LIYANG 15 MW LOW-CONCENTRATION CMM POWER GENERATION PROJECT

Document Prepared by Green Inclusive Technology (Beijing) Co., Ltd & Leon Low-Carbon and Environmental Protection Science and Technology (Beijing) Co., Ltd.

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1 PROJECT DETAILS

1.1 Summary Description of the Project

Liyang 15 MW Low-concentration CMM Power Generation Project (hereinafter referred to as the Project) will utilize the low concentration coal mine methane (CMM) from Liyang coal mine for power generation to supply electricity to the North China Power Grid (NCPG). Waste heat generated by the gas power generators will be utilized for heat supply to the coal mine. The Project is located in South Liyang Village, Liyang Township, Heshun County, Jinzhong City, Shanxi Province, China.

Prior to the implementation of the Project, Liyang coal mine was equipped with CMM extraction facilities and all extracted CMM was vented into the atmosphere directly; equivalent amount of electricity was provided by all power plants connecting to NCPG and the heat was provided by gas-fired boilers. The baseline scenario is the same as the scenario existing prior to the implementation of the project activity.

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. Twenty-four sets of CMM gas generators and one set of steam turbine generator will be installed to generate with a total installed capacity of 15MW (20*0.6MW+4*0.5MW+1MW), destroying 25.5 million Nm^3 of methane annually. After the full operation of the Project, the expected annual exported electricity will be 77,550 MWh, which will be supplied to the NCPG. The waste heat from generators is recovered by waste heat boilers, and saturated steam from waste heat boilers will be supplied to the steam turbine to produce electricity, surplus saturated steam will be supplied to the coal mine to replace part of the heat generated by the gas-fired boilers. However, to be conservative, emission reductions will not be claimed for heat supply.

The emission reductions of the Project come from two sources: 1) Methane (CH_4) emissions because 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 generated by power plants dominated by fossil fuel fired. It is estimated that in the 10 years crediting period of the Project (from 01-March-2022 to 29-February-2032), the expected average annual GHG emission reductions will be 484,446 tCO_2e, with the total emission reduction of 4,844,460 tCO_2e.

Audit Type	Period	Program	VVB Name	Number of years
Validation	To be determined	VCS	TÜV Rheinland (China) Ltd.	To be determined

Total	To be determined	-	-	To be determined

1.2 Sectoral Scope and Project Type

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

Sectoral Scope 8: Mining/mineral production

The project is not a grouped project.

1.3 Project Eligibility

The scope of the VCS Program includes:

a) The Seven Kyoto Protocol greenhouse gases: The emission reductions of the Project come from two sources: a) Methane (CH_4) emissions because 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 provided by the NCPG dominated by fossil fuel-fired power plants. Thus, the Project applicable to this scope.

b) Ozone-depleting substances: N/A.

c) Project activities supported by a methodology approved under the VCS Program through the methodology approval process: N/A.

d) 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 8.0) of the Project utilized is a methodology approved under CDM Program, that is a VCS approved GHG program.

e) Jurisdictional REDD+ programs and nested REDD+ projects as set out in the VCS Program document Jurisdictional and Nested REDD+ (JNR) Requirements: N/A

Meanwhile, the Project does not belong to the projects excluded in Table 1 of VCS Standard 4.4. Thus, the Project is eligible under the scope of VCS program.

1.4 Project Design

The Project has been designed to include a single location or installation only. The Project is not a grouped project.

Eligibility Criteria

N/A.

1.5 Project Proponent

Organization name	Beijing Yonder Environmental Energy Technology Co., Ltd
Contact person	Wang Chao
Title	Manager
Address	Floor 7, East Tower, Zhonghai International, Wanbolin District, Taiyuan, Shanxi Province
Telephone	+86 18303415669
Email	wangchao@china-yonder.com

1.6 Other Entities Involved in the Project

Organization name	Shanxi Shengdong Qingtian New Energy Co., Ltd.
Role in the project	Project Owner
Contact person	Wang Chao
Title	Manager
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Organization name	Leon Low-Carbon and Environmental Protection Science and Technology (Beijing) Co., Ltd.,
Role in the project	Consultant
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Organization name	Green Inclusive Technology (Beijing) Co., Ltd
Role in the project	Developer
Contact person	Mr. Lei Yan
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1.7 Ownership

Shanxi Shengdong Qingtian New Energy Co., Ltd. owns and operates the Project. Shanxi Shengdong Qingtian New Energy Co., Ltd. is Beijing Yonder Environmental Energy Technology Co., Ltd.'s fully subsidiary. Shanxi Shengdong Qingtian New Energy Co., Ltd. agrees to appoint Beijing Yonder Environmental Energy Technology Co., Ltd. to act as project proponent under Verra. Shanxi Shengdong Qingtian New Energy Co., Ltd. has obtained the approval from Shanxi Province 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 Shanxi Shengdong Qingtian New Energy Co., Ltd., and the EIA form has been approved by approved by Jinzhong City 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.

1.8 Project Start Date

01- March -2022 (Commissioning date)

1.9 Project Crediting Period

This project adopts a fixed crediting period of 10 years, from 01-March-2022 to 29-February-2032 (both days included).

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

Project Scale	
Project	

Large project	√

Year	Estimated GHG emission reductions or removals (tCO_2e)
01-March-2022 to 28-February-2023	484,446
01-March-2023 to 29-February-2024	484,446
01-March-2024 to 28-February-2025	484,446
01-March-2025 to 28-February-2026	484,446
01-March-2026 to 28-February-2027	484,446
01-March-2027 to 29-February-2028	484,446
01-March-2028 to 28-February-2029	484,446
01-March-2029 to 28-February-2030	484,446
01-March-2030 to 28-February-2031	484,446
01-March-2031 to 29-February-2032	484,446
Total estimated ERs	4,844,460
Total number of crediting years	10
Average annual ERs	484,446

1.11 Description of the Project Activity

Twenty-four sets of CMM power generators and one set of steam turbine generator with total capacity of 15 MW will be installed to utilize CMM for power generation. The amount of pure methane destructed is estimated to be 25.5 million Nm^3 per year, and the annual exported electricity is 77,550 MWh.

The low concentration CMM is delivered through methane extraction pumps to the pre-treatment system for safety treatment, and then goes into the gas generators for power generation. Then, the waste heat from gas generators will be recovered by the waste heat boilers, and saturated steam from waste heat boilers will be supplied to the steam turbine generator to produce electricity, surplus saturated steam will be supplied to the coal mine to replace part of the heat that would be generated by the gas-fired boilers. The generated electricity will be supplied to the NCPG.

The Project uses domestic power generators. After site survey and taking advice from professional experts, the preparation organization of Feasibility Study Report (FSR) determined the annual operating hours to be 5,500 hours in the FSR, and thus the plant load factor (PLF) is 0.6279[1].

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

The Project will install gas analyzers, flow meters, thermometers and manometers to respectively monitor the methane concentration and CMM volume sent to the CMM power plants. Bidirectional meters will be installed to monitor the electricity export and import. Detailed monitoring information can be found in section 5.3.

The emission reductions of the Project come 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 emissions from the production of the equivalent amount of electricity replaced by the Project that would otherwise have been generated by power plants dominated by fossil fuel fired.

Table 1-1 Gas Generator Specifications

Type	600GFZ1-RWD-TEM2-4	500GF-1
Quantity	20	4
Rated power (kW)	600	500
Rated speed (r/min)	1000	1500
Power factor	0.8	0.8

[1] 0.6279=5,500 hours/8,760 hours

Lifetime (year)	10	10

Table 1-2 Steam turbine generator Specifications

Type	YD-N1
Quantity	1
Rated power (kW)	1000
Rated speed (r/min)	7200
Power factor	0.8
Lifetime (year)	10

1.12 Project Location

The Project is located in South Liyang Village, Liyang Township, Heshun County, Jinzhong City, Shanxi Province, China. The geographical coordinates for the project site are east longitude 113°37'23"and north latitude 37°24'24".

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

Figure 1-1 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:

a) All the low concentration CMM extracted from the coal mines in the Project would be vented into the atmosphere.

b) The NCPG provided the equivalent amount of electricity produced by the Project (as discussed above, the electricity generated by the Project will only replace electricity from all power plants connecting to NCPG).

c) Heat was provided by gas fired boilers (emission reductions due to heat replacement will not be claimed).

Baseline scenario is the same as the scenario existing prior to the implementation of the Project activity. All extracted CMM from Liyang coal mine would be vented into the atmosphere directly; equivalent amount of electricity would be provided by all power plants connecting to NCPG, and the heat would be provided by gas-fired boilers.

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

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

a) "Several opinions of the General Office of the State Council on accelerating the extraction and utilization of coal mine gas (coal mine methane)"[2] points out that power generation should be used on a priority basis in the mining area, and the surplus electricity that needs to be supplied to the grid. The Project will use low concentration CMM from Liyang Coal Mine for power generation, and the surplus electricity is supplied to NCPG. Thus, this project is in line with the relevant opinions.

b) According to Chinese National Coalmine Safety Regulation[3], 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 Liyang 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 occur.

c) 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 Coal Mine Gas (Coal Mine Methane)"[4].

The Project obtained the approval letters from Shanxi Province Development and Reform Commission and Jinzhong City Environmental Protection Bureau. The approvals well demonstrate that local government permits the construction of the Project. Consequently, the Project is compliance with laws, status and other regulatory frameworks.

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.

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[2] http://www.gov.cn/zhengce/content/2008-03/28/content_2576.htm#

[3] https://www.mem.gov.cn/gk/gwgg/agwzlfl/zjl_01/201603/t20160325_233784.shtml

[4] http://www.nea.gov.cn/2011-12/31/c_131337364.htm

1.15.2 Projects Rejected by Other GHG Programs

N/A.

1.16 Other Forms of Credit

1.16.1 Emissions Trading Programs and Other Binding Limits

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 covering 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[5]. 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[6] in public information. Hence, it is confirmed that the emission reductions will not be double counted.

1.16.2 Other Forms of Environmental Credit

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

Supply Chain (Scope 3) Emissions

This project doesn't affect emissions associated with a good or service in the supply chain.

1.17 Sustainable Development Contributions

The Project is to utilize the extracted CMM with low concentration methane concentration to generate electricity and supply the electricity to NCPG.

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

- This project will promote utilization of clean energy. During the crediting period, less carbon-intensive electricity will be generated to displace the fossil fuel dominated power generation

[5] https://www.mee.gov.cn/xxgk2018/xxgk/xxgk05/202103/t20210330_826728.html

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

in the baseline scenario. Thus, the Project will achieve SDG7 "Ensure access to affordable, reliable, sustainable and modern energy"[7]

- 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"[8].

- The Project will achieve a GHG emission reduction of 4,844,460 tCO_2e per year during the crediting period. Thus, the Project will achieve SDG 13 "Take urgent action to combat climate change and its impacts"[9].

The Project contributes to achieving Chinese sustainable development priorities is described as below:

SDG	Indicators	Chinese Sustainable Development Progress	Project activity contribution
	Ensure access to affordable, reliable, sustainable and modern energy	China has implemented an innovation-driven development strategy, focusing on deepening supply-side structural reforms, building a clean, low-carbon, safe and efficient energy system, and continuing to promote international cooperation in the energy field, energy utilization efficiency has been significantly improved, and energy has entered a new stage of high-quality development.	The project activity is designed to introduce CMM-based power generation to displace the carbon-intensive electricity that would be dominantly generated by fossil fuels in NCPG as a business-as-usual scenario in the project area. The public can have access to clean energy by reducing use of fossil fuels.
	Promote sustained, inclusive and sustainable economic growth, full and productive	China is implementing the innovation-driven development strategy in-depth, and small, medium and micro enterprises are developing rapidly. China adheres to the policy of employment first and adopts	The project activity can provide employment opportunities for local villagers. This contributes to one of China's actions for promoting sustainable development: "by 2030,

[7] Goal 8 | Department of Economic and Social Affairs (un.org)

[8] Goal 8 | Department of Economic and Social Affairs (un.org)

[9] Goal 13 | Department of Economic and Social Affairs (un.org)

	employment and decent work for all	various measures to actively promote employment. The unemployment rate is at a relatively low level. We have scientifically coordinated epidemic prevention and control with economic and social development. China has become the only major economy to achieve positive growth in 2020, making a positive contribution to the global economic recovery.	achieve full and productive employment and decent work for all women and men, including young people and persons with disabilities, and equal pay for work of equal value”.
	Take urgent action to combat climate change and its impacts	In 2020, China's energy consumption per unit of GDP was reduced by 24.4% compared with 2012; carbon dioxide emissions per unit of GDP were reduced by 18.8% compared with 2015 and 48.4% compared with 2005, all of which have already fulfilled China's commitment to the international community in 2020 ahead of schedule.	The Project is to utilize the extracted CMM with low concentration methane concentration for electricity generation to avoid methane emissions and CO_2 emissions from the production of the equivalent amount of electricity replaced by the Project that would otherwise have been generated by power plants dominated by fossil fuel fired. This contributes to achieving China’s stated sustainable development priorities "China's carbon dioxide emissions would strive to peak by 2030 and strive to achieve carbon neutrality by 2060".

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

N/A.

2 SAFEGUARDS

2.1 No Net Harm

The Project started construction on 1-March-2021 and operated on 1-March-2022, the following measures in the construction and operation phase were carried out by the project owner to mitigate the potential impact.

Air Pollution

During the construction phase, the project owner set up construction fences at the construction site and installed spill prevention measures under the fences to prevent dust from escaping. At the same time, the project owner promptly took dust suppression measures such as watering and dust suppression for the dust generated by earth excavation and backfilling. When transport vehicles left the site, their bodies and tires were washed clean. Vehicles that were prone to produce dust were covered with waterproof cloth, and vehicle speed was controlled reasonably; overloading was not allowed.

During the operation phase, the project owner used the exhaust gas treated by waste heat boilers to meet the stage standard requirements of “Emission limits and measurement methods of pollutants from automotive compression-ignition and gas combustion ignition engines” (GB17691-2005), which did not cause a significant environmental impact.

Wastewater

During the construction phase, the wastewater generated included wastewater from the sand and gravel processing system, wastewater from construction equipment washing, and wastewater from oil spills from construction machinery that flowed into surface runoff. The wastewater was treated in an oil-water separator and returned to the construction site for reuse, without discharge.

During the operation phase, circulating cooling water and concentrated reverse osmosis water entered the mine water treatment system through the sewage collection system for treatment, without discharge. Domestic wastewater was pretreated by a septic tank and then entered the sewage collection system for treatment, without discharge.

Noise

During the construction phase, to reduce the environmental pollution caused by construction noise, the project owner used low-noise construction machinery and construction methods. High-noise machinery use was strictly prohibited at night (10pm - 6am) during construction.

During the operation phase, the project owner used low-noise equipment, performed foundation shock absorption, installed mufflers, and maintained protective facilities regularly to ensure their normal effectiveness.

Solid Waste

During the construction phase, due to the small construction area of this project, all the excavated earth was used for construction backfill, without generating waste soil.

During the operation phase, hazardous waste temporary storage rooms were set up to store hazardous wastes such as waste lubricating oil and waste cotton yarn, which were regularly treated by enterprises with relevant processing qualifications entrusted by the project owner. The domestic waste generated by the project was collected in enclosed garbage cans at the station and regularly sent to designated garbage collection points for disposal.

In summary, through the measures taken by the project owner, the project do not have a negative impact on the environment and/or socio-economic aspects.

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 Liyang Coal Mine, local villagers, and government officials by the project owner on 14-November-2020. The survey questionnaire was designed to assess the project impacts on the local environment and social economic development. The structure of the survey respondents is listed in Table 2-1 below:

Table 2-1 Structure of stakeholders surveyed

Item	Distribution	Quantity	Percentage
Number of stakeholders surveyed	Male	29	58%
	Female	21	42%
Age	<25	6	12%
	25-45	21	42%
	46-55	17	34%

	>55	6	12%
Education	Junior high school or below	24	48%
	Senior high school	17	34%
	College or above	9	18%
Occupation	Worker	15	30%
	Farmer	22	44%
	Management personnel	4	8%
	Civil servant	4	8%
	Unspecified	5	10%

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 project?	Quite much	37	74%
		Heard of	12	24%
		Nothing	1	2%
2	What is your attitude towards the project construction?	Supportive	48	96%
		Against	0	0%
		Indifferent	2	6%
3	What is the most probable environmental impact do you think the project will cause after the construction finish? (Multiple choice)	None	49	98%
		Air pollution	0	0%
		Water pollution	0	0%
		Noise pollution	0	0%
		Harm to indigenous animals and plants	0	0%
		No idea	1	2%
4	Are you willing to participate in the Project construction or operation?	Yes	48	96%
		No	0	0%
		No idea	2	4%
5	Do you think the Project will affect the local economic development?	Positive effect	40	80%
		None	10	20%
		Negative effect	0	0%
6		Positive	45	90%

	What influence do you think the Project will bring about to you and your family?	None	5	10%
		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	Do you think the Project will have beneficial impacts on local community? (Multiple choice)	None	0	0%
		Improvement of local sustainable development	37	74%
		Reduce environmental pollution	44	88%
		Reduce carbon emissions	21	42%
		Reducing the impact of environmental pollution on health	44	88%
		Increasement of employment opportunities	44	88%
		Others	0	0%
		No idea	6	12%

The survey shows that the Project is well known by local residents. Almost all the respondents know or heard about the Project. Most of them support the project's construction. 96% of the respondents are willing to participate in the construction and operation of the Project. 98% of the respondents believe that the Project will not have any environmental impact.

90% of the respondents recognize the positive impact of the Project on individuals and families. 88% of the respondents believe that the Project will have beneficial impacts on the local community, with the majority believing that the project will help improve the level of local sustainable development, reduce environmental pollution and its health impacts, and increase employment opportunities. No one thinks that the Project will have a negative impact on local life. In terms 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 that the Project will improve the operational safety of the coal mine to some extent.

In general, local stakeholders support the Project's construction. The survey shows that most local stakeholders think the Project will help improve the lives of local people and promote local economic development without adverse environmental impact. The survey indicates that almost all the stakeholders support the Project, believing that the Project will provide more employment opportunities, improve the level of local sustainable development, and reduce environmental pollutants. Therefore, the implementation of the Project is regarded as beneficial by most of the local stakeholders.

The mechanism for ongoing communication with local stakeholders.

The project owner has set up an on-going communication mechanism to regularly hold stakeholder meetings, distribute questionnaires and give the response to various stakeholders. Communications with Local stakeholders are being carried out at periodic intervals. Moreover, local stakeholders can also raise their concerns and opinions directly by making a phone call to the project proponent.

How due account of all and any input received during the consultation has been taken.

To ensure all input received during the LSC has been taken, 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, Shanxi Zhongyi Qingjing Environmental Protection Technology Co., Ltd to conduct the Environmental Impact Assessment (EIA) on the project. The EIA report was completed in June 2019 and was approved by Jinzhong City Environmental Protection Bureau on 10-July-2019. The environmental impacts of the Project in construction period and in operation period are summarized as follows.

Construction Phase

Air pollution

During the construction stage, the main air pollutants are exhaust emissions from vehicles and dust. Vehicle exhaust emissions mainly come from transporting building materials, construction equipment and machinery, and construction materials.

Due to the small construction volume and limited amount of construction machinery, the exhaust emissions are small, and the impact is short-term and will disappear as the construction is completed. Dust during the construction period mainly comes from excavation and construction waste. In order to reduce dust during construction, the following measures can be taken: constructing walls around the construction site and installing anti-overflow devices below the walls to prevent dust from spreading; prohibiting on-site concrete mixing and storing building materials in designated areas; centralizing soil storage and timely backfilling. When working with dry soil that is prone to dust, measures such as sprinkling water and dust suppression should be taken. Transport vehicles should be cleaned at designated points and sedimentation ponds should be installed to ensure that vehicles do not carry soil out of the construction site, are not overloaded, and that their speed is reasonably controlled.

Wastewater

During the construction period, wastewater mainly comes from the sewage generated by sand and gravel processing systems, washing of construction equipment, and oil leakage from construction machinery that flows into surface runoff. After being treated by temporary oil separation and sedimentation tanks, the lower layer of clean water can be reused for construction production, mainly for site watering and dust reduction. At the same time, the construction unit should properly manage building materials and construction waste and set up drainage ditches around the construction site to collect runoff water, which can be treated by sedimentation before reuse.

Noise

Noise generated at the construction site mainly comes from machinery, construction work, and construction vehicles. To reduce the impact on the surrounding environment of the construction team, the following measures should be taken in a timely manner: the construction unit should pay attention to maintenance of construction machinery and keep the noise level low; machinery operation and construction time should be arranged reasonably, and high-noise machinery operation during nighttime (10.00 pm-6.00 am) should be strictly prohibited. High-noise machinery should be placed in the middle of the site, and sound barriers should be set up around the construction site to prevent noise from affecting the surrounding environment.

Solid Waste

Solid waste generated by the construction project includes levelling soil, underground excavation soil, construction waste, and construction personnel's domestic waste, etc. Due to the small area of the Project, all construction soil will be reused, and no waste will be produced.

Ecosystem

During the Project construction period, soil excavation on the site is prone to soil erosion caused by rainwater due to lose soil structure. To minimize soil erosion, temporary walls were built around the project before construction began, and waste soil was promptly removed. Hardened roads were used for construction roads, and drainage ditches were built on the construction site to prevent rainwater from eroding the site. The construction area was reasonably delineated, and both greening and construction were carried out simultaneously.

Operation Phase

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).

Wastewater

In this project, the circulating cooling water and sewage are channeled through the sewage collection system into the Liyang coal mine water treatment system. After treatment, they are comprehensively utilized for underground water sprinkling. Domestic sewage undergoes preliminary treatment in septic tanks before entering the sewage collection system and being sent to the coal mine's domestic sewage treatment facility. The concentrated water from reverse osmosis is collected through the sewage collection network, and after being treated in the Liyang coal mine water treatment system, it is also comprehensively utilized for underground water sprinkling.

Noise

During the operational period, the main sources of noise pollution come from various pumps, gas generators, and steam turbines. The project has chosen low-noise equipment, with all pumps installed in designated integrated pump rooms and provided with vibration isolation for their foundations. Steam turbine units and gas generator units are installed inside workshops, with sound-absorbing materials placed on the indoor walls. Mufflers are installed in the exhaust systems of gas generator units. The noise during the operational period meets the Category 2 standard limit requirements of the "Emission Standard of Noise at Boundary of Industrial Enterprises" (GB12348-2008).

Solid waste

During the operational period, solid waste mainly consists of daily domestic waste from employees, hazardous waste such as waste lubricating oil and waste cotton yarn generated during equipment maintenance, and waste engine oil regularly replaced in gas generator units. The project uses enclosed garbage bins for collecting domestic waste, which is regularly transported to the designated waste collection point of Liyang coal mine for disposal. Waste engine oil is regularly taken away and processed by qualified organizations. Hazardous waste such as waste lubricating oil and waste cotton yarn are stored in a temporary hazardous waste storage area and are periodically disposed of by organizations with the relevant qualifications for hazardous waste treatment.

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 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 open for public comment on Verra website.

2.5 AFOLU-Specific Safeguards

N/A.

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 8.0)[10].

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

- TOOL02 "Combined tool to identify the baseline scenario and demonstrate additionality” (Version 07.0)[11].
- TOOL05 "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation” (Version 03.0)[12].
- TOOL07 “Tool to calculate the emission factor for an electricity system” (Version 07.0)[13].
- TOOL24 “Common practice” (Version 03.1)[14].
- TOOL27 “Investment analysis” (version 12.0)[15].

3.2 Applicability of Methodology

The Project satisfies all the applicability criteria of the methodology ACM0008 (Version 8.0), 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	Applicable. The project uses the low concentration coal mine methane (CMM) from Liyang coal mine for

[10] https://cdm.unfccc.int/methodologies/DB/YSD3FQ5WR3VPC9Q64CDTLXHLFVKKKU

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

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

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

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

[15] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-27-v12.pdf

	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.	power generation to supply electricity to NCPG. 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 because 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 generated by power plants dominated by fossil fuel fired.
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

		Liyang 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.	Not relevant. Liyang coal mine that is involved by the Project 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 CO2 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;	Not relevant. 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.	Not relevant. 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.	Not relevant. 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 Joint-PD-MR 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.	Applicable. Only when the project is out of operation or abnormal operation, there is a small amount of electricity consumed by the project which is supplied by NCPG (Scenario A).

	The captive power plant(s) is/are not 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.	Applicable. The electricity generated by the Project is delivered to NCPG (Scenario I).
	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.	Not relevant. 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 Liyang coal mine for power generation to supply electricity to NCPG. 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 IIb. 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 aspects such as transmission capacity.	Applicable. 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.
	In case of CDM projects the tool is not applicable if the project	Applicable.

	electricity system is located partially or totally in an Annex I country	The Project electricity system is in a non-Annex I country.
	Under this tool, the value applied to the CO2 emission factor of biofuels is zero.	Not relevant. The Project does not involve 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.	Applicable. 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.	Applicable. The baseline and monitoring methodology refers to" Combined tool to identify the baseline scenario and demonstrate additionality" for the conduction of the common practice test. Therefore, this tool is applicable.
Investment analysis" (version 12.0)	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", the guidelines "Non-binding best practice examples to demonstrate additionality for SSC project activities", or baseline and monitoring methodologies that use	Applicable. Since the Project activity is using "Combined tool to identify the baseline scenario and demonstrate additionality", the tool is applicable.

	the investment analysis for the demonstration of additionality and/or the identification of the baseline scenario.	
	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.	Applicable. The baseline and monitoring methodology only refers to"Combined tool to identify the baseline scenario and demonstrate additionality" for the investment analysis. 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, Liyang coal mine is the coal mine from where the methane is 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 emission reduction 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 are installed and used.

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 electricity 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".

According to the latest China DNA published Operating Margin (OM) Emission Factor and the Build Margin (BM) Emission Factor[16], Northeast Power Grid (NEPG), Northwest Power Grid (NWPG) and Central China Power Grid (CCPG) supply electricity to NCPG, thus power plants connected to NCPG and NEPG and NWPG were included in the Project boundary.

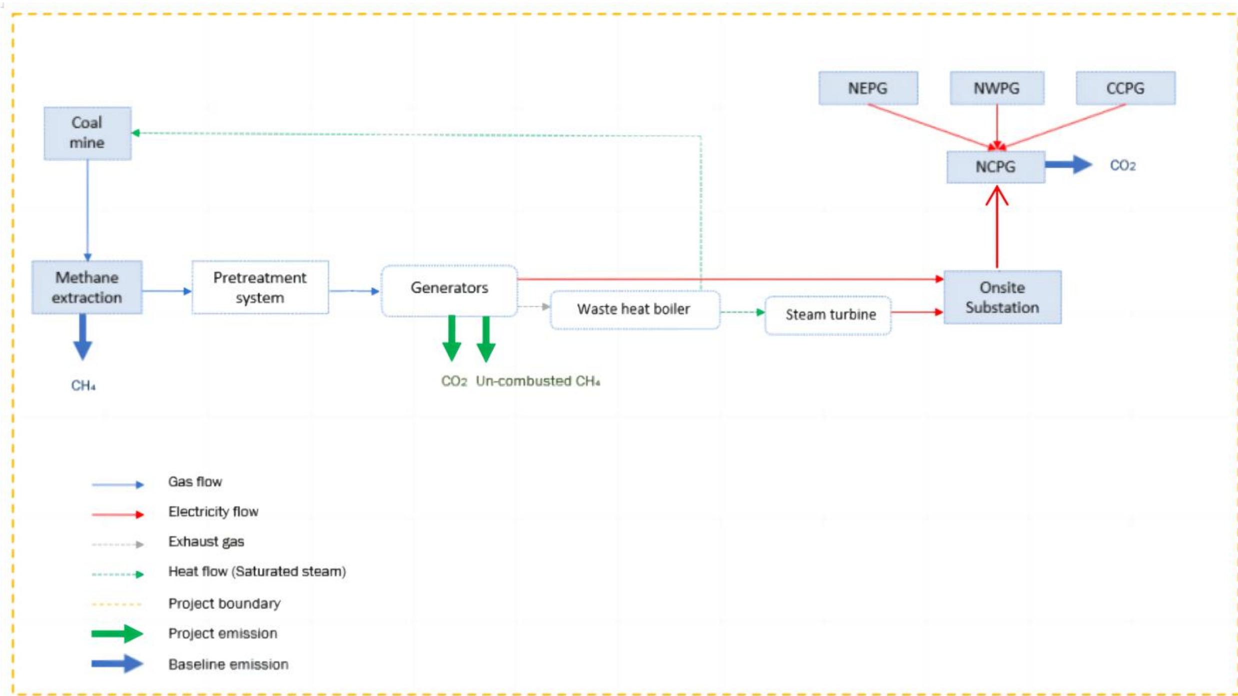

Figure 3-1 Diagram of the Project boundary

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	CO_2	No	No flaring or energy use in the baseline scenario.
		CH_4	No	Excluded for simplification.

[16] https://www.mee.gov.cn/ywgz/ydqhbh/wsqtkz/202012/t20201229_815386.shtml

Source		Gas	Included?	Justification/Explanation
	in the baseline	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	The Project activity is to replace electricity from the grid-connecting power plants, and emission reductions are claimed for such displacement.
		CH_4	No	Excluded for simplification.
		N_2O	No	Excluded for simplification.
Project	Project Emissions of methane as a result of continued venting	CH_4	No	The Project will consider 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.

3.4 Baseline Scenario

According to methodology ACM0008, “Combined tool to identify the baseline scenario and demonstrate additionality (Version 07.0)” is applied to identify the baseline scenario.

Project participants shall apply the following four Steps:

(a) STEP 0. Demonstration that a proposed project activity is the first-of-its-kind.

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

(b) 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.

Step 1a: Define alternative scenarios to the proposed CDM project activity.

Identify all alternative scenarios that provide the same output (service or product) as the proposed VCS project activity. These alternative scenarios shall include:

According to ACM0008(Version 8.0), the baseline scenario alternatives should include all feasible options to handle methane to comply with safety regulations. These alternatives may include, inter alia:

(A1) Extraction of methane prior to the mining (CBM/OCM);

(A2) Extraction of methane during and after the mining (CMM);

(A3) Extraction of methane through ventilation during the mining;

(A4) Extraction of methane from the abandoned mine;

(A5) Possible combinations of options (A1) to (A2) with the relative shares of gas specified.

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

(B1) Venting of methane;

(B2) Flaring of methane;

(B3) Use of methane for energy production, e.g., electricity generation, heat generation, vehicle fuel, gas production, etc.

(B4) Possible combinations of options (B1) to (B3) 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 NCPG;

(P2) The proposed project activity not undertaken as a VCS project activity;

(P3) Construction of a fossil fuel-fired power plant with equivalent power supply;

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

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 Coal Mine Safety Regulation (2016)[17], a coal mine must have a complete, independent ventilation system and gas drainage system to ensure the safe production underground. Therefore, a pumping system must be established for this project. Moreover, under normal circumstances, pre-mining and post-mining extraction are carried out through the same pumping system, making it difficult to separate the pre-mining and post-mining extraction areas. As a result, it is not in accordance with regulations to carry out pre-mining extraction, during-mining extraction, and post-mining extraction separately, and a combination of these methods must be adopted. Additionally, to ensure the safe production underground, the concentration of methane during mining ventilation is kept below 1%, rendering it unsuitable for electricity generation. Since Liyang coal mine is not an abandoned mine, options A1, A2, A3, and A4 are consequently excluded.

In conclusion, option A5 possible combinations of options A1 to A2 is following 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)[17], 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 B2 is eliminated.

Regarding option B3 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 waste heat boiler of the generator units, and there is no additional heat demand, no need for additional heating, so option B3 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

[17] https://www.gov.cn/zhengce/2022-11/15/content_5712798.htm

95%. The Project is located in Heshun County, which is hilly terrain, surrounded by mountains, and the terrain is relatively complex. The investment in constructing pipeline project 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 B3 use of methane for energy generation, e.g., vehicle fuel, gas production is excluded.

As option B4 possible combinations of options B1 to B3 with the relative shares of gas specified, according to analysis above, the possible combinations are option B1 venting of methane and option B3 use of methane for electricity generation. However, it is contradictory for methane venting and methane use for electricity, thus, option B4 is excluded.

In conclusion, options B1 venting of methane and B3 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 15 MW CMM-fired power plant. According to Chinese power regulation, the construction of a fossil fuel-fired power plant with a capacity of 135MW or below is prohibited[18]. 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 following legal and regulatory requirements.

Scenario ID	CMM extraction	CMM treatment	Energy production
Scenario 1 (A5+B1+P1)	Combinations of options A1 to A2	B1 Venting	P1 Equivalent quantity of electricity supply from NCPG
Scenario 2 (A5+B1+P2)	Combinations of options A1 to A2	B1 Venting	P2 The proposed project activity not undertaken as a VCS project activity;
Scenario 3 (A5+B1+P4)	Combinations of options A1 to A2	B1 Venting	P4 Power generation using renewable energy resources e.g., hydro, solar or wind power
Scenario 4 (A5+B3+P1)	Combinations of options A1 to A2	B3 Use of methane for electricity production	P1 Equivalent quantity of electricity supply from NCPG

[18] https://www.gov.cn/gongbao/content/2002/content_61480.htm

Scenario 5 (A5+B3+P2)	Combinations of options A1 to A2	B3 Use of methane for electricity production	P2 The proposed project activity not undertaken as a VCS project activity;
Scenario 6 (A5+B3+P4)	Combinations of options A1 to A2	B3 Use of methane for electricity production	P4 Power generation using renewable energy resources e.g., hydro, solar or wind power

(c) **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. Liyang mining area, however, is shortage of hydropower[19] and geothermal resources[20]. As to wind power, the high investment cost prevents the PO from developing a wind power project with equivalent installed capacity[21]. In addition, due to the large area required for the development of solar power plant projects and high investment cost[21], it is unrealistic to develop solar power plants at the Project site. Finally, the Project site is located in coal mine area, no adequate rice, corn, cotton, peanut or any other biomass materials will be 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 NCPG.

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 by 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:

[19] https://lib.cqvip.com/Qikan/Article/Detail?id=7104455777&from=Qikan_Search_Index

[20] http://journal25.magtechjournal.com/Jwk_dzdc/article/2018/2095-8706-5-5-13.html

[21] https://wenku.baidu.com/view/8da3edb9571252d380eb6294dd88d0d232d43c4c.html?_wkts_=1692173728961&bdQuery=%E5%B1%B1%E8%A5%BF%E6%99%8B%E4%B8%AD+%E9%A3%8E%E8%B5%84%E6%BA%90

Scenario ID	CMM extraction	CMM treatment	Energy production
Scenario 1 (A5+B1+P1)	Combinations of options A1 to A2	B1 Venting	P1 Equivalent quantity of electricity supply from NCPG
Scenario 5 (A5+B3+P2)	Combinations of options A1 to A2	B3 Use of methane for electricity production	P2 The Project activity not undertaken as a VCS project activity.

There are no barriers identified except for insufficient financial returns 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

In November 2019, the Feasibility Study Report (FSR) for the Project was completed and the Project was identified as a project that was not financially feasible without carbon revenue assistance. Therefore, the project owner was suggested to implement the Project as an emission reduction mechanism project to make it financially attractive.

On 19-August -2020, considering the unattractive financial performance of the Project, based on the suggestion of FSR and the survey on similar CMM projects in China, the project owner held a board meeting formally deciding to implement the Project activity as a VCS project.

The timeline of the major events of the proposed project activity is listed in Table 3-4 below:

Table 3-4 The timeline of the major events of the project

Time	Events
June-2019	Environmental Impact Analysis (EIA) Report completed
10-July-2019	EIA Approval by Jinzhong City Environmental Protection Department
November-2019	FSR completed
12-July-2020	Project Approval by Shanxi Province Development and Reform Commission
19-August-2020	The board meeting was held and gave serious consideration to the VCS revenues to make the investment decision.
14-November-2020	Stakeholder meeting
1-March-2021	Started construction date
1-March-2022	Started operation date

Step 3. Investment Analysis

According to Tool 02 “Combined tool to identify the baseline scenario and demonstrate additionality (Version07.0)”, 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 indicator for the project.

According to the “Interim Rules on Economic Assessment Electrical Engineering Retrofit Projects”[22], for greenfield or retrofit projects in Chinese electric power industry, the financial benchmark is 8% for project IRR (after tax). This project is a power generation plant, and the benchmark 8% for project IRR (after tax) can be applied to the project. All parameters for IRR calculation are sourced from the FSR.

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
Installed capacity	MW	15	FSR
Total static investment	10,000CNY	9,942	FSR
Working capital	10,000CNY	45	FSR
Annual electricity exported	MWh/year	77,550	FSR
Electricity Tariff (including VAT)	CNY/kWh	0.4048	FSR
Income tax	%	25	FSR
Value added tax (Electricity)	%	13	FSR
Municipal maintenance and construction tax	% of VAT	7	FSR
Surcharge for education	% of VAT	5	FSR
Depreciation period	Year	10	FSR
Scrap value of fixed assets	%	5	FSR

[22] https://m.doc88.com/p-208229107937.html?r=1#

Annual operation and management (O&M) cost	10,000CNY	2,009	FSR
Project operational lifetime	Year	10	FSR

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)	2.80%	8%	8.51%

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 analysed. The results of sensitivity analysis of the four indicators are shown in Figure 3-2.

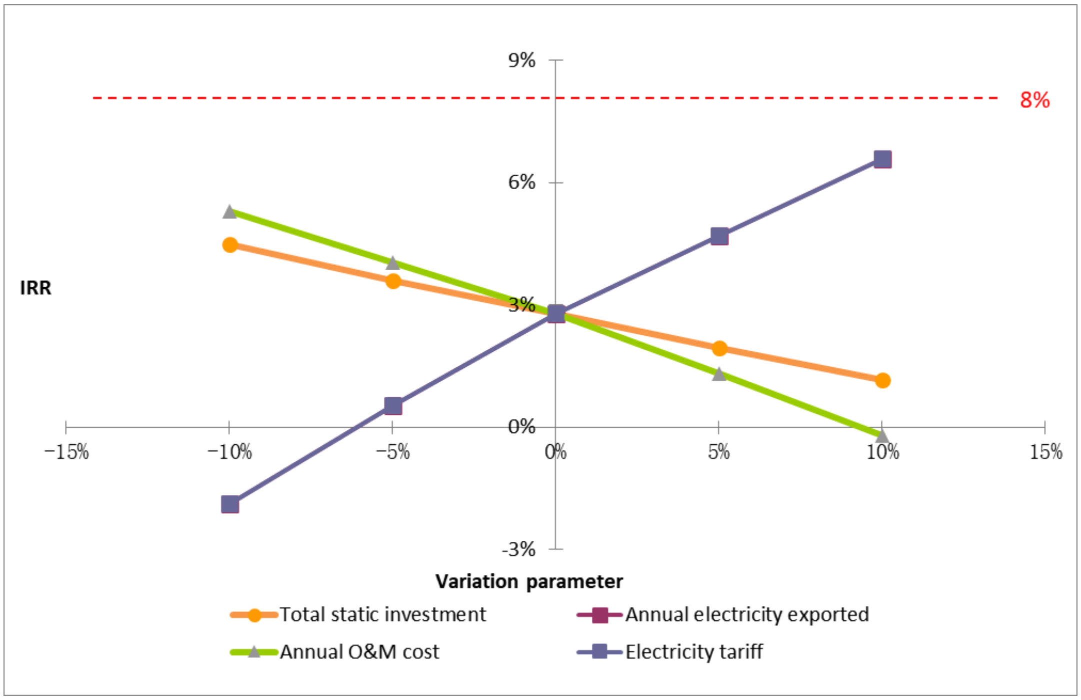

Figure 3-2 Sensitivity analysis of financial indicators of the project

It is clearly shown in the Figure of sensitivity analysis that with +/-10% variation on the four major parameters, the project IRR remains below 8%, confirming the financial unattractiveness of the project activity.

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

According to the TOOL24 Common Practice (Version 03.1), other activities similar to the proposed project activity are analysed as follows:

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 15 MW. Range of +/- 50% of the capacity is from 7.5 MW to 22.5 MW.

Sub-step 4-2: Identify similar projects (both CDM and non-CDM) which fulfil 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 Shanxi Province, P. R. China are chosen.

(b) The projects apply the same measure as the project activity. Thus, only the projects providing 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 7.5MW - 22.5MW 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 1-March -2021 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 publicly available sources[23][24], China's DNA website and UNFCCC website, all CMM power projects with capacity of 7.5MW-22.5MW operated before 1-March-2021 in Shanxi Province are listed below excluding those projects registered as CDM/VCS/CCER projects.

Table 3-7 The CMM power generation projects in Shanxi Province that started commercial operation before 1-March-2021

No.	Project Title	Capacity (MW)	Commissioning date
1	Hudi distributed gas power station phase II 10 MW low-concentration gas power generation project[25]	10.4	30/03/2019

There was one project which neither registered as CDM/VCS/CCER projects existed in Shanxi Province that started commercial operation before 1-March-2021. Thus, N_{all}=1.

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

[24] China Electric Power Yearbook

[25] https://www.sohu.com/a/306098206_756343

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 $N_{all} = 1$, $N_{diff}=0$, therefore, $N_{all}- N_{diff} =1$, which is less than 3.

$F=1-N_{diff}/N_{all}=1-0=1>0.2$.

According to "Common practice (version 03.1)", the 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. For this project, 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 A5, B1 and P1: Methane extraction: Combinations of methane extraction of prior to, during and after the mining; Liyang coal mine was equipped with CMM extraction facilities and all extracted CMM was vented into the atmosphere directly; The equivalent amount of electricity exported by the project was provided by the North China Power Grid (NCPG) dominated by fossil fuel-fired power plants.

Therefore, the project is additional.

3.6 Methodology Deviations

There are 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.

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

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, heat or other forms of useful energy 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:

$$BE_{MRy} = \sum_i \sum_s (MT_{PJ,s,i,y} - MT_{BL,s,i,y}) \times GWP_{CH4} \quad \text{Equation (2)}$$

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 (tCH_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 (tCH_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 (tCO_2e/tCH_4)

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

$$BE_{MRy} = \sum_{i}\sum_{s} MT_{PJ,s,i,y} \times GWP_{CH4}$$ Equation (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:

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

Where:

$BE_{Use,y}$	=	Baseline emissions from energy displaced by the project activity in year y (tCO_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 (tCO_2/energy unit)
k	=	Energy type displaced by the project activity

The waste heat from the generators of this project will be recovered by waste heat boilers to supply steam to the coal mine, and emission reductions will not be claimed for this part. Besides, this project does not involve supply of vehicle fuels. Thus, in this part, the Project just involves the baseline emissions from the production of power.

Baseline emissions factor for power generation

According to the methodology ACM0008 (Version 8.0), 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). As per TOOL05, a bidirectional meter is installed to measure both electricity supplied by the project to the grid and the electricity consumed by the project from the grid. Therefore, $EG_{PJ,grid,y}$ equals to the difference between electricity supplied to the grid minus electricity provided by the grid. According to this tool, for the project is in the case of Scenario I: Electricity is supplied to 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 TOOL07 “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;

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 North China Power Grid (NCPG) is identified as the relevant electric power system of the Project, which includes Beijing, Tianjin, Hebei, Shanxi, Shandong, Inner Mongolia Power Grids. According to the latest published “Baseline Emission Factors for Regional Power Grids in China”[16], there is net electricity imported from the Northeast Power Grid (NEPG), Northwest Power Grid (NWPG) and Central China Power Grid (CCPG) to the NCPG. Therefore, NEPG, NWPG and CCPG 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 (Option I).

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, which are described under Step 4:

(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. Thus, such data are not publicly available. Therefore, method (b) and method (c) are not suitable for the Project.

The Simple OM method (a) can only be applied when low-cost/must run resources constitute less than 50% of total grid generation in an average of the five most recent years. According to the data from China Electric Power Yearbook 2014-2018, from the year 2013 to the year 2017, for the NCPG, that the Project activity is connecting to, the proportion of low-cost/must-run electric power resources generation in the total grid generation are 5.94%, 6.39%, 6.91%, 8.59% and 10.10%, respectively, the average value is lower than 50%, which satisfies the applicability of the method (a), therefore, the simple OM method is chosen for the calculation of the OM emission factor $EF_{grid,OM,y}$.

For the simple OM, the simple adjusted OM and the average OM, the emissions factor can be calculated using either of the two following data vintages:

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-Joint-PD-MR 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 to calculate 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-2may 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 NCPG 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:

Under 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:

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

Where:

$EF_{grid,OMsimple,y}$	=	Simple operating margin CO_2 emission factor in year y (t CO_2/MWh)
$FC_{i,y}$	=	EAmount 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 y (GJ/mass or volume unit)
$EF_{CO2,i,y}$	=	CO_2 emission factor of fuel type i in year y (t CO_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 Joint-PD-MR, $NCV_{i,y}$ 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 NCPG, 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 NCPG is calculated as 0.9419 tCO_2/MWh. Details of the calculations and the published data are from the Chinese DNA[16], which uses official national statistics.

The calculation of the OM emission factor is done once (ex-ante) and will not be updated during the crediting period.

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 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 Project 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 Joint-PD-MR 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) ($SET_{\geqslant 20}$ per cent) and determine their annual electricity generation ($AEG_{SET\text{-}\geqslant 20\text{ per cent}}$, in MWh);

(c) From $SET_{5\text{-units}}$ and $SET_{\geqslant 20\text{ per cent}}$ select the set of power units that comprises the larger annual electricity generation (SET_{sample});

Identify the date when the power units in SET_{sample} started to supply electricity to the grid. If none of the power units in SET_{sample} started to supply electricity to the grid more than 10 years ago, then use SET_{sample} to calculate the build margin. In this case ignore Steps (d), (e) and (f).

Otherwise:

(d) Exclude from SET_{sample} the power units which started to supply electricity to the grid more than 10 years ago. Include in that set the power units registered as CDM project activities, 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 comprising at least 20 per cent of the annual electricity generation of the project electricity system (i.e., $AEG_{SET\text{-}sample\text{-}CDM} \geqslant 0.2 \times AEG_{total}$), 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 ($SET_{sample\text{-}CDM\text{-}>10yrs}$).

For the determination of the sample group of power units m, the approach of sample merging has been employed, since the data of electricity generation, fuel consumption or energy conversion efficiency of each newly added unit are not publicly available. Therefore, the newly added units in the recent years are sorted by year, province and power generation technology, and the newly added units of the same power generation technology in the same year and in the same province are treated as one "newly added power plant". The power generation of each "newly added power plant" in the most recent year y is estimated based on its installed capacity and the utilization hours of power generation in year y as follows:

$$EG_{m,y} = CAP_m \times H_{m,y} \qquad \text{Equation (6)}$$

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 added units (k) of the same technology in the same year (t) and in the same province (A) are treated as one “newly added power plant”, CAP_m equals to the installed capacity of a newly added unit of a given technology (k) in a given year (t) and in a given province (A):

$$CAP_m = CAP_m|_{m=(A,t,k)} = CAP_{A,t,k} \qquad \text{Equation (7)}$$

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 project, namely: Beijing, Tianjin, Hebei, Shanxi, Shandong, Inner Mongolia
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.

After the above data processing, the sample group m of "newly added power plants" for calculating BM emission factor can be determined according to aggregation of power generation. Referring to the flow chart of the "Tool to calculate the emission factor for an electricity system" for determining the sample of newly added units for calculating BM, the sampling of "newly added power plants" in each regional power grid starts from the most recent year y (For the calculation of BM in 2019, y is 2017), and traced back to the 'newly added power plants" of earlier years, until the aggregated power generation reaches 20% of the total power generation of the regional power grid in 2017.

Based on the detailed calculation, the "newly added power plants "of the NEPG covers the years of 2013-2017.

The build margin 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:

$$EF_{grid,BM,y} = \frac{\sum_m (EG_{m,y} \times EF_{EL,m,y})}{\sum_m EG_{m,y}} \qquad \text{Equation (8)}$$

Where:

$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in year y ($t\ CO_2/MWh$)
$EG_{m,y}$	=	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	=	Most recent historical year for which electricity generation data is available

The CO_2 emission factor of each power unit m ($EF_{EL,m,y}$)should be determined as per the guidance in Step 4 section 6.4.1 for the simple OM, using Options A1, A2 or A3, using for y the most recent historical year for which electricity generation data is available, and using for m the power units included in the build margin.

Option 2 is used for calculating the CO_2 emission factor of each power unit m ($EF_{EL,m,y}$) as follows, since for a power unit m only data on electricity generation and the fuel types used is available.

$$EF_{El,m,y} = \frac{EF_{CO2,m,i,y} \times 3.6}{\eta_{m,y}} \qquad \text{Equation (9)}$$

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)

For the power generation of hydropower, nuclear power, wind power, solar power, other thermal power, and others, the emission factor equals to zero. For coal-fired, gas-fired, oil-fired and waste to energy power generation, the CO_2 emission factor is calculated based on equation (7) and the average net energy conversion efficiency of the best commercialized practices in compliance with the conservative principle as follows:

$$EF_{Best,m,y} = \frac{EF_{CO2,m,i,y} \times 3.6}{\eta_{Best,m,y}} \qquad \text{Equation (10)}$$

Where:

$EF_{Best,m,y}$	=	CO_2 emission factor calculated based on the average net energy conversion efficiency of the best commercialized practices for the sample of “newly added power plants” of coal-fired, gas-fired, oil-fired or waste to energy power generation in year y (tCO_2/MWh);
$\eta_{Best,m,y}$	=	Average net energy conversion efficiency of the best commercialized practices of coal-fired, gas-fired, oil-fired or waste-to-energy in year y;
m	=	The sample of "newly added power plants" of coal-fired, gas-fired, oil-fired or waste to energy power generation in a given province in a given year.

According to the latest and available data at the time of this Joint-PD-MR submission, $EF_{grid,BM,y}$ of the NCPG is calculated to be 0.4819 tCO_2/MWh. Details of the calculations and the published data are from the Chinese DNA[16], which uses official national statistics.

The calculation of the BM emission factor is done once (ex-ante) and will not be updated during the crediting period.

Step 6: Calculate the combined margin emissions 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:

The calculation of the combined margin (CM) emission factor ($EF_{grid,CM,y}$) is 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 project is not located in (i), (ii), or (iii) as defined above, therefore, the Project chooses option a.

The combined margin emission factor is calculated as follows:

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

Where:

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

The following default values should be used for w_{OM} and w_{BM}:

(a) Wind and solar power generation project activities: w_{OM} = 0.75 and w_{BM} = 0.25 (owing to their intermittent and non-dispatchable nature) for the first crediting period and for subsequent crediting periods;

(b) All other projects: w_{OM} = 0.5 and w_{BM} = 0.5 for the first crediting period, and w_{OM} = 0.25 and w_{BM} = 0.75 for the second and third crediting period, unless otherwise specified in the approved methodology which refers to this tool.

For the Project, the weight w_{OM} and w_{BM} are both 0.5 by default for the fixed crediting period.

Thus, $EF_{grid,CM,y}$=0.9419 tCO_2/MWh *0.5+0.4819 tCO_2/MWh *0.5 = 0.7119 (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:

$$PE_y = PE_{ME,y} + PE_{MD,y} + PE_{UM,y}$$ Equation (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.

For the Project, 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 the project emissions calculation.

During the normal operation of the project activity, the auxiliary power demand of the project activity is met 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 from the grid, which is already considered and deducted in the $EG_{PJ,grid,y}$ as calculation of baseline emissions from the production of power following Tool05. Therefore, $PE_{ME,,y}$ = 0.

Project emissions from destruction of captured methane

When the captured methane is burned in a flare, power plant, or oxidized in a flameless oxidation unit, combustion emissions are released.

$$PE_{MD,y} = \sum_i MD_{i,y} \times CEF_{CH4}$$ Equation (13)

Where:

PE_{MD}	=	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 (tCO_2/tCH_4)

As mentioned above, since emission reductions will not be claimed for heat supply and the Project does not involve emission reductions from supply of vehicle fuels. The Project only involves methane destroyed through power generation. Thus, i=ELEC. And,

$$PE_{MD,y} = MD_{ELEC,y} \times CEF_{CH4} \quad \text{Equation (14)}$$

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.

$$MD_{i,y} = MM_{i,y} \times Eff_{i,y} \quad \text{Equation (15)}$$

Where:

$MD_{i,y}$	=	Methane destroyed through use i in year y (tCH_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:

$$PE_{MD,y} = MM_{ELEC,y} \times Eff_{ELEC,y} \times CEF_{CH4} \quad \text{Equation (16)}$$

Where:

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

Project emissions from un-combusted methane

Not all 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:

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

Where:

$PE_{UM,y}$	=	Project emissions from un-combusted methane (tCO_2e)
GWP_{CH4}	=	Global warming potential of methane (tCO_2e/tCH_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 (tCH_4)
$Eff_{i,y}$	=	Efficiency of methane destruction in use i in year y (%)

For the Project:

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

4.3 Leakage

Leakage may occur if the Project activity prevents methane from being used to meet baseline thermal energy demand, whether because 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 25.5 million Nm^3 methane 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 $0.67kg/m^3$ [26]. Therefore, the methane measured sent to power plant annually is calculated as follows:

$$MM_{ELEC,y} = 25.5 \times 10^6 m^3 \times 0.67 kg/m^3/1000 = 17{,}085\ tCH_4$$

1. Calculation of the baseline emissions

1.1 Baseline emissions from methane destroyed

As described in 5.1, $BE_{MD,y}$=0.

1.2 Baseline emissions from release of methane into the atmosphere

[26] 2006 IPCC Guidelines for National Greenhouse Gas Inventories

$$BE_{MR,y} = GWP_{CH4} \times MT_{PJ,s,j,y} = 28tCO_2/tCH_4 \times 17{,}085\ tCH_4 = 478{,}380\ tCO_2e$$

1.3 Baseline emissions from power generation replaced by the project

$$BE_{Use,y} = EG_{use,k,y} \times EF_{ELEC,y} = EG_{PJ,grid,y} \times EF_{ELEC,y} = 77{,}550MWh \times 0.7119tCO_2/MWh$$
$$= 55{,}207tCO_2e$$

Baseline emissions are calculated by the formulation below:

$$BE_y = BE_{MD,y} + BE_{MR,y} + BE_{Use,y} = 0tCO_2e + 478{,}380tCO_2e + 55{,}207tCO_2e = 533{,}587tCO_2e$$

2. Calculation of the project emissions

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

As described in section 5.2, the Project emissions from the energy use to capture and to use methane (auxiliary power demand) is considered and deducted in in the $EG_{PJ,grid,y}$ as calculation of baseline emissions from the production of power following Tool05. Therefore, $PE_{ME,,y} = 0$.

2.2 Project emissions from destruction of captured methane

$$PE_{MD,y} = \sum_i MD_{i,y} \times CEF_{CH4} = MD_{ELEC,y} \times CEF_{CH4} = MM_{ELEC,y} \times Eff_{ELEC,y} \times CEF_{CH4}$$
$$= 17{,}085\ tCH_4 \times 99.5\% \times 2.75\ tCO_2/t\ CH_4 = 46{,}749\ tCO_2e$$

2.3 Project emissions from un-combusted methane

$$PE_{UM,y} = GWP_{CH4} \times MM_{ELEC,y} \times (1 - Eff_{i,y}) = 28tCO_2/t\ CH_4 \times 17{,}085\ tCH_4 \times (1 - 99.5\%)$$
$$= 2{,}392\ tCO_2e$$

Project emissions are calculated by the formulation below:

$$PE_y = PE_{ME,y} + PE_{MD,y} + PE_{UM,y} = 0tCO_2e + 46{,}749\ tCO_2e + 2{,}392\ tCO_2e = 49{,}141tCO_2e$$

3. Calculation of the leakage

As described in section 5.3, LE_y=0.

4. Calculation of emission reductions

The emission reductions can be obtained from the equation below:

$$ER_y = BE_y - PE_y - LE_y = 533{,}587\ tCO_2e - 49{,}141tCO_2e - 0tCO_2e = 484{,}446\ tCO_2e$$

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-March-2022 to 28-February-2023	533,587	49,141	0	484,446
01-March-2023 to 29-February-2024	533,587	49,141	0	484,446
01-March-2024 to 28-February-2025	533,587	49,141	0	484,446
01-March-2025 to 28-February-2026	533,587	49,141	0	484,446
01-March-2026 to 28-February-2027	533,587	49,141	0	484,446
01-March-2027 to 29-February-2028	533,587	49,141	0	484,446
01-March-2028 to 28-February-2029	533,587	49,141	0	484,446
01-March-2029 to 28-	533,587	49,141	0	484,446

February-2030				
01-March-2030 to 28-February-2031	533,587	49,141	0	484,446
01-March-2031 to 29-February-2032	533,587	49,141	0	484,446
Total	5,335,870	491,410	0	4,844,460

5 MONITORING

5.1 Data and Parameters Available at Validation

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 8.0)
Value applied	2.75
Justification of choice of data or description of measurement methods and procedures applied	ACM0008 (Version 8.0) 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 calculate 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	Normal conditions of temperature and pressure are defined as 1 atm and 293.15K.

Data / Parameter	$EF_{k,y}$ ($EF_{grid,CM,y}$)

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	0.7119
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 baseline emissions.
Comments	According to section 5.1. 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 $EF_{k,y}$ is fixed during the crediting period

5.2 Data and Parameters Monitored

Data / Parameter	$MT_{PJ,s,i,y}$
Data unit	tCH_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 meters, thermometers, manometers 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	17,085 (ex-ante from the FSR)
Monitoring equipment	Flow meters, manometers and thermometers will be installed to continuously measure the gas flow (in volume), pressure and temperature. Gas analyzers will be installed to continuously measure the methane concentration in the CMM.

QA/QC procedures to be applied	Flow meters, manometers, thermometers and gas analyzers will be periodically checked and calibrated.
Purpose of data	Calculation of baseline emissions.
Calculation method	$MT_{PJ,s,i,y}$ is monitored by flow meters in volume unit, which will be converted to mass unit with the parameter of D_{CH4}.
Comments	Flow meters, manometers, thermometers 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 meters, manometers, thermometers and the 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	17,085 (ex-ante from the FSR)
Monitoring equipment	Flow meters, manometers and thermometers will be installed to continuously measure the gas flow (in volume), pressure and temperature. Gas analyzers will be installed to continuously measure the methane concentration in the CMM.
QA/QC procedures to be applied	Flow meters, manometers, thermometers and gas analyzers will be periodically checked and calibrated.

Purpose of data	Calculation of project emissions.
Calculation method	$MM_{ELEC,y}$ is monitored by flow meters in volume unit, which will be converted to mass unit with the parameter of D_{CH4}
Comments	Flow meters, manometers, thermometers 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/m3 (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	Bidirectional electricity meter is applied to measure the amount of electricity exported by the project activity. 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	77,550 (ex-ante from the FSR)
Monitoring equipment	Bidirectional electricity meter
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	$Eff_{i,y}$ ($Eff_{ELEC,y}$)
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 Joint-PD-MR assures that real, measurable, long-term GHG emission reductions can be monitored, recorded and reported. It is a crucial procedure to identify the final VCUs of the Project. This monitoring plan will be implemented by the project owner during the project operation. 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 in below Table 6-1:

Table 5-1 Corresponding parameters monitored.

Position	Parameter Monitored	Description
CMM Inflow Monitoring: Flow meters, manometers, thermometers 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: Bidirectional electricity meter is installed at the onsite substation to monitor the total electricity delivered to Liyang coal mine and the grid and the	$EG_{use,k,y}$ ($EG_{PJ,grid,y}$)	Net electricity supplied by the project to the grid are continuously monitored.

electricity imported from the grid. $EG_{use,k,y}$ ($EG_{PJ,grid,y}$) are measured by the monitored data of M.		
/	GWP_{CH4}, $Eff_{i,y}$ ($Eff_{ELEC,y}$), $EF_{grid,CM,y}$	Global warming potential (GWP) of methane, efficiency of methane destruction in use i 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 are responsible for internal check of the measurement, collection of relevant receipts and invoices, and the calculation of the emission reductions. A monitoring and management manual of the Project that identifies detailed duties and responsibilities of the relevant parties is developed and served as the basis of the Project monitoring. Figure 6-1 shows the operation and management structure of the Project.

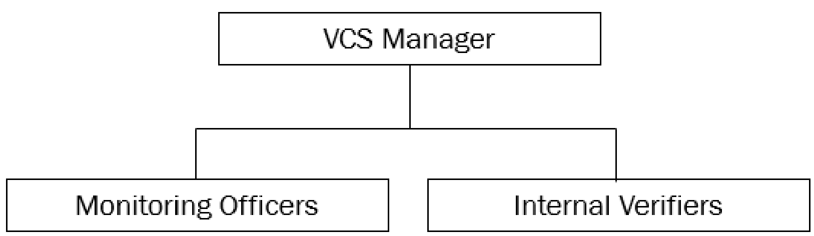

Figure 5-1 Operation and management structure of the project

C. Data collection

Monitoring officers are responsible for data collection. The designated team 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 verification, 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 installation of flow meter and gas analyzer will fulfill the national standard (MT448-2008 and JJG 1138-2017). All the meters will be checked and maintained periodically.

E. Emergency procedure

In case of any failure or malfunction of any monitoring instrument, the project participant and the equipment suppliers will repair or displace it as soon as possible, and the emission reductions achieved during the troubleshooting period will be calculated conservatively.

During the reported monitoring period, no emergency occurred, and no event, which might impact the monitoring plan, the applied methodology or the calculation of emission reductions, occurred.

F. Data file management

All monitoring data will be electronically filed by the end of each month. 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://www.docin.com/p-1944975618.html