GUIZHOU JINYAN CMM POWER GENERATION PROJECT

Document Prepared by Climate Bridge （Shanghai）Ltd.

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

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

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1 PROJECT DETAILS

1.1 Summary Description of the Project

Guizhou Jinyan CMM Power Generation Project (hereinafter referred to as the Project) will utilize the low concentration coal mine methane (CMM) from Jinyan coal mine for power generation to supply electricity to the coal mine where the Project is located and to China Southern Power Grid (CSPG) if there is any electricity surplus. The Project is located in Fengshan township, Dafang County, Bijie City, Guizhou Province, China. The Project Owner is Guizhou Jinyan Energy Technology Co., Ltd.

Prior to the implementation of the project, Jinyan coal mine was equipped with CMM extraction facilities and all extracted CMM was vented into the atmosphere directly; the electricity consumed at coal mines was imported from China Southern Power Grid (CSPG); the heat was provided by waste coal boilers. For CMM treatment and heat supply, baseline scenario is the same as the scenario existing prior to the implementation of the project activity. For electricity supply, the CSPG provides the equivalent amount of electricity produced by the Project in the baseline.

The purpose of the Project is to utilize the extracted CMM with low concentration methane concentration to produce electricity. No coal bed methane (CBM) or ventilation air methane (VAM) utilization is involved. Eight sets of CMM power generators will be installed with a total installed capacity of 4.8MW (8*0.6MW), destroying 8.7936 million m^3 of methane annually. After the full operation of the Project, the expected annual exported electricity will be 24,816 MWh, which will be supplied to the coal mine first through the electricity distribution network in Jinyan coal mine area, and then to China Southern Power Grid (CSPG) if there is any electricity surplus, replacing the electricity that would otherwise have been purchased from the CSPG and displace part of the electricity generated by CSPG dominated by fossil fuel-fired power plants. The waste heat from the generators will be recovered by waste heat boilers to provide free hot water to the coal mines, which was provided by waste coal fired boilers before the implementation of the Project. However, to be conservative, emission reductions will not be claimed for this part.

The emissions reduction of the Project comes from two sources: 1) Methane (CH_4) emissions as a result of the previously vented gas that will be captured and destroyed in the project scenario; 2) CO_2 emissions from the production of the equivalent amount of electricity replaced by the Project that would otherwise have been purchased from the CSPG. It is estimated that in the 10 years crediting period of the project (from 01-October-2020 to 30-September-2030), the expected average annual GHG emission reduction will be 160,655 tCO_2e, with the total emission reduction of 1,606,550 tCO_2e.

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

- Achieving significant GHG emission reductions and other air pollutant reductions by methane destruction;
- Displacing part of the grid electricity mainly generated by fossil fuel combustion, thus reducing the emission of CO_2 and other air pollutants;
- Creating new job opportunities.

1.2 Sectoral Scope and Project Type

According to CDM Standard: Applicability of sectoral scopes (CDM-EB88-A04-STAN), which came into effect on 11-March-2016, certain baseline and monitoring methodologies have to be reclassified with respect to the linked sectoral scopes, the mandatory sectoral scopes linked to the methodology ACM0008 are 1 and 8.

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

Sectoral Scope 8: Mining/mineral production

The project is not a grouped project.

1.3 Project Eligibility

The scope of the VCS Program includes:

1) The six Kyoto Protocol greenhouse gases: The emissions reduction of the project comes from two sources: a) Methane (CH_4) emissions as a result of the previously vented gas that will be captured and destroyed in the project scenario; b) CO_2 emissions from the production of the equivalent amount of electricity replaced by the Project that would otherwise have been purchased from the CSPG dominated by fossil fuel-fired power plants. Thus, the project applicable to this scope.

2) Ozone-depleting substances: NA

3) Project activities supported by a methodology approved under the VCS Program through the methodology approval process: NA

4) Project activities supported by a methodology approved under a VCS approved GHG program, unless explicitly excluded under the terms of Verra approval: The methodology ACM0008 (Version 08) of the project utilized is a methodology approved under CDM Program, that is a VCS approved GHG program.

5) Jurisdictional REDD+ programs and nested REDD+ projects as set out in the VCS Program document Jurisdictional and Nested REDD+ (JNR) Requirements: NA

Meanwhile, the project is not belonged to the projects excluded in Table 1 of VCS Standard 4.1.

Thus, the project is eligible under the scope of VCS program.

1.4 Project Design

The project has been designed to be a single installation of an activity, not a grouped project:

☒ The project includes a single location or installation only

☐ The project includes multiple locations or project activity instances, but is not being developed as a grouped project

☐ The project is a grouped project

1.5 Project Proponent

Organization name	Guizhou Jinyan Energy Technology Co., Ltd.
Contact person	Zhu Kunlei
Title	General Manager
Address	Caifuxincheng A2 Building, Yingbin Avenue, Guizhou Province, Dafang County, Bijie City, Guizhou Province, China
Telephone	+86-21 6246 2036
Email	3542346576@qq.com

1.6 Other Entities Involved in the Project

Organization name	Climate Bridge (Shanghai) Ltd.
Role in the project	Consultancy
Contact person	Gao Zhiwen
Title	General Manager
Address	Block B, Level 24, Jiangong Mansion, 33 Fushan Road, Pudong New Area, Shanghai, China 200120
Telephone	+86-21 6246 2036
Email	gao.zhiwen@climatebridge.com

1.7 Ownership

The project proponent of the project is Guizhou Jinyan Energy Technology Co., Ltd. The project proponent has obtained the approval from Dafang County Development and Reform Commission for the construction and operation of the Project. The Environmental Impact Assessment (EIA) of the Project shows that the Project is constructed and operated by the project proponent, and the EIA form has been approved by approved by Dafang County Environmental Protection Bureau.

Both the project approval and the EIA approval are issued by competent authorities, and they demonstrate that the project proponent has been granted the project ownership in compliance with relevant laws and regulations in China.

In addition, the equipment purchase contracts and the construction contract signed between the project proponent and suppliers/contractors demonstrate the ownership of the project proponent over the project.

1.8 Project Start Date

01-October-2020 (operation start date).

1.9 Project Crediting Period

This project adopts fixed crediting periods of 10 years, from 01-October-2020 to 30-September-2030 (both days included).

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

The estimated annual GHG emission reductions/removals of the project are:

☐ <20,000 tCO_2e/year

☐ 20,000 – 100,000 tCO_2e/year

☒ 100,001 – 1,000,000 tCO_2e/year

☐ >1,000,000 tCO_2e/year

Project Scale	
Project	✓
Large project	

Year	Estimated GHG emission reductions or removals (tCO_2e)
01-October-2020 to 31-December-2020	40,493[1]

[1] It covering 92 days from 01-October-2020 to 31-December-2020, thus the estimated emission reduction in the period is 40,493 tCO_2e, i.e.40,493 tCO_2e = 160,655 tCO_2e x 92days/365days.

01-January-2021 to 31-December-2021	160,655
01-January-2022 to 31-December-2022	160,655
01-January-2023 to 31-December-2023	160,655
01-January-2024 to 31-December-2024	160,655
01-January-2025 to 31-December-2025	160,655
01-January-2026 to 31-December-2026	160,655
01-January-2027 to 31-December-2027	160,655
01-January-2028 to 31-December-2028	160,655
01-January -2029 to 31-December-2029	160,655
01-January -2030 to 30-September-2030	120,162[2]
Total estimated ERs	1,606,550
Total number of crediting years	10
Average annual ERs	160,655

1.11 Description of the Project Activity

Eight sets of CMM power generators with total capacity of 4.8 MW will be installed to utilize CMM for power generation. The amount of pure methane destructed is estimated to be 8.7936 million Nm^3 per year, and the annual exported electricity is 24,816 MWh.

The technical process of the Project is shown in Figure 1-1. 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 will be recovered by the waste heat boilers to provide hot water to coal mines.

The power generators are produced by the Shandong Dongying Power Machinery Co.,Ltd. with the specifications shown in Table 1-1. After site survey and taking advice from professional experts, the preparation organization of feasibility study report determined the annual operating hours to be 5,500 hours in the FSR, and thus the plant load factor (PLF) is 0.6279[3].

The equipment employed in the project is all produced domestically without technology transfer.

[2] It covering 273 days from 01-January-2030 to 31-May-2030, thus the estimated emission reduction in the period is 120,162 tCO_2e, i.e.120,162 tCO_2e = 160,655 tCO_2e x 273days/365days.

[3] 0.6279=5,500 hours/8,760 hours

As shown in Figure 1-1, the Project will install gas analyzers and flow meters to respectively monitor the methane concentration and CMM volume sent to the CMM power plants. Electricity meters will be installed to monitor the electricity exported to coal mines. Detailed monitoring information can be found in section 5.3.

The emission reduction of the project comes from two sources: 1) CH_4 emission as a result of venting gas that will be captured and destroyed in the project scenario; 2) CO_2 emission from the production of equivalent amount of electricity replaced by the Project that would otherwise be purchased from CSPG.

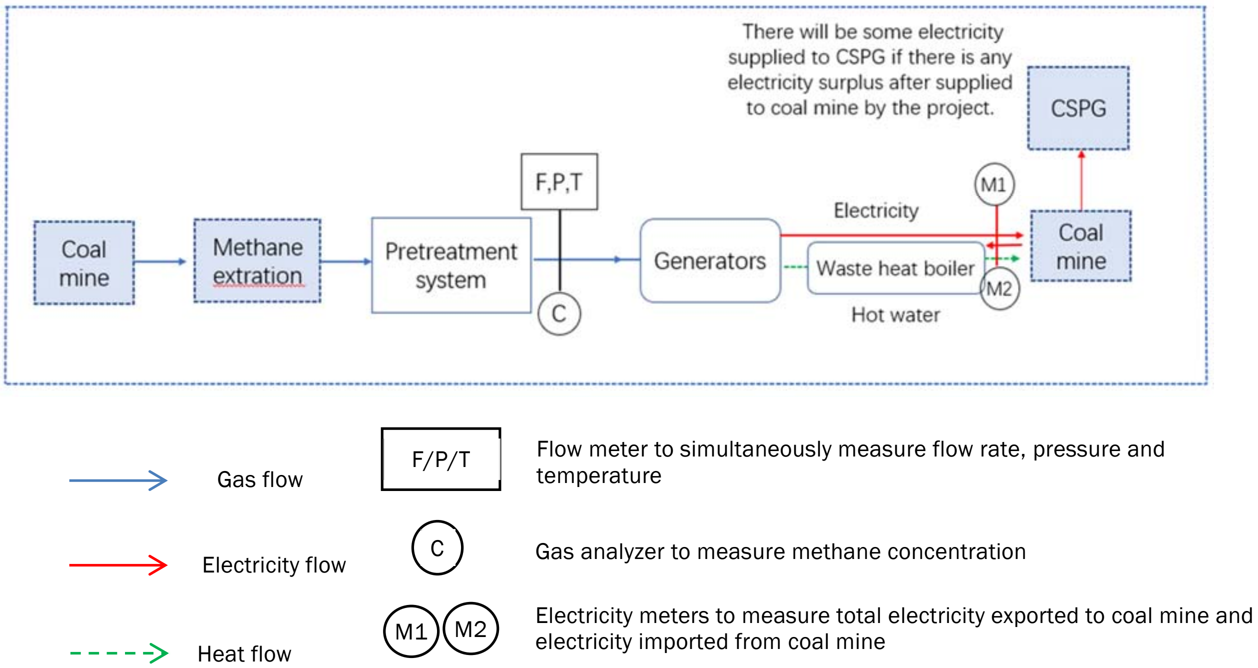

Figure 1-1 Project process diagram

Table 1-1 Generator Specifications[4]

Type	600GFZ-1RW
Supplier	Shandong Dongying Power Machinery Co.,Ltd
Quantity	8
Rated power（kW）	600
Rated current (A)	1,080
Rated voltage (V)	400

[4] Sourced from nameplate of the generator.

Rated speed (r/min)	1,000
Frequency（Hz）	50
Power factor	0.8
Life time (year)	10

1.12 Project Location

The Project is located in Fengshan township, Dafang County, Bijie City, Guizhou Province, People's Republic of China. The geographical coordinates for the project site are east longitude 105°45′6″ and north latitude 27°15′45″.

The geographic locations of the involved coal mines are shown in Figure 1-2.

Figure 1-2 Location of the project

1.13 Conditions Prior to Project Initiation

The scenario existing prior to the start of the implementation of the project activity is:

1) all the low concentration CMM extracted from the coal mines in the Project would be vented into the atmosphere; 2) the CSPG provided the equivalent amount of electricity produced by the project (as discussed above, the electricity generated by the Project will only replace electricity from CSPG) and 3) heat was provided by waste coal boilers (emission reductions due to heat replacement will not be claimed).

For CMM treatment and heat supply, baseline scenario is the same as the scenario existing prior to the implementation of the project activity. For electricity supply, the CSPG provides the equivalent amount of electricity produced by the Project in the baseline.

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

The project complies with all Chinese relevant regulations. Mainly include:

1. Opinions of the General Office of the State Council on Further Accelerating the Extraction and Utilization of Coalbed Methane (Coal Mine Gas)[5]. In the opinions It is supported that using CMM to generate electricity supplied to the grid. The electricity generated by CMM power plants shall be supplied to coal mine in priority, and the rich electricity that needs to be supplied to the grid shall be purchased by power grid enterprises. The project will utilize the low concentration coal mine methane (CMM) from Jinyan coal mine for power generation to supply electricity to the coal mine where the Project is located and to China Southern Power Grid (CSPG) if there is any electricity surplus. Thus, the project complies with the opinions.
2. According to Chinese National Coalmine Safety Regulation[6], CMM drainage is an indispensable link in the safety production of the Coal Mine. The project utilizes the low concentration coal mine methane (CMM) from Jinyan coal mine for power generation, which will reduce environmental pollution and atmospheric greenhouse effect. Due to the environmental and economic benefits brought by this project, the initiative of gas drainage can be further mobilized, the safe production of coal mines can be promoted, and coal mine safety accidents will be less or not occurred.
3. Besides the economic and environmental benefits, the CMM power generation promotes the development of related industries, creates employment opportunities, and brings corresponding social benefits. Thus, the comprehensive utilization of CMM is very necessary due to the significant economic, environmental and social benefits, which complies with the "Notice of the National Development and Reform Commission on the issuance of the twelfth Five-Year Plan for The Development and Utilization of Coalbed Methane (Coal Mine Gas)[7]".

The project obtained the approval letters from governmental authorities: Dafang County Development and Reform Commission, as well as Dafang County Environmental Protection Department. The two approvals well demonstrate that local government permits the construction of the project. Consequently, the project is compliance with laws, status and other regulatory frameworks.

[5] http://www.gov.cn/zhengce/content/2013-09/18/content_2540.htm

[6] https://www.mem.gov.cn/gk/zfxxgkpt/fdzdgknr/gz11/201602/t20160225_405787.shtml

[7] https://www.ndrc.gov.cn/xxgk/zcfb/ghwb/201112/t20111231_962121.html

1.15 Participation under Other GHG Programs

1.15.1 Projects Registered (or seeking registration) under Other GHG Program(s)

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

The project is seeking registration only in VCS program.

1.15.2 Projects Rejected by Other GHG Programs

NA.

1.16 Other Forms of Credit

1.16.1 Emissions Trading Programs and Other Binding Limits

Does the project reduce GHG emissions from activities that are included in an emissions trading program or any other mechanism that includes GHG allowance trading?

☐ Yes ☒ No

The project proponent is not part of any emission trading program. The net GHG emission reductions from the project will not be used for compliance with emission trading programs or to meet binding limits on GHG emissions. The project activity has not participated under any other GHG programs.

China has a national emissions trading scheme only cover the high-emission industries, such as thermal power generation, petrochemical, chemical, building materials, iron and steel, non-ferrous, paper, aviation and other key emission industries that emitted at least 26,000 tons of CO_2e/year[8]. And the project activity is not included the mandatory emission control scheme and there is no emission cap enforced for the project owner according to the enforced company list[9] in public information. Hence, it is confirmed that the emission reductions will not be double counted.

1.16.2 Other Forms of Environmental Credit

Has the project sought or received another form of GHG-related credit, including renewable energy certificates?

☐ Yes ☒ No

1.17 Sustainable Development Contributions

[8] http://www.mee.gov.cn/xxgk2018/xxgk/xxgk05/202103/t20210330_826728.html

[9] http://mee.gov.cn/xxgk2018/xxgk/xxgk03/202012/W020201230736907682380.pdf

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

- Displacing part of the grid electricity mainly generated by fossil fuel combustion, thus reducing the emission of CO_2 and other air pollutants; 24,816 MWh/yr of electricity from clean and environmentally sound technologies with CMM will be supplied to the coal mine. Thus, the project will achieve SDG 9 "Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation" [10];
- The project will achieve a GHG emission reduction of 160,655 tCO_2e/yr during the crediting period. Thus, the project will achieve SDG 13"Take urgent action to combat climate change and its impacts"[11];
- This project will increase income of local residences and accelerate economy development in rural areas. During the crediting period, direct and indirect employment opportunities will be generated. Thus, the project will achieve SDG 8 "Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all"[12].

1.18 Additional Information Relevant to the Project

Leakage Management

According to the methodology, the leakage of the project is zero, thus the leakage management is not applicable to the project.

Commercially Sensitive Information

No commercially sensitive information has been excluded from the public version of the project description.

Further Information

NA.

2 SAFEGUARDS

2.1 No Net Harm

[10] https://sdgs.un.org/goals/goal9

[11] https://sdgs.un.org/goals/goal13

[12] https://sdgs.un.org/goals/goal8

The project started construction on 20-August-2019 and operated on 01-October- 2020, the following measures in the construction and operation phase were carried out by the project owner to mitigated the potential impact.

Air pollution

In the construction phase, sprinkling dust control measures were taken timely by the project owner on the dust caused by earthwork excavation and backfilling. The body and tires were cleaned when the transport vehicles were out of the site. Vehicles that easy to cause dust were covered with tarps, and overload was not allowed.

In the operation phase, exhaust gas from combustion of gas units is treated by waste heat recovery device and discharged through the exhaust cylinder after meeting the V stage standard of "Emission Limits and Measurement Methods of Vehicle Exhaust Pollutants of Pressurized combustion and gas-fueled Ignition Engines and Vehicles" (GB17691-2005); The oil fume from the canteen is led to the roof of the building through a smoke duct for discharge after being treated by the oil fume purifier, which is meeting the small standard of "Lampblack Emission Standard of catering Industry (Trial)" (GB18483-2001).

Wastewater

In the construction phase, the waste water in construction phase was from the washing waste water of the concrete mixing system and mixing machinery. The waste water was returned to the construction after being treated in the grease trap and is not discharged outside. Other domestic sewage was reused reasonably after settling.

In the operation phase, the waste water from the water ring pump and the cooling water from the generators are recycled by the project owner and not discharged; The gas-filtered waste water and the waste water from the floor cleaning of the generator room are treated by the oil-separating sedimentation tank and then used for production without discharge; The oil slick collected in the oil-separating sedimentation tank belongs to hazardous waste, and it is collected and temporarily stored in the hazardous waste temporary storage room, and it is regularly entrusted to the units with corresponding qualifications for disposal; The canteen oily wastewater is pre-treated by grease trap and discharged into the improved septic tank for treatment with other domestic sewage. It is used as agricultural fertilizer regularly and is not discharged externally.

Noise

In order to eliminate noise impact on workers and local residents in the construction phase, the project owner selected low-noise construction equipment and construction was not conducted at night (10.pm-6.am).

In the operation phase, the generator and engine are installed in a semi-enclosed workshop. The workshop adopts brick and concrete structure, the inner wall is equipped with sound absorbing materials, and the inlet and outlet are equipped with mufflers. Strengthen management and maintain the normal operation of equipment.

Solid waste

In the construction phase, the waste materials such as steel bars and other recyclable materials were recycled by the project owner in a classified way. Other construction wastes that cannot be recycled were transported to the designated local places for disposal. The domestic wastes were collected uniformly and then handed over to the local sanitation departments for disposal.

In the operation phase, a standard hazardous waste storage room is be set up to store waste oil, waste batteries, waste oil drums, oily rags and other hazardous wastes, and the entity with relevant qualifications for disposal is entrusted by the project owner; Filter dust and slag regularly cleaned, disposed together with household garbage; Household wastes are collected separately. Recycled those that can be recycled and those that cannot be recycled are sent to the designated place of the local sanitation department for disposal.

In conclusion, through the above measures by the project owner, there are no negative environmental and/or socio-economic impacts due to the project.

2.2 Local Stakeholder Consultation

The Project owner collected comments by local stakeholders on the project activity. Survey questionnaires were distributed to relevant personnel of Jinyan Coal Mine, local villagers and government officials by the Project owner on 13-May-2019. 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	30	60%
	Female	20	40%
Age	<25	9	18%
	25-45	21	42%
	45-55	13	26%
	>55	7	14%

Education	Junior high school or below	27	54%
	Senior high school	13	26%
	College or above	10	20%
Occupation	Worker	12	24%
	Peasant	22	44%
	Management personnel	8	16%
	Civil servant	6	12%
	Unspecified	2	4%

Fifty 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 proposed project?	Quite much	44	88%
		Heard of	6	12%
		Nothing	0	0
2	What is your attitude towards the project construction?	Supportive	49	98%
		Against	0	0
		Indifferent	1	2%
3	What is the most probable environmental impact do you think the project will cause after the construction finish? (multiple choice)	None	47	94%
		Air pollution	0	0
		Water pollution	0	0%

			Noise pollution	0	0%
			Harm to indigenous animals and plants	0	0%
			No idea	3	6%
4	Do you think the project operation will bring about more benefits than loss?		Yes	50	100%
			No	0	0
			About the same	0	0
5	Are you willing to participate in the project construction or operation?		Yes	46	92%
			No	2	4%
			Indifferent	2	4%
6	What influence do you think the project will bring about to you and your family?		Positive	46	92%
			None	4	8%
			Negative	0	0
7	Do you think the project operation will affect the production safety of the coal mine?		Positive effect	47	94%
			None	3	6%
			Negative effect	0	0
8	What impact do you think the project will bring to local community?	Employment	Increase	50	100%
			Decrease	0	0
			No change	0	0

	(multiple choice)	Economy	Rise	47	94%
			Fall	0	0
			No change	3	6%
		Power Supply	Increase	46	92%
			Decrease	0	0
			No change	4	8%

The survey shows that the Project is well known by local residents. All respondents know or hear about the Project. Most of them are supportive of the project construction, and think the Project will bring more benefit than loss. 92% of the respondents are willing to participate in the construction and operation of the Project. 94% of the respondents believe that the Project will not have any environmental impact.

92% 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, 6% of the respondents believe the Project will not have any impact on coal mine safety, and 94% of the respondents consider the Project improve the operational safety of the coal mine to some extent.

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 proposed project, believing that the Project will provide more employment opportunities, help local economic development, and increase local power supply. Therefore, the implementation of the Project is regarded as beneficial by most of the local stakeholders.

Local Stakeholder Consultation during the project implementation stage:

Communications with Local stakeholders are being carried out at periodic intervals. Key implementation schedules or changes of the project will be communicated to the local authority, who will inform the neighbourhood committee and the local residents, the comments and suggestions from residents will be collected by the local authority meanwhile. And the local government agencies and competent authorities will 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.

2.3 Environmental Impact

The Project owner entrusted a third party, Beijing Gongda Zhiyuan Technology Development Co., Ltd., to conduct the Environmental Impact Assessment (EIA) on the project. The EIA report was completed in December 2018 and was approved by Dafang County Environmental Protection Bureau on 14-January-2019. 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 main air pollution sources during construction period are mechanical exhaust gas and dust. Mechanical exhaust gas is mainly the exhaust gas generated by construction machinery in the process of construction operation and transportation vehicles in transportation. The exhaust gas generated by construction machinery will disappear with the end of construction and the smoke volume is not large.

Dust is produced in construction site leveling, foundation excavation and so on. In order to reduce the influence of dust during construction, the following measures can be taken: building barriers around the site; In the construction of earthwork excavation and stacking, construction garbage cleaning and other dusty processes should be selected as far as possible in no strong wind weather, mixing field, raw material stacking best fixed timely removal of abandoned soil, and in the process of shipment to take effective cover, before the vehicle out of the site should be removed from the wheels of the soil.

1.2 Wastewater

Wastewater in the construction period consists of construction wastewater and domestic wastewater. Construction wastewater is from the construction process of foundation excavation, concrete mixing and maintenance during the construction of infrastructure. It will be collected and precipitated by the sedimentation tank and then used for site construction and sprinkling and dust removal. Domestic wastewater from construction personnel is suitable for dry toilets in the construction site. The excrement is cleaned regularly by special personnel and used for fertilizing the surrounding farmland. Therefore, no domestic sewage is generated in the construction site.

1.3 Noise

The noise generated by construction site is mainly the noise of civil construction equipment and traffic noise generated by transport vehicles. In order to reduce the influence of construction on the surrounding sound environment quality, the following measures should be taken in time: The construction entity should disperse the noise source as far as possible to reduce the influence on the surrounding sound environment; Construction time shall not be arranged from 10:00 PM to 6:00 am the next day, and low-noise machinery shall be used as far as possible; Keep high-noise devices away from residential areas.

1.4 Solid waste

During construction, a lot of abandoned soil will be generated, most of which will be used for backfilling the foundation, and the rest will be used for greening in the plant. Construction waste shall be transported to the landfill designated by the sanitation department for burial, and covered with tarpaulin to avoid waste loss and pollution along the way. Therefore, the construction solid waste can be reasonably disposed of, there will be no secondary pollution to the environment.

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. <u>Operation Phase</u>

2.1 Air pollution

The main air pollutants from CMM power generation are CO_2, SO_2, NO_x, etc. According to the specification of the generator sets, the concentration of SO_2 and NO_x both meet the standard requirements of Period II of the regulation “Emission Standard of Air Pollutants from boilers” (GB13271-2001).

2.2 Wastewater

The waste water from the water circulation pump in the project is collected by the circulation pool and recycled without discharge; The waste water from the electric generator cooling system is cooled by the cooling tower and discharged into the circulation pool after cooling and recycled without discharge; Gas-water separation and filtration waste water, cleaning waste water in the machine room, dust suppression water in the plant and reclaimed waste water of exchange resin are collected and precipitated by the sedimentation tank and then used for sprinkling and dust suppression in the open field of the plant, without external discharge; Domestic sewage is collected by septic tank and then sent to Jinyan Coal mine domestic sewage treatment station for treatment, which will be reused after reaching the level 1 standard of Comprehensive Sewage Discharge Standard (GB8978-1996).

2.3 Noise

Noise during operation is generated by the low-concentration CMM generators, 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 the machinery. 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 solid waste of the project is mainly dust residue generated by the filter, solid waste containing oil, waste oil, household garbage and exhaust gas battery. Entrust oil-bearing solid waste, waste oil and waste battery to be disposed of by entities with relevant hazardous waste disposal qualifications. Dust residue, sediment sludge and general household garbage will be collected and treated by the local sanitation department. After passing the above measures, all solid wastes of the project will be properly treated with a clear direction and will not cause secondary pollution to the surrounding environment.

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.

2.4 Public Comments

This project will be open for public comment on the verra website.

2.5 AFOLU-Specific Safeguards

NA.

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

The approved consolidated methodology applied in the project activity is ACM0008 – "Abatement of methane from coal mines" (version 08.0).

https://cdm.unfccc.int/methodologies/DB/YSD3FQ5WR3VPC9Q64CDTLXHLFVKKKU

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

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

https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-02-v7.0.pdf/history_view

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

https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf/history_view

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

https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v3.0.pdf/history_view

“Common practice” (version 03.1);

https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-24-v1.pdf/history_view

“Investment analysis” (version 11.0).

https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-27-v11.0.pdf/history_view

3.2 Applicability of Methodology

The project satisfies all the applicability criteria of the methodology ACM0008 (Version 08.0), of which the detailed description is listed in Table 3-1 below:

Table 3-1 Applicability of ACM0008

No.	Applicability	The project
1	This methodology applies to project activities that aim for the use and/or destruction of the methane extracted/obtained from a working or abandoned coal mine(s). The project activities include any of the following methods to treat the methane captured: (a) The methane is destroyed without energy production, for example through flaring; (b) The methane is used to produce energy. This may include electricity, heat, vehicle fuel, etc.	Applicable. The project uses the low concentration coal mine methane (CMM) from Jinyan coal mine for power generation to supply electricity to the coal mines where the Project is located. Therefore, the project belongs to category (b).

2	Emission reductions can be claimed for displacing or avoiding energy from other sources	Applicable. The emissions reduction of the project comes from two sources: 1) Methane (CH_4) emissions as a result of the previously vented gas that will be captured and destroyed in the project scenario; 2) CO_2 emissions from the production of the equivalent amount of electricity replaced by the Project that would otherwise have been purchased from the CSPG.
3	Methane used in the project activities shall be extracted using the following techniques: (a) Surface drainage boreholes to capture coal bed methane (CBM) or methane from open cast mines; (b) Underground boreholes in the mine, surface goaf wells, underground boreholes, gas drainage galleries or other goaf gas capture techniques, including gas from sealed areas, to capture coal mine methane (CMM); (c) Mine ventilation system to dilute and remove ventilation air methane (VAM); (d) Surface drainage boreholes in the case of sealed abandoned mines or ventilation system in the case of ventilated mines to capture abandoned mine methane (AMM).	Applicable. The project uses CMM from ‘Underground boreholes in the mine to capture pre mining CMM’ and ‘surface goaf well, underground boreholes, gas drainage galleries or other goaf gas capture techniques, including gas from sealed areas, to capture coal mine methane (CMM)’. The Project activity does not involve the extraction or utilization of CBM, VAM or AMM. Therefore, the project belongs to category (b).
4	The remaining share of the methane, to be diluted for safety reason, may still be vented.	Applicable. The project involves the capture and utilization of CMM for power generation at the operational Jinyan coal mine where the baseline is the total atmospheric release of the methane. The remaining unused share of the methane is vented for safety reasons.

5	In the case of open cast mines, in addition to the conditions listed above, project activities should meet the following requirements: (a) The mines should have had a working mining concession for at least three years prior to the start of project; (b) Only pre-mining drainage from wells placed within the area to be mined are eligible for crediting; (c) For the calculation of emission reductions, all provisions for CBM should be followed for the open cast mine methane.	Jinyan coal mine that the project involved is not a case of open cast mine.
6	The methodology does not apply to project activities with any of the following features: (a) Capture/use of virgin coal bed methane, e.g. methane extracted from coal seams for which there is no valid coal mining concession; (b) Use CO_2 or any other fluid/gas to enhance CBM drainage before mining takes place; (c) Methane extraction from abandoned mines that are flooded due to regulation.	The project does not involve the extraction or utilization of CBM. The project does not use CMM from open cast mining, or abandoned mines.
7	The methodology does not apply to project activities that involve use and/or destruction of CBM or OCM if the baseline scenario identification resulted in partial use and/or destruction of CBM or OCM.	The project does not involve use and/or destruction of CBM or OCM.
8	Emission reductions due to the use and/or destruction of CBM or OCM cannot be claimed if surface drainage to capture CBM or methane from open cast mine(s) is used within the project boundaries prior to the implementation of the project activity.	The project does not involve use and/or destruction of CBM or OCM.

In addition, the project meets the applicability conditions of the applied tools applied in the PD as follows:

Table 3-2 Applicability of applied tools

Tool	Applicability	The project

Combined tool to identify the baseline scenario and demonstrate additionality (version 07.0)	The tool is applicable to all types of proposed project activities. However, in some cases, methodologies referring to this tool may require adjustments or additional explanations as per the guidance in the respective methodologies. This could include, inter alia, a listing of relevant alternative scenarios that should be considered in Step 1, any relevant types of barriers other than those presented in this tool and guidance on how common practice should be established	Applicable. The project is a CMM power generation project.
Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation (version 03.0)	If emissions are calculated for electricity consumption, the tool is only applicable if one out of the following three scenarios applies to the sources of electricity consumption: (a) Scenario A: Electricity consumption from the grid. The electricity is purchased from the grid only, and either no captive power plant(s) is/are installed at the site of electricity consumption or, if any captive power plant exists on site, it is either not operating or it is not physically able to provide electricity to the electricity consumer; (b) Scenario B: Electricity consumption from (an) off-grid fossil fuel fired captive power plant(s). One or more fossil fuel fired captive power plants are installed at the site of the electricity consumer and supply the consumer with electricity. The captive power plant(s) is/are not	Applicable. Only when the project is out of operation or abnormal operation, there is a small amount of electricity consumed by the project from the coal mine which is supplied by China Southern Power Grid (CSPG) (Scenario A).

	connected to the electricity grid; or (c) Scenario C: Electricity consumption from the grid and (a) fossil fuel fired captive power plant(s). One or more fossil fuel fired captive power plants operate at the site of the electricity consumer. The captive power plant(s) can provide electricity to the electricity consumer. The captive power plant(s) is/are also connected to the electricity grid. Hence, the electricity consumer can be provided with electricity from the captive power plant(s) and the grid.	
	This tool can be referred to in methodologies to provide procedures to monitor amount of electricity generated in the project scenario, only if one out of the following three project scenarios applies to the recipient of the electricity generated: (a) Scenario I: Electricity is supplied to the grid; (b) Scenario II: Electricity is supplied to consumers/electricity consuming facilities; or (c) Scenario III: Electricity is supplied to the grid and consumers/electricity consuming facilities.	The electricity generated by the project is supplied to the coal mine and the surplus electricity is delivered to CSPG (Scenario III).
	This tool is not applicable in cases where captive renewable power generation technologies are installed to provide electricity in the project activity, in the baseline scenario or to sources of leakage. The tool only accounts for CO_2 emissions.	No captive renewable power generation technologies are installed to provide electricity in the project activity, in the baseline scenario or to sources of leakage.

Tool to calculate the emission factor for an electricity system (version 07.0)	This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity that is where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects)	Applicable. The project utilizes the low concentration coal mine methane (CMM) from Jinyan coal mine for power generation to supply electricity to the coal mines that would otherwise be purchased from CSPG. Therefore the tool is applied to estimate the OM, BM and /or CM when calculating baseline emissions for the project.
	Under this tool, the emission factor for the project electricity system can be calculated either for grid power plants only or, as an option, can include off-grid power plants. In the latter case, two sub-options under the step 2 of the tool are available to the project participants, i.e. option II a and option II b. If option II a is chosen, the conditions specified in “Appendix 1: Procedures related to off-grid power generation” should be met. Namely, the total capacity of off-grid power plants (in MW) should be at least 10 per cent of the total capacity of grid power plants in the electricity system; or the total electricity generation by off-grid power plants (in MWh) should be at least 10 per cent of the total electricity generation by grid power plants in the electricity system; and that factors which negatively affect the reliability and stability of the grid are primarily due to constraints in generation and not to other	In the host country as off-grid power generation is not significant. Therefore, emission factor for the project electricity system is calculated only for the grid power plants. Thus, this applicability criterion is satisfied.

	aspects such as transmission capacity.	
	In case of CDM projects the tool is not applicable if the project electricity system is located partially or totally in an Annex I country.	Applicable. The project electricity system is located in a non-Annex I country.
	Under this tool, the value applied to the CO_2 emission factor of biofuels is zero.	The project is not involved in biofuels.
Common practice (version 03.1)	This methodological tool is applicable to project activities that apply the methodological tool “Tool for the demonstration and assessment of additionality”, the methodological tool “Combined tool to identify the baseline scenario and demonstrate additionality”, or baseline and monitoring methodologies that use the common practice test for the demonstration of additionality.	Since the project activity is using “Combined tool to identify the baseline scenario and demonstrate additionality”, the tool is applicable.
	In case the applied approved baseline and monitoring methodology defines approaches for the conduction of the common practice test that are different from those described in this methodological tool, the requirements contained in the methodology shall prevail.	The baseline and monitoring methodology refers to “Combined tool to identify the baseline scenario and demonstrate additionality”. It required that the latest version of the “Methodological tool: Common practice” available on the UNFCCC website shall be applied. Therefore, this tool is applicable.
Investment analysis” (version 11.0)	This methodological tool is applicable to project activities that apply the methodological tool “Tool for the demonstration and assessment of additionality”, the	Since the project activity is using “Combined tool to identify the baseline scenario and demonstrate

	methodological tool "Combined tool to identify the baseline scenario and demonstrate additionality", the guidelines "Non-binding best practice examples to demonstrate additionality for SSC project activities", or baseline and monitoring methodologies that use the investment analysis for the demonstration of additionality and/or the identification of the baseline scenario.	additionality", the tool is applicable.
	In case the applied approved baseline and monitoring methodology contains requirements for the investment analysis that are different from those described in this methodological tool, the requirements contained in the methodology shall prevail.	The baseline and monitoring methodology refers to "Combined tool to identify the baseline scenario and demonstrate additionality". Therefore, this tool is applicable.

3.3 Project Boundary

The spatial extent of the project boundary comprises:

(a) The coal mine from where the methane is extracted;

For the project, the Jinyan coal mine is the coal mine from where the methane extracted.

(b) All equipment installed and used for the extraction, purification, compression, and storage of methane and transport to an off-site user;

For the project, there is no equipment for compression, CMM storage and transport to off-site user. Facilities for CMM drainage and extraction were installed prior to the implementation of the project activity. They are owned by the coal mine and are used primarily to maintain underground mining safety. Since they are not installed and used as part of the project activity, they are not considered in both the investment analysis and baseline calculations.

(c) Facilities that are installed and used as part of the project activity for flaring, flameless oxidation, captive power and heat generation, gas production and transportation;

For the project, CMM delivery system, power generation units and waste heat recovery units installed and used in the Project.

(d) Power plants connected to the electricity grid, where the project activity exports power to the grid and emission reductions are claimed for the displacement of grid emissions, as per the definition of project electricity system and connected electricity system given in the latest version of the "Tool to calculate the emission factor for an electricity system".

For the project, CCPG and ECPG supply electricity to CSPG, thus power plants connected to CSPG and CCPG and ECPG were included in the project boundary.

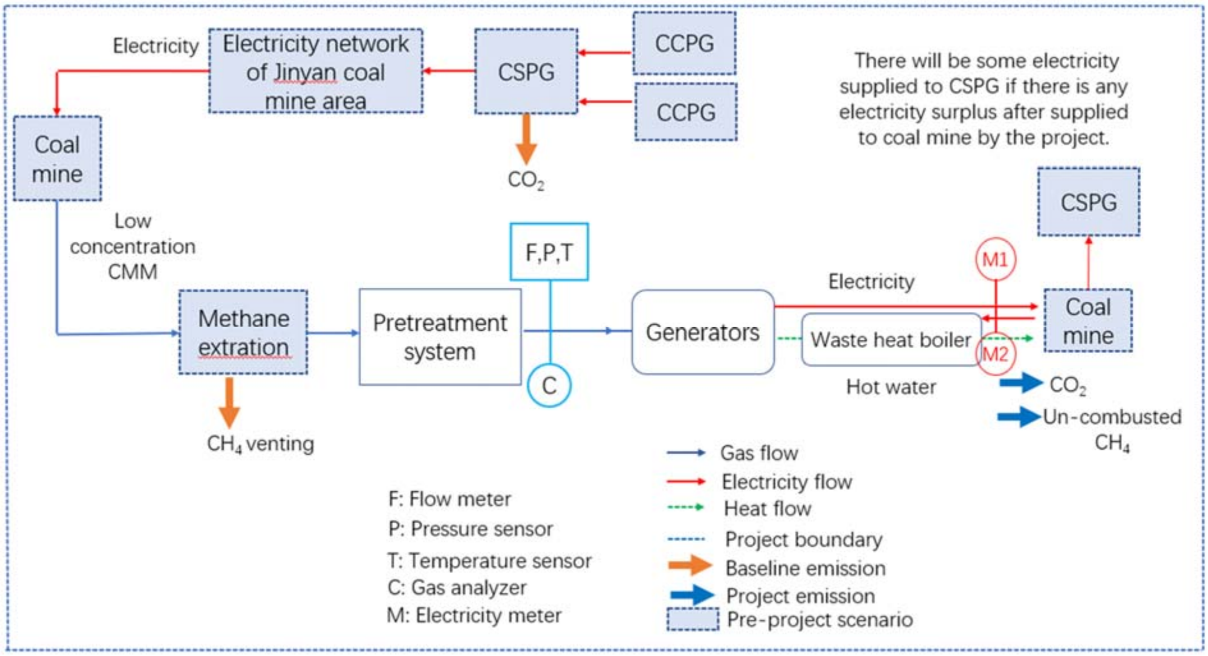

Figure 3-1 Diagram of the project boundary

The main emission sources and gases included in the project boundary are listed in Table 3-3 below:

Table 3-3 Emission sources included in or excluded from the project boundary

Source		Gas	Included?	Justification/Explanation
Baseline	Methane emissions as a result of venting	CH_4	Yes	Main emission source. All CMM captured and sent to electricity generators would be vented in the baseline scenario.

	Emissions from destruction of methane in the baseline	CO_2	No	No flaring or energy use in the baseline scenario.
		CH_4	No	Excluded for simplification.
		N_2O	No	Excluded for simplification.
	Electricity generation (electricity provided to the grid and/or to the captive user), heat and vehicle fuel use	CO_2	Yes	Only included if the project activity is to replace electricity from the grid, and emission reductions are claimed for such displacement.
		CH_4	No	Excluded for simplification.
		N_2O	No	Excluded for simplification.
Project scenario	Emissions of methane as a result of continued venting	CH_4	No	The project will take into account only the change in CMM emissions in ex ante estimate of GHG emission reduction; this will be done through rigorous monitoring of the amount of methane utilized or destroyed by the project activity.
	On-site electricity and fuel consumption due to the project activity, including transport of the gas	CO_2	Yes	Electricity consumed when the Project is shutdown. During operation, all auxiliary demand can be met by electricity generated.
		CH_4	No	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small.
	Emissions from methane destruction	CO_2	Yes	Emissions from the combustion of CMM in gas engines in the project activity will be considered.
	Fugitive emissions of unburned methane	CH_4	Yes	Unburned methane from gas engines will be considered.
	Fugitive methane emissions from on-site equipment	CH_4	No	Excluded for simplification. This emission source is assumed to be very small.

3.4 Baseline Scenario

According to methodology ACM0008, the latest approved version of the "Combined tool to identify the baseline scenario and demonstrate additionality" is applied to identify the baseline scenario.

Step 0: Demonstration whether the proposed project activity is the first-of-its-kind

The project activity is not the first-of-its-kind.

Step 1: Identification of alternative scenarios

This Step serves to identify all alternative scenarios to the proposed CDM project activity(s) which can be the baseline scenario.

Sub-step 1a: Define alternative scenarios to the proposed project activity

This project description identifies all alternative scenarios that provide the same output (service or product) as the proposed VCS project activity from following aspects.

Options to handle methane

According to ACM0008 (version 08.0), the baseline scenario alternatives should include all feasible options to handle methane to comply with safety regulations. These alternatives may include, inter alia:

(a) Extraction of methane prior to the mining (CBM/OCM);

(b) Extraction of methane during and after the mining (CMM);

(c) Extraction of methane through ventilation during the mining;

(d) Extraction of methane from the abandoned mine;

(e) Possible combinations of options (a) to (d) with the relative shares of gas specified.

Options to deal with methane

The baseline scenario alternatives should include all feasible options to deal with methane. These options could include:

(a) Venting of methane;

(b) Flaring of methane;

(c) Use of methane for energy production, e.g. electricity generation, heat generation, vehicle fuel, gas production, etc.

(d) Possible combinations of options (a) to (c) with the relative shares of gas specified.

Options for energy production

All possible options to generate electricity at the coal mines in the Project include:

P1. Equivalent quantity of electricity supply from CSPG;

P2. The proposed project activity not undertaken as a VCS project activity;

P3. Construction of a coal-fired captive power plant with equivalent power supply; or construction of a captive power plant using other fossil fuels;

P4. Power generation using renewable energy resources e.g. hydro, solar or wind power.

Sub-step 1b. Consistency with mandatory applicable laws and regulations:

Any options for CMM management and use that do not meet with local legal or regulatory requirements should be eliminated.

a. Eliminate options to handle methane

According to the Chinese National Coalmine Safety Regulation (2016), the coal mine must have a complete independent ventilation system and gas drainage system to ensure the safety production of underground. Therefore, the pumping system must be established in this project. Moreover, under normal circumstances, the pre-mining and post-mining extraction are carried out through the same set of pumping system, so it is difficult to separate the pre-mining and post-mining extraction areas. Therefore, it is not in accordance with the regulations to carry out pre-mining extraction, during and post-mining extraction separately, and the combination of the two methods must be adopted. Otherwise, the concentration of methane through ventilation during the mining is below 1% to ensure the safety production of underground, it can not be used for electricity generation. And since the Jinyan coal mine is not an abandoned mine, thus, option (a), (b), (c) and (d) is hence excluded.

In conclusion, option (e) possible combinations of options (a) to (c) is in compliance with legal and regulatory requirements to handle methane.

b. Eliminate options to deal with methane

The extracted CMM utilized in the project is low concentration methane, which is below 30%. According to the Chinese National Coalmine Safety Regulation (2016), CMM with methane concentration below 30% is prohibited to be used for safety consideration. However, since then, the technology of low concentration CMM utilization has been increasingly developed and widely applied in China. Currently low concentration methane utilization technology is rapidly maturing in China and CMM with a methane concentration above 6% can be safely used for power generation with domestically available technology. On 21-January-2010, the Decision on the Revision of Certain Aspects of the <Coalmine Safety Regulation> was released by the State Administration of Work Safety, stating that CMM with methane concentration of below 30% is forbidden to be combusted directly, but can be either vented or utilized for power generation by internal combustion engines.

According to the above regulations, flaring of methane with direct combustion of methane concentration of below 30% is prohibited. Therefore, Option (b) is eliminated.

Regarding option (c) Use of methane for energy production, e.g. electricity generation, heat generation, vehicle fuel, gas production, etc

The heat demand of the mining area has been able to be met by the boiler of the waste heat boiler of the unit, and there is no additional heat demand, no need for additional heating, so option (c) use of methane for heat generation is excluded.

The concentration and flow of CMM in coal mines are unstable, and the CMM gas sold to the high-pressure natural gas pipeline network should be purified to CH_4 concentration greater than 95%. The project is located in Dafang County, which is mainly composed of plateau mountains. The construction of pipeline project and investment are relatively large. Therefore, it is not suitable to transport to gas pipelines to be used as fuel for vehicles or gas production. Meanwhile, according to “the Urban Gas Specification” (GB50028-93), as urban gas, methane concentration of CMM should reach 36.8%~78.9%. so option (c) use of methane for energy generation, e.g. vehicle fuel, gas production is excluded.

As option (d) possible combinations of options (a) to (c) with the relative shares of gas specified, according to analyse above, the possible combinations are option (a) venting of methane and option (c) use of methane for electricity generation. However, it is contradictory for methane venting and methane use for electricity, thus, option (d) is excluded.

In conclusion, options (a) venting of methane and (c) use of methane for electricity generation are the applicable scenarios in compliance with legal and regulatory requirements.

c. Eliminate options for energy production

This project is to build a 4.8 MW CMM-fired power plant. According to Chinese power regulation, the construction of coal-fired power plant with a capacity of 135MW or below is prohibited in the national grid coverage area. Therefore, construction of a power plant with the same capacity as the Project using coal, diesel oil or natural gas as fuel would be prohibited. Option P3 is hence excluded.

In conclusion, options P1, P2 and P4 for energy production are in compliance with legal and regulatory requirements.

As above, the baseline alternative options that are technically feasible and comply with all legal and regulatory requirements are listed below:

Scenario ID	CMM extraction	CMM treatment	Energy production

Scenario 1 (e+a+P1)	Combinations of options (a) to (b)	Venting	Equivalent quantity of electricity supply from CSPG
Scenario 2 (e+a+P2)	Combinations of options (a) to (b)	Venting	The proposed project activity not undertaken as a VCS project activity;
Scenario 3 (e+a+P4)	Combinations of options (a) to (b)	Venting	Power generation using renewable energy resources e.g. hydro, solar or wind power
Scenario 4 (e+c+P1)	Combinations of options (a) to (b)	Use of methane for electricity production	Equivalent quantity of electricity supply from CSPG
Scenario 5 (e+c+P2)	Combinations of options (a) to (b)	Use of methane for electricity production	The proposed project activity not undertaken as a VCS project activity;
Scenario 6 (e+ c + P4)	Combinations of options (a) to (b)	Use of methane for electricity production	Power generation using renewable energy resources e.g. hydro, solar or wind power

Step 2: Barrier analysis

Step 2a: Identify barriers that would prevent the implementation of alternative scenarios

Scenario 1: This is the continuation of business as usual and thus faces no barrier. It remains as a possible baseline scenario alternative.

Scenario 2: This is a conflicted scenario for the methane is venting conflicted with methane utilized for electricity generation.

Scenario 3: This scenario involves electricity generation using renewable energy sources. The Jinyan mining area, however, is shortage of hydropower, wind power and geothermal resources. In addition, with annual radiation hours of only 988.9h~1,740h, Guizhou Province is classified as a level 5 area with the least solar resources in China[13]. Lack of solar resources and other bottlenecks such as weak technology capacity and high-cost silicon raw material, determine that it's not realistic to develop solar power plants at the Project site. Finally, the project site is located

[13] http://www.doc88.com/p-1344326182784.html

in coal mine area, no adequate rice, corn, cotton, peanut or any other biomass materials supplied for a biomass power.

Scenario 4: This is a conflicted scenario for use of methane for electricity production conflicted with equivalent quantity of electricity supply from CSPG.

Scenario 5: This is the project activity not implemented as a VCS project. This scenario faces investment barriers, which will be discussed in section 3.5.

Scenario 6: As shown scenario 3. The electricity generation using renewable energy sources in local area is facing kinds of barrier.

Step 2b: Eliminate alternative scenarios which are prevented by the identified barriers

Based on step 2a, scenarios 2, 3, 4 and 6 are excluded, the scenarios to form the baseline scenario alternative that do not face barriers are:

Scenario ID	CMM extraction	CMM treatment	Energy production
Scenario 1 (e+a+P1)	Combinations of options (a) to (b)	Venting	Equivalent quantity of electricity supply from CSPG
Scenario 5 (e+c+P2)	Combinations of options (a) to (b)	Use of methane for electricity production	The proposed project activity not undertaken as a VCS project activity.

There are no barriers identified that would prevent the implementation of either of the two alternative scenarios above. Therefore, neither of the two combined scenarios is eliminated by the step 2. The two combined scenarios need to be further discussed in section 3.5 Step 3.

3.5 Additionality

VCS Revenues have played an important role in the investment decision of the project. The Board meeting gave serious consideration to the VCS revenues to make the investment decision.

Table 3-4 Timeline of the major events of the Project

Time	Events
July-2018	FSR completed
27-August-2018	Project Approval by Dafang County Development and Reform Commission
19-October-2018	The project owner decided the project would be developed as VCS project.

December-2018	Environmental Impact Analysis (EIA) Report completed
14-January-2019	EIA Approval by Dafang County Environmental Protection Department
12-June-2019	Stakeholder meeting
20-August-2019	Start construction date
01-October-2020	Operation date

Step 3. Investment Analysis

According to "Combined tool to identify the baseline scenario and demonstrate additionality", the objective of Step 3 is to compare the economic or financial attractiveness of the alternative scenarios remaining after Step 2 by conducting an investment analysis. The latest approved version of the "Methodological tool: Investment analysis", shall be considered when applying this step.

The alternative scenarios of the project include:

Scenario 1 is the business as usual scenario, venting CMM does not create economic benefits, but no investment required for this scenario.

Scenario 5 is CMM used for electricity generation, i.e, implement the Project without VCS.

For Scenario 1, no investment is needed for the project developer, then use either the NPV or the IRR as financial indicators in the analysis". The IRR is chosen as the financial indicators by the project.

According to the Economic Evaluation Method and Parameters for Construction Projects issued by National Development and Reform Commission (DRC) and Ministry of Construction, the benchmark project IRR of power generation sector was determined as 8% (after tax)[14]. This project is a power generation plant, and the benchmark above can be applied to the project. In addition, this benchmark is also applied in the investment analysis of the Feasibility Study Report (FSR). The project FSR was approved by DRC of Dafang County.

Comparison of IRR for the project and the financial benchmark:

The main parameters for calculation of financial indicators are shown in the following table:

Table 3-5 Main parameters for financial analysis calculation

Item	Unit	Value	Source

[14] P74 Table 2.13-2, Economic Evaluation Method and Parameters for Construction Projects issued by National Development and Reform Commission (DRC) and Ministry of Construction in 2006 (The third Edition).

Installed capacity		MW	4.8	FSR
Total static investment		CNY	32,200,000	FSR
Working capital		CNY	800,000	FSR
Annual operating hour		Hour	5,500	FSR
Plant load factor		%	62.79	FSR
Annual electricity generation		MWh/year	26,400	FSR
Power self-consumption ratio		%	6	FSR
Annual electricity exported		MWh/year	24,816	FSR
Electricity Tariff (including VAT)		CNY/kWh	0.484	FSR
Income tax		%	25	FSR
Value added tax (electricity)		%	17	FSR
Municipal maintenance and construction tax		% of VAT	5	FSR
Surcharge for education		% of VAT	5	FSR
Depreciation period		Year	10	FSR
Scrap value of fixed assets		%	5	FSR
Annual operation and management (O&M) cost	Total	CNY	7,875,417	FSR
	Annual repair cost	CNY	1,487,450	FSR
	Annual staff salary and welfare	CNY	1,980,000	FSR
	Annual insurance	CNY	89,247	FSR
	Annual material fee	CNY	2,818,720	FSR
	Annual other cost	CNY	1,500,000	FSR
Project operational lifetime		Year	10	FSR
Expected VER Price		CNY/tCO_2e	20	Assumption

Table 3-6 below shows the difference between the Project IRR, with and without the revenue from carbon.

Table 3-6 Comparison of financial indicators with and without the revenue from carbon

Item	Without the revenue from carbon	Benchmark rate	With the revenue from carbon
Project IRR (after tax)	3.44%	8%	13.91%

Sensitivity analysis

The sensitivity analysis is conducted to check whether, under reasonable deviations in four major financial parameters, the Project would remain financially unattractive, i.e. the Project IRR without the revenue from carbon would remain below the benchmark IRR. The four major financial parameters that significantly affect the Project IRR are:

- Total static investment
- Electricity tariff
- Annual O&M cost
- Annual Electricity exported

The impacts of the above parameters on the Project IRR were analyzed. The results of sensitivity analysis of the four indicators are shown in Table 3-7 and Figure 3-2.

Table 3-7 Sensitivity analysis of Project IRR to different financial parameters

Hypothetic change	-10%	-5%	0	+5%	+10%
Total static investment	5.59%	4.47%	3.44%	2.48%	1.59%
Electricity tariff	-1.44%	1.25%	3.44%	5.53%	7.53%
Annual O&M Cost	6.20%	4.84%	3.44%	1.99%	0.49%
Annual electricity exported	-1.44%	1.25%	3.44%	5.53%	7.53%

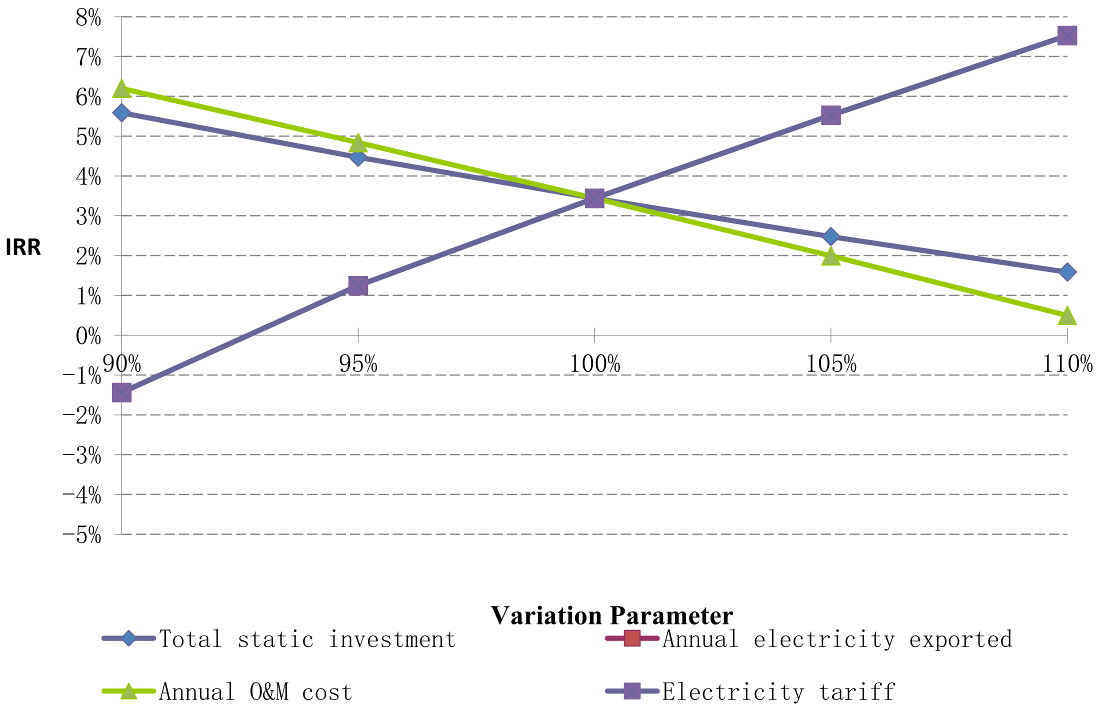

Figure 3-2 Sensitivity analysis of financial indicators of the Project

Table 3-8 below shows the necessary change in the four major parameters required for the Project IRR without CER revenue to reach the benchmark rate, ceteris paribus. All the speculated changes are clearly too large to be realistic.

Table 3-8 Critical Point Analysis

Hypothetic Project IRR	Necessary Change in Total Static Investment Alone	Necessary Change in Electricity Tariff Alone	Necessary Change in Annual O&M Cost Alone	Necessary Change in Annual Electricity Exported Alone
Benchmark Rate 8%	−19.53%	+11.21%	-16.84%	+11.21%

Total static Investment

The Project IRR would reach the benchmark rate of 8% when the total static investment decreases by 19.53%. According to the investment details by the project owner, the actual investment of the project is 30,812,000 RMB, 95.68% of the total static investment. Therefore, it is impossible that the total static investment can be reduced by 19.53% to make the IRR to cross the benchmark.

Electricity Tariff

The Project IRR would reach the benchmark rate of 8% when the tariff increased by 11.21% up to 0.538CNY/kWh. According to electricity purchase contract between the project owner and the coal mine, and the tariff approval by Development and Reform Commission of Guizhou Province, the actual electricity tariff supplied to coal mine and the grid is 0.412 RMB/kwh (VAT) and 0.4754 RMB/kwh (VAT) respectively, therefore, it is unlikely that the tariff would increase by 11.21%.

Annual O&M cost

The Project IRR would reach the benchmark when the Annual O&M cost decreases by 16.84%. Considering about the composition of the Annual O&M cost, the analysis focuses mainly on following items:

Raw material and fuel expenses. Based on statistics released by 2020 National Bureau of Statistics of China, producer price indices for purchasing goods are increasing in recent five years (93.9, 98, 108.1, 104.1 and 99.3) and therefore will not cause significant decrease.

Wages and welfare. Based on statistics released by 2020 National Bureau of Statistics of China, the index of wages keeps increasing in recent five years (110.1, 108.9, 110.0, 110.9 and 109.8). Therefore, there will not be decrease by 16.84% happened on wages and welfare.

Therefore, the IRR can't reach the benchmark by reducing annual O&M cost.

Annual electricity exported

The expected annual electricity generation of the project is 26,400MWh (i.e.26,400MWh=4.8MW x 5500h), 6% of which will be used for Internal consumption, thus the expected annual electricity exported for the project is 24,816 MWh (i.e. 24,816MWh=26,400MWh x (1-6%)). The annual electricity exported for the Project is determined by a qualified third party based on 1) generator performance and 2) availability and stability of CMM supply. The generators cannot be ignited when the CMM concentration fall below 8%. In addition, at times of low concentration of CMM or fluctuation of CMM volume, some of the generators will only run at partial loads, essentially reducing the effective operation hour assuming full load. Actually, because of instability in CMM power supply, Hence, there is a little possibility that the annual electricity exported can be increased 11.21% to make IRR to reach the benchmark.

Based on the Investment Analysis, the alternative that the project activity not undertaken as a VCS project activity is not financially attractive to the project owner, and it is thus not baseline scenario.

Only one alternative scenario (Scenario 1) is left.

Step 4: Common practice analysis

The Guidelines on "Common Practice (version 03.1)" is followed as below.

Sub-step 4-1: Calculate applicable capacity or output range as +/-50% of the total design capacity or output of the proposed project activity

The total installation capacity of the Project is 6MW. Range of +/- 50% of the capacity is from 3 MW to 9 MW.

Sub-step 4-2: Identify similar projects (both CDM and non-CDM) which fulfill all of the following conditions:

(a) The projects are located in the applicable geographical area. Since CMM projects located in the same province/region have similar grid structure, geological and transportation conditions and economic development, thus, only the projects located in Guizhou Province, P. R. China are chosen.

(b) The projects apply the same measure as the project activity. Thus, only the projects provided power generation based on CMM are chosen.

(c) The projects use the same energy source/fuel and feedstock as the proposed project activity, if a technology switch measure is implemented by the proposed project activity. Thus, only the projects use CMM are chosen.

(d) The plants in which the projects are implemented produce goods or services with comparable quality, properties and applications areas (e.g. clinker) as the proposed project plant. Thus, only projects with electricity generation are chosen.

(e) The capacity or output of the projects is within the applicable capacity or output range calculated in Step sub-step 4-1. Thus, only projects have a capacity of 2.4MW–7.2MW are chosen.

(f) The projects started commercial operation before the project design document is published for global stakeholder consultation or before the start date of proposed project activity, whichever is earlier for the project activity. Thus, only the projects started commercial operation before 20-August-2019 are chosen.

Sub-step 4-3: Within the projects identified in Sub-step 4-2, identify those that are neither registered CDM/VCS/CCER project activities, project activities submitted for registration, nor project activities undergoing validation. Note their number N_{all}.

Searching from public available sources[15,16], China's DNA website and UNFCCC website, all CMM power projects with capacity of 2.4MW-7.2MW operated before 20-August-2019 in Guizhou Province are listed below excluding those projects registered as CDM/VCS/CCER projects.

[15] http://news.bjx.com.cn/zt.asp?topic=%CD%DF%CB%B9%B7%A2%B5%E7

[16] China Electric Power Yearbook

Table 3-9 The CMM power generation projects in Guizhou Province that started commercial operation before 20-August-2019

No.	Project Title	Capacity (MW)	Project Status	Start date
1	Guizhou Qianxi Qinglong Coal Mine Methane Utilization Project[17]	3.8	Applied for CDM validation but not registered	Feb 2006
2	Guizhou Pangea No.2 Panxian CMM Utilization Project[18]	3	Applied for CDM validation but not registered	Aug 2011

There were two projects which has not successfully registered as CDM/VCS/CCER projects existed in Guizhou Province that started commercial operation before 20-August-2019. Thus, N_{all}=2.

Sub-step 4-4: Within similar projects identified in Sub-step 4-3, identify those that apply technologies that are different to the technology applied in the proposed project activity. Note their number N_{diff}.

For the project, N_{diff}=0.

Sub-step 4-5: Calculate factor $F=1-N_{diff}/N_{all}$ representing the share of similar projects (penetration rate of the measure/technology) using a measure/technology similar to the measure/technology used in the proposed project activity that deliver the same output or capacity as the proposed project activity.

Since N_{all} = 2, N_{diff}=0, therefore, N_{all} -N_{diff} =2, which is less than 3.

$F=1-N_{diff}/N_{all}=1-0=1$.

According to common practice (version 03.1), the proposed project activity is a “common practice” within a sector in the applicable geographical area if the factor F is greater than 0.2 and N_{all}-N_{diff} is greater than 3. However, the N_{all}-N_{diff} is less than 3.

Thus, the Project activity is not a “common practice”.

Outcome of Step 4:

Based on the analysis above, the baseline scenario of the project is:

Combination of e, a and P1: Methane extraction: Combinations of methane extraction of prior to, during and after the mining; Jinyan coal mine was equipped with CMM extraction facilities and

[17] http://cdm.unfccc.int/Projects/Validation/DB/C5QPMVAAK0DBVY7EDTDBB42MDZX54N/view.html

[18] https://cdm.unfccc.int/Projects/Validation/DB/BUUNXO8Z4X2YRAXTQMWCSXCTX80T7H/view.html

all extracted CMM was vented into the atmosphere directly; The electricity consumed at coal mine and supplied to China Southern Power Grid (CSPG) if there is any electricity surplus was imported from China Southern Power Grid (CSPG) dominated by fossil fuel-fired power plants.

Therefore, the proposed project is additional.

3.6 Methodology Deviations

There is no methodology deviations for the project.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

Baseline emissions are determined in two steps:

Step A. Determination of methane eligible for crediting

For the project, all captured CMM is eligible for crediting.

Step B. Determination of baseline emissions.

Baseline emissions would have occurred due to methane destruction, methane venting and use of other fossil fuels that are displaced by methane under the project activity. Baseline emissions due to venting should be discounted in case host country has regulations in place that are restricting the release of methane into the atmosphere.

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

Where:

BE_y	=	Baseline emissions in year y (tCO_2e)
$BE_{MD,y}$	=	Baseline emissions from destruction of methane in the baseline scenario in year y (tCO_2e);
$BE_{MR,y}$	=	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)

Methane destruction in the baseline

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 ($BE_{MD,y}$) is 0.

Methane venting in the baseline

The amount of methane that would have been emitted to the atmosphere in the baseline scenario shall be determined as follows:

$$BE_{MR,y} = \sum_{i} \sum_{s} (MT_{PJ,s,i,y} - MT_{BL,s,i,y}) \times GWP_{CH4} \qquad (2)$$

Where:

$BE_{MR,y}$	=	Baseline emissions from release of methane into the atmosphere in year y that is avoided by the project activity (tCO_2e)
$MT_{PJ,s,i,y}$	=	Methane from source s captured and destroyed by use i in the project activity in year y (t CH_4);
$MT_{BL,s,I,y}$	=	Methane from source s that would have been captured and destroyed by use i in the baseline scenario in the year y (t CH_4) ;
i	=	Use of methane (flaring, power generation, etc.)
s	=	Source of methane that would have been captured, sent to and destroyed by use i in the baseline scenario in the year y. This may include eligible CBM, CMM, VAM, eligible AMM and eligible OCM
GWP_{CH4}	=	Global warming potential of methane (t CO_2e/t CH_4)

In the baseline scenario, there is no CMM captured and destroyed, thus $MT_{BL,s,I,y}$ is 0;

Thus,

$$BE_{MR,y} = \sum_{i} \sum_{s} MT_{PJ,s,i,y} \times GWP_{CH4} \qquad (3)$$

Baseline emissions from the production of power, heat or vehicle fuels

The baseline emissions from displacement of power or heat generation, or supply of vehicle fuels are given by the following equation:

$$BE_{use,y} = \sum_{k} (EG_{use,k,y} \times EF_{k,y}) \qquad (4)$$

Where,

$BE_{use,y}$	=	Baseline emissions from energy displaced by the project activity in year y (t CO_2);

$EG_{use,k,y}$	=	Energy of type k displaced by the project activity in year y (energy unit);
$EF_{k,y}$	=	Baseline emissions factor for energy type k production in year y (t CO_2/energy unit);
k	=	Energy type displaced by the project activity

The waste heat from the generators of the project will be recovered by waste heat boilers to provide free hot water to the coal mines, which was provided by waste coal fired boilers before the implementation of the Project. However, to be conservative, emission reductions will not be claimed for this part. And for the project is not involved emission reduction from supply of vehicle fuels. Thus, in this part, the project is just involved the baseline emissions from the production of power.

Baseline emissions factor for power generation

According to the methodology ACM0008 (version 08.0), the emission factor for displaced electricity is calculated as per the latest version of methodological tool "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (version 03.0), the parameter $EG_{use,k,y}$ in this PD is equivalent to the quantity of electricity generated and supplied by the project power plant to the grid in year y ($EG_{PJ,grid,y}$) in the tool. According to this tool, for the project is in the case of Scenario A: Electricity consumption from the grid, the project participants choose Option A1: Calculate the combined margin emission factor of the applicable electricity system, using the procedures in the latest approved version of the "Tool to calculate the emission factor for an electricity system" (version 07.0) ($EF_{k,y} = EF_{grid,CM,y}$).

According to "Tool to calculate the emission factor for an electricity system" (version 07.0). The following six steps are applied to determine OM, BM, and CM used for calculating the project baseline emissions:

Step 1. Identify the relevant electricity systems

According to the Tool to calculate the emission factor for an electricity system (Version 07.0), project participants may delineate the project electricity system using any of the following options:

Option 1. A delineation of the project electricity system and connected electricity systems published by the DNA or the group of the DNAs of the host country(ies), In case a delineation is provided by a group of DNAs, the same delineation should be used by all the project participants applying the tool in these countries;

Option 2. A delineation of the project electricity system defined by the dispatch area of the dispatch centre responsible for scheduling and dispatching electricity generated by the project activity. Where the dispatch area is controlled by more than one dispatch centre, i.e. layered dispatch area, the higher level area shall be used as a delineation of the project electricity system (e.g. where regional dispatch centres are required to comply with dispatch orders of the national dispatch centre then area controlled by the national dispatch centre shall be used);

Option 3. A delineation of the project electricity system defined by more than one independent dispatch areas, e.g. multi-national power pools.

The Chinese DNA has published a delineation of the project electricity system and connected electricity systems, Option 1 is applied for the project. According to the delineations, the China Southern Power Grid (CSPG) is identified as the relevant electric power system of the project, which includes Guangdong, Guangxi, Yunnan, Guizhou and Hainan Provincial Power Grids. According to the “2019 Baseline Emission Factors for Regional Power Grids in China”, There is net electricity imported from the Central China Power grid (CCPG) and East China Power Grid (ECPG) to the South China Power grid. Therefore, Central China Power grid (CCPG) and East China Power Grid (ECPG) are chosen as the connected electric power system.

Step 2. Choose whether to include off-grid power plants in the project electricity system (optional)

Project participants may choose between the following two options to calculate the operating margin and build margin emission factor:

Option I: Only grid power plants are included in the calculation.

Option II: Both grid power plants and off-grid power plants are included in the calculation

Based on China’s real situation, only grid power plants are included in the calculation.

Step 3. Select a method to determine the operating margin (OM)

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods:

(a) Simple OM, or

(b) Simple adjusted OM, or

(c) Dispatch data analysis OM, or

(d) Average OM.

In China, specific data from the grid or each power plant is treated as business confidential and thus not public available. Therefore, method (b) and method (c) is not suitable for the project.

The Simple OM method (a) can only be applied when low-cost/must run resources19 constitute less than 50% of total grid generation in average of the five most recent years. According to the data from China Electric Power Yearbook 2014-2018, from year 2013 to year 2017, for the CSPG

[19] Low-cost/must-run resources are defined as power plants with low marginal generation costs or power plants that are dispatched independently of the daily or seasonal load of the grid. They typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. If coal is obviously used as must-run, it should also be included in this list, i.e. excluded from the set of plants.

the project activity connected to, the low-cost/must-run electric power resources generation accounts for the total grid total are 37.73%, 45.53%, 49.44%, 50.92% and 50.91%, respectively, average value is lower than 50%, which satisfied the applicability of the method (a), therefore, the simple OM method is chosen for the calculation of the OM emission factor $EF_{grid,OM,y}$.

As per the latest version of "Tool to calculate the emission factor for an electricity system" (version 07.0), one of the following methods should be chosen to calculate the simple OM emission factor:

- Ex ante option: If the ex ante option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required. For grid power plants, use a 3-year generation-weighted average, based on the most recent data available at the time of submission of the VCS-PD to the DOE for validation, or
- Ex post option: If the ex post option is chosen, the emission factor is determined for the year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring. If the data required calculating the emission factor for year y is usually only available later than six months after the end of year y, alternatively the emission factor of the previous year (y-1) may be used. If the data is usually only available 18 months after the end of year y, the emission factor of the year proceeding the previous year (y-2) may be used. The same data vintage (y, y-1 or y-2) should be used throughout all crediting periods.

Here the ex ante option is selected, and the $EF_{grid,OM}$ is fixed during the crediting period.

Step 4. Calculate the operating margin emission factor according to the selected method

Based on the analysis of the step 3, the simple OM method is used to calculate the CSPG OM emission factor in this step. The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/ units.

The simple OM may be calculated by one of the following two options:

Option A: Based on the net electricity generation and a CO_2 emission factor of each power unit; or

Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

For the project activity, the required data for the exercise of Option A is not available and those of Option B can be obtained from official sources, and off-grid power plants are not included in the calculation, therefore, Option B is chosen to calculate the operating margin emission factor:

For Option B, the Simple OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost / must-run power plants / units, and based on the fuel type(s) and total fuel consumption of the project electricity system, as follows:

$$EF_{grid,\ OMsimple,\ y} = \frac{\sum_{i,} (FC_{i,y} \times NCV_{i,y} \times EF_{CO2,\ i,y})}{EG_y} \qquad (5)$$

Where:

$EF_{grid,OMsimple,y}$	= Simple operating margin CO_2 emission factor in year y (tCO_2 /MWh)
$FC_{i,y}$	= Amount of fuel type i consumed in the project electricity system in year y (mass or volume unit)
$NCV_{i,y}$	= Net calorific value (energy content) of fuel type i in year (GJ / mass or volume unit)
$EF_{CO2,i,y}$	= CO_2 emission factor of fuel type i in year y (tCO_2 /GJ)
EG_y	= Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units, in year y (MWh)
i	= All fuel types combusted in power sources in the project electricity system in year y
y	= The three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation.

If available, $NCV_{i,y}$ and $EF_{CO2,i,y}$ from the fuel supplier of the power plants in invoices may be used; or, regional or national average default values may be used. In this PDD, $NCV_{i,y}$ of different fuels are obtained from China Energy Statistical Yearbook 2018. Emission factors ($EF_{CO2,i,y}$) of each type of fossil fuel come from IPCC 2006 default values.

The Simple OM Emission Factor ($EF_{grid,OMsimple,y}$) of the project is calculated on the basis of the fuel consumption data for electricity generation of the Northwest China Power Grid, not including those of low-operating cost and must-run power plants, such as wind power, hydropower and nuclear etc. These data are obtained from the China Electric Power Yearbook (2016~2018, published annually) and China Energy Statistical Yearbook (2016~2018). Based on these data, the Simple OM Emission Factor ($EF_{grid,OMsimple,y}$) of the Northwest China Power Grid is calculated as 0.8042 tCO_2/MWh. Details of the calculations and the published data from the Chinese DNA[20], which uses official national statistics.

Step 5. Calculate the build margin (BM) emission factor

In terms of vintage of data, project participants can choose between one of the following two options:

Option 1: For the first crediting period, calculate the build margin emission factor ex ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units

[20] http://www.mee.gov.cn/ywgz/ydqhbh/wsqtkz/index_1.shtml

already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

Option 2: For the first crediting period, the build margin emission factor shall be updated annually, ex post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated ex ante, as described in Option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

The PD chooses Option 1, which requires the project participant to calculate the Build Margin Emission Factor $EF_{grid,BM,y}$, ex-ante based on the most recent information available on units already built for sample group m at the time of PD submission.

The sample group of power units m used to calculate the build margin should be determined as per the following procedure, consistent with the data vintage selected above:

(a) Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently ($SET_{5\text{-}units}$) and determine their annual electricity generation ($AEG_{SET\text{-}5\text{-}units}$, in MWh);

(b) Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities (AEG_{total}, in MWh). Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20 per cent of AEG_{total} (if 20 per cent falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) ($SET_{\geq 20\ per\ cent}$) and determine their annual electricity generation ($AEG_{SET\text{-}\geq 20\ per\ cent}$, in MWh);
(c) From $SET_{5\text{-}units}$ and $SET_{\geq 20\ per\ cent}$ select the set of power units that comprises the larger annual electricity generation (SET_{sample});

Otherwise:

(d) Exclude from SET_{sample} the power units which started to supply electricity to the grid more than10 years ago. Include in that set the power units registered as CDM project activity, starting with power units that started to supply electricity to the grid most recently, until the electricity generation of the new set comprises 20 per cent of the annual electricity generation of the project electricity system (if 20 per cent falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) to the extent is possible. Determine for the resulting set ($SET_{sample\text{-}CDM}$) the annual electricity generation ($AEG_{SET\text{-}sample\text{-}CDM}$, in MWh);

If the annual electricity generation of that set is comprises at least 20 per cent of the annual electricity generation of the project electricity system (i.e. $AEG_{SET\text{-}sample\text{-}CDM} \geq 0.2 \times AEG_{total}$), then use the sample group $SET_{sample\text{-}CDM}$ to calculate the build margin. Ignore steps (e) and (f).

Otherwise:

(e) Include in the sample group $SET_{sample\text{-}CDM}$ the power units that started to supply electricity to the grid more than 10 years ago until the electricity generation of the new set comprises 20 per cent of the annual electricity generation of the project electricity system (if 20 per cent falls on part of the generation of a unit, the generation of that unit is fully included in the calculation);

(f) The sample group of power units m used to calculate the build margin is the resulting set ($SET_{sample\text{-}CDM\text{->}10yrs}$).

The BM emissions factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units *m* during the most recent year *y* for which electricity generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad (6)$$

Where:

$EF_{grid,BM,y}$	=	Build margin emission factor of NCPG ($t\ CO_2/MWh$)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
$EF_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* ($t\ CO_2/MWh$)
m	=	Power units included in the build margin
y	=	The most recent year for which the generation data is available

As it is difficult to obtain the detailed data on the power generation, fuel consumption and thermal efficiency of each newly built power unit from public documents, a deviation of TOOL “tool to calculate the emission factor for an electricity system" (07.0) is adopted following the clarifications[21] given by the CDM EB concerning the BM emission factor calculation:

[21] “Request for clarification on use of approved methodology AM0005 for several projects in China”, the EB’s guidance on DNV deviation request. http://cdm.unfccc.int/UserManagement/FileStorage/AM_CLAR_QEJWJEF3CFBP1OZAK6V5YXPQKK7WYJ

(1) The CDM EB suggested using the efficiency level of the best technology commercially available in the provincial/regional or national grid of China, as a conservative proxy, for each fuel type in estimating the fuel consumption to estimate the build margin.

(2) The EB agreed the use of capacity additions during last 1 ~ 3 years for estimating the build margin emission factor for grid electricity.

(3) The EB also agreed to use of weights estimated using installed capacity in place of annual electricity generation.

The newly built power plants in the past few years are bundled into “grouped new power plant” according to their construction year, their province and their fuel type. The annual net electricity generation in the year *y* of each “grouped new power plant” $EG_{m,y}$ is estimated according to their total capacity and the average utilization hours, as the following equation:

$$EG_{m,y} = CAP_m \times H_{m,y} \qquad (7)$$

where:

$EG_{m,y}$	=	Annual net electricity generation the unit m in year *y* (MWh)
CAP_m	=	Installed capacity of the unit m (MW)
$H_{m,y}$	=	Utilization hour of the unit m in the year *y* (h), determined according to the average utilization hour of the same type of unit in the same province
y	=	The most recent year for which the generation data is available. For the calculation of BM in 2019, *y* = 2017
m	=	grouped new power plant

Since the newly built power plants in the same province (A), in the same year (t) and using the same fuel type (k) are grouped into “a grouped new power plant”, CAP_m represents the total installed capacity of fuel type k power plants located in the provinces A and in the year t:

$$CAP_m = CAP_{A,t,k} \qquad (8)$$

where:

CAP_m	=	Installed capacity of the unit *m* (MW), with *m* representing the specified combination of A, t, and k
$CAP_{A,t,k}$	=	Total installed capacity of fuel type *k* power plants located in the province *A* and in the year *t*
A	=	Provinces covered by the NCPG, namely, Shanghai City, Jiangsu Province, Zhejiang Province, Anhui Province and Fujian Province
t	=	Years related to the grouped new power plants, for the 2019 calculation, *t* represents 2017, 2016, 2015…. Until the aggregated electricity generation of the grouped new power plants reaches 20% of the total electricity generation of the NCPG
k	=	Fuel type of the grouped new power plants, including hydro, thermal (coal, gas, oil, waste incineration, other thermal), nuclear, wind, solar and others.

Figure 5 shows the procedure to determine the sample group of power units *m*.

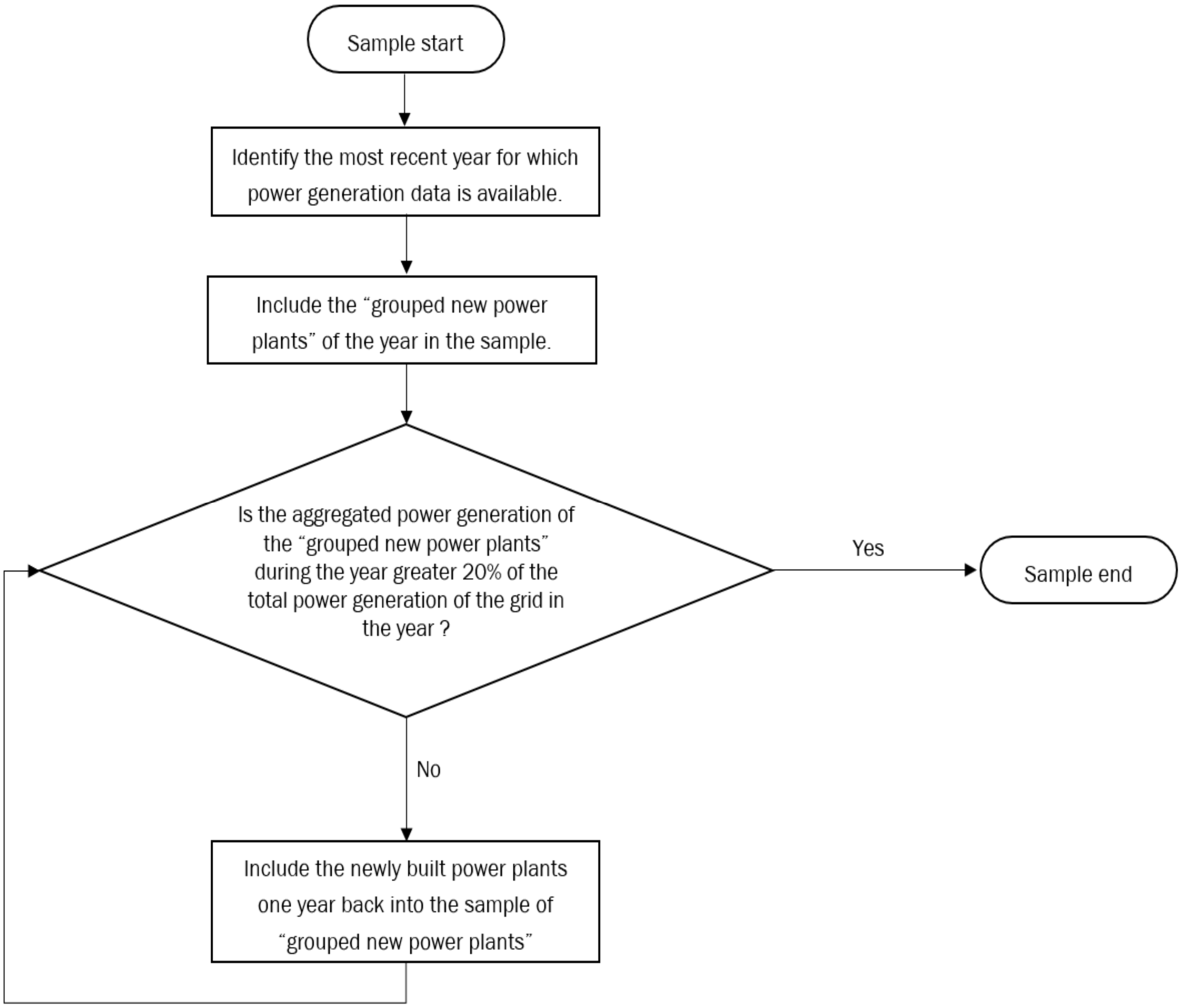

Figure 5: Procedure to determine the sample group of power units *m* used for the BM emission factor calculation

The emission factors of each fuel type $EF_{EL,m,y}$ are determined according to the Option A2 in the TOOL07, as the following equation:

$$EF_{EL,m,y} = \frac{EF_{CO2,m,i,y} \times 3.6}{\eta_{m,y}} \tag{9}$$

where:

$EF_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (t CO_2/MWh)

$EF_{CO2,m,i,y}$	=	Average CO_2 emission factor of fuel type *i* used in power unit *m* in year *y* (t CO_2/GJ)
$\eta_{m,y}$	=	Average net energy conversion efficiency of power unit *m* in year *y* (ratio)
m	=	All power units serving the grid in year *y* except low-cost / must-run power units
3.6	=	Conversion factor (GJ/MWh)

Among the fuel types, the emission factors of hydro, nuclear, wind, solar, other thermal and others are 0. Concerning the emission factors of coal, gas, oil and waste incineration, Equation (B-14) takes the following form due to conservativeness:

$$EF_{best,m,y} = \frac{EF_{CO2,m,i,y} \times 3.6}{\eta_{best,y}} \quad (10)$$

where:

$EF_{best,m,y}$	=	Emission factor of power unit *m* with the best technology commercially available in year *y* (t CO_2/MWh)
$\eta_{best,y}$	=	Power generation efficiency of the best technology commercially available in year *y*
m	=	Power units serving the grid with coal, gas, oil or waste incineration in year *y*

Key parameters used to calculate BM emission factor include the low calorific value of each fossil fuel, the oxidation rate, the potential emission factors, and the efficiency of various power generation technologies. The data of low calorific value of each fossil fuel and their oxidation rate comes from China Energy Statistical Yearbook 2018. The potential emission factors are sourced from *"2006 IPCC Guidelines for National Greenhouse Gas Inventories"* Table 1.3 and Table 1.4 of Page 1.21-1.24 in Chapter one, Volume 2 Energy. According to the latest and available data at the time of this PD submission, $EF_{grid,BM,y}$ is calculated to be 0.2135 tCO_2/MWh.

Step 6. Calculate the combined margin (CM) emission factor

As per the "tool to calculate the emission factor for an electricity system", the combined margin emission factor ($EF_{grid,CM,y}$) is calculated based on one of the following methods:

(a) Weighted average CM; or

(b) Simplified CM.

The weighted average CM method (option A) should be used as the preferred option.

The simplified CM method (option b) can only be used if:

The project activity is located in: (i) a Least Developed Country (LDC); or in (ii) a country with less than 10 registered CDM projects at the starting date of validation; or (iii) a Small Island Developing States (SIDS); and

The data requirements for the application of step 5 above cannot be met.

The PD choose option A.

The combined margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = \omega_{OM} \times EF_{grid,OM,y} + \omega_{BM} \times EF_{grid,BM,y} \quad (11)$$

Where,

$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EF_{grid,OM,y}$	=	Operating margin CO_2 emission factor in year y (tCO_2/MWh)
ω_{OM}	=	Weighting of operating margin emissions factor (per cent)
ω_{BM}	=	Weighting of build margin emissions factor (per cent)

The combined margin emissions factor $EF_{grid,CM,y}$ should be calculated as the weighted average of the Operating Margin emission factor ($EF_{grid,OM,y}$) and the Build Margin emission factor ($EF_{grid,BM,y}$), where ω_{OM} = 0.5 and ω_{BM} = 0.5 for all other projects (owing to their intermittent and non-dispatchable nature) for the first crediting period and ω_{OM}=0.25 and ω_{BM} =0.75 for the second and third crediting period.

For the project, the weight ω_{OM} and ω_{BM} are both 0.5 by default for the fixed crediting period. Thus, $EF_{grid,CM,y}$=0.8042 tCO_2/MWh *0.5+0.2135 tCO_2/MWh *0.5 = 0.5088 (tCO_2/MWh)

4.2 Project Emissions

Project emissions comprise the following sources:

(a) Emissions from the energy use to capture and use methane;

(b) Emissions from destruction of captured methane through production of various energy types and/or flaring and/or flameless oxidation;

(c) Emissions from the un-combusted methane.

Project emissions are defined by the following equation:

$PE_y = PE_{ME,y} + PE_{MD,y} + PE_{UM,y}$ (12)

Where:

PE_y	=	Project emissions in year *y* (tCO_2e)
$PE_{ME,y}$	=	Project emissions from energy use to capture and use methane (tCO_2e)
$PE_{MD,y}$	=	Project emissions from destruction of captured methane (tCO_2e)
$PE_{UM,y}$	=	Project emissions from un-combusted methane in year y (tCO_2e)

Project emissions from the energy use to capture and to use methane

During the normal operation of the project activity, the additional electricity consumption required by the project activity to capture and utilize the CMM is supplied by the power generation of the project; Only when the project is out of operation or abnormal operation, there is a small amount of power consumed.

According to methodology ACM0008 (v08.0), emissions due to electricity consumption should be determined using the latest version of the "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (v03.0) should be used.

Thus, $$PE_{ME,y} = PE_{EC,y} = \sum_{j} EC_{PJ,j,y} \times EF_{EF,j,y} \times (1 + TDL_{j,y}) \quad (13)$$

Where,

$PE_{EC,y}$	=	Project emissions from electricity consumption in year *y* (tCO_2/yr)
$EC_{PJ,j,y}$	=	Quantity of electricity consumed by the project electricity consumption source j in year y (MWh/yr)
$EF_{EF,j,y}$	=	Emission factor for electricity generation for source j in year y (tCO_2/MWh)
$TDL_{j,y}$	=	Average technical transmission and distribution losses for providing electricity to source j in year y
j	=	Sources of electricity consumption in the project

According to "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (version 03.0), $EF_{EF,j,y}=EF_{grid,CM,y}$. Furthermore, it is assumed that the amount of electricity consumed from the grid is zero ($EC_{PJ,j,y}$ =0) in ex-ante phase, which will be monitored in the verification period.

According to the tool "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (version 03.0), i) the project is the case of Scenario A: Electricity consumption from the grid; ii) the electricity consumption by all project and leakage electricity consumption sources (the data is 0 in ex-ante phase, which will be monitored in the verification period) is smaller than the electricity consumption of all baseline electricity consumption sources (According to FSR, the data is 24,816MWh annually). Thus, use as default values of 3% for project and leakage electricity consumption sources for the project, i.e. $TDL_{j,y}$ =3%.

Project emissions from destruction 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.

$$PE_{MD,y} = \sum_{i} MD_{i,y} \times CEF_{CH4} \qquad (14)$$

Where:

$PE_{MD,y}$	=	Project emissions from methane destroyed (tCO_2e)
$MD_{i,y}$	=	Methane destroyed through use i (tCH_4)
i	=	Use of methane (power generation, heat generation, supply to gas grid to various combustion end uses)
CEF_{CH4}	=	Carbon emission factor for combusted methane. Set as 2.75 (t CO_2/t CH_4)

As mentioned above, since emission reductions will not be claimed in heat generation. And for the project is not involved emission reduction from supply of vehicle fuels. The Project only involve in methane destroyed through power generation.

Thus, $PE_{MD,y}=MD_{ELEC,y}\times CEF_{CH4}$

In each end-use, the amount of methane destroyed depends on the efficiency of combustion of each end use and should be determined as follows.

$$MD_{i,y}= MM_{i,y} \times Eff_{i,y} \qquad (15)$$

Where:

$MD_{i,y}$	=	Methane destroyed through use i in year y (t CH_4)
$MM_{i,y}$	=	Methane measured sent to use i in year y (tCH_4)
$Eff_{i,y}$	=	Efficiency of methane destruction in use I in year y (%)

Thus, $PE_{MD,y}=MD_{ELEC,y}\times CEF_{CH4}= MM_{ELEC,y} \times Eff_{ELEC,y}\times CEF_{CH4}$ (16)

Where:

$MD_{ELEC,y}$	=	Methane destroyed through use of power generation in year y (t CH_4)
$MM_{ELELi,y}$	=	Methane measured sent to use of power generation in year y (tCH_4)
$Eff_{ELEL,y}$	=	Efficiency of methane destruction in use of power generation in year y (%)

Project emissions from un-combusted methane

Not all of the methane sent to the flare, to the flameless oxidizer or used to generate power and heat will be combusted, so a small amount will be released to the atmosphere. These emissions are calculated as follows:

$$PE_{UM,y} = GWP_{CH4} \times \sum_{i} MM_{i,y} \times (1 - Eff_{i,y}) \qquad (17)$$

Where:

$PE_{UM,y}$	=	Project emissions from un-combusted methane (tCO_2e)
GWP_{CH4}	=	Global warming potential of methane (t CO_2e/t CH_4)
i	=	Use of methane (power generation, heat generation, supply to gas grid to various combustion end uses)
$MM_{i,y}$	=	Methane measured sent to use i in year y (t CH_4), i is only for electricity, so $MM_{i,y}=MM_{ELEC,y}$
$Eff_{i,y}$	=	Efficiency of methane destruction in use I in year y (%), i is only for electricity, so $Eff_{i,y} = Eff_{ELEC,y}$

For the project, $PE_{UM,y}=GWP_{CH4}\times MM_{ELEC,y}\times(1-Eff_{ELEC,y})$ (18)

4.3 Leakage

Leakage may occur if the project activity prevents methane from being used to meet baseline thermal energy demand, whether as a result of physical constraints on delivery, or price changes.

Since the baseline scenario of the project does not include thermal energy use, the leakage (LE_y) is taken as zero.

4.4 Net GHG Emission Reductions and Removals

According to the FSR of the project, the estimated annual CMM measured sent to power plant will be 8.7936 million m^3 CMM per year when the project is fully operated. The volume of CMM utilized by the project is estimated under the temperature of 293.15K, so the density of methane is 0.67kg/m^3 [22]. Therefore, the methane measured sent to power plant annually is calculated as follows:

$MM_{ELEC,y}$ =8.7936×10^6 m^3×0.67 kg/m^3/1000 = 5,892 tCH_4

1. Calculation of the baseline emissions

1.1 Baseline emissions from methane destroyed

As described in 4.1, $BE_{MD,y}$=0.

[22] 2006 IPCC Guidelines for National Greenhouse Gas Inventories

1.2 Baseline emissions from release of methane into the atmosphere

$BE_{MRy} = GWP_{CH4} \times MT_{PJ,s,i,y}$ = 28 $tCO_2/tCH_4 \times 5{,}892$ tCH_4 = 164,976 tCO_2e

1.3 Baseline emissions from power generation replaced by the project

$BE_{Use,y} = EG_{use,k,y} \times EF_{ELEC,y} = EG_{PJ,grid,y} \times EF_{ELEC,y}$=24,816MWh×0.5088$tCO_2$/MWh = 12,626 tCO_2e

Baseline emissions are calculated by the formulation below:

$BE_y = BE_{MD,y}+BE_{MR,y}+BE_{Use,y}$ = 0 tCO_2e +164,976 tCO_2e +12,626 tCO_2e = 177,602 tCO_2e

2. Calculation of the project emissions

2.1 Project emissions from the energy use to capture and to use methane

As described in section 4.2, it is assumed that the amount of electricity consumed from the grid is zero ($EC_{PJ,j,y}$=0) in ex-ante phase, which will be monitored in the verification period. Thus, $PE_{EC,y}$ =0 in ex-ante phase.

2.2 Project emissions from destruction of captured methane

$$PE_{MD,y} = \sum_{i} MD_{i,y} \times CEF_{CH4}$$

$= MD_{ELEC,y} \times CEF_{CH4} = MM_{ELEC,y} \times Eff_{ELEC,y} \times CEF_{CH4}$= 5,892 tCH_4×99.5%×2.75 t CO_2/t CH_4 = 16,122 tCO_2e

2.3 Project emissions from un-combusted methane

$PE_{UM,y} = GWP_{CH4} \times MM_{ELEC,y} \times (1-EFF_{ELEC,y})$ = 28tCO_2/tCH_4×5,892 tCH_4×(1-99.5%) = 825 tCO_2e

Project emissions are calculated by the formulation below:

$PE_y = PE_{EC,y}+PE_{MD,y}+PE_{UM,y}$ =0 tCO_2e +16,122 tCO_2e +825 tCO_2e =16,947 tCO_2e

3. Calculation of the leakage

As described in section 4.3, LE_y=0.

4. Calculation of emission reductions

The emission reductions can be obtained from the equation below:

$ER_y = BE_y - PE_y - LE_y$ = 177,602 tCO_2e -16,947 tCO_2e -0 tCO_2e = 160,655 tCO_2e

Thus, the estimated emission reduction is summarized as follows:

Year	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)

01-Oct-2020 to 31-Dec-2020	44,765[23]	4,272 [24]	0	40,493
01-Jan-2021 to 31-Dec-2021	177,602	16,947	0	160,655
01-Jan-2022 to 31-Dec-2022	177,602	16,947	0	160,655
01-Jan-2023 to 31-Dec-2023	177,602	16,947	0	160,655
01-Jan-2024 to 31-Dec-2024	177,602	16,947	0	160,655
01-Jan-2025 to 31-Dec-2025	177,602	16,947	0	160,655
01-Jan-2026 to 31-Dec-2026	177,602	16,947	0	160,655
01-Jan-2027 to 31-Dec-2027	177,602	16,947	0	160,655
01-Jan-2028 to 31-Dec-2028	177,602	16,947	0	160,655
01-Jan-2029 to 31-Dec-2029	177,602	16,947	0	160,655
01-Jan-2030 to 30-Sep-2030	132,837 [25]	12,675[26]	0	120,162
Total	1,734,130	165,880	0	1,568,250

5 MONITORING

5.1 Data and Parameters Available at Validation

[23] It covering 92 days from 01-Oct-2020 to 31-Dec-2020, thus, the estimated baseline emission in the period is 44,765tCO_2e, i.e. 44,765 tCO_2e =177,602 tCO_2e x 92 days/365days.

[24] It covering 92 days from 01-Oct-2020 to 31-Dec-2020, thus, the estimated project emission in the period is 4,272tCO_2e, i.e.4,272 tCO_2e =16,947 tCO_2e x 92 days/365days.

[25] It covering 273 days from 01-Jan-2030 to 31-May-2030, thus, the estimated baseline emission in the period is 132,837 tCO_2e, i.e. 132,837 tCO_2e =177,602 tCO_2e x 273days/365days.

[26] It covering 273 days from 01-Jan-2030 to 31-May-2030, thus, the estimated project emission in the period is 12,675 tCO_2e, i.e. 12,675 tCO_2e =16,947 tCO_2e x 273days/365days.

Data / Parameter	$MT_{BL,s,i,y}$
Data unit	tCH_4
Description	Methane from source s that would have been captured and destroyed by use i in the baseline scenario in the year y
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	-
Purpose of Data	Calculation of baseline emissions
Comments	In the baseline scenario, there is no CMM captured and destroyed, thus $MT_{BL,s,I,y}$ is 0

Data / Parameter	CEF_{CH4}
Data unit	tCO_2e/ tCH_4
Description	Carbon emission factor for combusted methane
Source of data	ACM0008 (Version 08.0)
Value applied	2.75
Justification of choice of data or description of measurement methods and procedures applied	ACM0008 (Version 08.0) default value
Purpose of Data	Calculation of project emissions
Comments	$44/16 = 2.75tCO_2e/tCH_4$

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	Used to calculated the methane from source s captured and destroyed by the project activity in mass unit. For $MT_{PJ,s,i,y}$ ($MM_{ELEC,y}$) is monitored by flow meter in volume unit, which will be converted to mass unit with the parameter of D_{CH4}.
Comments	Applies at atmospheric pressure and 20˚C

Data / Parameter	$EF_{k,y}$,$EF_{EF,j,y}$ ($EF_{grid,CM,y}$)
Data unit	tCO_2/MWh
Description	Combined margin emission factor for the grid in year y
Source of data	“2019 Baseline Emission Factors for Regional Power Grids in China” published by DNA of China
Value applied	0.5088
Justification of choice of data or description of measurement methods and procedures applied	Calculated as per the latest version of “Tool to calculate the emission factor for an electricity system” (version 07.0) by DNA of China.
Purpose of Data	Calculation of project emissions.
Comments	According to section 4.1. the ex ante option is selected to calculate $EF_{grid, OM,y}$ and $EF_{grid,BM,y}$ and fixed in the crediting period, thus the $EF_{EF,j,y}$ is fixed during the crediting period

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	Methodological tool “Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation” (v03.0)
Value applied	3%

Justification of choice of data or description of measurement methods and procedures applied	According to the tool “Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation” (version 03.0), i) the project is the case of Scenario A; ii) the electricity consumption by all project and leakage electricity consumption sources (the data is 0 in ex-ante phase, which will be monitored in the verification period) is smaller than the electricity consumption of all baseline electricity consumption sources (According to FSR, the data is 24,816MWh annually). Thus, Use as default values of 3% for: (b) project and leakage electricity consumption sources
Purpose of Data	Calculation of project emissions.
Comments	The parameter will be updated according to the tool “Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation” (version 03.0).

5.2 Data and Parameters Monitored

Data / Parameter	$MT_{PJ,s,i,y}$
Data unit	t CH_4
Description	Methane from source s captured and destroyed by use i in the project activity in year y
Source of data	Calculated from the monitored data
Description of measurement methods and procedures to be applied	$MT_{PJ,s,i,y}$ is calculated by the gas flow rate, pressure, temperature and CH_4 concentration of CMM, which will be continuously measured by flow meter and gas analyzer. All electronic data and paper documents will be archived for two years following the end of the crediting period.
Frequency of monitoring/recording	Continuous
Value applied	5,892
Monitoring equipment	Measured by flow meter and gas analyzer.
QA/QC procedures to be applied	Flow meter and gas analyzer will be periodically checked and calibrated.

Purpose of data	Calculation of baseline emissions.
Calculation method	For $MT_{PJ,s,i,y}$ is monitored by flow meter in volume unit, which will be converted to mass unit with the parameter of D_{CH4}.
Comments	Flow meter will record gas volumes, pressure and temperature. Density of methane under normal conditions of temperature and pressure (defined as 1 atm, 293.15K) is 0.67kg/m^3 (2006 IPCC).

Data / Parameter	$MM_{ELEC,y}$
Data unit	t CH_4
Description	Methane measured sent to use of power generation in year y
Source of data	Calculated from the monitored data
Description of measurement methods and procedures to be applied	$MM_{ELEC,y}$ （same with $MT_{PJ,s,i,y}$） is calculated by the gas flow rate, pressure, temperature and CH_4 concentration of CMM, which will be continuously measured by flow meter and gas analyzer. All electronic data and paper documents will be archived for two years following the end of the crediting period.
Frequency of monitoring/recording	Continuous
Value applied	5,892
Monitoring equipment	Measured by flow meter and gas analyzer.
QA/QC procedures to be applied	Flow meter and gas analyzer will be periodically checked and calibrated.
Purpose of data	Calculation of project emissions.
Calculation method	For $MM_{ELEC,y}$ is monitored by flow meter in volume unit, which will be converted to mass unit with the parameter of D_{CH4}.
Comments	Flow meter will record gas volumes, pressure and temperature. Density of methane under normal conditions of temperature and pressure (defined as 1 atm, 293.15K) is 0.67kg/m^3 (2006 IPCC).

Data / Parameter	GWP_{CH4}
Data unit	tCO_2e/ tCH_4
Description	Global warming potential of methane
Source of data	IPCC Fifth Assessment Report (AR5)
Description of measurement methods and procedures to be applied	IPCC Fifth Assessment Report (AR5) default value
Frequency of monitoring/recording	The parameter will be updated according to the relevant documents
Value applied	28
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of data	Calculation of baseline emissions and project emissions.
Calculation method	-
Comments	-

Data / Parameter	$EG_{use,k,y}$ ($EG_{PJ,grid,y}$)
Data unit	MWh
Description	Energy of type k displaced by the project activity in year y
Source of data	Monitoring data provided by the project owner
Description of measurement methods and procedures to be applied	Electricity meter(s) and monthly recorded. All electronic data and paper documents will be archived for two years following the end of the crediting period.
Frequency of monitoring/recording	Continuously

Value applied	24,816
Monitoring equipment	The electricity meter(s)
QA/QC procedures to be applied	The data will be cross checked with Electricity Transaction Note. The electricity meter(s) will be periodically checked and maintained. Calibration will be carried out once a year to ensure normal operation.
Purpose of data	Calculation of baseline emissions.
Calculation method	-
Comments	-

Data / Parameter	$EC_{PJ,j,y}$
Data unit	MWh
Description	Quantity of electricity consumed by the project electricity consumption source j in year y
Source of data	Monitoring data provided by the project owner
Description of measurement methods and procedures to be applied	Electricity meter(s) and monthly recorded. All electronic data and paper documents will be archived for two years following the end of the crediting period.
Frequency of monitoring/recording	Continuously
Value applied	0
Monitoring equipment	The electricity meter(s)
QA/QC procedures to be applied	The data will be cross checked with Electricity Transaction Note. The electricity meter(s) will be periodically checked and maintained. Calibration will be carried out once a year to ensure normal operation.
Purpose of data	Calculation of project emissions.

Calculation method	-
Comments	-

Data / Parameter	$Fff_{i,y}$ ($Eff_{ELEC,y}$)
Data unit	%
Description	Efficiency of methane destruction in use i (for the project, i represents power generation)
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Description of measurement methods and procedures to be applied	IPCC reference
Frequency of monitoring/recording	-
Value applied	99.5
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of data	Calculation of project emissions.
Calculation method	-
Comments	The parameter will be updated according to IPCC.

5.3 Monitoring Plan

The monitoring plan presented in this PD assures that real, measurable, long-term GHG emission reductions can be monitored, recorded and reported. It is a crucial procedure to identify the final VCUs of the project. This monitoring plan will be implemented by the project owner during the project operation. The details of the monitoring plan are specified as follows:

（A） Data and parameters to be monitored

Data and parameters to be monitored are listed below shows the positions of the monitoring instruments and Table 5-1 lists the corresponding parameters monitored:

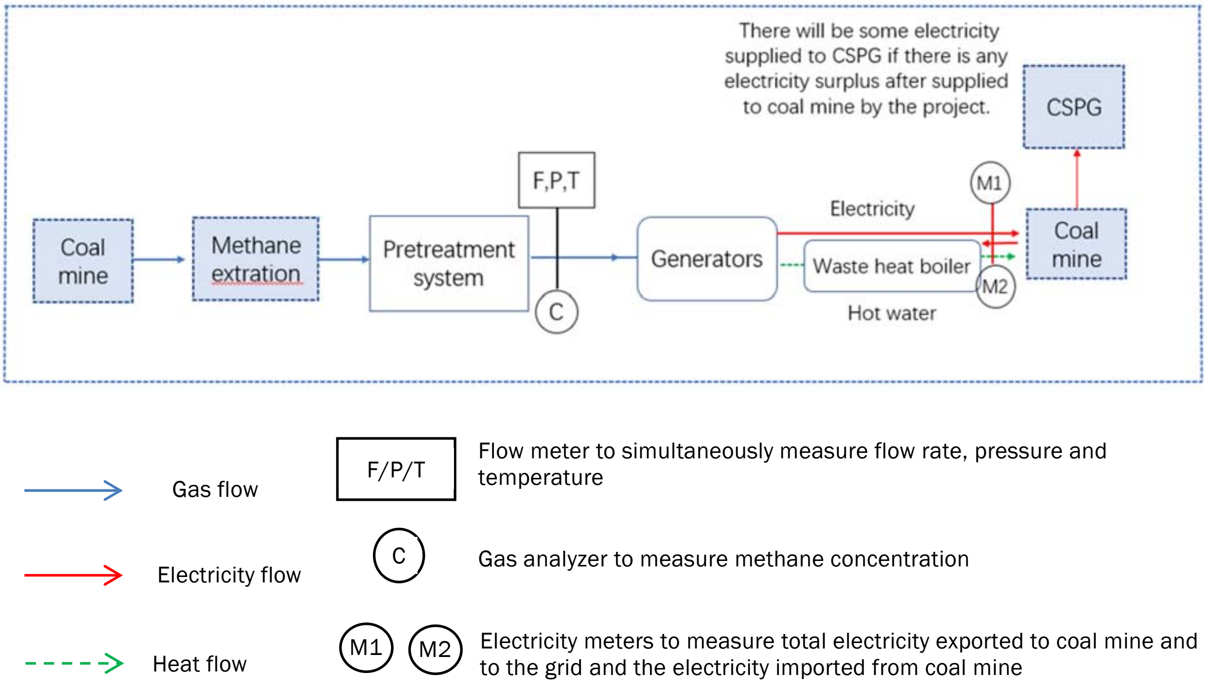

Figure 5-1 Project monitoring diagram

Table 5-1 Corresponding parameters monitored

Position	Parameter Monitored	Description
CMM Inflow Monitoring: the flow meter with pressure sensor and temperature sensor and gas analyzer are installed at the outlet of the pretreatment system.	$MT_{PJ,s,i,y}$ and $MM_{ELEC,y}$	Methane concentration, gas flow rate, pressure and temperature are monitored on-site and used to calculate methane from source s captured and destroyed by use of power generation and methane measured sent to use of power generation.
Electricity Monitoring: Electricity meters (M1 and M2) are installed at the project site to monitor the total electricity delivered to Jinyan coal mine and the grid (if there is some electricity surplus) and	$EG_{use,k,y}$ ($EG_{PJ,grid,y}$) 、 $EC_{PJ,j,y}$	Electricity generation by the project and electricity consumption for the project activity are continuously monitored.

the electricity imported from the coal mine.		
/	GWP_{CH4}、$Eff_{i,y}$ $(Eff_{ELEC,y})$、$TDL_{j,y}$、$EF_{grid,CM,y}$	Global warming potential of methane、efficiency of methane destruction in use i、average technical transmission and distribution losses for providing electricity to source j in year y will be updated according to relevant data sources, and the combined margin emission factor are fixed in the crediting period.

(B) Management Structure

The Project owner organizes a specific VCS team in project development department to be responsible for data collection, supervision and witness the whole process of data measuring and recording. A VCS manager is appointed to take full responsibility for the overall monitoring of the project. The monitoring and measurement of extracted gas, electricity generation and consumption etc. are carried out by a few designated monitoring officers. In addition, the Project developer appoints internal verifiers who is responsible for internal check of the measurement, collection of relevant receipts and invoices, and the calculation of the emission reductions. A monitoring and management manual of the project that identifies detailed duties and responsibilities of the relevant parties is developed and served as the basis of the project monitoring. Figure 5-2 shows the operation and management structure of the Project.

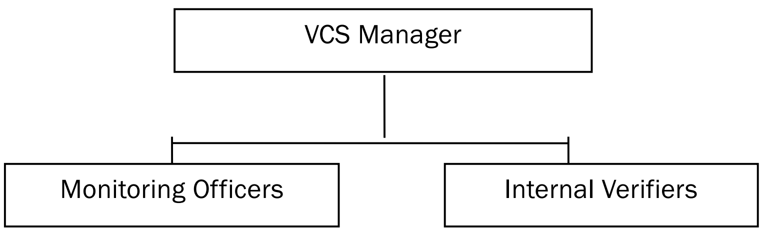

Figure 5-2 Operation and management structure of the project

(C) Data collection

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

(D) Quality assurance

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

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

The installation of the electricity metering equipment will fulfill the requirements of "*DL/T448–2016 Technical Administrative Code of Electric Energy Metering*"[27]. The accuracy should not be less than 0.5S. The installation of flow meters and gas analyzers will fulfill the national standard (MT448-2008 and JJG 1138-2017). All the meters will be checked and maintained periodically.

(E) Data file management

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

[27] https://wenku.baidu.com/view/c8ad0b432379168884868762caaedd3383c4b59e.html