



HUINENG LOW CONCENTRATION COAL MINE METHANE UTILIZATION PROJECT

Document Prepared by Vitol SA

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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

Huineng Low Concentration Coal Mine Methane Utilization Project (from hereafter referred to as the project activity) is located in Huineng coal mine area in Pingding County, Yangquan City, Shanxi Province, People's Republic of China.

Without implementing the project activity, the coal mine methane (CMM) gas extracted due to safety reasons from the Huineng coal mine would be vented into the atmosphere. One of the main components of the CMM gas is methane, a potent greenhouse gas, which would contribute to accelerating the climate change if released into the atmosphere. The project activity is designed to capture a large part of the CMM gas and destroy it through utilizing it for electricity production.

The mining capacity of the Huineng coal mine is 1.8 million tonnes per year. The project activity utilizes low-concentration CMM with a concentration of around 25%. The project activity installed the gas generators with the total capacity of 12,000 kW. The project activity also installed the waste heat recovery boilers for each gas generator which utilize the waste heat of them, but no GHG emission reductions from waste heat recovery are claimed.

The annual operating hours of the project activity are 6,000 h and the gross production is 72,000 MWh of electricity per year. The estimated annual net generation is 68,500 MWh which is provided to the North China Power Grid (NCPG). The project is expected to have an annual average of 352,106tCO₂ emission reduction over the crediting period. The estimated emission reductions are 3,399,511tCO₂ over the crediting period 04/11/2013–30/06/2023, only emission reductions from 01/01/2016 to 30/06/2023 will be claimed with expected amounts of 2,639,348 tCO₂e. The project generated 546,071 tons of emission reductions during this morning period from 01/01/2019 to 31/12/2021.

The project started construction on 18/09/2012. The project is not a grouped project. The project started operation on 04/11/2013, and all the generators are commissioned since 08/09/2017. Below Table 1 presents the milestone of the gas generators operation.

Table 1: Milestone of operation

Units and capacity	Operation start date
6 * 500kW	04/11/2013
4 * 1000 kW	29/11/2014
2 * 500 kW	08/05/2015
4 * 1000 kW	08/09/2017

1.2 Sectoral Scope and Project Type

Scope 8: Mining/mineral production

Scope 10: Fugitive emissions from fuels (solid, oil and gas)

Project Type: CMM gas capture and utilization project.

The project is not a grouped project.

1.3 Project Proponent

Organization name	Beijing Yonder Environmental Energy Technology Co., Ltd
Contact person	Mr. Wang Chao
Title	Carbon Manager
Address	1707-A021, Floor 17, No.9 North Fourth Ring West Road, Haidian District, Beijing, China
Telephone	+86 183 0341 5669
Email	wangchao@china-yonder.com

1.4 Other Entities Involved in the Project

Organization name	Vitol SA
Role in the Project	VCS account manager
Contact person	Ms. Livia Li
Title	Carbon manager
Address	Place des Bergues 3, 1201 Geneva, Switzerland
Telephone	+86 136 9360 7932
Email	lnl@vitol.com

1.5 Project Start Date

The project started operation on 04/11/2013, thus the project start date is 04/11/2013.

1.6 Project Crediting Period

04/11/2013– 30/06/2023 (9 years 239 days)

As per clarification 2 of Verra 19 April 2022 clarifications document, the VCS project crediting period must start on the same day as the project start date. Though the project may not issue VCUs with vintages prior to 1 Jan 2016, the crediting period start date must still equal the project start date. i.e. 04/11/2013. Considering the 10-year fixed crediting period under CDM from 01/07/2013 to 30/06/2023, thus the crediting period is determined as 04/11/2013– 30/06/2023. The project proponent will not claim VCUs for vintage prior to 01/01/2016.

1.7 Project Location

The project activity is located in Xincheng Village, Zhangzhuang Town, Pingding County, Yangquan City, Shanxi Province, People's Republic of China. The geographical coordinates are 113°34'15"~113°39'40" East and 37°41'11"~ 37°43'57" North. The location of the project activity is presented in the below figure.



审图号: GS(2019)1674号

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1.8 Title and Reference of Methodology

The project activity uses the following CDM methodologies and tools:

- Approved consolidated baseline and monitoring methodology ACM0008 Version 07:
“Consolidated methodology for coal bed methane, coal mine methane and ventilation air methane capture and use for power (electrical or motive) and heat and/or destruction through flaring or flameless oxidation.”
- Methodological tool “Tool to calculate the emission factor for an electricity system” Version 2.2.1
- Methodological tool “Demonstration and assessment of additionality” Version 06.0.0.

The methodologies and tools are publicly available at:

<https://cdm.unfccc.int/methodologies/PAMethodologies/approved>

1.9 Participation under other GHG Programs

The project has been registered under CDM under ACM0008, the CDM reference number is 8006. The crediting period under CDM is 01/07/2013 – 30/06/2023 (Fixed). Total 360,993tCO₂e of emission reductions have been issued as CERs for the monitoring period 01/07/2013-24/09/2015 under CDM.

The project has not been, and will not seek registration under other GHG Programs, except for CDM and VCS.

1.10 Other Forms of Credit

Emission Trading Programs and Other Binding Limits

Beijing Yonder Environmental Energy Technology Co., Ltd and its fully owned subsidiary Pingding County Yonder Coal Mine Methane Development Co., Ltd, who is in operation of the project activity, are not included in the compliance entity list by China national Emission Trading Scheme (ETS). Shanxi Province, where the project is located, have not been implemented for pilot ETS scheme.

Moreover, the project has not been registered and will not seek registration under China Certified Emission Reduction (CCER), and is not in the project data base of CCER. Thus, it is not eligible for emission reductions transaction under the China ETS.

Therefore, the project is not involved in an emission trading program or any other mechanism that includes GHG allowance trading. The GHG emission reductions and removals generated by the project will not be used for compliance in China. The project proponent has signed declaration on not being used for the compliance and no double counting claiming of the credits.

Other Forms of Environmental Credit

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

1.11 Sustainable Development Contributions

The project will contribute to the sustainable development through the following 3 SDGs:

- Created 15 job including 5 positions for female by the end of this monitoring period annually and achieved SDG 8 Decent Work and Economic. China government has

been encouraging creation of job opportunities, and promoting high quality job in production sector in different channels.¹

- Prevented the release of 546,071 tonnes of CO₂e into the atmosphere and achieved SDG 13 Climate Action. In September 2020, China announced they will achieve carbon emission peak value in 2030, and try to be carbon neutral in 2060.²
- Generated 79,881.1 MWh electricity that would otherwise be generated by the fossil fuels which increases the China's energy security and achieved SDG 7 Affordable and Clean Energy. As per 2030 China Fulfilling Sustainability Progress Report (2021), the energy consumption per GDP is to be reduced. The energy will be more efficiently utilized, and the energy consumption and carbon intensity dropped continuously.³

¹ Page 57 of 2030 China Fulfilling Sustainability Progress Report (2021)
http://switzerlandemb.fmprc.gov.cn/web/ziliao_674904/zt_674979/dnzt_674981/qtzt/2030kcxzyc_686343/zw/202109/P020211019126076276210.pdf

² Page 83 of 2030 China Fulfilling Sustainability Progress Report (2021)

³ Page 50 of 2030 China Fulfilling Sustainability Progress Report (2021)

Table 1: Sustainable Development Contributions

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
1)	7.a	Volumes of electricity supplied to the grid that reduces the consumption of fossil fuel use	Implemented activities to increase	The project has generated 79,881.1 MWh electricity during the monitoring period, thus reduced the consumption of the corresponding fossil fuels of NCPG and contributed to increasing China's energy security	The project generated 106,239.0 MWh during 01/01/2016 – 31/12/2018 and 79,881.1 MWh during 01/01/2019 – 31/12/2021 MWh electricity that would otherwise be generated by the fossil fuels. Total cumulative electricity generated is 186,120.1 MWh by the end of the reporting period.
2)	8.3	Numbers of decent job opportunities provided by implementation of the project	Implemented activities to increase	The project has created 15 jobs each year during this monitoring period from 2019 to 2021, including 5 positions for female by the end of the monitoring period which have an income rate higher than the local average level. The annual average salary paid to the skilled worker are CNY71,743 (2019), CNY 71,969 (2020) and CNY72,154 (2021).	15 people have been employed by the project as long-term employee by end of the reporting period.

3)	13	Tonnes of greenhouse gas emissions avoided or removed	Implemented activities to increase	By recovering of 19,156.22 tons of CH ₄ , and generated 79,881.1 MWh electricity, the Project has prevented the release of 546,071 tonnes of CO ₂ e into the atmosphere during the monitoring period	The project prevented the release of 732,284 tons of CO ₂ e during 01/01/2016 – 31/12/2018, and 546,071 tonnes of CO ₂ e during 01/01/2019 – 31/12/2021 into the atmosphere. Total cumulative tonnes of greenhouse gas emissions avoided is 1,278,355 by the end of the reporting period.
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2 SAFEGUARDS

2.1 No Net Harm

The Environmental Impact Assessment (EIA) of the project was approved by Environmental Protection Bureau of Shanxi Province on 10/05/ 2011.

Summary of the environmental impacts:

Air pollution

During the construction period, the air pollution means mainly dust from earthworks as well as from storage and transportation of construction materials. To mitigate the impact of dust on the environment, the project owner took measures such as avoiding earthwork during rainy season, stopping earthworks under heavy wind and covering the piled materials.

During the operation period, the gas engines emit flue gas whose main pollutant is NO_x. The emission factor of NO_x emissions is 0.59 g/kWh, which meets the grade IV requirement of 3.5 g/kWh in (GB17691—2005), and therefore the project activity causes no significant impact on the atmosphere. Besides, the project activity utilizes CMM thus reducing a significant amount of GHG emissions.

Noise

During the construction period, the noise is caused by construction machines. To reduce the noise pollution, the constructor selected machines with low noise level and did not use the pile driver at night.

During the operation period, the noise is caused by the generators, pumps and other equipment. The noise level is reduced by using measures such as constructing the generator room walls using materials with good sound absorption properties and adopting vibration reduction measures for some equipment.

Waste water

During the construction period, waste water is mainly domestic sewage and saline water pipeline pressure test. During the operation period, the waste water is mainly domestic sewage, waste water from chemical water treatment plant, waste water from cooling water and waste water from gas dehydration. The chemical waste water and cooling water is treated in the water treatment station of the coal mine. The gas dehydration waste water is treated by first removing oil and then it is treated in buried treatment facilities of the coal mine together with domestic sewage. The treated waste water is then be reused e.g. for sprinkling of roads.

Solid waste

Solid waste during the construction period is mainly waste land from the earthworks, waste produced from the daily life of the employees and packages of construction materials. The solid waste produced during the operation period is mainly from the daily life of the employees, filter ash as well as waste and motor oil. The waste from daily life is collected and regularly transported into a designated place at the coal mine area, from where it is disposed. To meet the requirements in (GB18597-2001) concerning treatment of hazardous waste, a temporary storage place was constructed for hazardous waste where the collected waste oil was taken. After taking all these measures, solid waste causes no harmful impacts on the environment.

Ecological impacts

Construction of the project activity occupies land and spoils some vegetation, and may cause erosion. The erosion is significantly mitigated by taking several efforts such as frequent sprinkling of water during the construction period as well as hardening road and taking greening efforts after the construction is finished.

Socio-economic impacts

The project did not and will not result in any significant environmental impacts or any negative socio-economic impacts. On the contrary, this project stimulated the local economy by providing employment opportunities and reduced the dependence on exhaustible fossil fuels for power generation, reduced GHGs emissions by utilizing CMM gas.

In conclusion, no net harm on local environment and social community has been detected for the project.

2.2 Local Stakeholder Consultation

LSC prior to the project implementation

Local stakeholder consultation meeting has been conducted on 01/03/2012. All comments received have been well addressed prior to the project implementation. Please refer to section E of the approved revised CDM-PDD (version 05 dated 02/05/2017) of the project for detailed information. In conclusion, there was no significant negative comments received in the project preparation stage.

The mechanism for on-going communication with local stakeholders.

During this monitoring period, the project proponent conducted a survey among local stakeholders on 06/03/2020. 30 questionnaires were distributed and collected. Below is the questionnaire the survey and feedback from local stakeholders:

No.	Question	Feedback	Number	Percentage
1	Are you acknowledge and understand about the project?	Very much	26	86.6%
		A little	4	13.3%
		Not at all	0	0

2	Are you supportive for the operation of the project?	Supportive	30	100%
		Against	0	0
		Don't mind	0	0
3	What's your concern of the project during its operation?	None	29	96.7%
		Air pollution	0	0
		Water pollution	0	0
		Noisy	1	3.3%
		Ecosystem	0	0
		Others (please specify)	0	0
4	Do you think the project will have overall positive for the environment?	Positive	30	100%
		None	0	0
		Negative	0	0
5	Do you think the project will increase the number of employees?	Yes	30	100%
		No	0	0
		No idea	0	0
6	Do you think the project will reduce emission reduction?	Yes	30	100%
		No	0	0
		No idea	0	0
7	Do you think the project will provide power supply and reduce consumption of fossil fuel?	Yes	30	100%
		No	0	0
		Have no idea	0	0
8	Do you have other comments for this project?	Yes (please specify)	0	0
		No	30	100%

The survey shows all local respondents know about the project, most of them are supportive of the project, all of the local residents believe the project will benefit the environment and will increase number of employees, reduce emission reduction and provide power supply.

A few respondents were concerned about the noise during the operation. During the operation period, the noise is caused by the generators, pumps and other equipment. The project proponent explained the requirements of national and industry standards that have to be followed as well as the mitigation measures taken: The noise has been reduced through using materials with good sound absorption and adopting vibration reduction measures for some equipment. The noise emission complies with Category 2 requirements in the national standard Emission Standard for Industry Enterprise Noise at Boundary (GB 12348-2008) both during the daytime and the night, and the environmental noise at the residential settlement satisfies

Category 2 requirements in the national standard Environmental Quality Standard for Noise (GB 3096-2008).

The respondents who initially raised concerns were no longer worried after acknowledging the information above. The project proponent also informed the respondents that they would be able to contact the project proponent directly by phone or by email should they have any concern over the environmental impact during the project implementation.

Besides questionnaire surveys that take place each 2-3 years during the project implementation, local stakeholders can also raise their concerns and opinions directly by making a phone call to the project proponent. No comments are received during this monitoring period. In addition, the project proponent informs the local authorities of key implementation events or changes of the project through the bulletin boards, then the local authorities inform the residents around the project site, and the comments and suggestions from residents are collected by the local authorities; the local government agencies also conduct spot checks on the project implementation on a regular basis, and give suggestions on potential issues. There is no negative comment nor grievance received from the project during this monitoring period.

How due account of all and any input received during ongoing communication has been taken. Include details on any updates to the project design or justify why updates are not appropriate.

The 7% of the respondents who think the project activity has small impacts on the environment (question 6) were worried of additional noise that the project activity may cause. However, the EIA report lists measures that the project activity will take to decrease the noise level, and also the EIA approval requires the project owner to take preventive measures to reach level 2 requirement of (GB12348-2008). The measures that will be taken include selecting equipment with a low noise-level, constructing the walls of the equipment room using materials with good sound absorption properties and adopting vibration reduction measures. These measures effectively reduce the noise pollution and the project activity causes no significant impacts on the environment, as can also be seen from the fact that the project activity has obtained an EIA approval.

2.3 AFOLU-Specific Safeguards

Not applicable as this is not an AFOLU project.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

The project started construction on 18/09/2012, started operation on 04/11/2013, and all the generators are commissioned since 08/09/2017. The project operates smoothly during this

monitoring period, no events that may impact the GHG emission reductions happened during this monitoring period.

The project activity utilizes the following technology.

CMM transport and dehydration system

The Project activity uses a transport system that is suitable for low-concentration methane. To prevent tempering, flame arresters on pipelines are installed. As the CMM must be dehydrated before burning it in the gas boilers, a fine water mist system is installed in transport pipelines. The dehydrated gas is then transmitted to the intake system of internal combustion engines.

Gas engines

The methane concentration in Huineng coal mine is around 25 % but may vary between 10 % and 30 %, which belongs to low-concentration range. To ensure safe operation and to be able to utilize the gas effectively, the project activity uses domestically-manufactured internal combustion engines which are suitable for low-concentration CMM.

The selected generators are domestically manufactured and the parameters are presented in the below table.

Table 3.1 The gas generator parameters

Manufacturer	Shandong Jichai Green Energy Power Equipment Co. Ltd.
Model	500GF-W1
Number of sets	8
Rated capacity	500kW
Continuous rating	500kW
Rated voltage	400V
Rated frequency	50Hz
Rated rotation speed	1,000r/min
Power factor	0.8 (lagging)
Lifetime	10-15 years

Manufacturer	Shandong Jichai Green Energy Power Equipment Co. Ltd.
Model	1000GF9-W2
Number of sets	8

Rated capacity	1000kW
Continuous rating	1000kW
Rated voltage	400V
Rated frequency	50Hz
Rated rotation speed	1,000r/min
Power factor	0.8 (lagging)
Lifetime	10-15 years

The project started construction on 18/09/2012. The Project started operation on 04/11/2013, and all the generators are commissioned since 08/09/2017. Below table presents the milestone of the gas generators operation.

Table 3.2: Milestone of operation

Units and capacity	Operation start date
6 * 500kW	04/11/2013
4 * 1000 kW	29/11/2014
2 * 500 kW	08/05/2015
4 * 1000 kW	08/09/2017

During the operation of the project, the remaining uncaptured methane is vented to the atmosphere, the project owner will make sure such operation is comply with relevant regulation

The project was in normal operation during the indicated monitoring period, and no event or situation may affect the applicability of the methodology occurred during the period.

3.2 Deviations

2.1.1 Methodology Deviations

No deviations from the methodology.

2.1.2 Project Description Deviations

A PRC was approved by CDM EB on 09/11/2017, the following changes were included:

- name of the transformer station of which the project connected to;
- the quantity of the monitoring equipment, i.e. electricity meter,
- the quantity and capacity of gas generators

The PRC has been validated and approved by EB that the deviations have no impact on the applicability of the methodology or the additionality of the project nor the appropriateness of the

baseline scenario and the project still meets all appropriate rules and requirements of the VCS standard. During this monitoring period, the project was implemented in line with the approved revised PDD. There is no other project description deviation applied.

3.3 Grouped Projects

The project is not grouped project, not applicable.

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Data / Parameter	<i>Eff_{ELEC}</i>
Data unit	-
Description	Efficiency of methane destruction/oxidation in power plant
Source of data	Default value, given in ACM0008 Version 07
Value applied	99.5 %
Justification of choice of data or description of measurement methods and procedures applied	Set at 99.5%(IPCC)
Purpose of Data	For the calculation of project emissions
Comments	N/A

Data / Parameter	<i>EF_{grid, CM, y}</i>
Data unit	tCO ₂ e/MWh
Description	Combined margin grid CO ₂ emission factor in year y
Source of data	Calculated
Value applied	0.81145
Justification of choice of data or description of measurement methods and procedures applied	The data is calculated based on official statistics and is reliable.
Purpose of Data	Calculation of the baseline emissions and project emissions

Comments	Other ex-ante parameters (i.e. $FC_{i,y}$, NCV_i , $OXID_i$, $EF_{CO_2,i}$, EG_y , η_i , η_b , $CAP_{i,j,y}$, $EF_{grid,BM,y}$) were used to calculate the combined margin CO ₂ emission factor ($EF_{grid,CM,y}$) during validation stage.
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Data / Parameter	ρ
Data unit	kg/m ³
Description	Methane density
Source of data	<i>2006 IPCC Guidelines for National Greenhouse Gas Inventories</i>
Value applied	0.67
Justification of choice of data or description of measurement methods and procedures applied	IPCC default value
Purpose of Data	Calculation of the baseline emissions and project emissions
Comments	N/A

Data / Parameter	GWP_{CH_4}
Data unit	tCO ₂ e/ tCH ₄
Description	Global warming potential of methane
Source of data	IPCC AR5
Value applied	28 tCO ₂ e/tCH ₄
Justification of choice of data or description of measurement methods and procedures applied	As per 3.14.4 of VCS Standard Version 4.3, for GHG emission reductions occurring on or after 1 January 2021, all ex-ante estimates and ex-post calculations shall be converted to CO₂e using GWP values from the IPCC Fifth Assessment Report (AR5). For GHG emission reductions occurring on or before 31 December 2020, all ex-ante estimates and ex-post calculations may be converted to CO₂e using either the GWP values from the IPCC Fourth Assessment Report (AR4) or those from AR5. The project proponent chooses to use AR5 for the GWP value, which is 28.
Purpose of Data	Calculation of the baseline emissions and project emissions
Comments	N/A

Data / Parameter	CEF_{CH_4}
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Data unit	tCO ₂ e/tCH ₄
Description	Carbon emission factor for combusted methane
Source of data	ACM0008 Version 7
Value applied	44/16 = 2.75 tCO ₂ e/tCH ₄
Justification of choice of data or description of measurement methods and procedures applied	ACM0008
Purpose of Data	Calculation of the baseline emissions and project emissions
Comments	N/A

4.2 Data and Parameters Monitored

Data / Parameter	CONSELEC,PJ
Data unit	MWh
Description	Additional electricity consumption for capture and use or destruction of methane
Source of data	Measured by electricity meter E
Description of measurement methods and procedures to be applied	When gas generators are not in operation, electricity may be taken from grid to support auxiliary functions or for maintenance purposes. The value of CONSELEC,PJ is the sum of the readings of electricity meter E (with accuracy class of 0.5S) installed in the grid-connection point at the grid company's side. The electricity consumption is continuously measured and monthly recorded. At the 24:00 of the end date of each month, the electricity records are recorded by the operator of the power grid company. DSZ178 Electricity meter is installed at the grid-operator (Yangquan Grid) side. Its accuracy class is 0.5S. The SN of the electricity meter is 1200703399.
Frequency of monitoring/recording	Continuously monitored and monthly recorded
Value monitored	01/01/2019 - 31/12/2019: 7.56 01/01/2020 - 31/12/2020:11.13 01/01/2021 - 31/12/2021:2.31
Monitoring equipment	Electricity meter Type: DSZ178

	SN: 1200703399	
	Accuracy: 0.5S	
	Calibration frequency: Annually	
	Calibration date	Validity
	30/11/2018	29/11/2019
	30/11/2019	29/11/2020
	30/11/2020	29/11/2021
	30/11/2021	29/11/2022
QA/QC procedures to be applied	The electricity meter has been calibrated annually according to national or industry standards. Meter's readings were cross-checked with the sales receipts issued by the grid company. All data and records will be archived at least 2 years after the end of the final crediting period.	
Purpose of the data	Calculation of project emissions	
Calculation method	-	
Comments	-	

Data / Parameter	MM _{ELEC}	
Data unit	tCH ₄	
Description	Methane sent to power plant	
Source of data	The parameter is calculated by the monitoring system with the data measured by gas flow meter and methane concentration analyzer.	
Description of measurement methods and procedures to be applied	The gas flow meter installed indicates the CMM flow under the normal condition which is calculated by the directly measured CMM flow, temperature and pressure by the gas flow meter. The methane concentration analyzer installed measures the methane concentration in the extracted CMM. MM _{ELEC} is calculated automatically based on the monitored data of gas flow meter and methane concentration analyzer.	
Frequency of monitoring/recording	Continuously monitored and recorded monthly	
Value monitored	01/01/2019 - 31/12/2019: 8,234.28 01/01/2020 - 31/12/2020: 6,877.43 01/01/2021 - 31/12/2021: 4,044.51	
Monitoring equipment	Equipment	Gas flow meter

	Type	TK7200BM6H (be in use from 04/05/2016)
	SN	15011257630045
	Accuracy	0.25
	Calibration frequency	Every 3 years
	Date of calibration	04/05/2016 24/04/ 2019
	Validity until	03/05/2019 23/04/2022
	The certifications of the calibrators have been provided to VVB for verification.	
	Equipment	Methane concentration analyzer
	Type	FGD2-A (old) (till 10/07/2019)
	SN	20151022034
	Accuracy	Class II
	Calibration frequency	Every 3 years
	Date of calibration	21/08/2016
	Validity until	20/08/2019
	Type	ES10B11-CH4 (new) (be in use from 10/07/2019)
	SN	ES101704081701
	Accuracy	Class II
	Calibration frequency	Every 3 years
	Date of calibration	10/07/2019
	Valid until	09/07/2022
QA/QC procedures to be applied	The gas follow meter and the methane concentration analyzer are calibrated in line with national or industry standards. All data and records will be archived at least 2 years after the end of the final crediting period. Methane volume sent to power plant were cross-checked with the confirmation letter issued by the coal production company	

Purpose of the data	Calculation of baseline emissions and project emissions
Calculation method	The methane sent to power plant is calculated by the monitoring system with the data measured by gas flow meter and methane concentration analyzer.
Comments	During this monitoring period, the old methane concentration analyzer in type of FGD2-A (SN. 20151022034) was replaced by the new one in type of ES10B11-CH4 (SN. ES101704081701) on 10/07/2019.

Data / Parameter	CEF _{NMHC}
Data unit	tCO ₂ e/tNMHC
Description	Carbon emission factor for combusted non methane hydrocarbons (NMHC) (various)
Source of data	Default
Description of measurement methods and procedures to be applied	Obtained from annual gas composition analysis. When the share of NMHC is less than 1 %, this factor is not needed.
Frequency of monitoring/recording	--
Value monitored	--
Monitoring equipment	--
QA/QC procedures to be applied	The analysis is undertaken by the certified external gas analysis institute annually, the testing reports have been provided to the VVB for verification.
Purpose of the data	For the calculation of project emission
Calculation method	As presented in the gas analysis reports, the NMHC in the CMM during this whole monitoring period is less than 1%. Therefore, this factor is not needed.
Comments	--

Data / Parameter	PC _{CH4}
Data unit	%

Description	Concentration (in mass) of methane in extracted gas (%), measured on wet basis																										
Source of data	Measured by the methane concentration analyzer installed at the project site.																										
Description of measurement methods and procedures to be applied	Continuously measured by the methane concentration analyzer																										
Frequency of monitoring/recording	Continuously measured and calculated on monthly average																										
Value monitored	2016:15.92 2017:17.33 2018:17.42																										
Monitoring equipment	Methane concentration analyzer <table border="1"> <tr> <td>Equipment</td><td>Methane concentration analyzer</td></tr> <tr> <td>Type</td><td>FGD2-A (old) (till 10/07/2019)</td></tr> <tr> <td>SN</td><td>20151022034</td></tr> <tr> <td>Accuracy</td><td>Class II</td></tr> <tr> <td>Calibration frequency</td><td>Every 3 years</td></tr> <tr> <td>Date of calibration</td><td>21/08/2016</td></tr> <tr> <td>Validity until</td><td>20/08/2019</td></tr> <tr> <td>Type</td><td>ES10B11-CH4 (new) (be in use from 10/07/2019)</td></tr> <tr> <td>SN</td><td>ES101704081701</td></tr> <tr> <td>Accuracy</td><td>Class II</td></tr> <tr> <td>Calibration frequency</td><td>Every 3 years</td></tr> <tr> <td>Date of calibration</td><td>10/07/2019</td></tr> <tr> <td>Valid until</td><td>09/07/2022</td></tr> </table>	Equipment	Methane concentration analyzer	Type	FGD2-A (old) (till 10/07/2019)	SN	20151022034	Accuracy	Class II	Calibration frequency	Every 3 years	Date of calibration	21/08/2016	Validity until	20/08/2019	Type	ES10B11-CH4 (new) (be in use from 10/07/2019)	SN	ES101704081701	Accuracy	Class II	Calibration frequency	Every 3 years	Date of calibration	10/07/2019	Valid until	09/07/2022
Equipment	Methane concentration analyzer																										
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SN	ES101704081701																										
Accuracy	Class II																										
Calibration frequency	Every 3 years																										
Date of calibration	10/07/2019																										
Valid until	09/07/2022																										
QA/QC procedures to be applied	The methane concentration analyzer is calibrated every three years according to national or industry standards. The calibration reports have been provided to VVB. All data and records will be archived at least 2 years after the end of the final crediting period.																										

Purpose of the data	Calculation of baseline emissions and project emissions
Calculation method	--
Comments	--

Data / Parameter	PC _{NMHC}																													
Data unit	%																													
Description	NMHC concentration (in mass) in extracted gas																													
Source of data	Gas composition testing reports issued by Shanxi Kelin Mineral Testing Technology Co., Ltd .																													
Description of measurement methods and procedures to be applied	Annual analysis of the gas content content is conducted by the external gas analysis institute - Shanxi Kelin Mineral Testing Technology Co., Ltd. If the concentration does not exceed 1 %, then this parameter can be omitted.																													
Frequency of monitoring/recording	Annually																													
Value monitored	PC _{NMHC} does not exceed 1 %, during this monitoring period as shown in the table below and thus PC _{NMHC} is omitted. <table><tr><td></td><td>CH₄ (%)</td><td>O₂ (%)</td><td>N₂ (%)</td><td>C₂-C₈ (%) (NMHC)</td><td>CO₂ (%)</td></tr><tr><td>2019</td><td>17.00</td><td>17.19</td><td>62.87</td><td>0.0086</td><td>1.7812</td></tr><tr><td>2020</td><td>14.93</td><td>15.67</td><td>66.99</td><td>0.0102</td><td>0.7638</td></tr><tr><td>2021</td><td>14.37</td><td>14.82</td><td>7.1303</td><td>0.0062</td><td>1.9941</td></tr></table>							CH ₄ (%)	O ₂ (%)	N ₂ (%)	C ₂ -C ₈ (%) (NMHC)	CO ₂ (%)	2019	17.00	17.19	62.87	0.0086	1.7812	2020	14.93	15.67	66.99	0.0102	0.7638	2021	14.37	14.82	7.1303	0.0062	1.9941
	CH ₄ (%)	O ₂ (%)	N ₂ (%)	C ₂ -C ₈ (%) (NMHC)	CO ₂ (%)																									
2019	17.00	17.19	62.87	0.0086	1.7812																									
2020	14.93	15.67	66.99	0.0102	0.7638																									
2021	14.37	14.82	7.1303	0.0062	1.9941																									
Monitoring equipment	External gas analysis institute																													
QA/QC procedures to be applied	The analysis is undertaken by the certified external gas analysis institute annually, the testing reports have been provided to the VVB for verification.																													
Purpose of the data	Calculation of project emissions																													
Calculation method	--																													
Comments	--																													

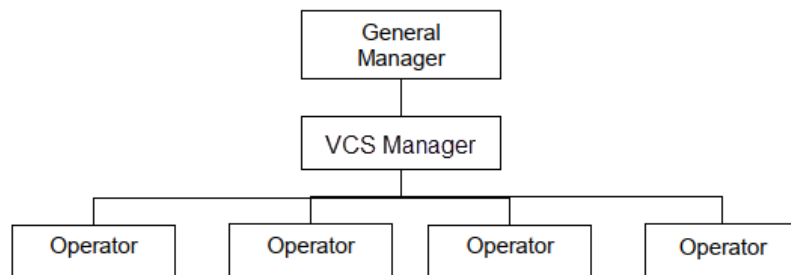
Data / Parameter	GEN _y												
Data unit	MWh												
Description	Electricity generation by project												
Source of data	The electricity meter E												
Description of measurement methods and procedures to be applied	Continuously monitored by the electricity meter E as net generation supplied to the grid (after meeting the demand of auxiliary equipment at the project site) The value of GEN _y is monitored by the electricity meter E (with accuracy class of 0.5S) installed in the grid-connection point at the grid company's side. The electricity generation is continuously measured and monthly recorded. At the 24:00 of the end date of each month, the electricity records are recorded by the operator of the power grid company.												
Frequency of monitoring/recording	Continuously monitored and monthly recorded												
Value monitored	01/01/2019 - 31/12/2019: 32,642.0 01/01/2020 - 31/12/2020: 29,053.9 01/01/2021 - 31/12/2021: 18,185.2												
Monitoring equipment	Electricity meter E <table border="1"> <tr> <td colspan="2">Type: DSZ178 SN: 1200703399 Accuracy: 0.5S Calibration frequency: Annually</td></tr> <tr> <td>Calibration date</td><td>Validity</td></tr> <tr> <td>30/11/2018</td><td>29/11/2019</td></tr> <tr> <td>30/11/2019</td><td>29/11/2020</td></tr> <tr> <td>30/11/2020</td><td>29/11/2021</td></tr> <tr> <td>30/11/2021</td><td>29/11/2022</td></tr> </table>	Type: DSZ178 SN: 1200703399 Accuracy: 0.5S Calibration frequency: Annually		Calibration date	Validity	30/11/2018	29/11/2019	30/11/2019	29/11/2020	30/11/2020	29/11/2021	30/11/2021	29/11/2022
Type: DSZ178 SN: 1200703399 Accuracy: 0.5S Calibration frequency: Annually													
Calibration date	Validity												
30/11/2018	29/11/2019												
30/11/2019	29/11/2020												
30/11/2020	29/11/2021												
30/11/2021	29/11/2022												
QA/QC procedures to be applied	The electricity meter has been calibrated annually according to national or industry standards. Meter's readings were cross-checked with the sales receipts issued by the grid company. All data and records will be archived at least 2 years after the end of the final crediting period.												
Purpose of the data	Calculation of baseline emissions												
Calculation method	--												
Comments	--												

4.3 Monitoring Plan

The organizational structure, responsibilities and competencies of the personnel that carried out the monitoring activities

The operational and management structure (as shown in the figure below) and the responsibilities of the principals are as follows.

The Project Owner has designated a Monitoring Manager for the project, heading the monitoring team in order to enforce monitoring, data recording and storage according to the monitoring plan indicated in the PDD.



The General Manager responsible for:

- The overall management and quality control of the monitoring and reporting.

The VCS Manager is responsible for:

- All the issues related to VCS monitoring.
- Checking and signing off all project operational-related activities
- Appointing and liaising with the validation and verification body (VVB)
- Identifying an audit team leader to be appointed by the Chief Engineer or a delegated authority
- Appointing a VCS technical team to undertake the operational activities
- Organising training and refresher courses
- Preparing and supervising a Health and Safety Plan for the VCS technical team
- Supervising the work of the VCS technical team

The operator is responsible for:

- Monitor and record the data;
- Execute emergency plan and report emergency when required.

The methods used for generating/measuring, recording, storing, aggregating, collating and reporting the data on *monitored parameters*

a. Monitoring System

a.1 Methane mass flow monitoring system

Table 6 : Data to be Monitored and Recorded

Details of monitoring parameters	Parameters to be measured	Monitoring system	Monitoring frequency
Additional electricity consumption by the project activity	CONS _{ELEC,PJ}	Three-phase electricity meter	Continuously monitored and monthly recorded
Methane sent to the power plant	MM _{ELEC}	Gas flow meter	Continuously monitored and recorded monthly
Concentration (in mass) of methane in extracted gas	PC _{CH4}	Methane concentration analyzer	Daily recorded and averaged monthly
Carbon emission factors for combusted non methane hydrocarbons	CEF _{NMHC}	Samples to be taken annually and analysed at a qualified laboratory	Obtained from annual gas composition analysis. When the share of NMHC is less than 1 %, this factor is not needed.
NMHC concentration in the CMM supply	PC _{NMHC}	Samples to be taken annually and analysed at a qualified laboratory	The analysis is undertaken by the certified independent lab.
Electricity generation supplied to the grid by the project activity	GEN _y	Three-phase electricity meter	Continuously monitored and monthly recorded

CMM flow, temperature and pressure are continuously measured by the flow meter installed. Methane concentration is continuously measured by the methane concentration analyzer installed. MMELEC is automatically calculated by the monitored data from gas flow meter and methane concentration analyzer is recorded monthly.

This project involves monitoring the mass flow of methane utilised under conditions of normal temperature and pressure, and the mass flow is measured using international standard methods. Input data from the transducers are recorded at daily intervals.

The gas flow monitoring system specification should allow for:

- Detection of emergency or inappropriate venting of gases
- Providing a certified instrument calibration record
- Measurement of barometric pressure, gas temperature, gas pressure, gas composition and mixture flow
- Gas flows to be adjusted to normal temperature and pressure automatically
- Additional parameters to be measured at the power generation plant: hours run on each engine

Conversion factors to be used

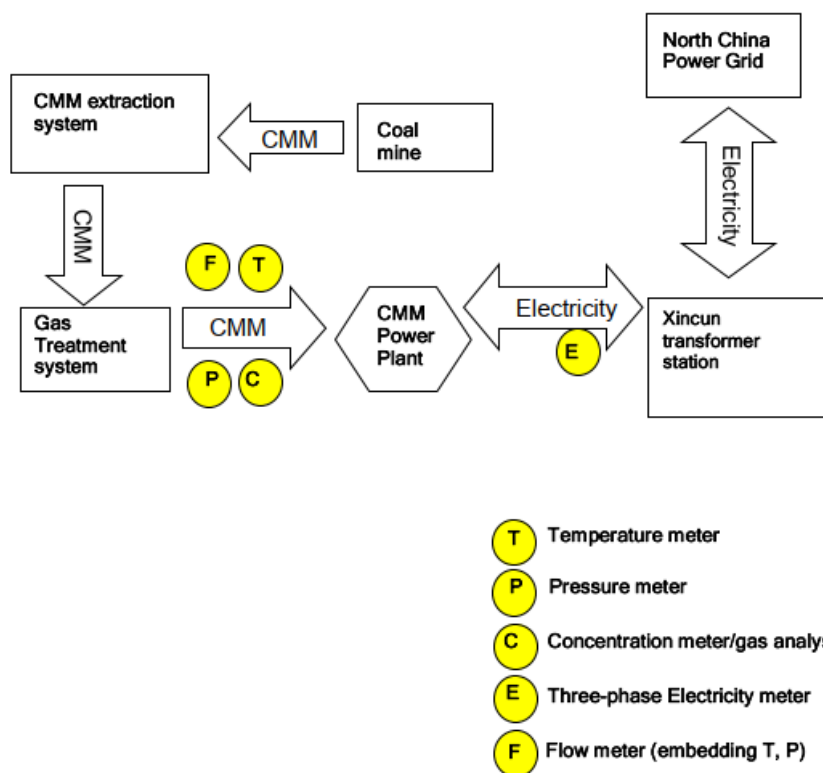
- Density of methane = 0.67 kg/m^3
- GWP of methane is 28

a.2 Other parameters monitoring

An electricity meter E is installed in the grid-connection point at the grid company's side. During normal operation, power is supplied to the grid after first meeting the demand of auxiliary equipment at the project site, and therefore the electricity generation (GEN_y) is measured as net generation supplied to the grid via Xincun transformer station. When the gas generators are not in operation, electricity may be taken from grid through the main line to support functions of auxiliary equipment or for maintenance purposes. This amount of electricity is also measured by E and is included in $CONSELEC,PJ$. The electricity generation and consumption is continuously measured and monthly recorded. At the 24:00 of the end date of each month, the electricity records will be recorded by the operator of the power grid company.

CMM gas concentration will be measured by methane concentration analyzer. All the equipment are serviced, calibrated and maintained in accordance with the national or industry standards (and the manufacturer's instructions where applicable) and complete records will be kept.

The below figure illustrates the methane flow and monitoring system. The NMHC samples are analysed by samples taken annually and analysed at a qualified professional institute.



b. Calibrations

All measuring equipment are calibrated and checked for accuracy by a qualified third party in accordance with national or industry standards. Calibrations take place so that equipment have a valid calibration certificate.

The electricity metering equipment are calibrated annually in accordance with national or industry standards; the meters E has an accuracy rating of 0.5S.

The gas flow metering equipment are calibrated every 3 years in accordance with Chinese national or industry standards fulfilling the project's production requirement on accuracy or linearity.

The methane concentration analyzer is calibrated every 3 years in accordance with Chinese national or industry standards fulfilling the project's production requirement on accuracy or linearity.

c. Data Collection

The concentration of methane in extracted gas daily recorded and averaged monthly. The gas flow meter measure and automatically record the gas volume continuously, and the data is also recorded manually on a monthly basis to serve as back-up in case of breakdown of the electrical recording system. Electricity is monitored continuously and recorded monthly. All the measuring data is collected and passed to the monitoring manager. These readings are checked for any anomalies before being filed for future reference.

The procedures used for handling any internal auditing performed and any non-conformities identified.

The operator develops and implements a protocol for adequate record keeping and data monitoring systems. Technicians are properly trained so as to be qualified for monitoring and recording data. The records are double checked by the VCS manager who are responsible for accuracy and frequency of the measurements. Then, the data records will be archived until 2 years after the end of crediting period. Readings of data are recorded on paper by technicians every day.

The operator transmits copies of completed worksheets on a regular basis while maintaining originals on file.

The project operator should prepare a brief annual report which should include: information on overall project performance, emission reductions generated and verified and comparison with targets, etc. The report can be combined with the periodic verification report.

The implementation of sampling approaches, including target precision levels, sample sizes, sample site locations, stratification, frequency of measurement and QA/QC procedures. Where applicable, demonstrate whether the required confidence level or precision has been met.

All measurement equipments are calibrated and checked for accuracy by a qualified third party in accordance with national or industry standards.

It is the responsibility of the operator to ensure that the required capacity and internal training is made available to its technicians to enable them to undertake the tasks required by this monitoring plan. Initial staff training must be provided before the project starts its monitoring process.

Any accidents or emergency situations that may affect the monitoring have to be reported to the CDM (VCS) manager immediately; the CDM (VCS) manager is responsible for handling these situations.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

a). Methane destruction in the baseline

$$BE_{MD,y} = 0$$

b). Methane released into the atmosphere

Period	MM _{ELEC}	Methane density (ρ)	MM _{ELEC} (tCH ₄) = MM _{ELEC} (m m ³) * ρ
	million m ³	(tCH ₄ /m m ³)	(tCH ₄)
01/01/2019-31/12/2019	12.29	670	8,234.28
01/01/2020-31/12/2020	10.26	670	6,877.43
01/01/2021-31/12/2021	6.04	670	4,044.51
Total	28.59		19,156.22

Period	MM _{ELEC}	GWP _{CH4}	BE _{MR} = MM _{ELEC} * GWP _{CH4}
	(tCH ₄)	(tCO ₂ e/tCH ₄)	(tCO ₂ e)
01/01/2019-31/12/2019	8,234.28	28	230,559
01/01/2020-31/12/2020	6,877.43	28	192,568
01/01/2021-31/12/2021	4,044.51	28	113,246
Total	19,156.22		536,373

c). Emissions from power generation by project

Period	GEN _y (MWh)	CEF _{ELEC} (MWh/tCO ₂ e)	BE _{Electric} = GEN _y * CEF _{ELEC} (tCO ₂ e)
01/01/2019-31/12/2019	32,642.0	0.81145	26,487
01/01/2020-31/12/2020	29,053.9	0.81145	23,575
01/01/2021-31/12/2021	18,185.2	0.81145	14,756
Total	79,881.1		64,818

$$BE_y = BE_{MD,y} + BE_{MR,y} + BE_{Use,y}$$

	BE _{MD}	BE _{MR}	BE _{Use}	BE
	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e
01/01/2019-31/12/2019	-	230,559	26,487	257,046
01/01/2020-31/12/2020	-	192,568	23,575	216,143
01/01/2021-31/12/2021	-	113,246	14,756	128,002

Total		536,373	64,818	601,191
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Detailed monthly data and calculation process are shown in the ER spreadsheet and has been provided to VVB for verification.

5.2 Project Emissions

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

No heat or fossil fuels are used, and therefore the only remaining terms are those related to electricity consumption.

Period	CONSELEC (MWh)	CEFELEC (MWh/tCO ₂ e)	PE _{ME} = CONSELEC * CEFELEC (tCO ₂ e)
01/01/2019-31/12/2019	7.56	0.81145	7
01/01/2020-31/12/2020	11.13	0.81145	10
01/01/2021-31/12/2021	2.31	0.81145	2
Total	21.00		19

b). Combustion emissions from use of captured methane

When the captured methane is burned in gas generators, the combustion emissions are released and are calculated underneath. As per the annual gas composition testing reports issued by Shanxi Kelin Mineral Testing Technology Co., Ltd, the NMHC accounts less than 1% each year during this monitoring period, therefore, the combustion emissions from NMHC are ignored.

The carbon emissions from combustion of the captured methane are calculated as:

Period	MM _{ELEC}	Methane density (ρ)	MM _{ELEC} (tCH ₄) = MM _{ELEC} (m ³) * ρ
	million m ³	(tCH ₄ /m ³)	(tCH ₄)
01/01/2019-31/12/2019	12.29	670	8,234.28
01/01/2020-31/12/2020	10.26	670	6,877.43
01/01/2021-31/12/2021	6.04	670	4,044.51
Total	28.59		19,156.22

Period	MM _{ELEC}	Eff _{ELEC}	MD _{ELEC} = ME _{ELEC} * Eff _{ELEC}	CEFC _{H4}	PE _{MD} = MD _{ELEC} * CEFC _{H4}
	tCH ₄	(%)	tCH ₄	tCO ₂ e/tCH ₄	tCO ₂ e
01/01/2019-31/12/2019	8,234.28	99.5	8,193.11	2.75	22,532
01/01/2020-31/12/2020	6,877.43	99.5	6,843.04	2.75	18,819

01/01/2021-31/12/2021	4,044.51	99.5	4,024.29	2.75	11,067
Total	19,156.22		19,060.44		52,418

c). Un-combusted methane from project activity

A small amount of CMM will escape to the atmosphere during the combustion in gas generator.

Period	MM _{ELEC}	Eff _{ELEC}	GWP _{CH4}	PE _{UM} = MM _{ELEC} * (1-Eff _{ELEC}) * GWP _{CH4}
	tCH ₄	(%)	(tCO ₂ e/tCH ₄)	tCO ₂ e
01/01/2019-31/12/2019	8,234.28	99.5	28	1,153
01/01/2020-31/12/2020	6,877.43	99.5	28	963
01/01/2021-31/12/2021	4,044.51	99.5	28	567
Total	19,156.22			2,683

Project emissions PE_y = PE_{ME} + PE_{MD} + PE_{UM}

	PE _{ME}	PE _{UM}	PE _{MD}	PE
	tCO ₂ e	tCO ₂ e	tCO ₂ e	tCO ₂ e
01/01/2019-31/12/2019	7	1,153	22,532	23,692
01/01/2020-31/12/2020	10	963	18,819	19,792
01/01/2021-31/12/2021	2	567	11,067	11,636
Total	19	2,683	52,418	55,120

5.3 Leakage

As illustrated in the approved revised PDD and according to the applied methodology ACM0008 (Version 07), the leakage emissions does not need to be considered.

5.4 Net GHG Emission Reductions and Removals

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
01/01/2019-31/12/2019	257,046	23,692	-	233,354
01/01/2020-31/12/2020	216,143	19,792	-	196,351
01/01/2021-31/12/2021	128,002	11,636	-	116,366
Total	601,191	55,120	-	546,071

The monitoring period (01/10/2019-31/12/2021) is 1,096 days. According to the registered PD, the estimated is 352,106 tones per year. Therefore, the amount estimated ex ante for this monitoring period is calculated as $(352,106 \times 1,096 / 365 = 1,057,382)$ tons. The actual ERs are less than estimated in the PD.

APPENDIX X: < EVIDENCE FOR SDGS >

Evidence for SDG 7 and SDG 13:

The project generated 106,239.0 MWh during 01/01/2016 – 31/12/2018 and 79,881 MWh during 01/01/2019 – 31/12/2021 MWh electricity that would otherwise be generated by the fossil fuels. Total cumulative electricity generated is 186,120.1 MWh by the end of the reporting period. The detailed calculation process have been displayed in Section 5 of the MR.

The project prevented the release of 732,284 tons of CO₂e during 01/01/2016 – 31/12/2018, and 546,071 tonnes of CO₂e during 01/01/2019 – 31/12/2021 into the atmosphere. Total cumulative tonnes of greenhouse gas emissions avoided is 1,278,355 by the end of the reporting period.

Evidence for SDG 8: The proof of annual income and the number of the employees are shown as below:

(Translation)

The statement of salary for Pingding County Yonder Coal Mine Methane Development Co., Ltd

Year	Employee No.	Female No.	Male No.	Annual salary (CNY/year/employee)
2016	16	5	11	69381
2017	16	5	11	70685
2018	16	5	11	71136
2019	15	5	10	71743
2020	15	4	11	71969
2021	15	5	10	72154

Pingding County Yonder Coal Mine Methane Development Co., Ltd

(stamp)

01/09/2022

平定县扬德煤层气利用有限公司员工薪资说明

我司汇能低浓度瓦斯发电站员工及薪资情况如下：

年份	人数	女性员工	男性员工	人均年薪(元)
2016	16	5	11	69381
2017	16	5	11	70685
2018	16	5	11	71136
2019	15	5	10	71743
2020	15	4	11	71969
2021	15	5	10	72154

特此说明

