoring equipment	The monitoring meters are bidirectional electricity meters. Calibration frequency: annual Please refer to Table 4-1 for details of meters.										
QA/QC procedures to be applied	The electricity meters are calibrated according to the industrial standard “Technical administrative code of electric energy metering (DL/T448-2016)”. Electricity transaction notes (ETNs) have been provided for crosscheck.										
Purpose of the data	Calculation of baseline emission from power generation replaced by the project.										
Calculation method	-										

Comments	-
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Data / Parameter	CEF _{NMHC}
Data unit	tCO ₂ /tNMHC
Description	Carbon emission factor for combusted non methane hydrocarbons (various)
Source of data	Composition analysis report by Laboratory of Coal Mine Exploration of Guizhou Province.
Description of measurement methods and procedures to be applied	NMHC concentration monitored and analysed annually. In case the NMHC concentration is above 1%, the carbon emission factors of the different components shall be determined.
Frequency of monitoring/recording	Annually
Value monitored	Not applicable since PC _{NMHC} <1%
Monitoring equipment	-
QA/QC procedures to be applied	Gas sampled and analyzed annually.
Purpose of the data	Calculation of project emission from methane released into atmosphere.
Calculation method	-
Comments	-

Data / Parameter	PC _{CH4}
Data unit	%
Description	Concentration (in mass) of methane in extracted gas (%), measured on wet basis.
Source of data	Monitoring data by Gas Analyzers on project site
Description of measurement methods and procedures to be applied	Methane concentration was monitored continuously by gas analyzer at each CMM power plant.
Frequency of monitoring/recording	Measuring continuously and recording hourly

Value monitored	The concentration of methane in extracted gas is continuously measured and recorded hourly through the monitoring system. Please refer to ER spreadsheet for details of monthly values (weighted average of daily methane sent to the power generators and methane concentration).
Monitoring equipment	Gas Analysers Calibration frequency: annual Please refer to Table 4-1 for details of meters.
QA/QC procedures to be applied	The Gas Analyzers are periodically checked and calibrated in compliance with the monitoring requirements.
Purpose of the data	Calculation of baseline emission from methane released into atmosphere.
Calculation method	-
Comments	-

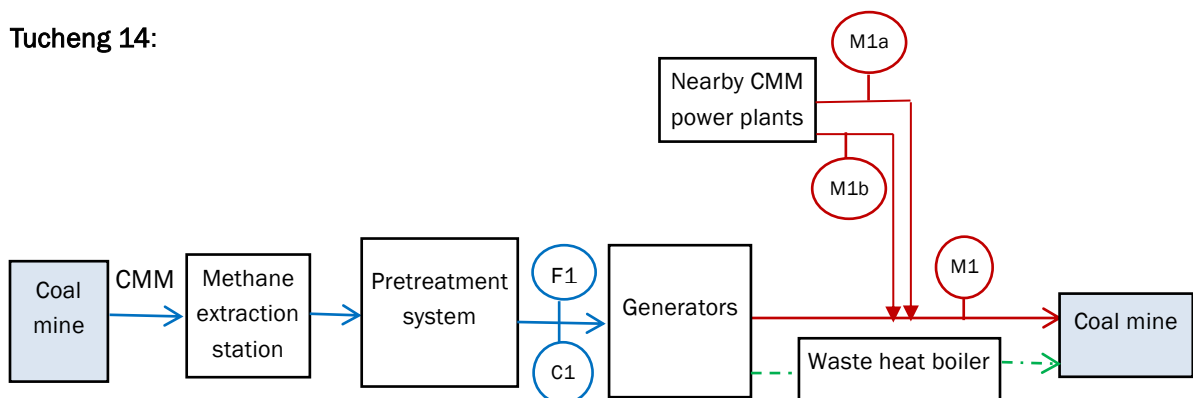
Data / Parameter	PC _{NMHC}																				
Data unit	%																				
Description	NMHC concentration (in mass) in extracted gas.																				
Source of data	Obtained through annual composition analysis of the extracted gas dated 26-Apr-2020 and 06-Jan-2021.																				
Description of measurement methods and procedures to be applied	Gas sample was taken once a year and analyzed.																				
Frequency of monitoring/recording	Annually.																				
Value monitored	<table><tr><td>Power Plant</td><td>PC_{NMHC} In 26-Apr-2020</td><td>PC_{NMHC} 06-Jan-2021</td></tr><tr><td>Tucheng 14</td><td>0.12%</td><td>0.29%</td></tr><tr><td>Tucheng 13</td><td>0.40%</td><td>0.27%</td></tr><tr><td>Laowuji Nanyi</td><td>N.D.</td><td>N.D.</td></tr><tr><td>Songhe Cansan</td><td>0.13%</td><td>0.09%</td></tr><tr><td>Songhe Cai'er</td><td>0.05%</td><td>0.02%</td></tr></table> Note: N.D. means not detected. The trace NMHC in the gas stream is below the detection limit of the lab equipment, hence the testing			Power Plant	PC _{NMHC} In 26-Apr-2020	PC _{NMHC} 06-Jan-2021	Tucheng 14	0.12%	0.29%	Tucheng 13	0.40%	0.27%	Laowuji Nanyi	N.D.	N.D.	Songhe Cansan	0.13%	0.09%	Songhe Cai'er	0.05%	0.02%
Power Plant	PC _{NMHC} In 26-Apr-2020	PC _{NMHC} 06-Jan-2021																			
Tucheng 14	0.12%	0.29%																			
Tucheng 13	0.40%	0.27%																			
Laowuji Nanyi	N.D.	N.D.																			
Songhe Cansan	0.13%	0.09%																			
Songhe Cai'er	0.05%	0.02%																			

	result shows not detected. This means the concentration of NMHC is significantly lower than 1%. The test results of NMHC concentration in extracted gas of all power plants are below 1%.
Monitoring equipment	Tested by the Laboratory of Coal Mine Exploration of Guizhou Province in accordance with “Analysis of natural gas by Gas Chromatography” (GB/T 13610-2014). No onsite monitoring equipment required.
QA/QC procedures to be applied	The Laboratory of Coal Mine Exploration of Guizhou Province with inspection and testing agency accreditation.
Purpose of the data	Calculation of project emission from NMHC destruction.
Calculation method	-
Comments	-

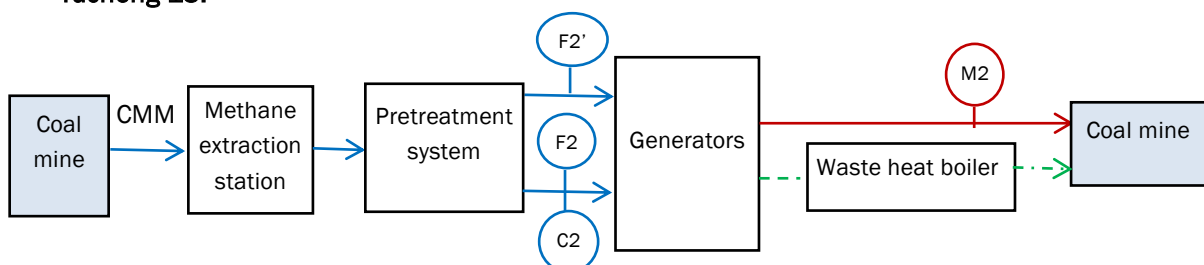
4.3 Monitoring Plan

Figure 4-1 below shows the positions of the monitoring instruments and Table 4-1 lists the information of monitoring equipment installed for the four power plants in operation in this monitoring period:

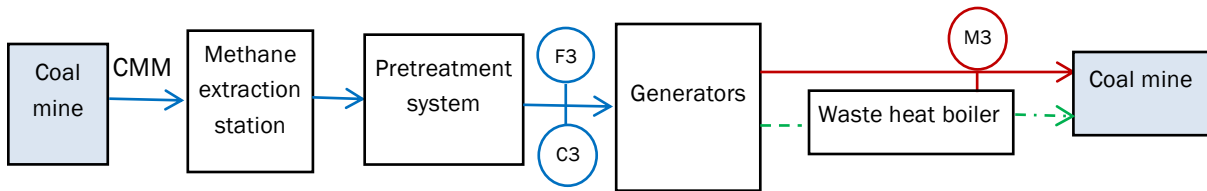
Tucheng 14:



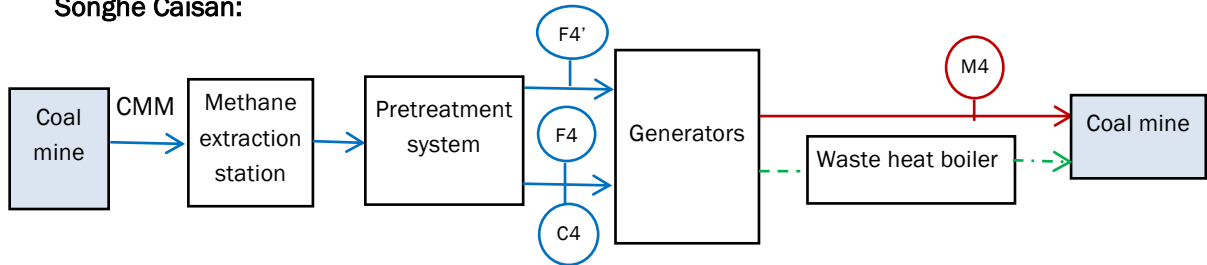
Tucheng 13:



Laowuji Nanyi:



Songhe Caisan:



Songhe Cai'er:

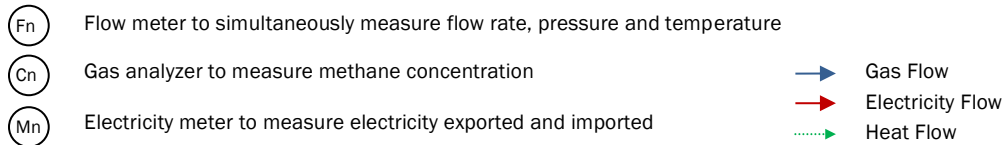
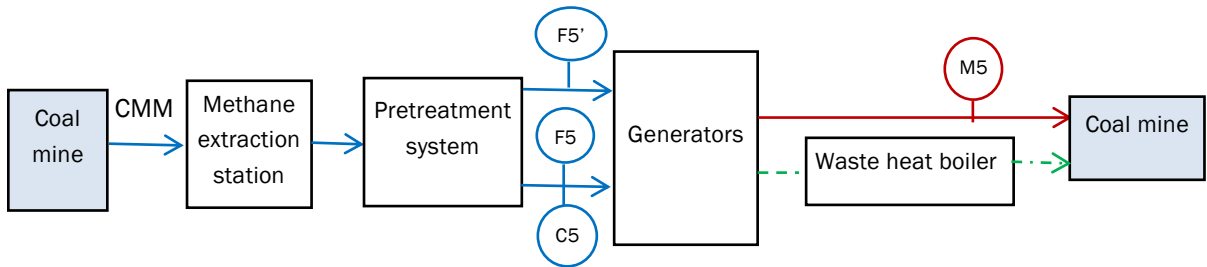


Figure 4-1 Project monitoring diagram

There're two gas pipelines in power plant Tucheng 13, Songhe Cai'er and Songhe Caisan. Each gas pipeline is equipped with one flow meter. That means there're two flow meters and one gas analyser in each of the three power plants. The meters installation of the three power plants is in accordance with the monitoring plan and the applied methodology, and the monitoring system can accurately monitor the amount of methane sent to the generator, because the methane concentration is the same in both pipelines as will be explained in the following paragraph:

The monitoring system of methane is designed and built by a qualified third-party China Coal Technology Engineering Group Chongqing Research Institute (CQCCRI), which have provided methane monitoring system for multiple coal mines and CMM power stations in China. The CMM gas flow of power plant Tucheng 13, Songhe Cai'er and Songhe Caisan is extracted from the coal mine and sent to the pre-treatment system of the CMM power plants through one gas pipeline, the CMM is then treated in the pre-treatment system and lead to the CMM generator through two gas pipelines with identical parameters (diameter, build material, etc.). Since the CMM gas has been sufficiently mixed during the pre-treatment process, the components and corresponding concentration (including methane concentration) of the CMM in the two gas pipelines leading to the generator are identical, based on CQCCRI's expertise, one gas analyser is sufficient and the

installation of a second gas analyser would add additional costs to the project without increasing the accuracy. That the gas concentration is identical in the two gas pipelines has been proven by the fact that the methane concentration of the three CMM samples (sampled from the sampling points set in the outlet of pre-treatment system and the installation point of flow meters at the two gas pipelines) are the same. The samples are regularly (at least once a day) tested by the project owner using portable methane analysers during daily operation. In conclusion, appropriate flow and concentration meters have been installed by the project owner to directly measure the amount of methane delivered to the CMM generators. Hence the CMM monitoring system of the project is in accordance with paragraph 1, page 15 of the applied methodology.

Furthermore, the amount of methane is automatically calculated by the DCS system in the central control room of the project site. The DCS system automatically collects the gas flow rate, pressure and temperature measured by the two flow meters and methane concentration measured by the gas analyser; the two sets of data (gas flow rate, pressure and temperature) are calculated by the DCS system and then integrated into one set. The amount of methane is then calculated by the DCS system and can be exported as excel form. Hence there is no separate data for the two flow meters. The amount of methane delivered to the generator has been correctly reported in the MR and ER spreadsheet. Besides, the monitoring team of the project owner regularly check the energy balance to identify any abnormal data if any, the accuracy of the monitoring data can be guaranteed.

Table 4-1 Information of installed monitoring instruments

Power plants	Equipment	Model	Serial No.	Accuracy	Date of calibration	Validity	Parameter monitored
Tucheng 14	Flow meter	GLY80	10300 (F1)	1.5%	03-Sep-2019 03-Sep-2020	02-Sep-2020 02-Sep-2021	MM _{ELEC}
	Pressure transmitter			1.5%			
	Temperature transmitter			2.5%			
	Gas analyzer	GJG100 H(C)	4548 (C1)	0~1%: $\pm 0.07\%$; 1%~100%: $\pm 7\%$	29-May-2019 29-May-2020	28-May-2020 28-May-2021	MM _{ELEC} PC _{CH4}
	Electricity meter	DSSD13 2	83336 (M1)	0.5S	30-Aug-2019 30-Aug-2020	29-Aug-2020 29-Aug-2021	GEN _y CONS _{ELEC,PJ}
		DSSD66 6	64465(M1a) 64469(M1b) (for nearby power plant)	0.5S	30-Aug-2019 30-Aug-2020	29-Aug-2020 29-Aug-2021	
Tucheng 13	Flow meter	GLY80(A)	121613 (F2)	1.5%	28-Aug-2019 28-Aug-2020	27-Aug-2020 27-Aug-2021	MM _{ELEC}
	Pressure transmitter		121614 (F2')	1.5%			
	Temperature transmitter			2.5%			
	Gas analyzer	GJG100 H(C)	4560 (C2)	0~1%: $\pm 0.07\%$; 1%~100%: $\pm 7\%$	29-May-2019 29-May-2020	28-May-2020 28-May-2021	MM _{ELEC} PC _{CH4}
	Electricity meter	DSSD13 2	93649 (M2)	0.5S	30-Aug-2019 30-Aug-2020	29-Aug-2020 29-Aug-2021	GEN _y CONS _{ELEC,PJ}
Songhe Caisan	Flow meter	GLY80(A)	121611(F4')	1.5%	28-Aug-2019 28-Aug-2020	27-Aug-2020 27-Aug-2021	MM _{ELEC}
	Pressure transmitter		121612(F4)	1.5%			
	Temperature transmitter			2.5%			
	Gas analyzer	GJG100 H(C)	4571 (C4)	0~1%: $\pm 0.07\%$; 1%~100%: $\pm 7\%$	29-May-2019 29-May-2020	28-May-2020 28-May-2021	MM _{ELEC} PC _{CH4}
	Electricity meter	DSSD66 6	64467 (M4)	0.5S	30-Aug-2019 30-Aug-2020	29-Aug-2020 29-Aug-2021	GEN _y CONS _{ELEC,PJ}
Laowuji Nanyi	Flow meter	GLY80(A)	121610 (F3)	1.5%	28-Aug-2019 28-Aug-2020	27-Aug-2020 27-Aug-2021	MM _{ELEC}
	Pressure transmitter			1.5%			
	Temperature transmitter			2.5%			
	Gas analyzer	GJG100 H(B)	5659 (C3)	0~1%: $\pm 0.07\%$; 1%~100%: $\pm 7\%$	29-May-2019 29-May-2020	28-May-2020 28-May-2021	MM _{ELEC} PC _{CH4}

	Electricity meter	DSSD79-GF	30278 (M3)	0.5S	30-Aug-2019 30-Aug-2020	29-Aug-2020 29-Aug-2021	GEN _y CONSELEC,PJ
Songhe Cai'er	Flow meter	GLY80(A)	131539 (F5)	1.5%	15-Sep-2019 15-Sep-2020	14-Sep-2020 14-Sep-2021	MM _{ELEC}
	Pressure transmitter		131540 (F5')	1.5%			
	Temperature transmitter			2.5%			
	Gas analyzer	GJG100 H(B)	1528 (C5)	0~1%: ±0.07%; 1%~100%: ±7%	29-May-2019 29-May-2020	28-May-2020 28-May-2021	MM _{ELEC} PC _{CH4}
	Electricity meter	DSSD79-GF	02217 (M5)	0.5S	30-Aug-2019 30-Aug-2020	29-Aug-2020 29-Aug-2021	GEN _y CONSELEC,PJ

(A) Data and parameters to be monitored

Table 4 2 Corresponding parameters monitored

Parameter	Meters used	Data Collection	Description	
MM _{ELEC} PC _{CH4}	Flow meter Gas analyser	Continuously monitored and automatically recorded by computer	Methane concentration measured by gas analyser, gas flow rate, pressure and temperature measured by the flow meter are used to calculate mass of the methane sent to the generators.	
PC _{NMHC} CEF _{NMHC}	Sent to Lab (no onsite meter involved)	Sampled and analysed annually	If the concentration of NMHC in the extracted gas is less than 1%, emission from NMHC destruction is considered to be zero in the emission calculation according to ACM0008 (Version 07).	
GEN _y CONSE _{ELEC,PJ}	Electricity Meter	Continuously monitored and recorded monthly	Power plant	Measurement method
			Tucheng 14	M1-(M1a+M1b)
			Tucheng 13	M2
			Laowuji Nanyi	M3
			Songhe Caisan	M4
			Songhe Caier	M5
			There exists a nearby power plant at the project site of power plant Tucheng 14. The two power plants share the same meter M1, which measures the total electricity generation and consumption by the two power plants. The electricity generation and consumption by the nearby power plant is measured by meter M1a (SN 64465) and M1b (SN 64469) and should be deducted from the measured values of	

			meter M1 in order to get the net electricity generation and consumption by power plant Tucheng 14.
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(B) Management Structure

The Project owner organized 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 has been appointed to take full responsibility for the overall monitoring of the project. The monitoring and measurement of extracted gas, electricity generation and consumption etc. is carried out by designated monitoring officers. In addition, the Project developer appointed internal verifiers who are 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 has been developed and serves as the basis of the project monitoring. Figure 4-2 shows the operation and management structure of the Project.

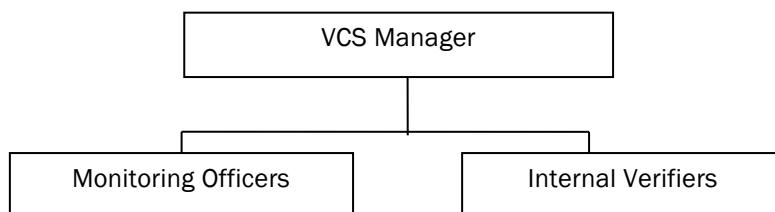


Figure 4-2 Operation and management structure of the project

The responsibilities of different roles in the management structure are summarized in Table 4-3.

Table 4-3 Role and responsibility of the monitoring team

Role	Responsibility
VCS manager	- Coordinate with external consultant to design and execute the monitoring plan - Supervise the Monitoring section to ensure a timely, adequate and accurate data recording - Ensure the enforcement of QA/QC plan performed by the Audit section - Calculate emission reductions and make regular summary following requirements as VCS projects - Work with external consultant to prepare the monitoring report - Assist with emission reduction issuance and DOE communication
Monitoring officer	- Collect, record and archive the monitoring data - Maintain the monitoring meters
Internal verifier	- Perform the routine QA/QC procedure to ensure data accuracy - Ensure timely calibration of the monitoring meters

(C) Data collection

Monitoring officers are responsible for data collection. Designated teams read and collect the monitored data regularly. Automatic records serve as the main data source for emission reductions calculation. All data files, relevant electricity transaction notes (ETNs) are collected by a designated monitoring officer, who will prepare backup in time and archive all documents properly.

Continuous data collecting (PC_{CH4} , MM_{ELEC} , GEN_y , and $CONS_{ELEC,PJ}$)

The computer system automatically monitors and records relevant meter data. The concentration (in mass) of methane in extracted gas (PC_{CH4}) is monitored by gas analyzers. The methane sent to the power generators (MM_{ELEC}) is calculated based on gas flow rate, pressure, temperature measured by flow meters and methane concentration of CMM measured by gas analyzers. The monitored hourly data of gas flow rate, pressure, temperature and CH_4 concentration are automatically collected and recorded by the DCS system. The DCS system then converts the monitored pressure and temperature to reference conditions (1 atm and 20°C) and calculates the hourly value of MM_{ELEC} . The monthly aggregated value of MM_{ELEC} is reported in the monitoring report and ER calculation spreadsheet.

Electricity generated (GEN_y) and consumed ($CONS_{ELEC,PJ}$) by the project are monitored continuously by bidirectional electricity meters and recorded monthly. The data was recorded on the monthly report and the electricity transaction notes (ETNs) are issued based on the monthly data confirmed by the both parties.

Periodical sampling data (PC_{NMHC} and CEF_{NMHC}).

The NMHC concentration (in mass) in extracted gas (PC_{NMHC}) is monitored through sampling once a year by a qualified third party in accordance with “Analysis of natural gas by Gas Chromatography” (GB/T 13610-2014).

As per the applied methodology, the carbon emission factor for combusted non methane hydrocarbons (CEF_{NMHC}) shall be monitored by gas sampled and analyzed annually only if PC_{NMHC} is larger than 1%. In this monitoring period the parameter of PC_{NMHC} is less than 1% for all power plants. According to the methodology ACM0008 (version 07), if NMHC accounts for less than 1% of extracted gas in volume, under normal operating conditions, emission from NMHC destruction can be ignored. Thus, the parameter of CEF_{NMHC} does not need to be monitored in this monitoring period.

(D) Quality assurance & Emergency Procedure

All monitoring equipment was installed as per relevant industrial standards and good practice, and was calibrated regularly for accuracy (please refer to Table 4-1). NMHC in the extracted gas for each power plant are sampled regularly each year and analysed. The Project owner preserves the calibration records and NMHC analysis results, along with the data files of project monitoring.

Error check routine has been established onsite and at the point of data storage to detect data measuring/transmission failures as well as malfunctions. In the case of meter malfunctioning, the meter supplier will provide technical support to engage the problem promptly and emission reductions during the corresponding period will be calculated conservatively.

No emergency occurred in this monitoring period.

(E) Data file management

All monitoring data are well kept with both electronic copy and hard copy. All data collected as part of monitoring will be archived and be kept at least for 2 years after the end of the crediting period.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

According to the methodology ACM0008 (version 07), baseline emissions are given by the following equation:

$$BE_y = BE_{MD,y} + BE_{MR,y} + BE_{Use,y} \quad (1)$$

Where:

BE_y	=	Baseline emissions in year y (tCO ₂);
$BE_{MD,y}$	=	Baseline emissions from destruction of methane in the baseline scenario in year y (tCO ₂);
$BE_{MR,y}$	=	Baseline emissions from release of methane into the atmosphere in year y that is avoided by the project activity (tCO _{2e});
$BE_{Use,y}$	=	Baseline emissions from the production of power replaced by the project activity in year y (tCO _{2e}).

1. Baseline emissions from methane destroyed

The baseline scenario does not involve any flaring or usage of CMM, therefore, there is no methane destruction in the baseline. So, destruction of methane in the baseline scenario is 0.

2. Baseline emission from methane released into the atmosphere

This methane would have been emitted to the atmosphere in the baseline scenario, unless some capture and use activities form part of the baseline:

$$BE_{MR,y} = GWP_{CH_4} \times [(CMM_{PJ,y} - CMM_{BLi,y}) + (PMM_{PJ,y} - PMM_{BLi,y})] \quad (2)$$

Where:

- $BE_{MR,y}$ = Baseline emissions from release of methane into the atmosphere in year y that is avoided by the project activity (tCO₂e);
- $CMM_{PJ,y}$ = Pre-mining CMM captured, sent to and destroyed by power generation in the project activity in year y (expressed in tCH₄); not distinguishable from $PMM_{PJ,y}$;
- $CMM_{BL,y}$ = Pre-mining CMM that would have been captured, sent to and destroyed by use i in the baseline scenario in year y (expressed in tCH₄);
- $PMM_{PJ,y}$ = Post-mining CMM captured, sent to and destroyed by power generation in the project activity in year y (tCH₄); not distinguishable from $CMM_{PJ,y}$;
- $PMM_{BL,y}$ = Post-mining CMM that would have been captured, sent to and destroyed by use i in the baseline scenario in year y (tCH₄);
- GWP_{CH_4} = Global warming potential of methane (25 tCO₂e/tCH₄).

In the baseline scenario, there is no CMM captured, sent to and destroyed, thus $CMM_{BLi,y}$ and $PMM_{BLi,y}$ is 0; $CMM_{PJ,y}$ and $PMM_{PJ,y}$ will together be directly monitored and measured as MM_{ELEC} , given that the common extraction system is located in the underground mine.

$$BE_{MR,y} = GWP_{CH_4} \times (CMM_{PJ,y} + PMM_{PJ,y}) = GWP_{CH_4} \times MM_{ELEC}$$

The MM_{ELEC} used for BE_{MR,y} calculation is listed as follows:

Monitored values of Methane sent to the power generators MM _{ELEC} (tCH ₄)											
Monitoring period ⁵		Songhe Caisan		Laowuji Nanyi		Songhe Cai'er		Tucheng 13		Tucheng 14	
Start date	End date	Methane flow(m ³)	MM _{ELEC} (tC H ₄)	Methane flow(m ³)	MM _{ELEC} (tC H ₄)	Methane flow(m ³)	MM _{ELEC} (tC H ₄)	Methane flow(m ³)	MM _{ELEC} (tC H ₄)	Methane flow(m ³)	MM _{ELEC} (tC H ₄)
26-Dec-2019 ⁶	31-Dec-2019	230,197.16	154.23	0.00	0.00	0.00	0.00	161,516.42	108.22	106,170.45	71.13
Subtotal (tCH ₄ ,2019)		230,197.16	154.23	0.00	0.00	0.00	0.00	161,516.42	108.22	106,170.45	71.13
Total (tCH ₄ ,2019)		333.58									
01-Jan-2020	25-Jan-2020	715,024.23	479.07	0.00	0.00	0.00	0.00	456,590.52	305.92	336,707.57	225.59
26-Jan-2020	25-Feb-2020	1,052,782.92	705.36	0.00	0.00	0.00	0.00	834,551.91	559.15	378,517.86	253.61
26-Feb-2020	25-Mar-2020	932,092.92	624.50	0.00	0.00	0.00	0.00	646,127.28	432.91	297,457.92	199.30
26-Mar-2020	25-Apr-2020	923,924.07	619.03	0.00	0.00	0.00	0.00	669,712.05	448.71	323,458.92	216.72
26-Apr-2020	25-May-2020	818,821.71	548.61	0.00	0.00	0.00	0.00	554,853.24	371.75	250,554.87	167.87
26-May-2020	25-Jun-2020	787,229.28	527.44	0.00	0.00	0.00	0.00	447,540.39	299.85	250,917.75	168.11
26-Jun-2020	25-Jul-2020	736,201.71	493.26	0.00	0.00	0.00	0.00	536,982.21	359.78	164,332.80	110.10
26-Jul-2020	25-Aug-2020	675,732.78	452.74	0.00	0.00	0.00	0.00	712,349.64	477.27	104,753.25	70.18
26-Aug-2020	25-Sep-2020	846,999.18	567.49	0.00	0.00	0.00	0.00	515,244.24	345.21	76,937.85	51.55
26-Sep-2020	25-Oct-2020	634,520.30	425.13	0.00	0.00	0.00	0.00	502,229.48	336.49	89,356.28	59.87
26-Oct-2020	25-Nov-2020	947,436.75	634.78	0.00	0.00	0.00	0.00	482,471.64	323.26	144,326.61	96.70

⁵ The data from December 26th to December 31st from monthly reports provided by project owners.

⁶ This monitoring period starts from 08:00 of 25-December-2019 as last monitoring period (1st VCS) ended at 08:00 of 25 -December-2019. The emission reductions achieved from 08:00 to 24:00 of 25-December-2019 are claimed in this monitoring period.

26-Nov-2020	25-Dec-2020	612,927.00	410.66	0.00	0.00	0.00	0.00	368,984.97	247.22	127,622.79	85.51
26-Dec-2020	31-Dec-2020	185,964.98	124.60	0.00	0.00	0.00	0.00	95,620.96	64.07	38,193.64	25.59
Subtotal (tCH ₄ ,2020)		9,869,657.83	6,612.67	0.00	0.00	0.00	0.00	6,823,258.53	4,571.58	2,583,138.11	1,730.70
Total (tCH ₄ ,2020)		12,914.96									
01-Jan-2021	25-Jan-2021	774,854.10	519.15	0.00	0.00	0.00	0.00	398,420.71	266.94	159,140.17	106.62
26-Jan-2021	25-Feb-2021	891,384.75	597.23	0.00	0.00	0.00	0.00	636,197.49	426.25	217,617.03	145.80
26-Feb-2021	25-Mar-2021	892,355.94	597.88	0.00	0.00	100,684.62	67.46	790,055.37	529.34	335,609.73	224.86
26-Mar-2021	25-Apr-2021	1,098,724.50	736.15	0.00	0.00	108,343.17	72.59	855,174.51	572.97	353,395.71	236.78
26-Apr-2021	25-May-2021 ⁷	882,371.07	591.19	0.00	0.00	135,661.23	90.89	800,609.67	536.41	358,872.93	240.44
Subtotal (tCH ₄ ,2021)		4,539,690.36	3,041.59	0.00	0.00	344,689.02	230.94	3,480,457.75	2,331.91	1,424,635.57	954.51
Total (tCH ₄ ,2021)		6,558.95									
Subtotal (tCH ₄ , 2019-2021)		14,639,545.35	9,808.50	0.00	0.00	344,689.02	230.94	10,465,232.70	7,011.71	4,113,944.13	2,756.34
Total (tCH ₄ , 2019-2021)		19,807.49									

⁷ The crediting period ends at 24:00 of 25-May-2021, so the ending time of this monitoring period is 24:00 of 25-May-2021. The emission reductions achieved from 08:00 to 24:00 of 25-May-2021 are claimed in this monitoring period.

Thus, the calculation result of $BE_{MR,y}$ is as the following table 5-1.

Table 5-1 Calculation of $BE_{MR,y}$

Year	MM_{ELEC}	GWP_{CH_4}	$BE_{MR,y}$
	tCH_4	tCO_2/tCH_4	tCO_2
26-Dec-2019~31-Dec-2019	333.58	28	9,340
01-Jan-2020~31-Dec-2020	12,914.96	28	361,618
01-Jan-2021~25-May-2021	6,558.95	28	183,650
Total			554,608

3. Baseline emission from power generation replaced by project

The total potential emissions reductions from displacement of power generation are given by the following equation:

$$BE_{Use,y} = (GEN_y - CONS_{ELEC,PJ}) \times EF_{ELEC} + HEAT_y \times EF_{HEAT} + VFUEL_y \times EF_v \quad (3)$$

Where:

- $BE_{Use,y}$ = Potential total baseline emissions from the production of power replaced by the project activity in year y (tCO_2e);
- GEN_y = Electricity generated by project activity in year y (MWh);
- $CONS_{ELEC,PJ}$ = Additional electricity consumption for capture and use or destruction of methane, if any (MWh);
- EF_{ELEC} = Emissions factor of electricity replaced by project (tCO_2/MWh);
- $HEAT_y$ = Heat generation by project activity in year y (GJ), including through the use of CBM;
- EF_{HEAT} = Emissions factor for heat production replaced by project activity (tCO_2/GJ);
- $VFUEL_y$ = Vehicle fuel provided by the project activity in year y (GJ);
- EF_v = Emissions factor for vehicle operation replaced by project activity (tCO_2/GJ);

Since the Project does not claim the emission from heat or provide vehicle fuel, the equation can be simplified as followed:

$$BE_{Use,y} = (GEN_y - CONS_{ELEC,PJ}) \times EF_{ELEC}$$

The values of electricity generation by the project GEN_y used for $BE_{Use,y}$ calculation is listed as follows:

Monitored values of Electricity generation by the project GEN_y (MWh)								
Monitoring period ⁸		Songhe Caisan (M4)	Laowuji Nanyi (M3)	Songhe Cai'er (M5)	Tucheng 13 (M2)	Tucheng 14		
Start date	End date					Total monitored value (M1)	Nearby plant (M1a)	Nearby plant (M1b)
26-Dec-2019	31-Dec-2019	753.96	0.000	0.000	475.848	337.464	0.000	0.000
Subtotal (MWh,2019)		753.960	0.000	0.000	475.848	337.464	0.000	0.000
Total (MWh,2019)		1,567.272						
01-Jan-2020	25-Jan-2020	2071.920	0.000	0.000	1369.512	996.552	0.000	0.000
26-Jan-2020	25-Feb-2020	3146.820	0.000	0.000	2495.664	1131.624	0.000	0.000
26-Feb-2020	25-Mar-2020	2782.920	0.000	0.000	1932.120	876.528	0.000	0.000
26-Mar-2020	25-Apr-2020	2747.940	0.000	0.000	2001.096	964.944	0.000	0.000
26-Apr-2020	25-May-2020	2433.660	0.000	0.000	1651.968	736.128	0.000	0.000
26-May-2020	25-Jun-2020	2334.480	0.000	0.000	1324.944	746.928	0.000	0.000
26-Jun-2020	25-Jul-2020	2183.340	0.000	0.000	1598.256	477.144	0.000	0.000
26-Jul-2020	25-Aug-2020	1986.300	0.000	0.000	2127.888	294.120	0.000	0.000
26-Aug-2020	25-Sep-2020	2502.780	0.000	0.000	1529.424	210.456	0.000	0.000
26-Sep-2020	25-Oct-2020	1871.940	0.000	0.000	1480.104	243.072	0.000	0.000
26-Oct-2020	25-Nov-2020	2811.060	0.000	0.000	1433.304	410.760	0.000	0.000
26-Nov-2020	25-Dec-2020	1812.780	0.000	0.000	1082.952	366.408	0.000	0.000
26-Dec-2020	31-Dec-2020	552.190	0.000	0.000	284.180	111.410	0.000	0.000
Subtotal (MWh,2020)		29238.130	0.000	0.000	20311.412	7566.074	0.000	0.000
Total (MWh,2020)		57,115.616						
01-Jan-2021	25-Jan-2021	2300.810	0.000	0.000	1184.116	464.230	0.000	0.000
26-Jan-2021	25-Feb-2021	2646.540	0.000	0.000	1896.840	634.968	0.000	0.000
26-Feb-2021	25-Mar-2021	2659.980	0.000	276.840	2357.208	1002.168	0.000	0.000
26-Mar-2021	25-Apr-2021	3276.240	0.000	382.800	2569.824	1050.912	0.000	0.000
26-Apr-2021	25-May-2021	2630.940	0.000	322.080	2407.680	1074.672	0.000	0.000
Subtotal (MWh,2021)		13514.510	0.000	981.720	10415.668	4226.950	0.000	0.000
Total (MWh,2021)		29,138.848						
Subtotal (MWh,2019-2021)		43506.600	0.000	981.720	31202.928	12130.488	0.000	0.000
Total (MWh,2019-2021)		87821.736						

⁸ The electricity transaction cut-off date is 8:00 on the 25th of each month, and the data from December 26th to December 31st is provided by the grid company.

The values of additional electricity consumption for capture and use or destruction of methane $CONS_{ELEC,PJ}$ used for $BE_{Use,y}$ calculation is listed as follows:

Monitored values of Additional electricity consumption for capture and use or destruction of methane $CONS_{ELEC,PJ}$ (MWh)								
Monitoring period ⁹		Songhe Caisan (M4)	Laowuji Nanyi (M3)	Songhe Cai'er (M5)	Tucheng 13 (M2)	Tucheng 14		
Start date	End date					Total monitored value (M1)	Nearby plant (M1a)	Nearby plant (M1b)
26-Dec-2019	31-Dec-2019	0.120	0.000	0.000	1.296	0.000	0.000	0.000
Subtotal (MWh,2019)		0.120	0.000	0.000	1.296	0.000	0.000	0.000
Total (MWh,2019)		1.416						
01-Jan-2020	25-Jan-2020	0.120	0.000	0.000	2.230	4.100	0.000	0.000
26-Jan-2020	25-Feb-2020	0.960	0.000	0.000	2.950	3.960	0.000	0.000
26-Feb-2020	25-Mar-2020	26.040	0.000	0.000	0.860	7.490	0.000	0.000
26-Mar-2020	25-Apr-2020	6.600	0.000	0.000	1.940	1.150	0.000	0.000
26-Apr-2020	25-May-2020	5.640	0.000	0.000	4.900	7.630	0.000	0.000
26-May-2020	25-Jun-2020	2.040	0.000	0.000	5.180	1.440	0.000	0.000
26-Jun-2020	25-Jul-2020	0.120	0.000	0.000	1.010	1.300	0.000	0.000
26-Jul-2020	25-Aug-2020	7.200	0.000	0.000	2.300	3.100	0.000	0.000
26-Aug-2020	25-Sep-2020	1.920	0.000	0.000	2.380	4.390	0.000	0.000
26-Sep-2020	25-Oct-2020	3.000	0.000	0.000	3.960	6.190	0.000	0.000
26-Oct-2020	25-Nov-2020	0.120	0.000	0.000	2.950	2.380	0.000	0.000
26-Nov-2020	25-Dec-2020	2.520	0.000	0.000	2.520	2.160	0.000	0.000
26-Dec-2020	31-Dec-2020	0.180	0.000	0.000	0.910	0.760	0.000	0.000
Subtotal (MWh,2020)		56.460	0.000	0.000	34.090	46.050	0.000	0.000
Total (MWh,2020)		136.600						
01-Jan-2021	25-Jan-2021	0.780	0.000	0.000	3.840	3.200	0.000	0.000
26-Jan-2021	25-Feb-2021	0.000	0.000	0.000	3.960	6.700	0.000	0.000
26-Feb-2021	25-Mar-2021	0.120	0.000	0.000	3.530	4.250	0.000	0.000
26-Mar-2021	25-Apr-2021	0.000	0.000	0.000	0.360	6.340	0.000	0.000
26-Apr-2021	25-May-2021	0.120	0.000	1.080	1.220	5.260	0.000	0.000
Subtotal (MWh,2021)		1.020	0.000	1.080	12.910	25.750	0.000	0.000
Total (MWh,2021)		40.760						
Subtotal (MWh,2019-2021)		57.600	0.000	1.080	48.296	71.800	0.000	0.000
Total (MWh,2019-2021)		178.776						

⁹ The electricity transaction cut-off date is 8:00 on the 25th of each month, and the data from December 26th to December 31st is provided by the grid company.

The calculation result of $BE_{Use,y}$ is as table 5-2.

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

Year	GEN_y	$CONS_{ELEC,PJ}$	EF_{ELEC}	$BE_{Use,y}$
	MWh	MWh	tCO ₂ /MWh	tCO ₂
26-Dec-2019~31-Dec-2019	1,567.272	1.416	0.6323	990
01-Jan-2020~31-Dec-2020	57,115.616	136.600	0.6323	36,027
01-Jan-2021~25-May-2021	29,138.848	40.760	0.6323	18,398
Total				55,415

As a summary, the baseline emission is as table 5-3.

Table 5-3 Summary of baseline emission

Year	$BE_{MD,y}$	$BE_{MR,y}$	$BE_{Use,y}$	BE_y
	tCO ₂	tCO ₂	tCO ₂	tCO ₂
26-Dec-2019~31-Dec-2019	0	9,340	990	10,330
01-Jan-2020~31-Dec-2020	0	361,618	36,027	397,645
01-Jan-2021~25-May-2021	0	183,650	18,398	202,048
Total	0	554,608	55,415	610,023

5.2 Project Emissions

Project emissions are defined by following equations:

$$PE_y = PE_{ME} + PE_{MD} + PE_{UM} \quad (4)$$

Where:

- PE_y Project emissions in year y (tCO₂e);
- PE_{ME} Project emissions from energy use to capture and use methane (tCO₂e);
- PE_{MD} Project emissions from methane destroyed (tCO₂e);
- PE_{UM} Project emissions from un-combusted methane (tCO₂e).

1. Combustion emissions from additional energy required for CMM capture and use

According to the registered PDD, there is no additional energy required for CMM capture compared with the baseline scenario. The energy use for power plant is considered in the baseline emission calculation. Therefore, PE_{ME} is calculated as 0.

$$PE_{ME}=0 \quad (5)$$

2. Combustion emissions from use of captured methane

When the captured methane is burned in a flare, heat or power plant, or oxidized in a flameless oxidation unit, combustion emissions are released. In addition, if NMHC account for more than 1% by volume of the extracted CMM, combustion emission from these gases should also be included.

$$PE_{MD} = (MD_{FL} + MD_{OX} + MD_{ELEC} + MD_{HEAT} + MD_{GAS}) \times (CEF_{CH_4} + r \times CEF_{NMHC}) \quad (6)$$

with:

$$r = PC_{NMHC} / PC_{CH_4} \quad (7)$$

Where:¹⁰

PE_{MD}	Project emissions from CMM and VAM destroyed (tCO ₂ e);
MD_{FL}	Methane destroyed through flaring (tCH ₄);
MD_{OX}	Methane destroyed through flameless oxidation (tCH ₄);
MD_{ELEC}	Methane destroyed through power generation (tCH ₄);
MD_{HEAT}	Methane destroyed through heat generation (tCH ₄);
MD_{GAS}	Methane destroyed after being supplied to gas grid or for vehicle use (tCH ₄);
CEF_{CH_4}	Carbon emission factor for combusted methane (2.75 tCO ₂ /tCH ₄);
CEF_{NMHC}	Carbon emission factor for combusted non methane hydrocarbons (the concentration varies and, therefore, to be obtained through periodical analysis of captured methane) (tCO ₂ /tNMHC);
r	Relative proportion of NMHC compared to methane;
PC_{CH_4}	Concentration (in mass) of methane in extracted gas (%), measured on wet basis;
PC_{NMHC}	NMHC concentration (in mass) in extracted gas (%).

The Project doesn't involve flaring, flameless oxidation, heating and supplying to gas grid, thus MD_{FL} , MD_{OX} , MD_{HEAT} and MD_{GAS} is 0. According to the gas composition test report by the third party, the concentration of NMHC accounts for less than 1% by volume of extracted coal mine gas, thus emission from NMHC destruction is not calculated.

$$\text{Thus, } PE_{MD} = MD_{ELEC} \times CEF_{CH_4} \quad (8)$$

$$\text{Where } MD_{ELEC} = MM_{ELEC} \times Eff_{ELEC} \quad (9)$$

MD_{ELEC}	Methane destroyed through power generation (tCH ₄);
MM_{ELEC}	Methane measured sent to power plant (tCH ₄);
Eff_{ELEC}	Efficiency of methane destruction/oxidation in power plant (taken as 99.5% from (IPCC).

Therefore, $PE_{MD} = MM_{ELEC} \times Eff_{ELEC} \times CEF_{CH_4}$, which is calculated as the follows.

¹⁰ Note that throughout this baseline methodology, it is assumed that measured quantities of coal mine gas are converted to tonnes of methane using the measured methane concentration of the coal mine gas and the density of methane.

Table 5-4 Calculation of PE_{MD}

Year	MM_{ELEC}	Eff_{ELEC}	CEF_{CH_4}	PE_{MD}
	tCH ₄	%	tCO ₂ / tCH ₄	tCO ₂
26-Dec-2019~31-Dec-2019	333.58	99.5	2.75	913
01-Jan-2020~31-Dec-2020	12,914.96	99.5	2.75	35,339
01-Jan-2021~25-May-2021	6,558.95	99.5	2.75	17,947
Total				54,199

3. Un-combusted methane from project activity

Not all of the methane used to generate power will be combusted, so a small amount will escape to the atmosphere. These emissions are calculated using the following:

$$PE_{UM} = GWP_{CH_4} \times MM_{ELEC} \times (1 - Eff_{ELEC}) + PE_{flare} + PE_{OX} \times GWP_{CH_4} \quad (10)$$

Where:

PE_{UM}	=	Project emissions from un-combusted methane (tCO ₂ e);
GWP_{CH_4}	=	Global warming potential of methane (25 tCO ₂ e/tCH ₄);
MM_{ELEC}	=	Methane measured sent to the power plant (tCH ₄);
Eff_{ELEC}	=	Efficiency of methane destruction in the power plant (%) (taken as 99.5% from IPCC);
PE_{flare}	=	Project emissions of non-combusted CH ₄ expressed in terms of CO ₂ e from flaring of the residual gas stream (tCO ₂ e);
PE_{OX}	=	Project emissions of non-oxidized CH ₄ from flameless oxidation of the VAM stream (tCH ₄).

As discussed above, $PE_{flare} = 0$, $PE_{OX} = 0$,

thus, $PE_{UM} = GWP_{CH_4} \times MM_{ELEC} \times (1 - Eff_{ELEC})$, is calculated as the following table.

Table 5-5 Calculation of PE_{UM}

Year	MM_{ELEC}	Eff_{ELEC}	GWP_{CH_4}	PE_{UM}
	tCH ₄	%	tCO ₂ / tCH ₄	tCO ₂
26-Dec-2019~31-Dec-2019	333.58	99.5	28	47
01-Jan-2020~31-Dec-2020	12,914.96	99.5	28	1,809

01-Jan-2021~25-May-2021	6,558.95	99.5	28	919
Total				2,775

Hence, the project emission is summarized as follows.

Table 5-6 Summary of project emission

Year	PE _{ME}	PE _{MD}	PE _{UM}	PE _y
	tCO ₂	tCO ₂	tCO ₂	tCO ₂
26-Dec-2019~31-Dec-2019	0	913	47	960
01-Jan-2020~31-Dec-2020	0	35,339	1,809	37,148
01-Jan-2021~25-May-2021	0	17,947	919	18,866
Total	0	54,199	2,775	56,974

5.3 Leakage

The formula for leakage is given as follows:

$$LE_y = LE_{d,y} + LE_{o,y} \quad (11)$$

Where:

- LE_y = Leakage emissions in year y (tCO₂e);
- LE_{d,y} = Leakage emissions due to displacement of other baseline thermal energy uses of methane in year y (tCO₂e);
- LE_{o,y} = Leakage emissions due to other uncertainties in year y (tCO₂e)

Since the baseline scenario does not include thermal energy use, LE_y = LE_{o,y}

The leakage of the project activity does not result from:

- Impact of VCS project activity on coal production - the VCS project activity is not designed to affect the on-going coal production, with the gas extraction and ventilation systems as part of the baseline scenario, and therefore leakage from this is zero;
- Impact of VCS project activity on coal prices and market dynamics - according to the methodology ACM0008 (Version 07), the proposed project is considered having no impact on coal price and market dynamics ex ante, unless the EB instruct otherwise in future.

Therefore, LE_y=0.

5.4 Net GHG Emission Reductions and Removals

The emission reductions can be obtained from the equation below:

$$ER_y = BE_y - PE_y - LE_y \quad (12)$$

Thus, the emission reduction is summarized as follows:

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)
26-December-2019~31-December-2019	10,330	960	0	9,370
01-January-2020~31-December-2020	397,645	37,148	0	360,497
01-January-2021~25-May-2021	202,048	18,866	0	183,182
Total	610,023	56,974	0	553,049

Comparison of actual emission reductions with estimates during validation:

The actual emission reductions of 553,049 tCO₂e achieved in this monitoring period is 35.31%¹¹ lower than the estimated emission reductions 854,973 tCO₂e¹² which is calculated in line with the VCS PD.

Since the actual installed capacity of the project during this monitoring period is 20.4MW (only 6 sets of CMM generators have been installed at power plant Songhe Cai'er, instead of 10 sets, please refer to section 3.1 for details), while the designed installed capacity of the project is 22.8MW, the estimated emission reductions for this monitoring period was re-calculated based on the actual installed capacity. The re-calculated estimated emission reductions for this monitoring period are 764,975 tCO₂e (=854,973 tCO₂e × 20.4MW / 22.8MW). The actual emission reductions achieved in this monitoring period are 27.70%¹³ lower than the re-calculated estimated emission reductions. The main reason is that Laowuji Nanyi power plant was at the status of equipment halting at whole the monitoring period, and Songhe Cai'er stopped operation

¹¹ (553,049 tCO₂e-854,973 tCO₂e)/ 854,973 tCO₂e=-35.31%

¹² As per the registered PD, the emission reduction in 2019 is 604,778 tCO₂e, thus the estimated emission reduction in 2019 (covering 6 days) is 9,941 tCO₂e, i.e. 9,941 tCO₂e =604,778 tCO₂e *6days/365days. And the emission reduction in 2020 is 604,778 tCO₂e, the emission reduction in 2021 is 240,254 tCO₂e, so the estimated emission reduction in this monitoring period is 854,973 tCO₂e

¹³ (553,049 tCO₂e – 764,975 tCO₂e)/ 764,975 tCO₂e=-27.70%

at the periods of 26-December-2019 to 25-February-2021 due to the concentration of CH₄ in CMM gas was not enough for electricity generation. Besides, in the registered PD, ex-ante calculations converted to CO₂e using GWP_{CH₄} values from the IPCC Fourth Assessment Report (AR4) which is 25 tCO₂e/tCH₄, as per Section 3.14.4 of VCS Standard 4.1, ex-post calculations shall be converted to CO₂e using GWP_{CH₄} values from the IPCC Fifth Assessment Report (AR5) which is 28 tCO₂e/tCH₄. Taking these into consideration, the estimated emission reductions achieved in this monitoring period are 566,010 tCO₂e¹⁴, thus, the actual emission reductions achieved in this monitoring period is 2.29% ¹⁵ lower than the estimated emission reductions, which is in the normal fluctuation range.

¹⁴ In this monitoring period, the power plants of Tucheng 13 (4.8MW), Tucheng 14 (2.4MW), and Songhe Caisan (7.2MW) operated 517 days, Songhe Caier (3.6MW) operated 89 days, thus, the estimated emission reductions are calculated as 789,569 tCO₂e, ie. $566,010 \text{ tCO}_2\text{e} = 854,973 \text{ tCO}_2\text{e} \times 14.4 \text{ MW} / 22.8 \text{ MW} + 854,973 \text{ tCO}_2\text{e} \times 3.6 \text{ MW} / 22.8 \text{ MW} \times 89 \text{ days} / 517 \text{ days} \times 28 \text{ tCO}_2\text{e} / \text{tCH}_4 / 25 \text{ tCO}_2\text{e} / \text{tCH}_4$.

¹⁵ $(553,049 \text{ tCO}_2\text{e} - 566,010 \text{ tCO}_2\text{e}) / 566,010 \text{ tCO}_2\text{e} = -2.29\%$