



LUOHE GEOTHERMAL BASED SPACE HEATING SYSTEM



Document Prepared by China Certification Center, Inc.

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Summary:

China Certification Center, Inc. (hereafter referred to as “CCCI”) has performed the 2nd verification of greenhouse gas emission reductions of the project activity “Luohe Geothermal Based Space Heating System” (VCS Ref. No. 2635, hereafter referred to as “the project”) reported in the monitoring report covering the monitoring period from 01-Apr-2021 to 31-Mar-2023.

The project activity developed in Luohe City, Henan Province, P. R. China, is to introduce geothermal energy-based space heating system to realize heat supply to a series of new residential buildings over winter season, which will displace heat supply from isolated coal-fired boilers as a business-as-usual scenario in the project area. The project activity involves the construction and operation of geothermal system with a total heating load of 414.15MW which can supply geothermal heat to 8,283 thousand m² of residential buildings. The project is expected to achieve 481,744 tCO₂e of emission reduction annually. The project started operation on 01-Nov-2020, the VCS ID is 2635.

The approved CDM methodology AM0072 "Fossil Fuel Displacement by Geothermal Resources for Space Heating" (version 03.0) is applied to quantify the GHG removals achieved in this project. The calculation of the GHG emission reductions is carried out in a transparent and conservative manner.

The objective of the verification is to have an independent review ex post determination by a VVB (Validation and Verification Body) of the monitored GHG emission reductions that have occurred as a result of the implementation of the project activity during a defined monitoring period.

This is the 2nd monitoring period started from 01-Apr-2021 to 31-Mar-2023 for VCS scheme.

China Certification Center, Inc. (CCCI) conducted the verification using procedures in line with the requirements specified in the latest version of the VCS Validation and Verification Manual and applying auditing techniques. The verification team assessed the project activity's compliance against the VCS Standard Version 4.4, the selected CDM methodology and the monitoring report. The project is eligible under Project Scope 1. The verification criteria followed the guidance documents provided by VCS included the following:

VCS Standard Version 4.4, VCS Program Guide Version 4.3 and the applied CDM methodology AM0072 "Fossil Fuel Displacement by Geothermal Resources for Space Heating" (version 03.0).

In the course of the verification, 9 Corrective Action Requests (CARs), 1 Clarification Requests (CLs) were raised and successfully closed. The assessment is included in the report.

There are no restrictions of uncertainty for this verification.

China Certification Center, Inc. was commissioned by Profit Carbon Environmental Energy Technology (Shanghai) Co., Ltd. to carry out the Verified Carbon Standard (VCS) 2nd periodical verification of the project, "Luohe Geothermal Based Space Heating System" (VCS ID 2635) with regard to the relevant requirements of VCS standard Version 4.4. CCCI confirms all verification activities including objectives, scope and criteria, level of assurance, monitoring system and monitoring report adhere to VCS Standard Version 4.4.

Based on the work performed, it is CCCI's conclusion that the project activity "Luohe Geothermal Based Space Heating System" in China, as described in the final version of Monitoring Report, meets all relevant requirements for VCS verification activity and correctly applied the methodology AM0072 Version 03.0. Hence CCCI therefore provide positive verification opinion as per the requirement of VCS Standard and certify that the GHG emission reduction from the project during the monitoring period from 01-Apr-2021 to 31-Mar-2023 amount to 847,153 tCO_{2e} VCUs.

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1 INTRODUCTION

1.1 Objective

China Certification Center, Inc. was commissioned by Profit Carbon Environmental Energy Technology (Shanghai) Co., Ltd. to carry out the Verified Carbon Standard (VCS) 2nd periodical verification of the project for the monitoring period from 01-Apr-2021 to 31-Mar-2023 (both days included).

The objective of verification is to have an independent review ex-post determination by a VVB of the monitored GHG emission reductions that have occurred as a result of the project activity implemented during a defined monitoring period. The evaluation is done against the requirements of the VCS Standard Version 4.4 based on the monitoring report. In order to confirm that the GHG emission reductions sound reasonable and meet the identified criteria, the verification involves the assessment of monitoring plan conformance to VCS rules and applied methodology. Verification is a requirement and is seen as necessary to provide assurance on the generation of VCUs.

1.2 Scope and Criteria

The scope of the verification is to verify that: (a) the actual monitoring system and procedures are in compliance with the monitoring systems and procedures described in the monitoring plan; (b) the GHG emission reductions data and express a conclusion with a reasonable level of assurance about whether the reported GHG emission reductions data are free from material misstatement; (c) the reported GHG emissions data is sufficiently supported by evidence. Verification shall ensure that the reported GHG emission reductions are complete and accurate in accordance with the applicable VCS criteria in order to be certified. CCCI conducted the verification using CCCI procedures in line with the requirements specified in the VCS Standard and ISO14064-3 requirements and applying auditing techniques. The verification team assessed and determined that the implementation and operation of the project activity, and steps to report GHG emission reductions comply with the VCS rules. The verification involved a document review of relevant documentation and interview with the project participants. Verification is not meant to provide any consultancy towards the project participants; however, stated request for clarifications and/or corrective actions may have provided input for improvement of the monitoring.

1.3 Level of Assurance

All GHG sinks, sources and GHG emissions equal to or greater than 1% of the total GHG assertions are considered. The project is expected to generate average of 481,744 VCUs per year, and therefore can be considered as a project per the VCS rules, in regards to its scale, subject to a 1% materiality threshold. The assessment was conducted to provide a reasonable level of assurance of compliance against the defined audit criteria and materiality threshold within the audit scope. Based on the audit findings the

verification statement reasonably assure that the GHG assertion is materially correct and is a fair representation of the GHG data and information.

1.4 Summary Description of the Project

The project is implemented by Wanjiang New Energy Group Co. Ltd. and aims to introduce geothermal energy based space heating system to realize heat supply to a series of new residential buildings over winter season, which will displace heat supply from isolated coal-fired boilers as a business-as-usual scenario in the project area in Luohe City, Henan Province, P.R. China. The project activity involves the construction and operation of geothermal system with a total heating load of 414.15MW which can supply geothermal heat to 8,283 thousand m² of residential buildings which has been confirmed by site inspection and checking the JPM of the project/3/ and it is located inside the Luohe City, Henan Province, China.

The project activity enables a series of new residential buildings to use of geothermal energy instead of the combustion of fossil fuel for space heating, finally provides the affordable and clean Energy to communities in China, which has been verified by on-site inspection, and checking the related documentations, interview with the project implementer.

The project generates GHG emission reductions by displace heat supply from isolated coal-fired boilers. The estimated emission reduction from the project is 481,744 tCO₂e per year during the fixed 10-year crediting period from 01-Nov-2020 to 31-Oct-2030.

In the monitoring period from 01-Apr-2021 to 31-Mar-2023, the total verified carbon units (VCUs) achieved in the monitoring period are 847,153 tCO₂e, which has been verified by on-site inspection, and checking the related documentations, interview with the project implementer that has been stated in the whole verification report.

The project activity generates GHG emission reductions by avoid GHG emission of methane from anaerobic treatment of swine manure and wastewater would be vented into the atmosphere directly. Thus the project generates GHG emission reductions and produces financial, social and environmental benefits. The project has resulted in the local sustainable development as described in Section 1 of the Monitoring Report. The project was registered as a VCS project (joint validation and 1st verification approved together) with VCS Ref. No. 2635 and the emission reductions of 847,153 tCO₂e are certified as verified carbon units (VCUs) for this 2nd monitoring period.

2 VERIFICATION PROCESS

2.1 Method and Criteria

A project specific verification plan was developed to guide the verification auditing process to ensure efficiency and effectiveness. The purpose of the verification is to present a risk assessment for determining the nature and extent of verification procedures necessary to ensure the risk of auditing error is reduced to a reasonable level. According to the ISO14064-3, the criteria are the policy, procedure or requirement used as reference against which evidence is compared. Therefore, verification of the monitoring plan and the reported project results were measured for compliance against the following criteria:

- VCS Standard, v4.4/43/
- VCS Program Guide, v4.3/42/
- VCS Program Definitions, v4.3/41/
- VCS-Monitoring-Report-Template-v4.2/44/

The verification process derived from all items in the verification criteria stated above. Field inspection and techniques based on the project parameters, scope and best professional judgement of the verification team in order to meet a reasonable level of assurance. The verification method of the project consisted of the following steps:

- Contract review
- Appointment of team members and technical reviewers
- Send Verra-Notice-of-Validation-Verification-Services-NOVS form of this project to VERRA
- A desk review of the VCS Monitoring Report/1/ submitted by the client and additional supporting documents with the use of customized verification documents checklist
- Verification planning
- On-site visit and verification
- Background investigation and follow-up interviews with personnel of the project developer and representative of stakeholders
- Draft verification reporting
- Resolution of Corrective Action Requests (CARs) and Clarification Requests (CLs)
- Final verification reporting
- Technical review
- Final approval of the verification.

The verification process derived from all items in the verification criteria stated above. Field inspection and techniques based on the project parameters, scope and best professional judgement of the verification team in order to meet a reasonable level of assurance.

There is no sampling approach utilized by VVB during the verification.

2.2 Document Review

The VCS MR/1/ of the project and supporting background documents related to the project implementation and monitoring system were reviewed. Documents review was conducted to ensure consistency with and identify any deviation from VCS program requirements. Desk review included an examination of the project details, data and parameters, and quantification of GHG emission reductions.

Furthermore, the verification team used additional documentation by third parties like host party legislation, technical reports referring to the monitoring or to the basic conditions and technical data.

The references used in the course of this verification are summarized in Appendix B.

The verification was performed basing on the documents check and site inspection/measurements, refer to the section 4 of this report for the verification process detail and corresponding documents review.

2.3 Interviews

The objective of the interview process was to solicit important information from personnel related to project and relevant to the verification process. Onsite interviews and information discussions were conducted with project implementer and operation staffs of the project, local officers from government, representatives from local property management companies and end-users from communities and Project VCS development consultant. The interviews were performed by the verification team on-site (within the project area in Luohe City, Henan Province, P.R. China) and the following is a list of the main interviewees and subject.

No.	Interviewee			Date	Subject, Reference Number/ID	Team member
	Last name	First name	Affiliation			
1.	Wang	Yingying	Wanjiang New Energy Group Co. Ltd. / Manager	01-Jun-2023	Project design and implementation, Main equipment, Technical parameters, Project boundary, Monitoring plan, Monitoring system, Monitoring devices, SDG impacts, ER calculation, Heat supply, Heating season	Ran Fanlin
2.	Tang	Yan	Wanjiang New Energy Group Co. Ltd. / Monitoring staff	01-Jun-2023	Monitoring procedures	
3.	Liao	Lan			Monitoring devices	
4.	Yu	Rong			Data collection	
5.	Xu	Xin			QA/QC	
6.	Xiao	Xiaojie			Data management	
7.	Kang	Kang Shenshen			Emergency procedure	
					Calibration	
					Training	
					Salary	

8.	Lai	Yunshi			
9.	Wan	Jinwen			
10.	Lu	Yunting			
11.	Fang	Jiayun			
12.	Guo	Angran			
13.	Lin	Lin Kaile		02-Jun-2023	
14.	Su	Su Qimai			
15.	Yao	Yao Ming			
16.	Liang	Qing			
17.	Gu	Ji			
18.	Tian	Man			
19.	Tian	Ran			
20.	Kong	Hezheng			
21.	Guo	Duan			
22.	Meng	Qian			
23.	Gao	Cong			
24.	Jiang	Ji			
25.	Xie	Zheng			
26.	Shi	Lun			
27.	Ma	Lang			
28.	Xu	Shou			
29.	He	Yu			
30.	Jiang	Zhen			
31.	Wu	Yue	Local Stakeholders, officer/Luohe Urban and Rural Construction Bureau	01-Jun-2023	Continuous Stakeholder Consultation issues, SDG impacts, Continuous Inputs,

32.	Peng	Linghao	Local Stakeholders, officer/ Luohe City Environmental Protection Bureau		Grievances mechanism, Heat supply, Heating season, Local legislation to heat, Water Usage Permission	
33.	Li	Feng	Local Stakeholders, officer/ Luohe City Water Resources Utilization Bureau			
34.	Zhang	Shuo	Local Stakeholders, End user/Representatives from Property Companies (total 3) who sign the heating supply contract with PP	01-Jun-2023	Heat supply, Heating area, Contracts Signed, Heating Price Heating season, Carbon waiver, Scenario before the project started, Comments to the project	
35.	Liu	Xin				
36.	Wang	Fengyu				
37.	Tang	Fengfeng	Local Stakeholders/ End users in communities	01-Jun-2023	Heat supply, Heating area, Time of living Temperature in home Comments to the project	
38.	Li	Xiaozi				
39.	Zhang	Xiaofeng				
40.	Liu	Shun				
41.	Zhou	Tianhui		02-Jun-2023		
42.	Li	Lei				
43.	Yan	Mingming				
44.	Liu	Zifei				
45.	Liu	Liping				
46.	Zhou	Meimei				
47.	Li Xiag	Xiang				
48.	Zhu	Jingfei				
49.	Sun	Xiaomin				
50.	Wang	Xuyang	Profit Carbon Environmental Energy Technology (Shanghai) Co.,	01-Jun-2023~02-Jun-2023	Ex-ante and monitoring parameters, MR and ER editable issues	

			Ltd./ Senior Manager			
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2.4 Site Visits

The verification site inspection was conducted on 01-Jun-2023~02-Jun-2023. A ground inspection of the project was conducted during the site visit and the verification team interviewed project implementer representative and operation staffs.

During the site inspection, the project was inspected and documents evidence were checked, details as following table,

Duration of on-site inspection: 01-Jun-2023~02-Jun-2023				
No.	Activity performed on-site	Site location	Date	Team member
1.	Opening meeting Interview with PP Representative, local officers, representatives from local property management companies, end-users from community and consultant representatives	Office in Wanjiang New Energy Group Co. Ltd. in Luohe City Henan Province, P.R. China	01-Jun-2023	Ran Fanlin
2	On-site inspection of 10 sub-areas of the project Interview with operation staffs	Project Area in Luohe City, Henan Province, P.R. China	01-Jun-2023 ~ 02-Jun-2023	
3	Documents check	Office in Wanjiang New Energy Group Co. Ltd. in Luohe City Henan Province, P.R. China	02-Jun-2023	
4	Finding Summary	Office in Wanjiang New Energy Group Co. Ltd. in Luohe City Henan Province, P.R. China	02-Jun-2023	
5	Close Meeting	Office in Wanjiang New Energy Group Co. Ltd. in Luohe City Henan Province, P.R. China	02-Jun-2023	

2.5 Resolution of Findings

Material discrepancies identified in the course of the verification are addressed either as CARs, CLs or FARs.

A Corrective Action Request (CAR) is established where:

- The project participants have made mistakes that will influence the ability of the project activity to achieve real, measurable additional emission reductions;
- The VCS Standard Version 4.4 requirements have not been met;
- There is a risk that the emission reductions cannot be monitored or calculated.

A Clarification Request (CL) will be issued where information is insufficient, unclear or not transparent enough to establish whether a requirement is met.

A Forward Action Request (FAR) will be issued when certain issues related to project implementation should be reviewed during the next verification.

A detailed list of the CARs CLs and FAR raised and discussed in the course of this verification is included in Appendix D of this report.

In the course of the verification 9 Corrective Action Requests (CARs), 1 Clarification Requests (CLs) were raised and successfully closed. The assessment is included in the report.

2.5.1 Forward Action Requests

This is the 2nd periodical verification, and there is no FAR raised in the 1st periodical verification report and validation report/4/.

2.6 Eligibility for Validation Activities

The VVB CCCI holds accreditation for both validation and verification for the relevant sectoral scope 1.

3 VALIDATION FINDINGS

3.1 Participation under Other GHG Programs

The project has neither been registered nor seeking registration under any other GHG programs. The project is seeking registration only in VCS program/50/. A declaration from PP/24/,/25/ has been provided and checked, PP has confirmed that the project is not registered under any other GHG programs and the Verified Carbon Units (VCUs) generated from this monitoring period is not double counted.

Also, the assessment team checked the registries of CDM EB/49/, CCER/47/ and Gold Standard/48/ to confirm the same.

The net GHG emission reductions during this monitoring period from the project was not 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 which has been confirmed via checking the UNFCCC, GS, VCS and other GHG schemes' website, it is verified that the implementation of the project is consistent with the description in the MR and the monitoring system is fully functional to generate Verified Carbon Units (VCUs) without any double counting for this monitoring period from 01-Apr-2021 to 31-Mar-2023.

Besides, based on VVB's local expertise, China has a national emissions trading scheme only cover the high-emission industries, such as power generation sector that emitted at least 26,000 tons of CO₂e/year which has been verified in the public website/45/, and CCCI confirms that the project activity is not included the mandatory emission control scheme and there is no emission cap enforced for the project owner by checking the enforced company list in public information/46/. Hence, CCCI confirms that the emission reductions will not be double counted.

3.2 Methodology Deviations

Not applicable as not deviation for methodology.

3.3 Project Description Deviations

Not applicable as not deviation for project description.

3.4 Grouped Project

Not applicable.

4 VERIFICATION FINDINGS

4.1 Project Implementation Status

Through the onsite visit, interviewing the project developer and reviewing the project operation, CCCI confirms that the project installed new geothermal energy-based space heating system with a total heating load of 414.15MW which can supply geothermal heat to 8,283 thousand m² of residential buildings. The verifier has performed a site visit to check the project equipment and interview with operation staffs from project site, it is found that the project started construction on 01-Apr-2020 which has been confirmed by checking the Contract for Construction of Geothermal Space Heating System/13/, and started test run and put into operation on the same day on 01-Nov-2020 (winter season) which has been confirmed by checking the operation log of the project/16/. The factors and parameters used during this monitoring period to arrive at the emission reduction calculations are transparently described in the MR/1/.

By displaces heat supply from isolated coal-fired boilers as a business-as-usual scenario in the project area. Thus the project generates GHG emission reductions and produces financial, social and environmental benefits.

Via checking the MR/1/ and by site inspection, it is verified that there are no changes on the key equipment and technology since the last periodical verification of the project/4/.

On the basis of site visit and the reviewed project monitoring report and other supporting docs, it can be confirm that the realized technology, as well as the monitoring and metering equipment, the project has been implemented and operated as applied methodology/35/ and monitoring plan described in the registered JPM/3/.

This verification covers the period from 01-Apr-2021 to 31-Mar-2023 (including both days). 847,153 tCO₂e emission reductions are achieved during this monitoring period.

The utilization hours of the geothermal heating system were 3,624 hours (151 days*24h) during 2021-2022 heating season and 3,624 hours (151 days*24h) during 2022-2023 heating season within this monitoring period. It provided geothermal heat to 7,309,097m² of residential buildings with a total heating load of 365.45MW for 2021-2022 heating season (01-Nov-2021 to 31-Mar-2022) and provided geothermal heat to 7,435,015m² of residential buildings with a total heating load of 371.75MW for 2022-2023 heating season (01-Nov-2022 to 31-Mar-2023) which is confirmed as in line with the heating supply contracts/10/ due to not all residential buildings access to geothermal energy-based space heating system in the 2021-2022 and 2022-2023 winter seasons.

Via on-site investigation, CCCI confirms that during this monitoring period, the project run continuously/16/. The actual operations are found in accordance with the descriptions provided in the Joint-PD-MR with only not all the residential buildings access to geothermal energy-based space heating system in the early of 2021-2022 and 2022-2023 winter seasons. No events or situations, which may impact the applicability of the applied methodology, occurred during this monitoring period.

On the basis of site visit and the reviewed project documentation it can be confirms that the realized technology, the project equipment, as well as the monitoring and metering equipment, the project has been implemented and operated as applied monitoring methodology and monitoring plan described in the Joint-

PD-MR and the monitoring system is fully functional to generate Verified Carbon Units (VCUs) without any double counting for this monitoring period from 01-Apr-2021 to 31-Mar-2023.

There are no any methodology deviations relevant.

In conclusion, the verification team confirms that the project implementation is in accordance with the project description contained in the MR/1/ and approved JPM/3/.

The project has neither been registered and rejected nor seeking registration under any other GHG programs, the project activity is not part of any emission trading program, the net GHG emission reductions during this monitoring period from the project was not used for compliance with emission trading programs or to meet binding limits on GHG emissions, which has been confirmed as above section 3.1.

The project does not involve Supply Chain (Scope 3) Emissions as the project does not affects associated with a good or services in a supply chain which has been confirmed by site inspection.

The project was registered as a VCS project activity with the VCS Ref. No. 2635/50/, with 10 years fixed crediting period under VCS Program started from 01-Nov-2020 to 31-Oct-2030. This monitoring period (01-Apr-2021 to 31-Mar-2023) is the 2nd monitoring period.

The project site is located in Luohe City, Henan Province P. R. China. The geographical coordinates for the project site are between 113° 27' to 114° 16' and Latitude North 33° 24' to 33° 59'. Detailed coordinates of the 60 geothermal wells are provided in the MR, the geographical coordinates for the project site and geothermal wells are verified as consistent with on-site investigation by GPS devices and checking the google earth map.

Basic technical details of the project have been provided in the MR which has been verified as actual during site visit/30/ and consistent with the information in approved JPM/3/.

The approved consolidated methodology applied in the project activity is AM0072 - "Fossil Fuel Displacement by Geothermal Resources for Space Heating" (version 03.0)/35/. Also refers to the latest approved version of the following tools and guidelines:

- Tool 02 Combined tool to identify the baseline scenario and demonstrate additionality (Version 07.0)/36/
- Tool 05 Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation (Version 03.0)/37/
- Tool 07 Tool to calculate the emission factor for an electricity system (Version 07.0)/38/
- Tool 24 Common practice (Version 03.1)/39/

Reference to the following link for detail information about the methodology and tools:

<https://cdm.unfccc.int/methodologies/DB/TMGAEU1XHW6BFN1CDFCTWV9VUGVI19>

CCCI verify that the project contributes the sustainable development goal through the following aspects through on-site inspection and interview with the project implementer:

- Renewable energy share in the total final energy consumption (Goal 7 of UN SDG, Target 7.2) – verified by interview with local residents and by checking FSR/8/ and heating supply contracts/10/, it is confirmed that the local residents in actual heating area is 7,309,097 m²

from 01-Apr-2021 to 31-Mar-2022 and 7,435,015m² from 01-Apr-2022 to 31-Mar-2023 have accesses to and relied on renewable energy during this monitoring period and local residents in actual heating area is 7,423,829.37m² have accesses to and relied on renewable energy since the project started operation, hence the contribution to this SDG has been confirmed for both monitoring period and project lifetime;

- Proportion of informal employment in non - agriculture employment, by sex (Goal 8 of UN SDG, Target 8.3) – verified by interview with staffs and checking the Labor Contracts/26/ and monthly payroll/27/, it is confirmed that 30 job opportunities (15 females and 15 males) have been provided during this monitoring period and 30 job opportunities (15 females and 15 males) have been provided since the project started operation, hence the contribution to this SDG has been confirmed for both monitoring period and project lifetime;
- Tonnes of greenhouse gas emissions avoided or removed (Goal 13 of UN SDG, Target 13.0) – verified by checking the Emission Reduction Calculation sheet/2/, it is confirmed that total 847,153 tCO₂e Emission Reduction have been achieved during this monitoring period and total 1,247,730 tCO₂e Emission Reduction have been achieved since the project started operation, hence the contribution to this SDG has been confirmed for both monitoring period and project lifetime.

Via checking the Joint validation report and verification report/4/, it is verified that there were no any previously validated methodology deviations.

In conclusion, Verification Team was able to confirm that the project implementation is in accordance with the project description contained in the registered JPM/3/.

CAR 01, CAR 02, CAR 03 were raised and successfully closed. Refer to Appendix D for detail assessment.

4.2 Safeguards

4.2.1 No Net Harm

In China, an Environmental Impacts Assessment is required according to Chinese legislation/53/. The EIA was designed by Luohe Yonglan Environmental Technology Co., Ltd./6/ and approved by Luohe Ecological Environment Bureau on 31-Dec-2019/7/. The analysis of the environmental impacts of the project activity is sufficiently described according to EIA/6/. The assessment is as below,

It is considered that the environmental impacts and the relevant mitigation methods have been comprehensively described in Section 2.3 of approved JPM/3/ including the air pollution and wastewater, noise, and solid waste impact on the ecosystem and environment of local area in project site according to the EIA report/6/.

Associated with the review of EIA/6/, there was no adverse effect on the ecology, air, water and solid waste, for the project subject to the implementation of pollution mitigation measures according to the EIA report/6/. There was also no any endangered species found in the project location.

As per the approval of EIA/7/, it stated that the inspectors from the local Environmental Protection Bureau have to carry out monitoring work for the environmental impact arisen from the project activity during

project commissioning periodically. Via interview with the officer from local Environmental Protection Bureau, CCCI confirms that they are satisfactory with the environmental protection and recovery works have been carried out by the project owner. The local Environmental Protection Bureau also did not receive any public comment on the project activity during 2nd monitoring period.

During the on-site interview, the local residents were interviewed to confirm if there was critical impact to their living environment. It is verified that the project activity does not cause adverse effect to their daily life.

Furthermore, via interview with local officer and stakeholders, CCCI confirms that the implementation of the project improves local socio-economic development through creating career opportunities and paying taxes.

CCCI is able to conclude that there were some impacts on environment during the construction and operation periods which has been demonstrated in the MR/1/ and approved JPM/3/ and EIA/6/, also the proper measurements have been carried out by project implementer to mitigate such impacts. Therefore, no net harm on local environment and social community has been detected for the project.

4.2.2 Local Stakeholder Consultation

During this monitoring period, the project owner carried out a questionnaire survey for the local stakeholder to collect the relevant comments and suggestions from 10-April-2022 to 13-April-2022. Via checking the filled 40 questionnaires (40% participations are women) filled/28/, interview with the local officer and local resident during site visit, CCCI confirm that 72.5% of them believed that the project had positive impact on local employment and economy and 62.50% of them believed that the project brings positive impact to their families. There were no negative comments and issues from the local stakeholders during the implementation period. Hence there is no need to change the project design based on the stakeholder inputs and CCCI confirms that all the processes have been implemented to receive comments from local stakeholders as well as communicate with them at periodic intervals which in compliance with the VCS requirements.

Hence it is confirmed that the local authority and PP has conducted follow-up interviews and ongoing communication with local stakeholders to collect any comments or inputs to the project implementation. Based on the verification team's expertise, it is confirmed that the local government agencies and competent authorities conducts spot checks on the implementation of the project from time to time as per the request from the local government's regulations and the mechanism for on-going communication with local stakeholder has been established successfully and have been carried out at periodic intervals.

All stakeholders are allowed to record their grievances or comments in the book. The project owner will reply to the related issue. Via site inspection of the books, VVB confirmed that there were no negative comments received during this monitoring period.

Furthermore, PP has ensured that all the input received during the consultation has been taken by collecting comments and suggestions from residents by the local authority, the local government agencies and competent authorities conducts spot checks on the implementation of the project from time to time, and give suggestions on the involved rectification problems and confirmed as effective by site interview with local stakeholders and local officers, the processes have been implemented to receive inputs from local stakeholders as well as communicate with them at periodic intervals which verified in line with the VCS requirements.

CL 01 was raised and successfully closed. Refer to Appendix D for detail assessment.\

4.3 AFOLU-Specific Safeguards

N/A.

4.4 Accuracy of GHG Emission Reduction and Removal Calculations

4.4.1 Assessment of implementation Status of the Project Activity

In accordance with the approved JPM/3/, the project is implemented by Wanjiang New Energy Group Co. Ltd. and aims to introduce geothermal energy based space heating system to realize heat supply to a series of new residential buildings over winter season, which will displace heat supply from isolated coal-fired boilers as a business-as-usual scenario in the project area in Luohe City, Henan Province, P.R. China. The project activity involves the construction and operation of geothermal system with a total heating load of 414.15MW which can supply geothermal heat to 8,283 thousand m² of residential buildings which has been confirmed by site inspection and checking the JPM of the project/3/. Via checking the MR/1/ and by site inspection, it is verified that there are no changes on the key equipment and technology since the last periodical verification of the project.

The utilization hours of the geothermal heating system were 3,624 hours (151 days*24h) during 2021-2022 heating season and 3,624 hours (151 days*24h) during 2022-2023 heating season within this monitoring period. It provided geothermal heat to 7,309,097m² of residential buildings with a total heating load of 365.45MW for 2021-2022 heating season (01-Nov-2021 to 31-Mar-2022) and provided geothermal heat to 7,435,015m² of residential buildings with a total heating load of 371.75MW for 2022-2023 heating season (01-Nov-2022 to 31-Mar-2023) which is confirmed as in line with the heating supply contracts/10/ due to not all residential buildings access to geothermal energy-based space heating system in the 2021-2022 and 2022-2023 winter seasons.

Basic technical details of the project have been provided in the Joint-PD-MR which has been verified during site visit /15/,/30/.

On the basis of site visit and the reviewed project monitoring report and other supporting docs, it can be confirmed that the realized technology, as well as the monitoring and metering equipment, the project has been implemented and operated/30/ as applied methodology/35/ and monitoring plan described in the registered JPM/3/.

The main timeline of the project is listed in section 1.1 of the MR, which has been confirmed in the Contract for Construction of Geothermal Space Heating System/13/, operation log of the project/16/ and heating supply contracts/10/ against the on-site inspection.

Via on-site investigation, CCCI confirms that during this monitoring period, the project run continuously/16/ with only not all the residential buildings access to geothermal energy-based space heating system in the 2021-2022 and 2022-2023 winter seasons. No events or situations, which may impact the applicability of the applied methodology, occurred during this monitoring period. On the basis of site visit and the reviewed project documentation it can be confirms that the realized technology, the project equipment, as well as

the monitoring and metering equipment, the project has been implemented and operated as applied monitoring methodology and monitoring plan described in the JPM and the monitoring system is fully functional to generate Verified Carbon Units (VCUs) without any double counting for this monitoring period from 01-Apr-2021 to 31-Mar-2023. 847,153 tCO₂e emission reductions are achieved during this monitoring period.

In conclusion, the verification team confirms that the project implementation is in accordance with the project description contained in the MR/1/ and approved JPM/3/.

CAR 04 was raised and successfully closed. Refer to Appendix D for detail assessment.

4.4.2 Assessment of Data and parameters Available at Validation

By means of comparison of the MR/1/ and the ER calculation/2/ with the registered JPM/3/, the verification team has checked whether all parameters fixed ex-ante have been applied correctly.

Please refer to the following tables for assessment of each parameter determined ex-ante:

Data/parameter	$EF_{CO_2,i}$ The CO ₂ emission factor per unit of energy of the fuel of technology <i>i</i> that would have been used in the baseline heating technology
Value	87.3 tCO ₂ /TJ
Source	Fuel type of coking coal is used in baseline scenario. Emission Factor is derived from IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol.2 (Energy) of 2006 IPCC Guidelines on National GHG Inventories.
Means of verification	Confirmed as in line with the JPM/3/. The fuel type is verified as only coal which has been assessed in the validation report/4/. The emission factor of coking coal is confirmed as correct via checking the IPCC value/34/ against the applied methodology/35/. The 2019 Refinement to 2006 IPCC has been checked and it is confirmed no update to this value, so the value from 2006 IPCC is still applicable.
Conclusion	The verification team confirms that the data and parameters fixed ex ante have been sufficiently and correctly listed.

Data/parameter	$\eta_{BL,i}$ Net thermal efficiency of the boiler technology <i>i</i> using fossil fuel that would have been used in the absence of the project activity
Value	85%
Source	The value is determined following the guidance given in the applied methodology AM0072 (Version 03.0). Three manufacturers of coal-fired boiler were checked, and the efficiencies of their products are from 79% to 85%. Thus, the highest efficiency value provided by the three manufacturers is 85%. As per Table 4 Default baseline efficiency for different boilers of AM0072 (Version 03.0), it is confirmed that the highest value of 85% for new coal-fired boiler is applicable for the proposed project. Therefore, the $\eta_{BL,i}$ is determined as 85%.

Means of verification	Confirmed as in line with the JPM/3/, data source of manufacturers of coal-fired boiler/51/ is verified and default baseline efficiency for different boilers of AM0072 (Version 03.0)/35/ is compared.
Conclusion	The verification team confirms that the data and parameters fixed ex ante have been sufficiently and correctly listed.

Data/parameter	$Loss^{BL}_{i,y}$ The net distribution losses of the heat supply system, in the absence of project activity, during the year y
Value	0 TJ/yr
Source	The historical information is not available, a conservative value of 0% of losses can be used as per paragraph 66 option 1 of AM0072 (Version 03.0).
Means of verification	Confirmed as in line with the JPM/3/ and the applied methodology/35/.
Conclusion	The verification team confirms that the data and parameters fixed ex ante have been sufficiently and correctly listed.

Data/parameter	Subscript i Type of technology used in the baseline scenario
Value	Coal fired boilers in boiler houses, supplying several buildings through a heat distribution network
Source	Heat supply system using coal-fired boilers is identified as the baseline scenario of the proposed project activity
Means of verification	Confirmed as in line with the JPM/3/. The baseline scenario is verified as reasonable which has been assessed in the validation report/4/
Conclusion	The verification team confirms that the data and parameters fixed ex ante have been sufficiently and correctly listed.

Data/parameter	Subscript j Geothermal well number
Value	1 to 60
Source	The value of total of 60 geothermal wells including 42 production wells and 18 re-injection wells in the boundary of the proposed project activity is derived from FSR which is verified as actual by site inspection.
Means of verification	Confirmed as in line with the JPM. The FSR/8/ is checked and confirmed by site visit.
Conclusion	The verification team confirms that the data and parameters fixed ex ante have been sufficiently and correctly listed.

Data/parameter	Subscript m Space heating construction type
Value	Residential and commercial
Source	The space heating construction type of the proposed project activity only involves residential and commercial space heat derived from FSR/8/ which is verified as actual by site inspection.
Means of verification	Confirmed as in line with the JPM.

	The FSR/8/ is checked and confirmed by site visit.
Conclusion	The verification team confirms that the data and parameters fixed ex ante have been sufficiently and correctly listed.

Data/parameter	Subscript <i>k</i> Sub-station number
Value	1 to 44
Source	The value of total of 44 sub-stations in the boundary of the proposed project activity is derived from FSR/8/ which is verified as actual by site inspection through unique identification code and GPS coordinates.
Means of verification	Confirmed as in line with the JPM. The FSR/8/ is checked and confirmed by site visit through unique identification code and GPS coordinates.
Conclusion	The verification team confirms that the data and parameters fixed ex ante have been sufficiently and correctly listed.

Data/parameter	$Loss^{PJ}_y$ Net distribution loss of the geothermal heat supply system during the year <i>y</i>
Value	Refer to ER calculation sheet for more details
Source	The value is calculated based on design heat losses from heat network manufacturer per the methodology formular $Loss^{PJ}_y = \sum_m 10\% \times A_m \times Hl_m \times T_j \times CF \times 10^{-9}$
Means of verification	Confirmed as in line with the JPM/3/ and as per the applied methodology/35/.
Conclusion	The verification team confirms that the data and parameters fixed ex ante have been sufficiently and correctly listed.

Data/parameter	W_i Heat generation ratio for baseline heating technology <i>i</i>
Value	1
Source	The value is derived from Paragraph 51(a)(ii) option 2 Assign weights based on available historical records of AM0072 (Version 03.0) As assessed above, baseline scenario of the project is 3(i) "Coal fired boilers in boiler houses, supplying several buildings through a heat distribution network". Only one technology would be used. Via checking the Research on Heating in Winter of Luohe City published by Housing and Urban-Rural Development Department of Henan Province/29/, it is confirmed that all the heating in winter of residential buildings and commercial buildings were supplied by coal fired boilers. As per paragraph 51(a)(ii) option 2 Assign weights based on available historical records of AM0072 (Version 03.0), W_i is equal to 1.
Means of verification	Confirmed as in line with the JPM/3/ and as per the applied methodology/35/ and verified by Research on Heating in Winter of Luohe City published by Housing and Urban-Rural Development Department of Henan Province/29/.

Conclusion	The verification team confirms that the data and parameters fixed ex ante have been sufficiently and correctly listed.
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Data/parameter	H_{ff} Heat supplied by fossil fuel boiler, in case a boiler is used to meet the heat demand of network
Value	0 TJ
Source	There are no fossil fuel boilers used to meet the heat demand of the project heating network derived from on-site metering of heat (e.g. flow of steam/hot water multiplied by enthalpy) at the outlet of the boiler which is verified as actual by site inspection.
Means of verification	Confirmed as in line with the JPM/3/. No fossil fuel boilers used to meet the heat demand of the project heating network is confirmed by site visit of metering of heat installed at the outlet of the boiler.
Conclusion	The verification team confirms that the data and parameters fixed ex ante have been sufficiently and correctly listed.

In conclusion, the parameter fixed ex ante has been indicated in the registered JPM/3/. And the MR is checked as in line with the JPM/3/.

CAR 05 was raised and successfully closed. Refer to Appendix D for detail assessment.

4.4.3 Assessment of Data and parameters Monitored

During the 2nd periodical verification all relevant monitoring parameters as listed in JPM/3/ have been verified and summarized in the below table.

Data/parameter	$\Delta t_{j,d,y}$		
Unit	°C		
Description	Average temperature difference between inlet and outlet temperatures at the downstream of each heat exchanger in year y.		
Value	Refer to ER sheet for details		
Source of data	Operation record of the geothermal based space heating system		
Measuring /Reading /Recording frequency	Measured Hourly/Recording Monthly		
Monitoring equipment with calibration information	Ultrasonic calorimeters installed at downstream inlet and outlet points of each heat exchanger (total 84) Measurement range: 4 °C to 95 °C Accuracy: 0.01 °C		
	Serial No.	Calibrated Date	Validity
	LH00000158	06-October-2020	05-October-2025
	LH00000159	06-October-2020	05-October-2025
	LH00000160	06-October-2020	05-October-2025
	LH00000161	06-October-2020	05-October-2025
	LH00000162	06-October-2020	05-October-2025
	LH00000163	06-October-2020	05-October-2025
	LH00000164	06-October-2020	05-October-2025

	LH00000165	06-October-2020	05-October-2025
	LH00000166	06-October-2020	05-October-2025
	LH00000167	06-October-2020	05-October-2025
	LH00000168	06-October-2020	05-October-2025
	LH00000169	06-October-2020	05-October-2025
	LH00000170	06-October-2020	05-October-2025
	LH00000171	06-October-2020	05-October-2025
	LH00000172	06-October-2020	05-October-2025
	LH00000173	06-October-2020	05-October-2025
	LH00000174	06-October-2020	05-October-2025
	LH00000175	06-October-2020	05-October-2025
	LH00000176	06-October-2020	05-October-2025
	LH00000177	06-October-2020	05-October-2025
	LH00000178	06-October-2020	05-October-2025
	LH00000179	07-October-2020	06-October-2025
	LH00000180	07-October-2020	06-October-2025
	LH00000181	07-October-2020	06-October-2025
	LH00000182	07-October-2020	06-October-2025
	LH00000183	07-October-2020	06-October-2025
	LH00000184	07-October-2020	06-October-2025
	LH00000185	07-October-2020	06-October-2025
	LH00000186	07-October-2020	06-October-2025
	LH00000187	07-October-2020	06-October-2025
	LH00000188	07-October-2020	06-October-2025
	LH00000189	07-October-2020	06-October-2025
	LH00000190	07-October-2020	06-October-2025
	LH00000191	07-October-2020	06-October-2025
	LH00000192	07-October-2020	06-October-2025
	LH00000193	07-October-2020	06-October-2025
	LH00000194	07-October-2020	06-October-2025
	LH00000195	07-October-2020	06-October-2025
	LH00000196	07-October-2020	06-October-2025
	LH00000197	07-October-2020	06-October-2025
	LH00000198	07-October-2020	06-October-2025
	LH00000199	07-October-2020	06-October-2025
	LH00000244	08-October-2020	07-October-2025
	LH00000245	08-October-2020	07-October-2025
	LH00000246	08-October-2020	07-October-2025
	LH00000247	08-October-2020	07-October-2025
	LH00000248	08-October-2020	07-October-2025
	LH00000249	08-October-2020	07-October-2025
	LH00000250	08-October-2020	07-October-2025
	LH00000251	08-October-2020	07-October-2025
	LH00000252	08-October-2020	07-October-2025
	LH00000253	08-October-2020	07-October-2025
	LH00000254	08-October-2020	07-October-2025
	LH00000255	08-October-2020	07-October-2025
	LH00000256	08-October-2020	07-October-2025
	LH00000257	08-October-2020	07-October-2025
	LH00000258	08-October-2020	07-October-2025
	LH00000259	08-October-2020	07-October-2025
	LH00000260	08-October-2020	07-October-2025

	LH00000261	08-October-2020	07-October-2025
	LH00000262	08-October-2020	07-October-2025
	LH00000263	08-October-2020	07-October-2025
	LH00000264	08-October-2020	07-October-2025
	LH00000265	09-October-2020	08-October-2025
	LH00000266	09-October-2020	08-October-2025
	LH00000267	09-October-2020	08-October-2025
	LH00000268	09-October-2020	08-October-2025
	LH00000269	09-October-2020	08-October-2025
	LH00000270	09-October-2020	08-October-2025
	LH00000271	09-October-2020	08-October-2025
	LH00000272	09-October-2020	08-October-2025
	LH00000273	09-October-2020	08-October-2025
	LH00000274	09-October-2020	08-October-2025
	LH00000275	09-October-2020	08-October-2025
	LH00000276	09-October-2020	08-October-2025
	LH00000277	09-October-2020	08-October-2025
	LH00000278	09-October-2020	08-October-2025
	LH00000279	09-October-2020	08-October-2025
	LH00000280	09-October-2020	08-October-2025
	LH00000281	09-October-2020	08-October-2025
	LH00000282	09-October-2020	08-October-2025
	LH00000283	09-October-2020	08-October-2025
	LH00000284	09-October-2020	08-October-2025
	LH00000285	09-October-2020	08-October-2025
Means of verification	Data monitoring: The monitoring plan/3/ requires this parameter to be Measured Hourly/Recording Monthly. The verification team checked the ultrasonic calorimeters during site visit, reviewed the operation record of the geothermal based space heating system/19/ and confirmed that the measurements were hourly measured and recorded monthly as required by the monitoring plan/3/. Data generation and recording: The temperature difference is outlet temperature minus inlet temperature at the downstream of each heat exchanger, all the temperature data were measured by the ultrasonic calorimeters installed at downstream inlet and outlet points of each heat exchanger. Monitoring team read the readings of ultrasonic calorimeters hourly, the average daily inlet and outlet temperature were calculated based on the 24-hourly temperature data separately. The average monthly inlet and outlet temperature were calculated based on all the daily inlet and outlet temperature of this month, and then the average temperature difference is calculated for each month. Finally, the operation record of the geothermal heating system during the related heating season were summarized by all the monthly record. The flow of information from data generation, aggregation, to recording, calculation and reporting was verified by interviews with the key personnels and review of following documents: - Monitoring Manual/17/ - Operation record of the geothermal based space heating system/19/		

	QA/QC procedures applied: QA/QC procedures was verified via interviews with key personnels and review of following documents: The actual average temperature difference between inlet and outlet temperatures at the downstream of each heat exchanger ($\Delta t_{j,d,y}$) are measured by ultrasonic calorimeters and recorded in operation record of the geothermal based space heating system/19/. The average temperature change of the 42 heat exchange system of the 2021-2022 heating season (12°C) and 2022-2023 heating season (11.99°C) from operation record of the geothermal based space heating system/19/ is cross-checked with the design temperature difference of the end-user ($10\text{-}15^{\circ}\text{C}$). It is confirmed that the average temperature change of the 42 heat exchange systems of the Luohe geothermal heating system is about 12°C. Therefore, during this monitoring period, the average temperature change of the 42-heat exchange system of the 2021-2022 heating season (12°C) and 2022-2023 heating season (11.99°C) is reasonable. The calibration information of monitoring equipment has been confirmed by checking the calibration reports/11/ which has been conducted by qualified parties/12/. Via checking the calibration reports/11/, it is confirmed that all the ultrasonic calorimeters are calibrated based on JJG 225-2001 Verification Regulation of Heat Meters/32/. And based on this regulation, if the ultrasonic calorimeter can be used normally, recalibration is not required. The validity is five years. And based on the validity as above table, the verification team confirmed that the installed monitoring equipment has been duly calibrated for this entire monitoring period. The verification team confirmed that the QA/QC procedures applied is in accordance with the monitoring plan/3/.
Conclusion	The verification team confirms that: ✓ The monitoring has been carried out in accordance with the monitoring plan contained in the registered JPM/3/. ✓ The parameter required by the monitoring plan have been sufficiently monitored and correctly listed.

Data/parameter	$FR_{j,d,y}$
Unit	kg/h
Description	Average flow rate at the downstream of each heat exchanger (upstream of which is connected with water supply from the geothermal well j) in year y.
Value	643,154 kg/h from 01-April-2021 to 31-March-2022 643,147 kg/h from 01-April-2022 to 31-March-2023
Source of data	Operation record of the geothermal based space heating system
Measuring /Reading /Recording frequency	Measured Hourly/Recording Monthly
Monitoring equipment with calibration information	Ultrasonic calorimeters installed at downstream inlet and outlet points of each heat exchanger (total 42) Measurement range: $1,000\text{ m}^3/\text{h}$ Accuracy: $0.01\text{ m}^3/\text{h}$

	Serial No.	Calibrated Date	Validity
	LH00000244	08-October-2020	07-October-2025
	LH00000245	08-October-2020	07-October-2025
	LH00000246	08-October-2020	07-October-2025
	LH00000247	08-October-2020	07-October-2025
	LH00000248	08-October-2020	07-October-2025
	LH00000249	08-October-2020	07-October-2025
	LH00000250	08-October-2020	07-October-2025
	LH00000251	08-October-2020	07-October-2025
	LH00000252	08-October-2020	07-October-2025
	LH00000253	08-October-2020	07-October-2025
	LH00000254	08-October-2020	07-October-2025
	LH00000255	08-October-2020	07-October-2025
	LH00000256	08-October-2020	07-October-2025
	LH00000257	08-October-2020	07-October-2025
	LH00000258	08-October-2020	07-October-2025
	LH00000259	08-October-2020	07-October-2025
	LH00000260	08-October-2020	07-October-2025
	LH00000261	08-October-2020	07-October-2025
	LH00000262	08-October-2020	07-October-2025
	LH00000263	08-October-2020	07-October-2025
	LH00000264	08-October-2020	07-October-2025
	LH00000265	09-October-2020	08-October-2025
	LH00000266	09-October-2020	08-October-2025
	LH00000267	09-October-2020	08-October-2025
	LH00000268	09-October-2020	08-October-2025
	LH00000269	09-October-2020	08-October-2025
	LH00000270	09-October-2020	08-October-2025
	LH00000271	09-October-2020	08-October-2025
	LH00000272	09-October-2020	08-October-2025
	LH00000273	09-October-2020	08-October-2025
	LH00000274	09-October-2020	08-October-2025
	LH00000275	09-October-2020	08-October-2025
	LH00000276	09-October-2020	08-October-2025
	LH00000277	09-October-2020	08-October-2025
	LH00000278	09-October-2020	08-October-2025
	LH00000279	09-October-2020	08-October-2025
	LH00000280	09-October-2020	08-October-2025
	LH00000281	09-October-2020	08-October-2025
	LH00000282	09-October-2020	08-October-2025
	LH00000283	09-October-2020	08-October-2025
	LH00000284	09-October-2020	08-October-2025
	LH00000285	09-October-2020	08-October-2025
Means of verification	Data monitoring: The monitoring plan/3/ requires this parameter to be Measured Hourly/Recording Monthly. The verification team checked the ultrasonic calorimeters during site visit, reviewed the operation record of the geothermal based space heating system/19/ and confirmed that the measurements were hourly measured and recorded monthly as required by the monitoring plan/3/.		

	Data generation and recording: The volume flow rate data (m^3/h) were measured by the ultrasonic calorimeters installed at downstream of each heat exchanger. Density of the water is $1,000 \text{ kg}/\text{m}^3$. Hence, the final mass flow values are calculated as volume flow rate times density of water. Monitoring team read the readings of ultrasonic calorimeters hourly and recorded temperatures of outlet and inlet monthly, and then the average temperature difference is calculated for each month. Finally, the operation record of the geothermal heating system during the related heating season were summarized by all the monthly record. The flow of information from data generation, aggregation, to recording, calculation and reporting was verified by interviews with the key personnels and review of following documents: - Monitoring Manual/17/ - Operation record of the geothermal based space heating system/19/ QA/QC procedures applied: QA/QC procedures was verified via interviews with key personnels and review of following documents: The average volume flow rate of the 42 heat exchange system of the 2021-2022 heating season ($643.15 \text{ m}^3/\text{h}$), 2022-2023 heating season ($643.15 \text{ m}^3/\text{h}$) derived from operation record of the geothermal based space heating system/19/ is cross-checked with the rated flow of the circulating pumps ($1,400 \text{ m}^3/\text{h}$) which has been provided in the JPM/3/ and flow rate range value in previous verification report/4/, it is verified that all the data provided for cross-check are correct and reasonable. The calibration information of monitoring equipment has been confirmed by checking the calibration reports/11/ which has been conducted by qualified parties/12/. Via checking the calibration reports, it is confirmed that all the ultrasonic calorimeters are calibrated based on JJG 225-2001 Verification Regulation of Heat Meters/32/. And based on this regulation, if the ultrasonic calorimeter can be used normally, recalibration is not required. The validity is five years. And based on the validity as above table, the verification team confirmed that the installed monitoring equipment has been duly calibrated for this entire monitoring period. The verification team confirmed that the QA/QC procedures applied is in accordance with the monitoring plan/3/.
Conclusion	The verification team confirms that: ✓ The monitoring has been carried out in accordance with the monitoring plan contained in the registered JPM/3/. ✓ The parameter required by the monitoring plan have been sufficiently monitored and correctly listed.

Data/parameter	T_j
Unit	Hours
Description	Hours per hear heat utilization in well j
Value	3,624h (151 days*24h) during 2021-2022 heating season 3,624h (151 days*24h) during 2022-2023 heating season

Source of data	Operation record of the geothermal based space heating system
Measuring /Reading /Recording frequency	Monthly
Monitoring equipment with calibration information	N/A
Means of verification	Data monitoring: The monitoring plan/3/ requires this parameter to be Measured Monthly. The verification team reviewed the operation record of the geothermal based space heating system/19/ and confirmed that the measurements were conducted monthly as required by the monitoring plan/3/. Data generation and recording: Monitoring staff record the heating hours into the operation record of the geothermal based space heating system/19/ monthly, and then the final values are sum of the monthly data. The flow of information from data generation, aggregation, to recording, calculation and reporting was verified by interviews with the key personnels and review of following documents: - Monitoring Manual/17/ - Operation record of the geothermal based space heating system/19/ QA/QC procedures applied: QA/QC procedures was verified via interviews with key personnels and review of following documents: The operation record of the geothermal based space heating system/19/ is cross-checked with Research on Heating in Winter of Luohe City published by Housing and Urban-Rural Development Department of Henan Province/29/. During this monitoring period, for residential buildings, the heating days are 151 days for each heating season and 24-hour continuous heating supply per day are needed and for commercial buildings which is verified as correct and reasonable based on verification team's local expertise. The verification team confirmed that the QA/QC procedures applied is in accordance with the monitoring plan/3/.
Conclusion	The verification team confirms that: ✓ The monitoring has been carried out in accordance with the monitoring plan contained in the registered JPM/3/. ✓ The parameter required by the monitoring plan have been sufficiently monitored and correctly listed.

Data/parameter	Hl_m
Unit	W/m ²
Description	Heating index for construction type m
Value	50 W/m ² for residential buildings
Source of data	Monitoring data was derived from FSR/8/
Measuring /Reading /Recording frequency	N/A

Monitoring equipment with calibration information	N/A
Means of verification	Data monitoring: The monitoring plan/3/ states this parameter data derived from FSR/8/ and Heating index is 50 W/m² for residential buildings used for project activity, which is also confirmed in line with the requirement of CJJ 34-2010 Design Code for City Heating Network published by Ministry of Housing and Urban-Rural Development of the People's Republic of China/31/. Data generation and recording: As per the FSR/8/ and CJJ 34-2010 Design Code for City Heating Network published by Ministry of Housing and Urban-Rural Development of the People's Republic of China/31/, Heating index is 50 W/m² for residential buildings used for project activity, hence it is verified that the data in MR is correct. The flow of information from data generation, aggregation, to recording, calculation and reporting was verified by interviews with the key personnels and review of following documents: - FSR/8/ - CJJ 34-2010/31/ QA/QC procedures applied: QA/QC procedures was verified via interviews with key personnels and review of following documents: Via checking the FSR/8/ and CJJ 34-2010/31/ and interview with local officers, CCCI confirmed that the method is in line with the JPM monitoring plan/3/ and via comparing the data in MR with the evidence, CCCI verified that the data in MR is correct. There was no updated version of the related national and local standards and CJJ 34-2010/31/ is validated by space heating experts at the project site. The verification team confirmed that the QA/QC procedures applied is in accordance with the monitoring plan/3/.
Conclusion	The verification team confirms that: ✓ The monitoring has been carried out in accordance with the monitoring plan contained in the registered JPM/3/. ✓ The parameter required by the monitoring plan have been sufficiently monitored and correctly listed.

Data/parameter	$EC_{PJ,j,y}$ (EC_y)		
Unit	MWh		
Description	Electricity consumption for the year y in operating the geothermal heating system		
Value	96,098.67		
Source of data	Electricity meter reading records		
Measuring /Reading /Recording frequency	Measured Hourly/Recording Monthly		
Monitoring equipment with calibration information	Electricity meters installed at each substation (total 42) Accuracy: 0.5s		
	Serial No.	Calibrated Date	Validity

	110238121401	08-October-2020	07-October-2025
	110238121402	08-October-2020	07-October-2025
	110238121403	08-October-2020	07-October-2025
	110238121404	08-October-2020	07-October-2025
	110238121405	08-October-2020	07-October-2025
	110238121406	08-October-2020	07-October-2025
	110238121407	08-October-2020	07-October-2025
	110238121408	08-October-2020	07-October-2025
	110238121409	08-October-2020	07-October-2025
	110238121410	08-October-2020	07-October-2025
	110238121411	08-October-2020	07-October-2025
	110238121412	08-October-2020	07-October-2025
	110238121413	09-October-2020	08-October-2025
	110238121414	09-October-2020	08-October-2025
	110238121415	09-October-2020	08-October-2025
	110238121416	09-October-2020	08-October-2025
	110238121417	09-October-2020	08-October-2025
	110238121418	09-October-2020	08-October-2025
	110238121419	09-October-2020	08-October-2025
	110238121420	09-October-2020	08-October-2025
	110238121421	09-October-2020	08-October-2025
	110238121422	09-October-2020	08-October-2025
	110238121423	10-October-2020	09-October-2025
	110238121424	10-October-2020	09-October-2025
	110238121425	10-October-2020	09-October-2025
	110238121426	10-October-2020	09-October-2025
	110238121427	10-October-2020	09-October-2025
	110238121428	10-October-2020	09-October-2025
	110238121429	10-October-2020	09-October-2025
	110238121430	10-October-2020	09-October-2025
	110238121431	10-October-2020	09-October-2025
	110238121432	10-October-2020	09-October-2025
	110238121433	11-October-2020	10-October-2025
	110238121434	11-October-2020	10-October-2025
	110238121435	11-October-2020	10-October-2025
	110238121436	11-October-2020	10-October-2025
	110238121437	11-October-2020	10-October-2025
	110238121438	11-October-2020	10-October-2025
	110238121439	11-October-2020	10-October-2025
	110238121440	11-October-2020	10-October-2025
	110238121441	11-October-2020	10-October-2025
	110238121442	11-October-2020	10-October-2025
Means of verification	Data monitoring: The monitoring plan/3/ requires this parameter to be Measured Hourly/Recording Monthly. The verification team checked the electricity meters during site visit, reviewed the electricity meter reading records/20/ and confirmed that the measurements were hourly measured and recorded monthly as required by the monitoring plan/3/. Data generation and recording:		

	The electricity consumptions were measured by the electricity meter installed at each substation (total 42 electricity meters). Monitoring staff read the readings of electricity monthly and recorded meter reading data into meter reading records/20/ monthly, and then the electricity consumption is calculated for each month, then the electricity costs during the heating season were settled by the community property service company of each sub-area and local power grid company, which includes the electricity consumption of the geothermal heating system, finally the project owner prepares electricity bill/21/ to the related community property service company for confirmation. The flow of information from data generation, aggregation, to recording, calculation and reporting was verified by interviews with the key personnels and review of following documents: - Electricity meter reading records/20/ - Monitoring Manual/17/ - Electricity bill/21/ QA/QC procedures applied: QA/QC procedures was verified via interviews with key personnels and review of following documents: The Electricity meter reading records/20/ is cross-checked with Electricity bill/21/, it is verified that all the data provided for cross-check are correct and reasonable and the values are consistent in both sources. The calibration information of monitoring equipment has been confirmed by checking the calibration reports/11/ which has been conducted by qualified parties/12/. Via checking the calibration reports, it is confirmed that all the electricity meters are calibrated based on JJG596-2012 Electrical Meters for Measuring Alternating-current Electrical Energy/33/. And based on this regulation, if the electricity meters can be used normally, recalibration is not required. The validity is five years. And based on the validity as above table, the verification team confirmed that the installed monitoring equipment has been duly calibrated for this entire monitoring period. The verification team confirmed that the QA/QC procedures applied is in accordance with the monitoring plan/3/.
Conclusion	The verification team confirms that: ✓ The monitoring has been carried out in accordance with the monitoring plan contained in the registered JPM/3/. ✓ The parameter required by the monitoring plan have been sufficiently monitored and correctly listed.

Data/parameter	$EF_{EL,j,y} (EF_{grid,CM,y})$
Unit	tCO ₂ /MWh
Description	Combined margin emission factor for the grid in year y
Value	0.5721
Source of data	Baseline emission factors of China's regional power grid for emission reduction projects in 2019 published by Ministry of Ecology and Environment of the People's Republic of China

Measuring /Reading /Recording frequency	Once each monitoring period
Monitoring equipment with calibration information	N/A
Means of verification	Data monitoring: The monitoring plan/3/ states this parameter data derived from Baseline emission factors of China's regional power grid for emission reduction projects in 2019 published by Ministry of Ecology and Environment of the People's Republic of China/52/. Data generation and recording: As per the Tool 07 Tool to calculate the emission factor for an electricity system (Version 07.0)/38/, the monitoring parameter of $EF_{EL,j,y}$ ($EF_{grid,CM,y}$) is calculated by $EF_{grid,OM,y} \times 0.5 + EF_{grid,BM,y} \times 0.5$, and $EF_{grid,OM,y}$ and $EF_{grid,BM,y}$ were derived from Baseline emission factors of China's regional power grid for emission reduction projects in 2019 published by Ministry of Ecology and Environment of the People's Republic of China/52/ in line with the JPM. Baseline emission factors of China's regional power grid for emission reduction projects in 2019 published by Ministry of Ecology and Environment of the People's Republic of China/52/ is the latest public available EF data issued by China DNA, hence as per the Tool 07 Tool to calculate the emission factor for an electricity system (Version 07.0)/38/, the values from this source is applicable to this monitoring period. The flow of information from data generation, aggregation, to recording, calculation and reporting was verified by interviews with the key personnels and review of following documents: - Baseline emission factors of China's regional power grid for emission reduction projects in 2019 published by Ministry of Ecology and Environment of the People's Republic of China/52/ - Agreement of Electricity Charges/18/ QA/QC procedures applied: QA/QC procedures was verified via interviews with key personnels and review of following documents: Via checking the Agreement of Electricity Charges/18/, the verification team confirmed that the electricity consumed by facilities of the geothermal system is sourced from local power grid connected to Central China Power Grid (CCPG). Via checking the Baseline emission factors of China's regional power grid for emission reduction projects in 2019 published by Ministry of Ecology and Environment of the People's Republic of China/52/, it is confirmed that the calculation methods used by China DNA is in line with the tool/38/ and via comparing the data in MR with the evidence, thus verified that the data in MR is correct. The verification team confirmed that the QA/QC procedures applied is in accordance with the monitoring plan/3/.
Conclusion	The verification team confirms that: ✓ The monitoring has been carried out in accordance with the monitoring plan contained in the registered JPM/3/.

	✓ The parameter required by the monitoring plan have been sufficiently monitored and correctly listed.
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Data/parameter	$TDL_{j,y}$
Unit	/
Description	Average technical transmission and distribution losses for providing electricity to source j in year y .
Value	20%
Source of data	Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation (Version 03.0)
Measuring /Reading /Recording frequency	Annually. In the absence of data from the relevant year, most recent figures should be used, but not older than 5 years.
Monitoring equipment with calibration information	N/A
Means of verification	Data monitoring: The monitoring plan/3/ states this parameter data derived from Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation (Version 03.0)/37/. Data generation and recording: As per the Tool of Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation (Version 03.0)/37/, the verification team confirmed that different values applied to different scenarios. Via checking the Agreement of Electricity Charges/18/, it is confirmed that the electricity consumed by facilities of the geothermal system is sourced from local power grid connected to Central China Power Grid (CCPG). Hence, scenario A: Electricity consumption from the grid is applied to the proposed project. For project electricity consumption sources, a default value of 20% is used for $TDL_{j,y}$ in line with the tool/37/. The flow of information from data generation, aggregation, to recording, calculation and reporting was verified by interviews with the key personnels and review of following documents: • Agreement of Electricity Charges/18/ QA/QC procedures applied: N/A.
Conclusion	The verification team confirms that: ✓ The monitoring has been carried out in accordance with the monitoring plan contained in the registered JPM/3/. ✓ The parameter required by the monitoring plan have been sufficiently monitored and correctly listed.

Data/parameter	A_m
Unit	m^2
Description	Net heating area for construction type m .
Value	7,309,097 m^2 for 2021-2022 heating season 7,435,015 m^2 for 2022-2023 heating season

Source of data	Heating supply contracts for 2021-2022 and 2022-2023 heating season
Measuring /Reading /Recording frequency	Yearly
Monitoring equipment with calibration information	N/A
Means of verification	Data monitoring: The monitoring plan/3/ states this parameter data derived from Heating supply contracts for 2021-2022 and 2022-2023 heating season/10/. Data generation and recording: Via checking the Heating supply contracts for 2021-2022 and 2022-2023 heating season/10/ and interview with representatives from property management companies, it is confirmed that the net heating area data in MR is correct. The flow of information from data generation, aggregation, to recording, calculation and reporting was verified by interviews with the key personnels and review of following documents: • Heating supply contracts for 2021-2022 and 2022-2023 heating season/10/ QA/QC procedures applied: The data was cross-checked with Certificate of Enterprise Investment Project in Henan Province issued by Luohe Development and Reform Commission/14/, and it is confirmed that the net heating area sourced from the heating supply contract/10/ were lower than that of the government approval. Because all the communities covered by the project are newly built, some of the local resident haven't moved in yet, and there is no need for heating during the 2021-2022 and 2022-2023 heating season. The verification team confirmed that the QA/QC procedures applied is in accordance with the monitoring plan/3/.
Findings	No findings raised in this section.
Conclusion	The verification team confirms that: ✓ The monitoring has been carried out in accordance with the monitoring plan contained in the registered JPM/3/. ✓ The parameter required by the monitoring plan have been sufficiently monitored and correctly listed.

In conclusion, CCCI confirms that all monitoring parameters have been measured / determined without material misstatements and in line with approved JPM/3/, applied methodology/35/, all applicable standards and relevant requirements.

CAR 06, CAR 07 and CAR 08 were raised and successfully closed. Refer to Appendix D for detail assessment.

4.4.4 Assessment of in Compliance with monitoring plan

The verification team has checked the monitoring plan of the MR against the applied methodology and methodological tools and monitoring plan in registered JPM/3/.

Monitoring parameters

- a) Heating index for construction type m , HI_m
- b) Average technical transmission and distribution losses for providing electricity to source j in year y , $TDL_{j,y}$
- c) Combined margin emission factor for the grid in year y , $EF_{EL,j,y}$ ($EF_{grid,CM,y}$)
- d) Hours per hear heat utilization in well j , T_j
- e) Average temperature difference between inlet and outlet temperatures at the downstream of substation heat exchanger in year y , $\Delta t_{j,d,y}$
- f) Average flow rate at the downstream of heat exchanger (upstream of which is connected with water supply from the geothermal well j) in year y , $FR_{j,d,y}$
- g) Electricity consumption for the year y in operating the geothermal heating system, $EC_{PJ,j,y}$ (EC_y)
- h) Net heating area for construction type m , A_m

It is confirmed that all the monitoring parameters listed in the JPM have been provided in the MR. Refer to above section for detail assessment of each monitoring parameter.

Operational and management structure:

The MR contains a diagram illustrating the Organization Structure of the Monitoring Team to be implemented by the project owner in order to implement the project activity which is confirmed consistent with the JPM. The VCS monitoring team are responsible for the monitoring of all the parameters monitored for this monitoring period. And all the data was reviewed by the project developer. The organizational structure is considered sufficient to fulfil the monitoring requirements of the methodology and ensure that emission reductions verified for this monitoring period.

Monitoring equipment and installation

Measurement instruments are described in the MR as subject to appropriate national standards with respect to installation, accuracy and calibration interval. Main instruments ultrasonic calorimeters and electricity meters are used to monitor $\Delta t_{j,d,y}$, $FR_{j,d,y}$ and $EC_{PJ,j,y}$ (EC_y).

Via site inspection of the monitoring equipment, it is verified that all the measuring equipment have been installed as per the monitoring plan in the JPM, thus is considered sufficient to carry out the monitoring requirements as planned in the JPM and requested in the methodology, and the appropriate national standards have been followed.

Furthermore, accordingly to the monitoring plan in the JPM, if point of heat measurement is changed (e.g., due to a change in the heating network) or added during the current monitoring period, this should be documented transparently in the monitoring reports. PP has clearly stated in the MR that the heat measurement points or the heating network did not change. For this monitoring period, via on-site inspection, CCCI confirmed that the heat measurement points or the heating network did not change since the last verification/4/.

QA/QC procedure

The related QA/QC procedure has been conducted by PP for the monitoring process including data verification and cross check by monitoring team and project owner which has been verified by checking the monitoring manual/17/ and training records/23/.

It is confirmed that the QA/QC procedure has been implemented by PP properly during this monitoring period and the data management is confirmed as effective.

Training

Trainings related to monitoring have been provided to relevant personnel on 08-Oct-2021 and 10-Oct-2022 before the project operated for 2021-2022 and 2022-2023 heating seasons so that all the staffs are competent for the monitoring work which is verified by checking the training records/23/.

Data management

All data collected as part of monitoring plan will be archived electronically on hard disks and be kept at least 2 years after the end of the last crediting period.

Emergency Procedure

Project proponents will take actions to suspend or replace broken meters if any malfunction, and the most conservative approach are used for emission calculations during the emergency period.

Via checking the operation log/16/, calibration reports for monitoring equipment/11/ and comparing with the heat flow value as assessed in the above section, it is verified that there was no emergency occurred during this monitoring period.

Corrective actions

In case of nonconformities would be observed, a corrective action plan will be established and the whole VCS monitoring team will follow recognized standard data evaluation methods to guarantee that the data is reliable and accurate.

In conclusion, the implementation of monitoring plan including monitoring, data recording and collection, QA/QC procedure, emergency procedure is stated by PP which is confirmed as actual and reasonable by site inspection and interview with the monitoring team.

4.4.5 Compliance with the calibration frequency requirements for measuring instruments

During the verification the relevant monitoring equipment has been checked whether the calibration requirements have been met; especially if the calibration frequency is in line with the requirements of the registered JPM/3/ and/or the applicable calibration standards.

The information of monitoring equipment used for monitoring in this monitoring period is listed in MR and the calibration information/11/ has been assessed in above section 4.4.3 in each monitoring parameter table.

Furthermore, via checking the certificate of third party who conducted the calibration/12/, CCCI confirms that the third party get the related qualification.

In conclusion, the equipment used for monitoring is controlled and calibrated in accordance with the monitoring plan in approved JPM/3/.

Based on that CCCI confirms that all installed monitoring equipment has been duly calibrated for this entire monitoring period/11/.

4.4.6 Assessment of data and calculation of emission reductions or net removals

4.4.6.1 Calculation of baseline GHG emissions or removals

For verification of the estimated GHG emission reductions in the MR/1/ and ER calculation sheet/2/, CCCI has downloaded from the UNFCCC website the applicable version of the CDM methodology and all referenced methodological tools.

The calculation of ERs is done as per the applied methodology (AM0072, ver. 03.0)/35/ which has been assessed as below,

Baseline emissions:

$$BE_y = \sum_i (HS_{i,y}^{BL}) \times EF_{CO_2,i} / \eta_{BL,i} \quad (1)$$

Where:

BE_y = The baseline emissions from heat displaced by the project activity during the year y (t CO₂e/yr).

$EF_{CO_2,i}$ = The CO₂ emission factor per unit of energy of the fuel of technology i that would have been used in the baseline heating technology in (t CO₂/TJ). Where several fuel types are used in the boiler, use the fuel type with the lowest CO₂ emission factor.

$\eta_{BL,i}$ = The net thermal efficiency of the heating technology i using fossil fuel that would have been used in the absence of the project activity.

$HS_{i,y}^{BL}$ = The net output of heat generated by the baseline heat supply system using the technology i measured at the end point of the heat facility, during the year y (TJ/yr).

Both $EF_{CO_2,i}$ and $\eta_{BL,i}$ are ex ante fixed values for this monitoring period which the values have been assessed in the JPM and section 4.4.2 of this report.

For $HS_{i,y}^{BL}$, as per the JPM,

$$HS_{i,y}^{BL} = w_i \times (HS_{y-Loss}^{PJ} + Loss_{y-Loss}^{BL}) \quad (2)$$

Where:

$HS_{i,y}^{BL}$ = The net output of heat generated by the baseline heat supply system using the technology i measured at the end point of the heat facility, during the year y (TJ/yr).

w_i = Assign weights for heat generated by technology i . As per section 4.1 of the Joint-PD-MR, the baseline scenario of the project is 3(i) "Coal fired boilers in boiler houses, supplying several buildings through a heat distribution network". Only one technology will be used. According to *Research on Heating in Winter of Luohe City published by Housing and*

Urban-Rural Development Department of Luohe City, the heating in winter of Residential buildings were supplied by coal fired boilers in suburb of Luohe City. As per paragraph 51(a)(ii) option 2 Assign weights based on available historical records of AM0072 (Version 03.0), w_i is equal to 1.

HS_y = Net quantity of heat supplied by the geothermal heat resource(s) in the project activity, during the year y (TJ/yr).

$Loss^{PJ}_y$ = The net distribution losses of the geothermal heat supply system during the year y (TJ/yr).

$Loss^{BL}_y$ = The net distribution losses of the heat supply system, in the absence of project activity, during the year y (TJ/yr).

The net quantity of heat supplied by the project activity is estimated based on the heat provided by the geothermal well. It considers flow rates, temperature and usage time for each geothermal well to be considered by the project activity.

$$HS_y = \min\{H_{CAP}, HS_{y,estimated}\} \quad (3)$$

$HS_{y,estimated}$ can be determined by the use of the flow and temperature of water supplied by the substation heat exchanger k to the demand side space heating.

$$HS_{y,estimated} = \sum_j (Q_{j,d,y} \times T_j \times CF) \quad (4)$$

Where:

$HS_{y,estimated}$ = Estimated quantity of heat supplied by the geothermal heat resource(s) in the project activity, during the year y (TJ)

$Q_{j,d,y}$ = Heat supplied at the downstream of heat exchanger (upstream of which is connected with water supply from the geothermal well j) (GW). It can be calculated as formula (5).

T_j = Number of hours per year heat utilization at well j.

CF = Conversion factor from GWh to TJ (3.6).

$$Q_{j,d,y} = \frac{FR_{j,d,y} \times \Delta t_{j,d,y} \times 4.18}{3.6} \times 10^{-9} \quad (5)$$

Where:

$FR_{j,d,y}$ = Average flow rate at the downstream of heat exchanger (upstream of which is connected with water supply from the geothermal well j) in year y (kg/hr).

$\Delta t_{j,d,y}$ = Heat supplied at the downstream of heat exchanger (upstream of which is connected with water supply from the geothermal well j) (°C).

To ensure that the geothermal well is providing the required amount of energy a cap is defined. The basis to define the cap is from the space heating design, which considers the net heating area, the heating

index, the type of construction that will utilize the heat and the time used throughout the year for each construction type.

$$H_{CAP} = (\sum_m A_m \times HI_m \times T_j) \times CF + Loss_y^{PJ} - H_{ff} \quad (6)$$

Where:

- H_{CAP} = The net quantity of heat supplied by the geothermal heat resource(s) in the project activity, during the year y (TJ).
- A_m = Net heating area for construction type m (m²).
- HI_m = Heating index for construction type m (GW/m²).
- T_j = Number of hours per year heat utilization at well j.
- CF = Conversion factor from GWh to TJ (3.6).
- $Loss_y^{PJ}$ = Heat distribution losses from substation k to space heating areas (To be determined in Sub-step 2.b).
- H_{ff} = Heat supplied by fossil fuel boiler, in case a boiler is used to meet the heat demand of network. No fossil fuel boiler is utilized in the project activity and H_{ff} is 0 TJ.

The values of all the listed parameters for both ex-ante and monitored ones are assessed in above section 3.6. And the calculation process as elaborated in the ER sheet/2/ has been checked by verification team and re-produced as correct.

Hence based on the assessed values, Baseline emission calculation during this monitoring period are confirmed by the verification team to be:

Date	HS ^{BL} _{i,y} (TJ)	EF _{CO2,i} (t CO ₂ /TJ)	η _{BL,i}	BE _y (tCO ₂ e/yr)
01-Apr-2021~31-Oct-2021 ¹	0	0	0	0
01-Nov-2021~30-Nov-2021	880.93	87.3	85%	90,477
01-Dec-2021~31-Dec-2021	910.66	87.3	85%	93,530
01-Jan-2022~31-Jan-2022	910.09	87.3	85%	93,471
01-Feb-2022~28-Feb-2022	821.96	87.3	85%	84,420
01-Mar-2022~31-Mar-2022	910.27	87.3	85%	93,490
01-Apr-2021-31~Dec-2021	1,791.59	87.3	85%	184,007

¹ Winter heating season of Luohe City is usually from 01-November to 31-March of the next year. So, data from 01-April-2021 to 31-October-2021 is 0.

01-Jan-2022~31-Mar-2022	2,642.32	87.3	85%	271,381
01-Apr-2021~31-Mar-2022	4,433.91	87.3	85%	455,388
01-Apr-2022~31-Oct-2022 ²	0	0	0	0
01-Nov-2022~30-Nov-2022	911.56	87.3	85%	93,622
01-Dec-2022~31-Dec-2022	908.07	87.3	85%	93,263
01-Jan-2023~31-Jan-2023	908.07	87.3	85%	93,264
01-Feb-2023~28-Feb-2023	820.50	87.3	85%	84,269
01-Mar-2023~31-Mar-2023	908.68	87.3	85%	93,326
01-Apr-2022-31~Dec-2022	1,819.63	87.3	85%	186,885
01-Jan-2023~31-Mar-2023	2,637.25	87.3	85%	270,859
01-Apr-2022~31-Mar-2023	4,456.88	87.3	85%	457,744
Total for 2nd monitoring period	8,890.79	87.3	85%	913,132

In conclusion, the calculations of baseline GHG emissions have been carried out in accordance with the formulae and methods described in the registered monitoring plan, the applied methodology and, where applicable, the applied standardized baseline. Any assumptions used in emission calculations have been justified. Appropriate emission factors, GWP and other reference values have been correctly applied. No errors, miscalculations, omissions, misstatements or incomplete information has been identified. It can be confirmed that the baseline calculation is overall correct.

4.4.6.2 Calculation of Project GHG emissions or removals

As per the JPM/3/ and applied methodology/35/, Project emissions are calculated taking into consideration fugitive carbon dioxide and methane released from geothermal vents (PE_{FE}), electricity consumption from the use the pumps to extract the geothermal water (PE_{EC}) and fossil fuel used to operate the geothermal facility (PE_{FF}).

$$PE_y = PE_{FE,y} + PE_{EC,y} + PE_{FF,y} \quad (7)$$

Step 1: Calculate project emissions from fugitive emissions resulting from non-condensable gases from the geothermal vents during the year y

The geothermal system of the proposed project is designed to operate by extracting geothermal water at approximately 75 °C, which is considered to be a low-temperature system. Via the paragraph 84 of AM0072 (Version 03.0)/35/, fugitive emissions from low temperature geothermal system is considered negligible. Therefore, $PE_{FE,y} = 0$ tCO₂.

² Winter heating season of Luohe City is usually from 01-November to 31-March of the next year. So, data from 01-April-2022 to 31-October-2022 is 0.

Step 2: Calculate project emissions from additional electricity consumption as a result of the project activity

Project emissions from electricity consumption (PE_{EC}) used to pump geothermal water and operate the geothermal facility shall be calculated using *Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation* (Version 03.0)/37/. Electricity consumption from each relevant source should be monitored and summed up to $EC_{PJ,j,y}$.

As per the tool/37/, project emissions from consumption of electricity are calculated based on the quantity of electricity consumed, an emission factor for electricity generation and a factor to account for transmission losses, as follows:

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

Where:

- $PE_{EC,y}$ = Project emissions from electricity consumption in year y (t CO₂/yr).
- $EC_{PJ,j,y}$ = Quantity of electricity consumed by the project electricity consumption source j in year y (MWh/yr).
- $I_{j,y}$ = Emission factor for electricity generation for source j in year y (t CO₂/MWh).
- $TDL_{j,y}$ = Average technical transmission and distribution losses for providing electricity to source j in year y .

As per the assessment in section 4.4.2, a default value of 20% is used for $TDL_{j,y}$, $EF_{grid,CM,y}$ is calculated as $0.8587 \text{ tCO}_2/\text{MWh} \times 0.5 + 0.2854 \text{ tCO}_2/\text{MWh} \times 0.5 = 0.5721 \text{ tCO}_2/\text{MWh}$ for this monitoring period.

Step 3: Calculate project emissions from fossil fuel consumed as a direct result of the operations of the project activity

Via site inspection, the verification team confirmed that no fossil fuel will be used to operate the geothermal facilities. Therefore, $PE_{FF,y} = 0 \text{ tCO}_2$.

In conclusion, for this monitoring period, $PE_y = PE_{EC,y}$

So PE_y is calculated as below table

Date	$EC_{PJ,j,y}$	$I_{j,y}$	$(1+TDL_{j,y})$	$PE_{EC,y}$	PE_y
	(MWh)	(tCO ₂ /MWh)	/	(tCO ₂ e/yr)	(tCO ₂ e/yr)
01-Apr-2021~31-Oct-2021 ³	0	0.5721	1.2	0	0
01-Nov-2021~30-Nov-2021	9,456.03	0.5721	1.2	6,492	6,492

³ Winter heating season of Luohe City is usually from 01-November to 31-March of the next year. So, data from 01-April-2021 to 31-October-2021 is 0.

01-Dec-2021~31-Dec-2021	9,694.97	0.5721	1.2	6,656	6,656
01-Jan-2022~31-Jan-2022	9,987.44	0.5721	1.2	6,857	6,857
01-Feb-2022~28-Feb-2022	8,780.73	0.5721	1.2	6,029	6,029
01-Mar-2022~31-Mar-2022	9,719.02	0.5721	1.2	6,673	6,673
01-Apr-2021-31~Dec-2021	19,150.99	0.5721	1.2	13,148	13,148
01-Jan-2022~31-Mar-2022	28,487.19	0.5721	1.2	19,559	19,559
01-Apr-2021~31-Mar-2022	47,638.18	0.5721	1.2	32,707	32,707
01-Apr-2022~31-Oct-2022 ⁴	0.00	0.5721	1.2	0	0
01-Nov-2022~30-Nov-2022	9,619.10	0.5721	1.2	6,604	6,604
01-Dec-2022~31-Dec-2022	9,862.39	0.5721	1.2	6,771	6,771
01-Jan-2023~31-Jan-2023	10,160.09	0.5721	1.2	6,976	6,976
01-Feb-2023~28-Feb-2023	8,932.07	0.5721	1.2	6,133	6,133
01-Mar-2023~31-Mar-2023	9,886.84	0.5721	1.2	6,788	6,788
01-Apr-2022-31~Dec-2022	19,481.49	0.5721	1.2	13,375	13,375
01-Jan-2023~31-Mar-2023	28,979.00	0.5721	1.2	19,897	19,897
01-Apr-2022~31-Mar-2023	48,460.49	0.5721	1.2	33,272	33,272
Total for 2nd monitoring period	96,098.67	0.5721	1.2	65,979	65,979

In conclusion, the calculations of project GHG emissions have been carried out in accordance with the formulae and methods described in the registered monitoring plan, the applied methodology and, where applicable, the applied standardized project. Any assumptions used in emission calculations have been justified. Appropriate emission factors, GWP and other reference values have been correctly applied. No errors, miscalculations, omissions, misstatements or incomplete information has been identified. It can be confirmed that the project calculation is overall correct.

4.4.6.3 Calculation of Leakage GHG emissions or removals

The verification team has reviewed the leakage calculation as per the registered JPM/1/ and the applied methodology/35/. No leakage needs to be considered according to AM0072 Version 03.0.

⁴ Winter heating season of Luohe City is usually from 01-November to 31-March of the next year. So, data from 01-April-2022 to 31-October-2022 is 0.

4.4.6.4 Summary of calculation of GHG emission reductions or net anthropogenic GHG removals by sinks

The MR includes a summary table of the emission reductions calculation. Summary of emission reductions during the monitoring period is calculated as below formular which in line with the registered JPM/1/ and applied methodology/35/,

$$ER_y = BE_y - PE_y - LE_y$$

Hence, the emission reductions during this monitoring period are summarized in the table below

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-Apr-2021~31-Oct-2021	0	0	0	0
01-Nov-2021~30-Nov-2021	90,477	6,492	0	83,985
01-Dec-2021~31-Dec-2021	93,530	6,656	0	86,874
01-Jan-2022~31-Jan-2022	93,471	6,857	0	86,614
01-Feb-2022~28-Feb-2022	84,420	6,029	0	78,391
01-Mar-2022~31-Mar-2022	93,490	6,673	0	86,817
01-Apr-2021-31~Dec-2021	184,007	13,148	0	170,859
01-Jan-2022~31-Mar-2022	271,381	19,559	0	251,822
01-Apr-2021~31-Mar-2022	455,388	32,707	0	422,681
01-Apr-2022~31-Oct-2022	0	0	0	0
01-Nov-2022~30-Nov-2022	93,622	6,604	0	87,018
01-Dec-2022~31-Dec-2022	93,263	6,771	0	86,492
01-Jan-2023~31-Jan-2023	93,264	6,976	0	86,288
01-Feb-2023~28-Feb-2023	84,269	6,133	0	78,136
01-Mar-2023~31-Mar-2023	93,326	6,788	0	86,538
01-Apr-2022-31~Dec-2022	186,885	13,375	0	173,510
01-Jan-2023~31-Mar-2023	270,859	19,897	0	250,962
01-Apr-2022~31-Mar-2023	457,744	33,272	0	424,472

Total for 2nd monitoring period	913,132	65,979	0	847,153
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CAR 09 was raised and successfully closed. Refer to Appendix D for detail assessment.

4.5 Quality of Evidence to Determine GHG Emission Reductions and Removals

Refer to above sections 4.4.3 for the detail assessment of each monitoring parameters and Appendix C for the supporting evidence used to determine the GHG emission reductions.

For each reported data, the evidence is provided and verified as sufficient and quality is appropriate. Also, the cross-checks have been performed on the reported data with different source of evidence. The information flow from data generation and aggregation, to recording, calculation and final transposition into the monitoring report has been assessed by CCCI for each parameter and also the calibration have been conducted as per the frequency of monitoring equipment defined in the JPM and national regulation.

Therefore, it is concluded that the evidence provided are verified as sufficient and quality is appropriate and thus the evidence can be used to determine the GHG reductions and removals for this monitoring period.

4.6 Non-Permanence Risk Analysis

N/A

5 VERIFICATION OPINION

CCCI has been commissioned by Profit Carbon Environmental Energy Technology (Shanghai) Co., Ltd. to carry out the Verified Carbon Standard (VCS) 2nd periodic verification of the project activity Luohe Geothermal Based Space Heating System (VCS ID 2635), for the monitoring period from 01-Apr-2021 to 31-Mar-2023, with regard to the relevant requirements for VCS Standard Version 4.4.

The review of the project design documentation and the subsequent follow-up interviews have provided CCCI with sufficient evidence to determine the fulfilment of stated criteria.

In the course of the verification, 9 Corrective Action Requests (CARs), 1 Clarification Requests (CLs) were raised and successfully closed and no Forward Action Request (FAR) was raised for the project activity.

The verification is based on the approved CDM methodology AM0072 (version 03.0) and the MR. The PPs are responsible for the collection, calculation and determination of the GHG data in accordance with the monitoring plan and the reporting of GHG emission reductions on the basis set out within the MR.

Based on the reviewing the documented evidence and by an on-site assessment, CCCI can confirm that:

- The monitoring plan in the MR is as per the applied methodology;
- The monitoring complies with the monitoring plan in the approved JPM;
- The MR and other supporting documents provided are complete and verifiable and in accordance with the applicable VCS Standard Version 4.4;
- The monitoring equipment being essential for monitoring and determination of emission reduction runs reliably and is calibrated appropriately;
- The monitoring system is in place and generates GHG emission reductions data;
- The GHG emission reductions are calculated without material mis-statements.

Based on an understanding of the risks associated with reporting of GHG emission data and the controls in place to mitigate these, CCCI planned and performed verification work to obtain the information and explanations that we considered necessary to provide reasonable assurance that reported GHG emission reductions are fairly stated.

CCCI does not assume any responsibility towards the issuance and utilization of the VCU's hereby verified and certified. Request for issuance of VCU's shall be made by the project proponent to an approved VCS Program Registry based on the requirements set out under the most recent version of the VCS Program Guidelines clause on VCS Registration.

CCCI certified that the GHG emission reductions from the project during the monitoring period amount as follows:

Verification period: From 01-Apr-2021 to 31-Mar-2023

Verified GHG emission reductions and removals in the above verification period by vintage is

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-Apr-2021-31~Dec-2021	184,007	13,148	0	170,859
01-Jan-2022~31-Mar-2022	271,381	19,559	0	251,822
01-Apr-2021~31-Mar-2022	455,388	32,707	0	422,681
01-Apr-2022-31~Dec-2022	186,885	13,375	0	173,510
01-Jan-2023~31-Mar-2023	270,859	19,897	0	250,962
01-Apr-2022~31-Mar-2023	457,744	33,272	0	424,472
Total for 2nd monitoring period	913,132	65,979	0	847,153

The estimated ex-ante GHG emission reductions and removals, the achieved emission reductions and removals for this monitoring period, percentage difference and justification of the difference have been given in below table

Year	Ex-ante emissions reductions/removals	Achieved emissions reductions/removals	Percent difference	Justification for the difference
01-Apr-2021-31~Dec-2021	194,612	170,859	-12.21%	The actual ER value is lower than the ex-ante estimated value. The difference is due to not all residential buildings access to geothermal energy-based space heating system in the 2021-2022 and 2022-2023 winter seasons which make the monitoring result of main parameters is lower than the estimated values in the registered JPM which has been confirmed during site visit, interview with PP and checking the data from records of operation of geothermal system comparing with JPM.
01-Jan-2022~31-Dec-2022	481,744	425,332	-11.71%	
01-Jan-2023~31-Mar-2023	287,132	250,962	-12.6%	
01-Apr-2021~31-Mar-2023	963,488	847,153	-12.07%	
				It is verified there is no risk of increase.

APPENDIX A: ABBREVIATIONS

Abbreviations	Full texts
BE	Baseline Emission
CAR	Corrective Action Request
CCER	China Certified Emission Reduction
CCPG	Central China Power Grid
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CL	Clarification Request
CO ₂	Carbon dioxide
CP	Crediting Period
DNA	Designated National Authority
EB	Executive Board
EIA	Environmental Impact Assessment
ER	Emission Reduction
ETS	Emission Trading Scheme
FAR	Forward Action Request
PER	Project Evaluation Report
GHG	Green House Gas
GS	Gold Standard
GSC/GSP	Global Stakeholder Consultation Process
IPCC	Intergovernmental Panel on Climate Change
JPM	Joint-PD-MR
KP	Kyoto Protocol
LSC	Local Stakeholder Consultation
MoV	Means of Validation
MP	Monitoring Plan
ODA	Official Development Assistance
PA	Project Activity
PE	Project Emission
PP	Project Participant
PS	Project Standard
QC/QA	Quality control/Quality assurance
SD	Sustainable Development
SDG	Sustainable Development Goals

tCO ₂ e	Tonnes of Carbon di oxide equivalent
UNFCCC	United Nations Framework Convention on Climate Change
VVS	Validation and Verification Standard
VCS	Verified Carbon Standard
VCSA	Verified Carbon Standard Association
VCU	Verified Carbon Unit
VVB	Validation/Verification Body

APPENDIX B: COMPETENCE OF TEAM MEMBERS AND TECHNICAL REVIEWERS

Ms. Ran Fanlin	Team Leader	Ms. Ran Fanlin is an experienced technical expert in the field of climate change and GHG emission reduction. She has more than 10 years' experience in the development and implementation of CDM projects. She has participated in more than 30 CDM projects covering diversified scope, including wind power, hydro power, LNG power generation and biomass cogeneration. By developing project design document and monitoring report, desk review and onsite visit, she gained extensive experience in the whole process of CDM project developing.
Mr. Shen Meng	Technical Reviewer	Mr. Shen Meng is a Lead Auditor based in Beijing with experience in the validation and verification of more than 90 CDM projects, including wind power, hydro power, LNG cogeneration and energy efficiency projects. He has more than 5 years working experience for energy efficiency and energy conservation project. He has had responsibility to investigate new energy conservation technology, working together with the staffs on-site, establish and perform monitoring plan to confirm the actual effect of the technology, mainly focus on Boilers, Steam turbines, furnace efficiency, TRT, CDQ and Iron-steel production line, frequency control of motor speed, green light and efficiency of hydro turbines and then transfer to the relevant industry in China.

APPENDIX C: DOCUMENTS REVIEWED OR REFERENCED

No	Author	Title	References to the document	Provider
1.	Profit Carbon Environmental Energy Technology (Shanghai) Co., Ltd.	MR	Monitoring Report of Luohe Geothermal Based Space Heating System for 2 nd monitoring period - Draft Version 01, dated 24-May-2023 - Final Version 02, dated 20-Jun-2023 - Final Version 03, dated 18-Feb-2024	Profit Carbon Environmental Energy Technology (Shanghai) Co., Ltd.
2.	Profit Carbon Environmental Energy Technology (Shanghai) Co., Ltd.	ER Sheet	Emission Reduction Calculation sheet (related to this monitoring period) - Draft Version 01, dated 24-May-2023 - Final Version 02, dated 20-Jun-2023 - Final Version 03, dated 18-Feb-2024	Profit Carbon Environmental Energy Technology (Shanghai) Co., Ltd.
3.	Profit Carbon Environmental Energy Technology (Shanghai) Co., Ltd.	Approved JPM	Approved Joint-PD-MR of Luohe Geothermal Based Space Heating System, version 3.0, dated 02-June-2022	VERRA Website
4.	CTI	Joint Validation and Verification report	Joint Validation and Verification report of Luohe Geothermal Based Space Heating System, version 2.0, dated 06-Jun-2022	VERRA Website
5.	Local Market Supervision and Administration Bureau	Business License	Business License of Wanjiang New Energy Group Co., Ltd. and Profit Carbon Environmental Energy Technology (Shanghai) Co., Ltd.	PP
6.	Henan Juli Lianchuang Environmental Protection Technology Co., Ltd.	Environment Impact Assessment	Issued in February 2019	PP
7.	Luohe Ecological Environment Bureau	EIA approval	Issued on 31-May-2019	PP
8.	Zhejiang Jingwei Engineering Project Management Co., Ltd.	Feasibility Study Report	Issued in April 2019	PP
9.	Luohe Development and Reform Commission	Project Approval	Issued in February 2019	PP
10.	Project owner with end users	Heating supply contracts	Signed by project owner with 3 local property management	PP

			companies who handled 10 different sub-areas 1. Luohe New Century Property Service Co., Ltd. dated in 2021 2. Henan Jianye Property Management Co., Ltd. dated in 2021 3. Lvdu Property Management Co., Ltd. dated in 2021	
11.	Henan Institute of Metrology & State Grid Metrology Center Co., Ltd.	Calibration Reports	Calibration Reports to all the ultrasonic calorimeters with validity covering this monitoring period issued by Henan Institute of Metrology. Calibration Reports to all the electronical meters with validity covering this monitoring period issued by State Grid Metrology Center Co., Ltd.	PP
12.	General Administration of Quality Supervision, Inspection and Quarantine and CNAS	Certificate of Metrological Authorization	Certificate of Metrological Authorization of Henan Institute of Metrology issued by General Administration of Quality Supervision, Inspection and Quarantine on 01-Nov-2017 valid to 31-Oct-2022 and issued on 18-Jul-2022 valid to 17-Jul-2027 Certificate of Metrological Authorization of State Grid Metrology Center Co., Ltd. issued by CNAS on 05-Nov-2019 valid to 19-May-2023	PP
13.	Zhejiang Haiheng Pipe Industry Technology Co., Ltd. and Project Owner	Contract for Construction of Geothermal Space Heating System	Signed on 15-March-2020	Project Owner
14.	Luohe Development and Reform Commission	Certificate	Certificate of Enterprise Investment Project in Henan Province	PP
15.	Manufacturers	Technical agreement and Operating Instruction	Technical agreement and Operating Instruction of Geothermal Space Heating System	Project Owner
16.	PP	Operation log of the project	Hourly and Daily Operation log of the project	Project Owner
17.	PP	Monitoring manual	Monitoring manual for the monitoring of project	Project Owner
18.	State Grid Henan Electric Power Company Luohe Power	Agreement of Electricity Charges	Agreement of Electricity Charges dated on 25-Aug-2020	Project Owner

	Supply Company and project owner			
19.	PP	Operation record	Operation record of the geothermal based space heating system covering this monitoring period	PP
20.	PP	Meter reading records	Meter reading records of 42 meters covering this monitoring period	PP
21.	State Grid Henan Electric Power Company Luohe Power Supply Company	Monthly Electricity bills	Monthly Electricity bills issued by State Grid Henan Electric Power Company Luohe Power Supply Company for this monitoring period	PP
22.	Luohe Water Conservancy Bureau	Water drawing permit	Water drawing permit issued on 08-Jun-2020	PP
23.	Project Owner	Technical Training Records	Technical Training Records of project 1. Training Records in this monitoring period 2. Training register list	Project Owner
24.	PP	Declaration of No Double Counting	Issued on 10-Jan-2021	PP
25.	PP	Declaration of not involved in other GHG scheme	Issued on 10-Jan-2021	PP
26.	PP and employees	Labor contracts	Labor contracts signed with employees for implementation of this project	Project Owner
27.	PP	Salary slips	Monthly salary slips for employees	Project Owner
28.	Project Owner and local stakeholders	Local Stakeholder Consultation Records	Local stakeholder consultation process evidences during this monitoring period: 40 filled questionnaires by attendance	Project Owner
29.	Housing and Urban-Rural Development Department of Henan Province	Research on Heating in Winter of Luohe City	Research on Heating in Winter of Luohe City published on 20-Jan-2020	PP
30.	VVB	Site Visit Photo	Photo taken by VVB during site visit including main equipment, monitoring devices, etc.	N/A
31.	Ministry of Housing and Urban-Rural Development of the People's Republic of China	CJJ 34-2010	Design Code for City Heating Network	Public Website
32.	General Administration of Quality Supervision,	JGJ 225-2001	Verification Regulation of Heat Meters	Public Website

	Inspection and Quarantine			
33.	General Administration of Quality Supervision, Inspection and Quarantine	JJG 596-2012	Electrical Meters for Measuring Alternating-current Electrical Energy	Public Website
34.	IPCC	IPCC	2006 IPCC Guidelines for National Greenhouse Gas Inventories 2019 Refinement to 2006 IPCC Guidelines for National Greenhouse Gas Inventories	Project Owner
35.	UNFCCC	CDM Approved Methodology AM0072	“AM0072 Fossil Fuel Displacement by Geothermal Resources for Space Heating” (Version 03.0)	Project Owner
36.	UNFCCC	Methodological tool	Combined tool to identify the baseline scenario and demonstrate additionality (Version 07.0)	Project Owner
37.	UNFCCC	Methodological tool	Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation (Version 03.0)	Project Owner
38.	UNFCCC	Methodological tool	Tool to calculate the emission factor for an electricity system (Version 07.0)	Project Owner
39.	UNFCCC	Methodological tool	Common practice (Version 03.1)	Project Owner
40.	VERRA	Registration and Issuance Process	Registration and Issuance Process version 4.3	VCS website
41.	VERRA	VCS Program Definitions	VCS Program Definitions, v4.3	VCS website
42.	VERRA	VCS Program Guide	VCS Program Guide, v4.3	VCS website
43.	VERRA	VCS Standard	VCS Standard version 4.4	VCS website
44.	VERRA	Joint-PD-MR Template	VCS-Joint-Project-Description-Monitoring-Report-Template-v4.2	VERRA
45.	Ministry of Ecology and Environment of China	China cap & trade scheme	http://www.mee.gov.cn/xxgk2018/xxgk/xxgk02/202101/t20210105_816131.html	Public Website
46.	Ministry of Ecology and Environment of China	Enforced company list	http://mee.gov.cn/xxgk2018/xxgk/xxgk03/202012/W020201230736907682380.pdf	Public Website
47.	China CER Exchange Info-platform	China CER	http://cdm.ccchina.org.cn/ccer.aspx	Website
48.	GS	Gold Standard	http://www.goldstandard.org/	Website
49.	UNFCCC	UNFCCC	http://cdm.unfccc.int	Website
50.	VCS	VCS	https://verra.org/project/vcs-program/	Website

51.	Three manufacturers	Three manufacturers of coal-fired boiler	Zozen Boilers 79%. https://www.zhongzhengguolu.cn/product/DZL-ran-mei-zheng-gi.html , Fengcheng Energy Equipment Factory 80%. https://www.nyglrq.com/CWNGre-shuiguolu/270.html , Henan Hengxin Boiler Manufacturing Co., Ltd 85%. http://hxglzz.com/3g/show.asp?m=1&d=3439 .	Public Website
52.	Ministry of Ecology and Environment of the People's Republic of China	Baseline emission factor of China	2019 China regional power grid carbon dioxide baseline emission factor OM calculation instructions http://www.mee.gov.cn/ywgz/xdqhbh/wsqtz/202012/t20201229_815386.shtml	Project Owner
53.	China Government	Laws	"Environmental Protection Law of P.R. China" and "Law of the People's Republic of China on the Environmental Impact Assessment"	Public Website

APPENDIX D: CLARIFICATION REQUESTS, CORRECTIVE ACTION REQUESTS AND FORWARD ACTION REQUESTS

Table 1.Remaining FAR from validation and/or previous verification

FAR ID	N/A	Section no.		Date:
Description of FAR				
Project participant response				Date:
Documentation provided by project participant				
VVB assessment				Date:

Table 2.CL from this verification

CL ID	01	Section no.	2.2	Date : 07/06/2023
Description of CL				
PP did not clarify that if any comments received from grievance books during this monitoring period.				
Project participant response				Date : 20/06/2023
/1/- version 02				
Documentation provided by project participant				
MR has been supplemented. During this monitoring period, there is no comment received in the grievance books.				
VVB assessment				Date: 21/06/2023
The revised MR is checked, the clarification has been added. All stakeholders are allowed to record their grievances or comments in the book. The project owner will reply to the related issue. Via site inspection of the books, VVB confirmed that there were no negative comments received during this monitoring period. CL 01 is closed.				

Table 3.CAR from this verification

CAR ID	01	Section no.	1.1	Date : 07/06/2023
Description of CAR				
The table of audit history is not provided in line with MR template requirement. Revision is requested.				
Project participant response				Date : 20/06/2023
The table of audit history has been added to the MR Version 2.				
Documentation provided by project participant				
/1/- version 02				
VVB assessment				Date: 21/06/2023
The revised MR is checked, CCCI confirms that audit history information has been provided in line with MR template requirement and time periods are verified as correct by checking the dedicated VCS website for this case. CAR 01 is closed.				
CAR ID	02	Section no.	1.5	Date : 07/06/2023

Description of CAR	
The version of VCS standard used by the PP in MR is not the latest version, revision is requested,	
Project participant response	Date : 20/06/2023
The version of VCS standard is updated to Version 4.4 in the revised MR.	
Documentation provided by project participant	
/1/- version 02	
VVB assessment	Date: 21/06/2023
The updated MR is checked, PP has updated the version to 4.4 which is verified as the latest valid version by checking VCS website.	
CAR 02 is closed.	

CAR ID	03	Section no.	1.11	Date : 07/06/2023
Description of CAR				
1. The supporting evidence of SDG 7 is not provided in Appendix 1.				
2. For the contributions over project lifetime of SDG 7, the figure is not correct, it should not be the sum of figure in this monitoring period with previous, as there are same areas in previous and this monitoring period.				
Project participant response				Date : 20/06/2023
1. The supporting evidence of SDG 7 in Appendix 1 has been provided in the MR Version.				
2. From the operation start date of this project activity to the end of this monitoring period, the actual total heating area is 7,435,015 m ² , which covers the heating area of 6,987,854m ² in the first monitoring period (1st-November-2020~31st-March-2021).				
Documentation provided by project participant				
/1/- version 02				
VVB assessment				Date: 21/06/2023
1. The updated MR is checked, it is confirmed that the supporting evidence of SDG 7 is provided in Appendix 1. Renewable energy share in the total final energy consumption (Goal 7 of UN SDG, Target 7.2) – verified by interview with local residents and by checking FSR/8/ and heating supply contracts/10/.				
2. The updated MR is checked, it is confirmed that the local residents in actual heating area is 7,309,097 m ² from 01-Apr-2021 to 31-Mar-2022 and 7,435,015m ² from 01-Apr-2022 to 31-Mar-2023 have accesses to and relied on renewable energy during this monitoring period and local residents in actual heating area is 7,423,829.37m ² have accesses to and relied on renewable energy since the project started operation by considering these area covers the heating area of 6,987,854m ² in the first monitoring period, hence the contribution to this SDG has been confirmed for both monitoring period and project lifetime has been confirmed as correct.				
CAR 03 is closed.				

CAR ID	04	Section no.	3.1	Date : 07/06/2023
Description of CAR				
The actual value of heating load and areas of residential buildings for this monitoring period is missing.				
Project participant response				Date : 20/06/2023
For the monitoring period from 01-April-2021 to 31-March-2022, 7,309,097m ² of residential buildings with a heating load of 365.45MW. For the monitoring period from 01-April-2022 to 31-March-2023, 7,435,015m ² of residential buildings with a heating load of 371.75MW. The relevant information has been added to the latest MR.				
Documentation provided by project participant				
/1/- version 02				
/11/				
VVB assessment				Date: 21/06/2023

The updated MR is checked, PP has provided the related information as requested.
The utilization hours of the geothermal heating system were 3,624 hours (151 days*24h) during 2021-2022 heating season and 3,624 hours (151 days*24h) during 2022-2023 heating season within this monitoring period. It provided geothermal heat to 7,309,097m² of residential buildings with a total heating load of 365.45MW for 2021-2022 heating season (01-Nov-2021 to 31-Mar-2022) and provided geothermal heat to 7,435,015m² of residential buildings with a total heating load of 371.75MW for 2022-2023 heating season (01-Nov-2022 to 31-Mar-2023) which is confirmed as in line with the heating supply contracts/10/ due to not all residential buildings access to geothermal energy-based space heating system in the 2021-2022 and 2022-2023 winter seasons.
CAR 04 is closed.

CAR ID	05	Section no.	4.1	Date : 07/06/2023
Description of CAR				
For ex ante fixed parameter which refer to IPCC as the data source, the IPCC version need to be updated to the latest one and the related figure need to be updated if necessary.				
Project participant response				Date : 20/06/2023
2019 Refinement to 2006 IPCC did not change the value from 2006 IPCC, hence the value in 2006 is still applicable. The relevant information has been added to the latest MR.				
Documentation provided by project participant				
/1/- version 02				
VVB assessment				Date: 21/06/2023
The updated MR is checked, PP has added related information. The 2019 Refinement to 2006 IPCC has been checked and it is confirmed no update to the used value, so the value from 2006 IPCC is still applicable. CAR 05 is closed.				

CAR ID	06	Section no.	4.2	Date : 07/06/2023
Description of CAR				
For parameter $\Delta t_{i,d,y}$, the actual value for this monitoring period not correct, PP provided the value in last monitoring period.				
Project participant response				Date : 20/06/2023
As per the measured data during this monitoring period from 01-April-2021 to 31-March-2023, the average temperature change of the 42-heat exchange system of the 2021-2022 heating season (12 °C) and 2022-2023 heating season (11.99 °C) were cross checked by the design temperature difference of the end-user (10-15 °C). The relevant information has been added to the latest MR.				
Documentation provided by project participant				
/1/- version 02 /19/				
VVB assessment				Date: 21/06/2023
The updated MR is checked, PP has provided the actual value for this monitoring period, which is consistent with the operation record of the geothermal based space heating system/19/. CAR 06 is closed.				

CAR ID	07	Section no.	4.2	Date : 07/06/2023
Description of CAR				
For parameter $EC_{PJ,j,y}$, 1. The actual value for this monitoring period is not provided. 2. The cross-check result for this monitoring period is missing.				
Project participant response				Date : 20/06/2023
1. As per the measured data during this monitoring period from 01-April-2021 to 31-March-2023, the electricity consumption was 96,098.67 MWh. The relevant information has been added to the latest MR. 2. There were no missing data or damaged data during the 2 nd monitoring period. The electricity				

consumption of this monitoring period from 01-April-2021 to 31-March-2023 (96,098.67MWh) was cross checked with the electricity bill confirmed by each community property service company and payment receipt of the geothermal heating system. The relevant information has been added to the latest MR.	
Documentation provided by project participant	
/1/- version 02 /20/ /21/	
VVB assessment	Date: 21/06/2023
1. The updated MR is checked, PP has provided the actual value for this monitoring period, which is consistent with the source of electricity meter reading records/20/ and is cross-checked with Electricity bill/21/.	
2. The Electricity meter reading records/20/ is cross-checked with Electricity bill/21/, it is verified that all the data provided for cross-check are correct and reasonable and the values are consistent in both sources.	
CAR 07 is closed.	

CAR ID	08	Section no.	4.2	Date : 07/06/2023
Description of CAR				
For parameter A_m , the actual values for this monitoring period including two heating seasons are not provided respectively.				
Project participant response				Date : 20/06/2023
The relevant information has been added to the latest MR that 7,309,097 m ² for residential buildings of 2021-2022 heating season. 7,435,015 m ² for residential buildings of 2022-2023 heating season.				
Documentation provided by project participant				
/1/- version 02 /10/				
VVB assessment				Date: 21/06/2023
The updated MR is checked, PP has provided the actual value for this monitoring period, which are verified as correct by checking the heating supply contracts/10/.				
CAR 08 is closed.				

CAR ID	09	Section no.	5.4	Date : 07/06/2023
Description of CAR				
In section 5.4, the table of comparison of actual emission reduction and the estimation in the Joint-PD-MR is not consistent with the MR template. Revision is requested.				
Project participant response				Date : 20/06/2023
The comparison of actual emission reduction and the estimation in the Joint-PD-MR has been revised and updated in accordance with the requirements of the MR template. It has been added to the MR Version 2.				
Documentation provided by project participant				
/1/- version 02				
VVB assessment				Date: 21/06/2023
The updated MR is checked, PP has updated the table in line with the MR template. Refer to section 5 of this report for detail assessment.				
CAR 09 is closed.				

Table 4.FAR from this verification

FAR ID	N/A	Section No.	-	Date: -
Description of FAR				
Project participant response				Date: -

Documentation provided by project participant	
VVB assessment	Date: