HOUSING DECARBONISATION IN THE UNITED KINGDOM

Earthood

Document Prepared by Earthood Services Private Limited

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[1] Arctica Partners has been renamed as PNZ Carbon; throughout this report 'Arctica Partners', 'Arctica', 'Project Proponent' and 'PP' shall be read as PNZ Carbon.

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Summary:

Earthood Services Private Limited (hereafter referred to as Earthood) has been contracted by Arctica Partners Limited (hereafter referred to as Arctica Partners, Project Proponent or PP) to conduct the verification of the Grouped project - "*Housing Decarbonisation in the United Kingdom*" (VCS ID 2649), regarding the relevant requirements of VCS program guidelines and standard (VCS standard version 4.4 and VCS program guide version 4.3)/1,2/. Relevant requirements as well as confirming that the implementation of the registered monitoring plan as described under VCS PD, version 10.1/4/ and application of the monitoring methodology VM0008: "*Methodology for Weatherization of Single-Family and Multi-Family Buildings*", version 1.1 (VM0008 Methodology)/3/.

The grouped project activity involves emission reduction improvements made to dwellings, that is, energy efficiency measures directed at reducing the consumption of fossil fuel and grid-connected electicity within a dwelling. Examples include, but are not limited to, insulating, air sealing, improving the efficiency of the central heating system and reducing the grid-connected electricity consumption of appliances in existing dwellings.

Purpose: The objective of the verification is to perform a complete and independent review of the registered grouped project activity against the applicable VCS

requirements and monitoring methodology VM0008: "*Methodology for Weatherization of Single-Family and Multi-Family Buildings*", version 1.1, including the compliance with the registered monitoring plan. The verification is the periodic independent review and ex-post determination by Earthood of the monitored reductions in GHG emissions that have occurred as a result of the registered VCS project activity during a defined monitoring period.

Scope: The verification scope includes an independent and objective examination of the monitoring report (MR). The MR is evaluated in light of the applicable criteria and decisions made by the VCS Secretariat, including the approved baseline and monitoring methodology and registered VCS PD. The verification was conducted in accordance with the VCS standard, Version 4.4/1/, the VCS programme guide Version 4.3/2/, as well as a review of the registered PD/4/, Final Validation report/5/ and monitoring methodology VM0008: "Methodology for Weatherization of Single-Family and Multi-Family Buildings", version 1.1/3/.

This is the first monitoring under VCS, and the monitoring period covered under this verification is from 01/07/2022 to 31/12/2022.

The verification process, which was conducted following Earthood's internal quality procedures, consisted of the following phases:

i. Document review involving:

a) Review of data and information

b) Cross-checks between information provided in the monitoring report and information from sources using all available resources without regard to the Project Proponent's information.

ii. On-site assessment, including:

a) Evaluation of the registered VCS grouped project activity's implementation and operation in accordance with the registered VCS PD.

b) Evaluation of information flows for creating, collecting, and reporting monitoring parameters.

c) Interviews with relevant stakeholders to ensure that the operating and data collection procedures in the final monitoring period are carried out in line with the registered monitoring plan.

d) Cross-referencing information from the monitoring report with data from other sources, such as project databases, monitoring results, or other comparable data sources.

e) A review of the monitoring equipment, including calibration performance and observations of monitoring procedures in relation to the VCS PD and the methodology chosen.

f) Examine the calculations and assumptions used to determine GHG data and emission reductions.

g) Identifying quality control and quality assurance systems in place to avoid or detect and remedy any errors or omissions in the provided monitoring parameters.

iii. The final verification report and opinion, as well as the resolution of lingering difficulties.

A risk-based approach has been followed to perform this verification, and there are no uncertainties associated with this verification. During the current verification, a total of 04 findings were raised, which include 01 Corrective Action request (CARs) and 03 Clarification requests (CLs). Additionally, FAR01, which was raised during validation, was reviewed during this verification. The project proponent has successfully resolved all raised issues.

The MR, emissions reduction calculations and accompanying documents provided are all in compliance with VCS criteria. The verification was completed with a reasonable level of, assurance, and no uncertainties were found relatedto the project activity verification.

Earthood Services Private Limited (hereafter referred to as Earthood) certifies that the project is implemented in accordance with the registered VCS PD and the applied baseline and monitoring methodology VM0008.

Furthermore, the project meets the requirements of the VCS Standard v4.4 and is in line with all relevant VCS requirements. The emission reductions achieved during the current monitoring period are calculated without material misstatements. Earthood's verification approach is based on the understanding of the risks associated with reporting of GHG emission data and the controls in place to mitigate these. Earthood planned and performed the verification by obtaining evidence and other information and explanations that Earthood considered necessary to give reasonable assurance that reported GHG emission reductions are fairly stated.

Based on the information evaluated, we confirm that the emission reductions from the grouped project activity, *"Housing Decarbonisation in the United Kingdom"* during the monitoring period 01/07/2022 to 31/12/2022 amounts to 1,481 tons of CO2e. Note that this project is a Grouped Project. Additional PAIs have been added since validation commenced. As per the registered VCS PD, the project initially estimated achieving 82 tCO2e emission reductions per year based on an initial 28 PAIs. However, since validation of the PD commenced, additional PAIs have been added and the Monitoring Report includes information regarding the first 6,717 PAIs included in the project activity. The

registered VCS PD only reflected the emission reductions that were anticipated from the initial 28 PAIs and was, therefore, not a reflection of the emission reductions that will be achieved during the verification periods. Additional PAIs will continue to be added throughout the crediting period.

This project covers emission reduction improvements made to dwellings, that is, energy efficiency measures directed at reducing the consumption of fossil fuel and grid-connected electricity within a dwelling. Examples include but are not limited to, insulating, air sealing, improving the efficiency of the central heating system and reducing the grid-connected electricity consumption of appliances in existing dwellings. The project uses the "Methodology for Weatherization of Single-Family and Multi-family Buildings" VM0008 Version 1.1 (VM0008 Methodology).

The VVB has confirmed that:

- The MR has been produced in accordance with the monitoring plan.
- The monitoring report is transparent and adequate.

1 INTRODUCTION

1.1 Objective

Earthood Services Private Limited (hereafter referred to as Earthood) has been contracted by Arctica Partners Limited (hereafter referred as Arctica Partners) to conduct the verification of the Grouped project titled "*Housing Decarbonisation in the United Kingdom*" (VCS ID - 2649). The assessment team has reviewed the GHG data collected to date for the monitoring period from 01/07/2022 to 31/12/2022 covered in the current verification.

The purpose of the verification is to review the monitoring results and verify that the monitoring methodology was implemented according to the registered monitoring plan and monitoring data, used to confirm the reductions in anthropogenic emissions by sources is sufficient, definitive, and presented in a concise and transparent manner. In order to establish that the grouped project activity has been implemented in line with registered design and conservative assumptions, as documented, the monitoring plan, monitoring report, and the project's compliance with applicable VCS, and host party requirements are specifically verified. This verification is a thorough and independent assessment of the registered project activity against the applicable VCS requirements by the VVB. The verification process shall determine whether registered project activity complies with the requirements of the latest VCS guidelines, applicability conditions of the monitoring methodology, relevant host country regulations and guidance issued by the VCS Board.

1.2 Scope and Criteria

The scope of verification is to assess the claim and assumptions made in the VCS monitoring report against the VCS criteria, including but not limited to, VCS standard version 4.4 applied methodology and other relevant rules and requirements established for VCS project activities.

- To verify the project implementation and operation with respect to the registered VCS PD.
- To verify the implemented monitoring plan with the registered VCS PD and applied baseline and monitoring methodology.
- To verify that the actual monitoring systems and procedures are in compliance with the monitoring systems and procedures described in the registered monitoring plan.
- To evaluate the GHG emission reduction data and express a conclusion with a reasonable level of assurance about whether the reported GHG emission reduction data is free from material misstatements.
- To verify that reported GHG emission data is sufficiently supported by evidence.

The verification is not meant to provide any consultation towards the project proponent. However, stated requests for clarification and/or corrective action requests may have provided inputs for improvement of the project design. The verification shall ensure that the reported emission reductions are complete and accurate in order to be certified.

1.3 Level of Assurance

⊗ Reasonable level of assurance

○ Limited level of assurance

The level of assurance of the verification report falls under reasonable assurance engagement as selected by the client. Reasonable assurance is a high level of assurance regarding material misstatements, but not an absolute one.

Reasonable assurance includes the understanding that there is a remote likelihood that material misstatements will not be prevented or detected on a timely basis. To achieve reasonable assurance, the auditor needs to obtain sufficient appropriate audit evidence to reduce audit risk to an acceptably low level. This means that there is some uncertainty arising from the use of sampling, since it is possible that a material misstatement will be missed.

The evidence used to achieve a reasonable level of assurance is specified in section 2.3 and 2.4 of this report.

1.4 Summary Description of the Project

The grouped project activity *"Housing Decarbonisation in the United Kingdom"* includes emission reduction improvements to single family dwellings using the *"Methodology for Weatherization of Single-Family and Multi-family Buildings"* VM0008 Version 1.1 (VM0008 Methodology). Emission reduction improvements are made to existing dwellings. Emission reductions are generated by energy efficiency measures directed at reducing the consumption of fossil fuel and grid-connected electricity within a dwelling compared to baseline consumption. Emission reduction improvements made to existing dwellings are referred to as "decarbonisation" throughout this document. This project targets a range of individual single-family dwellings (referred to as "individual dwellings" or "project activity instances" (PAIs) throughout this document).

As per the registered PD and validation report the project initially estimated achieving 82 tCO2e emission reductions per year based on an initial 28 PAIs. However, since validation of the PD commenced, additional PAIs have been added and the Monitoring Report (hereafter referred to as MR) includes information regarding the first 6,717 PAIs included in the project activity. The registered VCS PD only reflected the emission reductions that were anticipated from the initial 28 PAIs and was therefore, not a reflection of the emission reductions that will be achieved during the verification periods.

This project is defined as a "Grouped Project" where the project proponent acts as a central administrator towards the objective of expediting the pace of housing decarbonisation throughout the United Kingdom. The project proponent collects, monitors, and aggregates data necessary to demonstrate additionality and quantify GHG emission reductions.

The project activity location is within the boundaries of the United Kingdom and all dwellings added to the project activity fall within the physical boundary of the sovereign state of the United Kingdom. The geodetic coordinates of each individual dwelling in the project activity have been recorded and each dwelling in the project assigned a unique identification number. The project crediting period start date is 01/07//2022. The project crediting period continues for seven years to 30/06/2029 (1st crediting period), twice renewable for a total of 21 years.

2 VERIFICATION PROCESS

The registered VCS project is undergoing first verification under its initial 7 years crediting period, the approach adopted to ensure the quality of emission reduction is described in the following sections.

2.1 Method and Criteria

The verification approach consists of two phases:

In the first phase, Earthood completed a strategic review and risk assessment of the project activities and processes in order to gain a full understanding of:

- Activities associated with all the sources contributing to the project emissions and emission reductions, including leakage if relevant.
- Protocols used to estimate or measure GHG emissions from these sources.
- Collection and handling of data.
- Controls on the collection and handling of data.
- Means of verifying reported data.
- Compilation of the Verification Report.

At the end of this phase, Earthood produced a Verification Checklist which, based on the risk assessment of the parameters and data collection and handling processes for each of those parameters, describes the verification approach and the sampling plan.

In the second phase, Earthood verified the implementation of the monitoring plan and the data presented in VCS MR for the current monitoring period. This involves desk review of the Monitoring Report, on-site interviews of project proponent representative's and on-site visit to the households of project beneficiaries. This verification report describes the findings of this assessment.

2.2 Document Review

The verification is performed as a document review of the registered VCS PD/4/ & monitoring report/24/, validation report/5/ and associated documents as listed in appendix 1 of this document. The assessment is performed by a verification team as a protocol. The review is based on cross check between information provided in the Monitoring Report, VCS PD and information from sources other than those made available by the PP, through the team's sectoral or local expertise and, if necessary, independent background investigations.

2.3 Interviews

In accordance with VCS standard, version 4.4/1/, para 4.1.9 *"A site visit that includes a visit to facilities and/or project areas shall be conducted at validation. Such a site visit shall be conducted at verification under the following circumstances:*

1) The first verification of the project after validation;

2) Verification of project baseline reassessments; and

3) Verifications that assess a project description deviation where the deviation impacts the applicability of the methodology, additionality, or the appropriateness of the baseline scenario"

The Team Leader and TA Expert have carried out onsite interviews with support of the local expert in order to verify the information included in the project documentation and to gain additional information regarding the compliance of the project with the registered monitoring plan and requirement of the applied methodology.

The on-site inspection and interviews for a selection of the sample project locations was carried out by the assessment team, which consisted of the Team Lead, TA Expert, and Local Expert/Verifier (trainee). This was conducted from 03/04/2023 to 05/04/2023 and the following stakeholders were interviewed, and their attendance recorded in the attendance log.

Interviews with the representatives of Project Proponent and Field Assistance:

Name of Interviewee	Affiliation	Topic	Date of inteview
Simon Turek	Managing Director, Arctica Partners	Multiple discussions with a representative of Arctica Partners regarding all aspects of the project	Date(s) Interviewed: 03/04/2023 - 05/04/2023
Martin Parker	RetrofitCredits	Multiple discussions	Date(s) Interviewed:

	Director, Arctica Partners	with a representative of Arctica Partners regarding the energy assessment aspects of the project	03/04/2023 - 04/04/2023
xxxxxx[2]	Head of Climate Change at Luton Borough Council	A discussion with a representative of LBC regarding the legal aspects of the project	Date(s) Interviewed: 04/04/2023
xxxxxx	Project Manager for Retrofit Projects, Luton Borough Council	A discussion with a representative of LBC regarding the physical installed measures within the project	Date(s) Interviewed: 04/04/2023

During the on-site audit by the assessment team, the interviews of the field personnel with representatives from the housing owners were also conducted to verify the details regarding the dates and which decarbonisation measures were applied and with the PP representatives for verification of the processes involved in the monitoring report data collection. For the interviews of the field personnel, this was carried out by the assessment team, along with a PP representative. A number of households (19) were also interviewed during the site visits.

For cross-checking of the monitoring report results, in line with standard for 'Sampling and Surveys for CDM Project Activities and Programmes of Activities' v09.0/26/, the assessment team has visited 19 PAIs in the United Kingdom, based on simple random sampling. The information of the households interviewed, and the topics covered during the onsite audit are given in the below.

PAI	Improvement Measure	Provider	Date	Discussion
28296	External Wall Insulation	Luton Borough Council	04/04/2023	Confirmed implemented measures with Project Manager for Retrofit Projects
28297	External Wall Insulation	Luton Borough Council	04/04/2023	Confirmed implemented measures with Project

[2] Name removed for confidentiality. Annex submitted with the validation report

				Manager for Retrofit Projects
28107	External Wall Insulation	Luton Borough Council	04/04/2023	Confirmed implemented measures with Project Manager for Retrofit Projects
28292	External Wall Insulation	Luton Borough Council	04/04/2023	Confirmed implemented measures with Project Manager for Retrofit Projects
28170	External Wall Insulation	Luton Borough Council	04/04/2023	Confirmed implemented measures with v
28291	External Wall Insulation	Luton Borough Council	04/04/2023	Confirmed implemented measures with Project Manager for Retrofit Projects
23996	Loft Insulation	Luton Borough Council	04/04/2023	Confirmed implemented measures with Project Manager for Retrofit Projects
24014	Loft Insulation	Luton Borough Council	04/04/2023	Confirmed implemented measures with Project Manager for Retrofit Projects
24015	Loft Insulation	Luton Borough Council	04/04/2023	Confirmed implemented measures with Project Manager for Retrofit Projects
24145	Loft Insulation	Luton Borough Council	04/04/2023	Confirmed implemented measures with Project Manager for Retrofit Projects
21589	Boiler Replacement	Golding Homes	05/04/2023	Confirmed implemented measures with households
21978	Boiler Replacement	Golding Homes	05/04/2023	Confirmed implemented measures with households
21679	Boiler Replacement	Golding Homes	05/04/2023	Confirmed implemented measures with households
22074	Boiler Replacement	Golding Homes	05/04/2023	Confirmed implemented measures with households
21699	Boiler Replacement	Golding Homes	05/04/2023	Confirmed implemented measures with households
21508	Boiler Replacement	Golding Homes	05/04/2023	Confirmed implemented measures with households

22202	Boiler Replacement	Golding Homes	05/04/2023	Confirmed implemented measures with households
22401	Boiler Replacement	Golding Homes	05/04/2023	Confirmed implemented measures with households
21961	Boiler Replacement	Golding Homes	05/04/2023	Confirmed implemented measures with households

Through the onsite interviews conducted by the verification team and comparing them with the evidence and monitoring conducted by the PP, the assessment team confirms the project is implemented in line with the registered PD. There is no change in the registered monitoring and the operational plan.

2.4 Site Visits

As already discussed in the above section, physical site inspection is done for the current verification in line with paragraph 4.1.9 of the VCS standard, version 4.4. An on-site audit was undertaken by members of the assessment team from 03/04/2023 to 05/04/2023 to carry out the following:

- An assessment of the implementation and operation of the registered project activity as per the registered VCS PD and MR.
- Interview with relevant personnel to determine whether data collection procedures are implemented in accordance with the registered monitoring plan in the PD.
- A cross check between information provided in the monitoring report and data and parameters from other sources and centralised data repositories, government databases, monitoring results spreadsheets, or similar data sources.
- A review of calculation and assumptions made in determining the baseline and actual GHG data and emission reductions
- Relevant QA/QC procedures were checked to prevent, identify, and correct, any error in the reported monitoring parameters.

VVB Sampling Approach:

In compiling the sample group, the following requirements from 'Sampling and surveys for CDM project activities and programmes of activities Version 09.0' have been applied:

The VVB may apply a sampling approach for on-site visits and/or remote surveys as part of validation/verification, applying the *"Guideline: Sampling and surveys for CDM project activities and programme of activities"*/27/, irrespective of whether the above-mentioned sampling plan exists or the project proponents or the coordinating/managing entity have undertaken sampling surveys.

When the project proponents or the coordinating/managing entity have not applied a sampling approach, the VVB may apply a sampling approach, choosing a different confidence/precision than the ones indicated in paragraph 11 above, provided that samples are randomly selected and are representative of the population.

Our target level of confidence and the precision was set at 90/20.

The sample group is a simple random sample.

The sample size *n* and margin of error *E* are given by

$$Z(^{c}/_{100})^{2}r(100\text{-}r)$$

$$^{N\,x}/_{((N\text{-}1)E^{2}\,+\,x)}$$

$$\text{Sqrt}[^{(N\,-\,n)x}/_{n(N\text{-}1)}]$$

where *N* is the population size, *r* is the fraction of responses that you are interested in, and *Z*(*c*/100) is the critical value for the confidence level *c*.

Where: N = 6,717

E = 20%

r = 50%

Z(c/100) = 90%

Based on the above calculation (which was also cross-checked against an online tool for calculation of the sample size for a population/15/), the minimum sample size required is 17, we carried out site visits on two extra PAIs to total 19 PAIs. These were composed of different decarbonisation approaches, 6 of which being external wall insulation, 4 of which being loft insulation, and 9 of which being boiler replacements.

2.5 Resolution of Findings

The objective of the step is to identify, discuss, and conclude on the issues related to the monitoring, implementation and operations of the registered project activity that could impair the capacity of the registered project activity to achieve emission reductions or influence the monitoring and reporting of emission reductions. This is done based on the desk review and on-site assessment. The verification team prepares and/or updates a verification protocol (internal document) that records the conformities and non-conformities, which may be of following types:

CAR (Corrective Action Request) is raised if one of the following occurs:

- Non-compliance with the monitoring plan, the applied methodology or the standardized baseline are found in monitoring and reporting and has not been sufficiently documented by the project proponents, or if the evidence provided to prove conformity is insufficient.
- Modifications to the implementation, operation and monitoring of the registered project activity has not been sufficiently documented by the project proponents.
- Mistakes have been made in applying assumptions, data or calculations of emission reductions that will impact the quantity of emission reductions.
- Changes to the key sustainable development indicators.
- Issues identified in a FAR during validation to be verified during verification or previous verification(s) have not been resolved by the project proponents.

Clarification request (CL) is raised if information is insufficient or not clear enough to determine whether the applicable requirements have been met.

Forward Action Request (FAR) is raised during verification if the monitoring and reporting require attention and/or adjustment for the next verification period.

All CARs and CLs raised by the Earthood during verification shall be resolved prior to submitting a request for issuance. All the findings that are raised and communicated to project proponents during the verification are included under Appendix 4. The section also includes the responses by the project proponents and an assessment by the verification team if it was closed out or otherwise.

The total of 03 CLs and 01 CAR were raised in the current verification and successfully closed. Additionally, FAR01, which was raised during validation, was also addressed, and closed during this verification.

2.5.1 Forward Action Requests

The project activity is undergoing first verification in VCS. No FAR was raised during the current monitoring period. Additionally, the open FARs from the registered PD and validation report applicable for the current monitoring period have been addressed, details for which can be found in Appendix 4 of this verification report.

2.6 Eligibility for Validation Activities

This section is not applicable for present verification as Earthood holds the accreditation for the validation of project under Sectoral Scope 03.

3 VALIDATION FINDINGS

3.1 Participation under Other GHG Programs

The project is registered under VCS only (VCS ID – 2649).

The Project Proponent has provided a declaration/20/ that the net GHG emission reductions generated by the project activity will not be used for compliance with any other emission trading program or to meet binding limits on GHG emissions for the same monitoring period. This was further cross-checked and confirmed from the other GHG registries. The project is not found to be participating in any other GHG programme.

3.2 Methodology Deviations

There are no methodology deviations identified during the current monitoring period.

3.3 Project Description Deviations

There are no project description deviations identified during the current monitoring period.

3.4 Grouped Project

The grouped project activity has identified every individual dwelling as a single PAI. The eligibility criteria for inclusion of dwellings have been explained below. The Project Proponent has included 6,717 dwellings (individual households) as total PAIs (28 PAIs were already included at the time of registration and the rest during this monitoring period/18/). The Project Proponent has designed 16 points eligibility criteria for the inclusion of any PAIs in the project activity. Every PAI will be assessed against the 16 points criteria before inclusion by the Project Proponent. The evidence of such assessment will be recorded by the Project Proponent.

The 16 points eligibility criteria and the validation of inclusion of the new PAIs by the assessment team, has been summarized below:

1. Criteria: The dwelling is located within the project boundary.

   Validation of inclusion: The Project Participant has included 6,717 PAIs and has implemented energy efficiency measures in these PAIs. All these PAIs have a participant contract signed with Arctica Partners and the Housing Associations' Charitable Trust (hereon referred to as HACT). Every PAI has been given a unique code or serial number. In the UK every property has a Unique Property Reference Number (UPRN) and all UPRN applicable to these PAIs were recorded and provided to the VVB/6/. The UPRN can be cross-checked on the government website for the verification of address and geo-coordinates/7/. The address and geo-coordinates of 19 sampled PAIs was cross verified from the website, and it was confirmed the location for all these dwellings is the same as reported by project proponent and within the project boundary, i.e., in the United Kingdom.

2. Criteria: The dwelling is a single-family dwelling.

   Validation of inclusion: Local Authorities issue a license for any dwelling to be a house of multiple occupants and maintain a record and make it public (Register of Licenses of Houses in Multiple Occupation)/8/. The register was reviewed and found that the no sampled dwelling is categorized as house in multiple occupation/9/. This was further confirmed during site-visit through interviews with the housing managers. It is therefore confirmed that all PAIs are single-family dwellings.

3. Criteria: The dwelling is in the same income group (low-income).

Validation of inclusion: The PAIs added during this monitoring period are identifiable from the project database. Where the dwelling is social housing stock under the Housing and Regeneration Act 2008/10/, these PAIs fall in the low-income group as per the definition in the registered PD/11/. The dwellings falling under the status of social housing stock have been confirmed to be falling in the low-income group/5/. This was further confirmed from the declaration provided by each regulated provider of social housing or public entity in their participant contract/13/. For non-social housing, the neighborhoods falling under the category 'deprived' as defined by the Department for Levelling Up, Housing and Communities/21/ are in the low-income group as per the definition in the registered PD.

4. Criteria: The dwelling is in the same income group (middle-income).

   Validation of inclusion: The PAIs added during this monitoring period are identifiable from the project database as middle income groups. These PAIs are not social housing under the Housing and Regeneration Act 2008/10/. All such PAIs are in the middle-income group as per the definition in the registered PD/11/. These dwellings have been confirmed to be falling in the middle-income group. Further, dwellings not located within a 'deprived' neighbourhood are middle-income dwellings with 95% certainty, as already established in the registered PD/4/. This confidence level exceeds the confidence interval of 90% established by VCS Methodology VM0008 and is therefore, acceptable.

5. Criteria: The dwelling is not in the same income group (high-income).

   Validation of inclusion: Please refer to validation for criteria 3 and 4. None of the PAIs fall in the high-income group as per the definition in the registered PD.

6. Criteria: Project ownership is accorded to the project proponent by a contractual agreement with the holder of the statutory, property or contractual right in the plant, equipment or process that generates GHG emission reductions.

   Validation of inclusion: The verification team reviewed the project proponent contract, namely Contract for Provision of Verified Carbon Unit Services/13/, which is signed between Arctica Partners, HACT and the holder of the statutory, property or contractual right in the plant, equipment or process that generates GHG emission reductions. The contract vests the ownership in the project proponent, thus meeting the inclusion criterion.

7. Criteria: The condition of the dwelling is adequate for project activities according to nationally recognised best practice standards. Project activities do not result in violation of health and safety, environmental, or other relevant regulations.

Validation of inclusion: All PAIs (both social and non-social housing stock) have a Building Regulation Compliance Certificate, a certificate under Publicly Available Specifications (PAS) or equivalent standard, a declaration by the holder of the statutory, property or contractual right in the plant, equipment or process that generates GHG emission reductions that work was carried out by a person registered with a competent person scheme, or a declaration by a regulated provider of social housing or public entity, for confirmation that dwellings remain adequate for project activities and do not result in a violation of health, safety, environment and other regulations. Sample Contract for Provision of Verified Carbon Unit Services/13/, which is signed between Arctica Partners, HACT and the holder of the statutory, property or contractual right in the plant, equipment or process that generates GHG emission reductions, were cross-checked by the verification team to confirm that all holders of the statutory, property or contractual right in the plant, equipment or process that generates GHG emission reductions have provided a declaration for meeting the required criterion.

8. Criteria: The replacement appliances replaces functioning appliances.

   Validation of inclusion: The Contract for Provision of Verified Carbon Unit Services signed between the PP and the holder of the statutory, property or contractual right in the plant, equipment or process that generates GHG emission reductions requires the confirmation and declaration from the owner that the replacement of appliances replaces functioning appliances. The contracts were reviewed and found meeting the criterion/13/.

9. Criteria: The dwelling is occupied at the time of project activity. Vacancy is permitted on an intermittent basis for up to three months, or if the dwelling is occupied seasonally on an annual basis.

   Validation of inclusion: The occupancy of dwellings was checked from the records of the Regulator of Social Housing Register, and it was confirmed that all PAIs part of the sampling are occupied. During the site visit, the housing managers and dwellings were also interviewed to confirm that these dwellings were occupied during the monitoring period. Further, the Contract for Provision of Verified Carbon Unit Services signed between the PP and the holder of the statutory, property or contractual right in the plant, equipment or process that generates GHG emission reductions requires the confirmation and declaration from the owner about occupancy of the dwelling at the time of project activity, with vacancy permitted on an intermittent basis for up to three months. The contracts were reviewed and found to meet the criterion/13/.

10. Criteria: The capacity of any replacement appliance or component of a central heating system satisfies the energy load (the sum of the heat load and the electricity demand) within the dwelling.

    Validation of inclusion: All PAIs have a Building Regulation Compliance Certificate, Gas Safety Certificate, a certificate under Publicly Available Specifications (PAS) or equivalent standard, a declaration by the holder of the statutory, property or contractual right in the plant, equipment or process that generates GHG emission reductions that work was carried out by a person registered with a competent person scheme, or a declaration by a regulated provider of social housing or public entity, for confirmation that the capacity of any replacement appliance or component of a central heating system satisfies the energy load. Sample Contract for Provision of Verified Carbon Unit Services/13/, which is signed between Arctica Partners, HACT and the holder of the statutory, property or contractual right in the plant, equipment or process that generates GHG emission reductions, were cross-checked by the verification team to confirm that all holders of the statutory, property or contractual right in the plant, equipment or process that generates GHG emission reductions have provided a declaration for meeting the required criterion.

11. Criteria: In the case of heating systems that serve multiple dwellings, all residential dwellings connected to the system are included in the project.

    Validation of inclusion: Sample Contract for Provision of Verified Carbon Unit Services/13/, which is signed between Arctica Partners, HACT and the holder of the statutory, property or contractual right in the plant, equipment or process that generates GHG emission reductions, were cross-checked by the verification team to confirm that all holders of the statutory, property or contractual right in the plant, equipment or process that generates GHG emission reductions have declared that heating systems supplying the dwellings do not serve multiple dwellings.

12. Criteria: The project activity is not mandated or required by law or regulation.

Validation of inclusion: No energy efficiency measures which are part of the project activity are mandated by the local laws and it was cross-checked against the relevant Regulator of Social Housing's requirements/16/. Confirmation that the project activity is not mandated by law has also been included as a condition of the Contract for Provision of Verified Carbon Unit Services to be signed between the PP and the holder of the statutory, property or contractual right in the plant, equipment or process that generates GHG emission reductions. Sample Contract for Provision of Verified Carbon Unit Services/13/, which is signed between Arctica Partners, HACT and the holder of the statutory, property or contractual right in the plant, equipment or process that generates GHG emission reductions, were cross-checked by the verification team to confirm that all holders of the statutory, property or contractual right in the plant, equipment or process that generates GHG emission reductions have provided a declaration for meeting the required criterion.

13. Criteria: The dwelling meets or exceeds the performance benchmark as calculated for the Same Building Stock.

    Validation of inclusion: The PP has calculated the performance benchmark using the model which uses data collected from the pre-retrofit energy assessment for every dwelling and then a post-retrofit energy assessment after the implementation of energy efficiency measures. These assessments were conducted by third party accredited energy assessors certified by a public authority, or a private certification program recognised by a public authority. Energy assessments are conducted using the Standard Assessment Procedure (SAP) which is the Government-approved National Calculation Methodology for assessing the energy performance of dwellings/17/. The performance benchmark reported in the VCS PD for sample PAIs has been cross checked with the actual data and calculations are found correct/4/. Any dwelling not meeting the benchmark is not considered for claiming the emission reductions calculations.

14. Criteria: The decarbonisation measures fall into one of categories A or B.

    Validation of inclusion:

    Category A — A combination of energy efficiency measures directed at the enhancement of the building envelope (e.g., air infiltration, insulation), and improving the efficiency of the central heating and/or cooling system and reducing fossil fuel and grid-connected electricity consumption of appliances (e.g., replacement of ventilation units and lamps).

    Category B — A combination of energy efficiency measures directed at the enhancement of the building envelope (i.e., air infiltration, insulation), and improving the efficiency of the central heating and/or cooling system only.

Sample Contract for Provision of Verified Carbon Unit Services/13/, which is signed between Arctica Partners, HACT and the holder of the statutory, property or contractual right in the plant, equipment or process that generates GHG emission reductions, were cross-checked by the verification team to confirm that all holders of the statutory, property or contractual right in the plant, equipment or process that generates GHG emission reductions have declared that the project activity involves a combination of energy efficiency measures directed at the enhancement of the building envelope, improving the efficiency of the central heating and/or cooling system and reducing energy consumption of appliances, thus meeting the required condition.

15. Criteria: The decarbonisation measures do not involve fuel switching

    Validation of Inclusion: Sample Contract for Provision of Verified Carbon Unit Services/13/, which is signed between Arctica Partners, HACT and the holder of the statutory, property or contractual right in the plant, equipment or process that generates GHG emission reductions, were cross-checked by the verification team to confirm that all holders of the statutory, property or contractual right in the plant, equipment or process that generates GHG emission reductions have declared that the project activity uses and applies electricity or another fuel source that was already a source of emissions in the dwelling prior to the project activity, thus meeting the required condition.

16. Criteria: To control the risk of leakage, all boilers that are replaced as part of the project activity are disposed of properly.

    Validation of inclusion: Sample Contract for Provision of Verified Carbon Unit Services/13/, which is signed between Arctica Partners, HACT and the holder of the statutory, property or contractual right in the plant, equipment or process that generates GHG emission reductions, were cross-checked by the verification team to confirm that all holders of the statutory, property or contractual right in the plant, equipment or process that generates GHG emission reductions have declared that to control the risk of leakage, all boilers that are replaced as part of the project activity are disposed of properly.

4 VERIFICATION FINDINGS

4.1 Project Implementation Status

The project activity is developed as a group project activity. The project activity involves emission reduction improvements made to dwellings, that is, energy efficiency measures directed at reducing the consumption of fossil fuel and grid-connected electricity within a dwelling.

A total of 6,717 dwellings were added during the current monitoring period as confirmed from the project database/22/. The installation and implementation are in line with the details provided in the registered PD. The measures installed in the dwellings include boiler replacement, external wall insulations, roof replacement, double glazing, etc. The implementation status of the measures was verified during the on-site audit and found to be in operational condition. The assessment team confirms that the measures are in place, in line with the PD requirements.

The project proponent of the project activity is Arctica Partners who owns the rights to carbon credits generated from the project activity.

The verification team has interviewed the project representatives, holders of the statutory, property or contractual right in the plant, equipment or process that generates GHG emission reductions and housing managers during the on-site audit and confirmed that the project has been implemented as planned and as mentioned in the VCS PD/4/, the records available and the monitoring survey forms. The project has been implemented as described in the revised VCS PD/4/ and no discrepancy was identified between the project implementation and the project description. The data and variables provided in the monitoring report are the same as stated in the approved PD/3/. PP has submitted the project records, including project specific reports generated for sampled dwellings/23/, Contract for Provision of Verified Carbon Unit Services with the Project Proponent/13/, source data for the SAP assessments, among other relevant documents.

This is the first verification of the project and the total emission reductions achieved under this monitoring period i.e., from 01/07/2022 to 31/12/2022 are 1,481 tCO2e.

The assessment team concludes the following:

1. There are no material discrepancies between project implementation and the project description provided in the registered PD.
2. The monitoring plan is implemented in line with the registered monitoring plan and monitoring system (i.e., process and schedule for obtaining, recording, compiling, and analysing the monitored data and parameters) is appropriate.
3. There are no material discrepancies between the actual monitoring system, and the monitoring plan set out in the project description/4/ and the applied methodology/3/.
4. All the ex-ante parameters which are used in the calculations of the emission reductions are consistent with the VCS PD/4/.
5. The GHG emission reductions or removals generated by the project have not been included in another emission trading program or any other mechanisms that include GHG allowance trading.
6. The project has not received or sought any other form of environmental credit or has become eligible to do so since validation.

7. The project activity is registered under VCS only.

In view of the information verified above, the assessment team can conclude that the project has been implemented as described in the project description.

4.2 Safeguards

4.2.1 No Net Harm

The verification team does not see and identify any potential negative environmental and socio-economic impacts. The assessment team also cross-checked this by assessing the project design and interviewing stakeholders during the visit and confirmed that there are not any potential negative environmental and socio-economic impacts attributed to the project activity.

4.2.2 Local Stakeholder Consultation

The project proponent has established a mechanism for ongoing communication with local stakeholders by promoting an email address to which local stakeholders have been invited to provide feedback (housing@arcticapartners.com). The project proponent has also partnered with HACT, the charity of the social housing sector and specialists in helping organisations active in the housing sector to evaluate, monitor and improve their services. HACT has supported the transformation and development of housing provision in the UK for over 60 years. HACT has been engaging with the local stakeholders at regular intervals. The project proponent has not reported any grievances or comments received during the monitoring period.

4.3 AFOLU-Specific Safeguards

This section is not applicable as the project is a non-AFOLU project.

4.4 Accuracy of GHG Emission Reduction and Removal Calculations

The assessment team has reviewed the monitoring plan and found out that the monitoring of GHG emission reduction from the project activity was implemented in accordance with the registered PD/4/. The monitoring plan has been implemented as per the applied methodology and all the parameters in the monitoring plan had been sufficiently monitored as per the applied methodology.

Data and Parameters monitored: The verification team has provided a detailed assessment of the monitored parameters specific to this monitoring period below, i.e., parameters specific to pre- and post-retrofit audit approach only. None of the other methods proposed in the applied methodology or the PD have been applied during this monitoring period for determination of the emission reductions.

1. **Pre-retrofit energy load of Dwelling *i*, EL*pre, i***

Means of verification	Criteria/Requirements	Assessment/Observation
	Measuring/ Reading/ Recording frequency	As per the applied methodology and registered PD, the parameter is to be recorded once per dwelling prior to implementation of the project activity.
	Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes/No)	Yes, measuring and reporting frequency is in accordance with registered monitoring plan and methodology.
	Monitored Value	The value is determined individually for each dwelling and reported in the emission reduction calculation sheet.
	Monitoring equipment	Energy modelling software used by the SAP Assessors that implements the latest version of SAP Manual/17/.
	Is the accuracy of the monitoring equipment as stated in the monitoring plan?	The software applies the latest calculation as per the approved worksheets and conventions for SAP calculations as set out in the SAP manual. Therefore, the

		software's accuracy is acceptable.
	Calibration Frequency/ interval	There is no calibration required since the value is obtained from the software by experience and certified SAP Assessors.
	How are the values in the monitoring report verified?	The SAP methodology considers various factors to determine the energy load of the dwellings. All these observations are added to the software which, based on the SAP methodology, provides the energy load of the dwellings. The energy load of all such dwellings is individually recorded by the Government of the UK. The specific reports generated for each household of dwellings picked through random sampling were checked to confirm the parameter value/23/. No discrepancies were observed in the data.
	If applicable, has the reported data been cross checked with other available data?	The EPC certificates of the dwellings/12/ were cross-checked and the data provided was comparable to project database details of the dwelling.

	Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Yes, the data management ensures correct transfer of data and reporting of emission reduction and all necessary QA/QC processes are in place.
Findings	No findings were raised.	
Conclusion	The parameter has been monitored appropriately, in accordance with the registered monitoring plan (as per measurement methods and procedures to be applied) and applied methodology. The monitoring results were recorded consistently as per the approved frequency in the monitoring plan. The verification team can confirm that the project is implemented as per the registered PD and there is no discrepancy observed between the actual monitoring system and the monitoring plan set out in the registered PD and the applied methodology.	

2. Post-retrofit energy load of Dwelling *i*, EL*post, i*

Means of verification	Criteria/Requirements	Assessment/Observation
	Measuring/ Reading/ Recording frequency	As per the applied methodology and registered PD, the parameter is to be recorded once per dwelling following the implementation of the project activity.
	Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes/No)	Yes, measuring and reporting frequency is in accordance with registered monitoring plan and methodology.
	Monitored Value	The value is determined individually for each dwelling and reported in the emission reduction calculation sheet.
	Monitoring equipment	Energy modelling software used by the SAP Assessors that implements the latest version of SAP Manual/17/.
	Is the accuracy of the monitoring equipment as stated in the monitoring plan?	The software applies the latest calculation as per the approved worksheets and conventions for SAP calculations as set out in the SAP manual. Therefore, the

		software's accuracy is acceptable.
	Calibration Frequency/ interval	There is no calibration required since the value is obtained from the software by experience and certified SAP Assessors.
	How are the values in the monitoring report verified?	The SAP methodology considers various factors to determine the energy load of the dwellings. All these observations are added to the software which, based on the SAP methodology, provides the energy load of the dwellings. The energy load of all such dwellings is individually recorded by the Government of the UK. The specific reports generated for each household of dwellings picked through random sampling were checked to confirm the parameter value/23/. No discrepancies were observed in the data.
	If applicable, has the reported data been cross checked with other available data?	The EPC certificates of the dwellings/12/ were cross-checked and the data provided was comparable to project database details of the dwelling.

	Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Yes, the data management ensures correct transfer of data and reporting of emission reduction and all necessary QA/QC processes are in place.
Findings	No findings were raised.	
Conclusion	The parameter has been monitored appropriately, in accordance with the registered monitoring plan (as per measurement methods and procedures to be applied) and applied methodology. The monitoring results were recorded consistently as per the approved frequency in the monitoring plan. The verification team is able to confirm that the project is implemented as per the registered PD and there is no discrepancy observed between the actual monitoring system and the monitoring plan set out in the registered PD and the applied methodology.	

3. Electricity consumed in the year prior to project implementation in dwelling *i* (baseline consumption), Elec*b,i*

Means of verification	Criteria/Requirements	Assessment/Observation
	Measuring/ Reading/ Recording frequency	As per the applied methodology and registered PD, the parameter is to be recorded once per dwelling prior to implementation of the project activity, after which it is fixed for the entire monitoring period.
	Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes/No)	Yes, measuring and reporting frequency is in accordance with registered monitoring plan and methodology.
	Monitored Value	The value is determined for same building stock and is fixed for the crediting period as provided below, based on the building stock that the dwelling is part of: Low-income single-family dwelling baseline consumption: 3,000 kWh annually Middle-income individual dwelling baseline consumption: 3,900 kWh annually

	Monitoring equipment	No monitoring equipment required.
	Is the accuracy of the monitoring equipment as stated in the monitoring plan?	Not applicable.
	Calibration Frequency/ interval	There is no calibration required.
	How are the values in the monitoring report verified?	The value was determined at the time of project registration from data published by the Department for Business, Energy & Industrial Strategy (BEIS)/19/. The value is applied to each dwelling based on the building stock it is part of. All social housing is considered low-income by default, whereas non-social housing dwellings are identified as either low-income or middle-income based on criteria established in the PD.
	If applicable, has the reported data been cross checked with other available data?	Not applicable.

	Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Yes, the data management ensure correct transfer of data and reporting of emission reduction and all necessary QA/QC processes are in place.
Findings	No findings were raised.	
Conclusion	The parameter has been monitored appropriately, in accordance with the registered monitoring plan (as per measurement methods and procedures to be applied) and applied methodology. The monitoring results were recorded consistently as per the approved frequency in the monitoring plan. The verification team is able to confirm that the project is implemented as per the registered PD and there is no discrepancy observed between the actual monitoring system and the monitoring plan set out in the registered PD and the applied methodology.	

4. Pre-retrofit electricity demand for dwelling *i*, E*dem*,*pre*,*i*

Means of verification	Criteria/Requirements	Assessment/Observation
	Measuring/ Reading/ Recording frequency	As per the applied methodology and registered PD, the parameter is to be recorded once per dwelling prior to implementation of the project activity.
	Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes/No)	Yes, measuring and reporting frequency is in accordance with registered monitoring plan and methodology.
	Monitored Value	The value is determined individually for each dwelling and reported in the emission reduction calculation sheet.
	Monitoring equipment	Energy modelling software used by the SAP Assessors that implements the latest version of SAP Manual/17/.
	Is the accuracy of the monitoring equipment as stated in the monitoring plan?	The software applies the latest calculation as per the approved worksheets and conventions for SAP calculations as set out in the SAP manual. Therefore, the

		software's accuracy is acceptable.
	Calibration Frequency/ interval	There is no calibration required since the value is obtained from the software by experience and certified SAP Assessors.
	How are the values in the monitoring report verified?	The SAP methodology considers various factors to determine the energy load of the dwellings. All these observations are added to the software which, based on the SAP methodology, provides the energy load of the dwellings. The energy load of all such dwellings is individually recorded by the Government of the UK. The specific reports generated for each household of dwellings picked through random sampling were checked to confirm the parameter value/23/. No discrepancies were observed in the data.
	If applicable, has the reported data been cross checked with other available data?	The EPC certificates of the dwellings/12/ were cross-checked and the data provided was comparable to project database details of the dwellings.

	Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Yes, the data management ensure correct transfer of data and reporting of emission reduction and all necessary QA/QC processes are in place.
Findings	No findings were raised.	
Conclusion	The parameter has been monitored appropriately, in accordance with the registered monitoring plan (as per measurement methods and procedures to be applied) and applied methodology. The monitoring results were recorded consistently as per the approved frequency in the monitoring plan. The verification team is able to confirm that the project is implemented as per the registered PD and there is no discrepancy observed between the actual monitoring system and the monitoring plan set out in the registered PD and the applied methodology.	

5. Post-retrofit electricity demand for dwelling *i* ($E_{dem,post,i}$)

Means of verification	Criteria/Requirements	Assessment/Observation
	Measuring/ Reading/ Recording frequency	As per the applied methodology and registered PD, the parameter is to be recorded once per dwelling following the implementation of the project activity.
	Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes/No)	Yes, measuring and reporting frequency is in accordance with registered monitoring plan and methodology.
	Monitored Value	The value is determined individually for each dwelling and reported in the emission reduction calculation sheet.
	Monitoring equipment	Energy modelling software used by the SAP Assessors that implements the latest version of SAP Manual/17/.
	Is the accuracy of the monitoring equipment as stated in the monitoring plan?	The software applies the latest calculation as per the approved worksheets and conventions for SAP calculations as set out in the SAP manual. Therefore, the

		software's accuracy is acceptable.
	Calibration Frequency/ interval	There is no calibration required since the value is obtained from the software by experience and certified SAP Assessors.
	How are the values in the monitoring report verified?	The SAP methodology considers various factors to determine the energy load of the dwellings. All these observations are added to the software which, based on the SAP methodology, provides the energy load of the dwellings. The energy load of all such dwellings is individually recorded by the Government of the UK. The specific reports generated for each household of dwellings picked through random sampling were checked to confirm the parameter value/23/. No discrepancies were observed in the data.
	If applicable, has the reported data been cross checked with other available data?	The EPC certificates of the dwellings/12/ were cross-checked and the data provided was comparable to project database details of the dwellings.

	Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Yes, the data management ensure correct transfer of data and reporting of emission reduction and all necessary QA/QC processes are in place.
Findings	No findings were raised.	
Conclusion	The parameter has been monitored appropriately, in accordance with the registered monitoring plan (as per measurement methods and procedures to be applied) and applied methodology. The monitoring results were recorded consistently as per the approved frequency in the monitoring plan. The verification team is able to confirm that the project is implemented as per the registered PD and there is no discrepancy observed between the actual monitoring system and the monitoring plan set out in the registered PD and the applied methodology.	

6. Fuel type *j* consumed in the year prior to project implementation for dwelling *i* (baseline consumption), (F*b,i,j*)

Means of verification	Criteria/Requirements	Assessment/Observation
	Measuring/ Reading/ Recording frequency	As per the applied methodology and registered PD, the parameter is to be recorded once per dwelling prior to implementation of the project activity, after which it is fixed for the entire crediting period.
	Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes/No)	Yes, measuring and reporting frequency is in accordance with registered monitoring plan and methodology.
	Monitored Value	The value is determined for the same building stock and is fixed for the crediting period as provided below, based on the building stock that the dwelling is part of: Low-income single-family dwelling baseline consumption: 1,104 m^3 annually Middle-income individual dwelling baseline consumption: 1,382 m^3 annually
	Monitoring equipment	No monitoring equipment required.

	Is the accuracy of the monitoring equipment as stated in the monitoring plan?	Not applicable.
	Calibration Frequency/ interval	There is no calibration required.
	How are the values in the monitoring report verified?	The value was determined at the time of project registration from data published by the Department for Business, Energy & Industrial Strategy (BEIS)/19/. The value is applied to each dwelling based on the building stock it is part of. All social housing is considered low-income by default, whereas non-social housings are identified as either low-income or middle-income based on criteria established in the PD.
	If applicable, has the reported data been cross checked with other available data?	Not applicable.

	Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Yes, the data management ensures correct transfer of data and reporting of emission reduction and all necessary QA/QC processes are in place.
Findings	No findings were raised.	
Conclusion	The parameter has been monitored appropriately, in accordance with the registered monitoring plan (as per measurement methods and procedures to be applied) and applied methodology. The monitoring results were recorded consistently as per the approved frequency in the monitoring plan. The verification team is able to confirm that the project is implemented as per the registered PD and there is no discrepancy observed between the actual monitoring system and the monitoring plan set out in the registered PD and the applied methodology.	

7. Heat load pre-retrofit for dwelling *i* based on size of the dwelling and historical HDD for the region (H*load,pre,i*)

Means of verification	Criteria/Requirements	Assessment/Observation
	Measuring/ Reading/ Recording frequency	As per the applied methodology and registered PD, the parameter is to be recorded once per dwelling prior to implementation of the project activity.
	Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes/No)	Yes, measuring and reporting frequency is in accordance with registered monitoring plan and methodology.
	Monitored Value	The value is determined individually for each dwelling and reported in the emission reduction calculation sheet.
	Monitoring equipment	Energy modelling software used by the SAP Assessors that implements the latest version of SAP Manual/17/.
	Is the accuracy of the monitoring equipment as stated in the monitoring plan?	The software applies the latest calculation as per the approved worksheets and conventions for SAP calculations as set out in the SAP manual. Therefore, the

		software's accuracy is acceptable.
	Calibration Frequency/ interval	There is no calibration required since the value is obtained from the software by experience and certified SAP Assessors.
	How are the values in the monitoring report verified?	The SAP methodology considers various factors to determine the energy load of the dwellings. All these observations are added to the software which, based on the SAP methodology, provides the energy load of the dwellings. The energy load of all such dwellings is individually recorded by the Government of the UK. The specific reports generated for each household of dwellings picked through random sampling were checked to confirm the parameter value/23/. No discrepancies were observed in the data.
	If applicable, has the reported data been cross checked with other available data?	The EPC certificates of the dwellings/12/ were cross-checked and the data provided was comparable to project database details of the dwellings.

	Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Yes, the data management ensure correct transfer of data and reporting of emission reduction and all necessary QA/QC processes are in place.
Findings	No findings were raised.	
Conclusion	The parameter has been monitored appropriately, in accordance with the registered monitoring plan (as per measurement methods and procedures to be applied) and applied methodology. The monitoring results were recorded consistently as per the approved frequency in the monitoring plan. The verification team is able to confirm that the project is implemented as per the registered PD and there is no discrepancy observed between the actual monitoring system and the monitoring plan set out in the registered PD and the applied methodology.	

8. Heat load post-retrofit for dwelling *i* based on size of the dwelling and historical HDD for the region ($H_{load,post,i}$)

Means of verification	Criteria/Requirements	Assessment/Observation
	Measuring/ Reading/ Recording frequency	As per the applied methodology and registered PD, the parameter is to be recorded once per dwelling following implementation of the project activity.
	Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes/No)	Yes, measuring and reporting frequency is in accordance with registered monitoring plan and methodology.
	Monitored Value	The value is determined individually for each dwelling and reported in the emission reduction calculation sheet.
	Monitoring equipment	Energy modelling software used by the SAP Assessors that implements the latest version of SAP Manual/17/.
	Is the accuracy of the monitoring equipment as stated in the monitoring plan?	The software applies the latest calculation as per the approved worksheets and conventions for SAP calculations as set out in the SAP manual. Therefore, the

		software's accuracy is acceptable.
	Calibration Frequency/ interval	There is no calibration required since the value is obtained from the software by experience and certified SAP Assessors.
	How are the values in the monitoring report verified?	The SAP methodology considers various factors to determine the energy load of the dwellings. All these observations are added to the software which, based on the SAP methodology, provides the energy load of the dwellings. The energy load of all such dwellings is individually recorded by the Government of the UK. The specific reports generated for each household of dwellings picked through random sampling were checked to confirm the parameter value/23/. No discrepancies were observed in the data.
	If applicable, has the reported data been cross checked with other available data?	The EPC certificates of the dwellings/12/ were cross-checked and the data provided was comparable to project database details of the dwellings.

	Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Yes, the data management ensure correct transfer of data and reporting of emission reduction and all necessary QA/QC processes are in place.
Findings	No findings were raised.	
Conclusion	The parameter has been monitored appropriately, in accordance with the registered monitoring plan (as per measurement methods and procedures to be applied) and applied methodology. The monitoring results were recorded consistently as per the approved frequency in the monitoring plan. The verification team is able to confirm that the project is implemented as per the registered PD and there is no discrepancy observed between the actual monitoring system and the monitoring plan set out in the registered PD and the applied methodology.	

9. Electricity correction factor for year *y*. The ECF is only to be applied in the equation if it is negative (ECFy)

Means of verification	Criteria/Requirements	Assessment/Observation
	Measuring/ Reading/ Recording frequency	As per the applied methodology and registered PD, the parameter is to be recorded annually for each year y.
	Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes/No)	Yes, measuring and reporting frequency is in accordance with registered monitoring plan and methodology.
	Monitored Value	The value is determined for same building stock annually, based on the building stock that the dwelling is part of: Low-income single-family dwelling baseline consumption: 0.9824 Middle-income individual dwelling baseline consumption: 0.9859
	Monitoring equipment	No monitoring equipment required.

	Is the accuracy of the monitoring equipment as stated in the monitoring plan?	Not applicable.
	Calibration Frequency/ interval	There is no calibration required.
	How are the values in the monitoring report verified?	The value for the first year of monitoring has been determined at the time of project registration from data published by the Department for Business, Energy & Industrial Strategy (BEIS)/19/. The value is applied to each dwelling based on the building stock it is part of. All social housing is considered low-income by default, whereas non-social housing dwellings are identified as either low-income or middle-income based on criteria established in the PD. The factor is only applicable when electricity consumption growth for the year is negative, compared to the average grid connected electricity consumption over a period of at least past 10 years, which is not the case in this monitoring period.

	If applicable, has the reported data been cross checked with other available data?	Not applicable.
	Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Yes, the data management ensures correct transfer of data and reporting of emission reduction and all necessary QA/QC processes are in place.
Findings	No findings were raised.	
Conclusion	The parameter has been monitored appropriately, in accordance with the registered monitoring plan (as per measurement methods and procedures to be applied) and applied methodology. The monitoring results were recorded consistently as per the approved frequency in the monitoring plan. The verification team is able to confirm that the project is implemented as per the registered PD and there is no discrepancy observed between the actual monitoring system and the monitoring plan set out in the registered PD and the applied methodology.	

10. Heating degree days for year *y* after project activity (HDDy)

Means of verification	Criteria/Requirements	Assessment/Observation
	Measuring/ Reading/ Recording frequency	As per the applied methodology and registered PD, the parameter is to be recorded annually for each year *y*.
	Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes/No)	Yes, measuring and reporting frequency is in accordance with registered monitoring plan and methodology.
	Monitored Value	The value is determined for each PAI individually for every monitoring period based on data retrieved from the Department of Business, Energy and Industrial Strategy (BEIS)/19/.
	Monitoring equipment	No monitoring equipment required.
	Is the accuracy of the monitoring equipment as stated in the monitoring plan?	Not applicable.

	Calibration Frequency/ interval	There is no calibration required.
	How are the values in the monitoring report verified?	The value for the monitoring period has been determined from data published by the Department for Business, Energy & Industrial Strategy (BEIS)/19/. The values are obtained from the Nottingham weather station, which was considered appropriate considering the central location of the weather station. The value is calculated for each dwelling based on the days on which the project activity was in operation/ use.
	If applicable, has the reported data been cross checked with other available data?	Not applicable.
	Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Yes, the data management ensures correct transfer of data and reporting of emission reduction and all necessary QA/QC processes are in place.

Findings	No findings were raised.
Conclusion	The parameter has been monitored appropriately, in accordance with the registered monitoring plan (as per measurement methods and procedures to be applied) and applied methodology. The monitoring results were recorded consistently as per the approved frequency in the monitoring plan. The verification team is able to confirm that the project is implemented as per the registered PD and there is no discrepancy observed between the actual monitoring system and the monitoring plan set out in the registered PD and the applied methodology.

11. Heating degree days for one year before project activity (HDD*b*)

Means of verification	Criteria/Requirements	Assessment/Observation
	Measuring/ Reading/ Recording frequency	As per the applied methodology and registered PD, the parameter is to be recorded one year prior to the PAI implementation.
	Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes/No)	Yes, measuring and reporting frequency is in accordance with registered monitoring plan and methodology.
	Monitored Value	The value is determined for each PAI individually for the baseline based on data retrieved from the Department of Business, Energy and Industrial Strategy (BEIS)/19/.
	Monitoring equipment	No monitoring equipment required.
	Is the accuracy of the monitoring equipment as stated in the monitoring plan?	Not applicable.

	Calibration Frequency/ interval	There is no calibration required.
	How are the values in the monitoring report verified?	The value for the monitoring period has been determined from data published by the Department for Business, Energy & Industrial Strategy (BEIS)/19/.
	If applicable, has the reported data been cross checked with other available data?	Not applicable.
	Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Yes, the data management ensures correct transfer of data and reporting of emission reduction and all necessary QA/QC processes are in place.
Findings	No findings were raised.	

Conclusion	The parameter has been monitored appropriately, in accordance with the registered monitoring plan (as per measurement methods and procedures to be applied) and applied methodology. The monitoring results were recorded consistently as per the approved frequency in the monitoring plan. The verification team is able to confirm that the project is implemented as per the registered PD and there is no discrepancy observed between the actual monitoring system and the monitoring plan set out in the registered PD and the applied methodology.

12. Number of fuel types (*J*)

Means of verification	Criteria/Requirements	Assessment/Observation
	Measuring/ Reading/ Recording frequency	As per the applied methodology and registered PD, the parameter is to be recorded annually.
	Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes/No)	Yes, measuring and reporting frequency is in accordance with registered monitoring plan and methodology.
	Monitored Value	The value is determined for each PAI individually on the basis of the SAP assessment, thus concluding which fuel is used in that particular dwelling.
	Monitoring equipment	Energy modelling software used by the SAP Assessors that implements the latest version of SAP Manual/17/.
	Is the accuracy of the monitoring equipment as stated in the monitoring plan?	The software applies the latest calculation as per the approved worksheets and conventions for SAP calculations as set out in the SAP manual. Therefore, the

		software's accuracy is acceptable.
	Calibration Frequency/ interval	There is no calibration required since the value is obtained from the software by experience and certified SAP Assessors.
	How are the values in the monitoring report verified?	The SAP methodology considers various factors to determine the energy load of the dwellings. All these observations are added to the software which, based on the SAP methodology, provides the energy load of the dwellings. The energy load of all such dwellings is individually recorded by the Government of the UK. The specific reports generated for each household of dwellings picked through random sampling were checked to confirm the parameter value/23/. No discrepancies were observed in the data.
	If applicable, has the reported data been cross checked with other available data?	The EPC certificates of the dwellings/12/ were cross-checked and the data provided was comparable to project database details of the dwellings.

	Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Yes, the data management ensures correct transfer of data and reporting of emission reduction and all necessary QA/QC processes are in place.
Findings	No findings were raised.	
Conclusion	The parameter has been monitored appropriately, in accordance with the registered monitoring plan (as per measurement methods and procedures to be applied) and applied methodology. The monitoring results were recorded consistently as per the approved frequency in the monitoring plan. The verification team is able to confirm that the project is implemented as per the registered PD and there is no discrepancy observed between the actual monitoring system and the monitoring plan set out in the registered PD and the applied methodology.	

13. Number of dwellings included in the pre- and post-retrofit energy assessment approach for the project (*I*)

Means of verification	Criteria/Requirements	Assessment/Observation
	Measuring/ Reading/ Recording frequency	As per the applied methodology and registered PD, the parameter is to be recorded annually.
	Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes/No)	Yes, measuring and reporting frequency is in accordance with registered monitoring plan and methodology.
	Monitored Value	The value is determined from the project database and confirmed as 6,717 dwellings for the current monitoring period.
	Monitoring equipment	N/A
	Is the accuracy of the monitoring equipment as stated in the monitoring plan?	N/A
	Calibration Frequency/ interval	N/A

	How are the values in the monitoring report verified?	The value is determined from the project database and confirmed as 6,717 dwellings for the current monitoring period. The implementation of some randomly sampled dwellings during the site visits further help ensure implementation of these measures in the dwellings listed in the project database.
	If applicable, has the reported data been cross checked with other available data?	N/A
	Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Yes, the data management ensures correct transfer of data and reporting of emission reduction and all necessary QA/QC processes are in place.
Findings	No findings were raised.	

Conclusion	The parameter has been monitored appropriately, in accordance with the registered monitoring plan (as per measurement methods and procedures to be applied) and applied methodology. The monitoring results were recorded consistently as per the approved frequency in the monitoring plan. The verification team is able to confirm that the project is implemented as per the registered PD and there is no discrepancy observed between the actual monitoring system and the monitoring plan set out in the registered PD and the applied methodology.

13. Number of dwellings included in the sample group (*S*)

Means of verification	Criteria/Requirements	Assessment/Observation
	Measuring/ Reading/ Recording frequency	As per the applied methodology and registered PD, the parameter is to be recorded annually.
	Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes/No)	Yes, measuring and reporting frequency is in accordance with registered monitoring plan and methodology.
	Monitored Value	The value is for quality assurance assessment is calculated as 50
	Monitoring equipment	N/A
	Is the accuracy of the monitoring equipment as stated in the monitoring plan?	N/A
	Calibration Frequency/ interval	N/A

	How are the values in the monitoring report verified?	The value is determined based on calculations for determination of sample size as per the requirements of PD/4/. It was confirmed from the ER calculator sheet that the sample size is in line with the registered PD requirements.
	If applicable, has the reported data been cross checked with other available data?	N/A
	Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Yes, the data management ensures correct transfer of data and reporting of emission reduction and all necessary QA/QC processes are in place.
Findings	No findings were raised.	

Conclusion	The parameter has been monitored appropriately, in accordance with the registered monitoring plan (as per measurement methods and procedures to be applied) and applied methodology. The monitoring results were recorded consistently as per the approved frequency in the monitoring plan. The verification team can confirm that the project is implemented as per the registered PD and there is no discrepancy observed between the actual monitoring system and the monitoring plan set out in the registered PD and the applied methodology.

Details of the parameters fixed at the beginning of the project are given below:

Parameter	Value	Unit	Assessment
Performance Standard (a)	Low-income dwelling: 5.0152; High income dwelling: 4.4992	N/A	The parameter is confirmed to be consistent with the registered PD/4/ and in line with applied methodology/3/.
Performance Standard (σ)	N/A	N/A	The parameter is confirmed to be consistent with the registered PD/4/ and in line with applied methodology/3/.
$Elec_{CO2}$	Electricity: 0.000212 tCO_{2e} / kWh from the Conversion Factors for Company Reporting dataset	tCO2e/kWh	The parameter is confirmed to be consistent with the registered PD/4/ and in line with applied methodology/3/.
Cal_j	0.0375	GJ/m^3	The parameter is confirmed to be consistent with the registered PD/4/ and in line with applied methodology/3/.

Sampling Approach:

PP QA sampling approach:

In compiling the sample group, the following Applicability Conditions from Sampling have been applied:

1) The sample is statistically valid, and may be one of the following:

a. Simple random sample

b. Systematic sampling

c. Stratified sampling within the Same Building Stock

d. Cluster sampling.

The sample group is a simple random sample.

2) The sample must be representative of the population.

The sample group is representative of the population. Sampling includes dwellings that are dispersed geographically (see sub-condition four below).

3) The data must come from an approved source, i.e. a certified energy auditor, or a nationally recognized data source.

Pre- and post-retrofit energy assessments are undertaken by accredited energy assessors certified by a public authority, or a private certification program recognised by a public authority.

4) Actions that may bias the sample shall be avoided. Sampling shall include Dwellings that are dispersed geographically. For each defined Building Stock included in the Project activity, sampling shall occur.

The sample group is statistically valid. Sampling includes dwellings that are dispersed geographically.

The minimum quality assurance sample size is established by multiplying by 0.6 the square root of the total number of dwellings, *i*, included in the pre- and post-retrofit energy assessment approach for the project. The approach is in accordance with the applied methodology VM0008 version 1.1- section 4, paragraph 4.6 and section 8, para 2.5.

Calculating the quality assurance sample with first instance data values for the 6,717 PAIs:

The sample size for *S* the quality assurance sample is established by multiplying by 0.6 the square root of the total number of dwellings, *i*, included in the Project.

Where:

i = 6,717

The sample size for sampling is 50.

In compiling the sample group, the following conditions from the Methodology have been applied:

1) The sample is statistically valid

2) The sample is representative of the population, for each defined Building Stock included in the project activity the criteria include region, dwelling type, and income group

3) The data comes from an approved source, i.e., a certified energy auditor, or a nationally recognised data source

4) Actions that may bias the sample are avoided

5) Sampling includes dwellings that are dispersed geographically.

The mean of the calculated reductions in energy load determined by the post-retrofit energy assessment for dwellings in the sample group is compared to the mean of the directly metered energy data. If the discrepancy between the two mean values is found to be significant, the project proponent will assess the need to adjust the HLF and/or EDF for the purpose of calculating emission reductions accurately.

For this verification period between 01/07/2022 and 31/12/2022, the mean of the calculated reductions in energy load determined by the post-retrofit energy assessment for dwellings in the sample group is compared to the mean of the actual reduction in consumption calculated from directly metered energy data for the Same Building Stock.

The values for the Ex-ante consumption reductions (savings) for first instance data values for crediting year 2022 as listed below are considered the values for control group (low-income group, which forms the majority of populations for the current monitoring period):

Decarbonisation measure	*Ex-ante consumption reductions (kWh/yr)*
Boiler Replacement	734
Loft Insulation	358
Cavity Wall Insulation	981
External Wall Insulation	2,537

For each type of measure in the sample group of 50, both the energy load determined by the post-retrofit assessment and the energy load from the directly metered control group is listed in ER calculation sheet tab "QA group". A mean of both groups was calculated (1522.56 kWh/yr for the post-retrofit assessment and 1190.02 kWh/yr for the control group) and a t-test was conducted using the t-test function in Microsoft Excel/14/. The t-test results concluded that the difference between two data sets (control group and implementation group) is not statistically significant, thus no adjustments to the monitored values is required.

The assessment team is able to conclude that the Quality Assurance test was performed in accordance with the requirements of the applied methodology and the values applied are consistent with the PD.

4.5 Quality of Evidence to Determine GHG Emission Reductions and Removals

The assessment team confirms that the calculation and data is authentic. The quality of the supporting documents submitted for verification are adequate. The assessment team has checked the quality and maintenance of the supporting documents during the on-site visit to confirm the authenticity of the documents and to check the appropriate calculations. The assessment team confirms that proper evidence is available for the whole monitoring period and the same is verifiable and the data collection system meets the requirement of the monitoring plan and the applied methodology according to the assessment carried out.

The primary data required for calculating emission reductions (i.e., pre- and post-retrofit heat load and electricity demand, etc.) are obtained from SAP assessments and data is directly sourced from the data published by BEIS/19/. The data is considered reliable and verifiable.

Further details for the sources of all parameters' has been provided in detail in section 4.4 above. All evidence is either government-sourced data or from other reliable sources, thus ensuring that quality of evidence is maintained and a verification opinion with a finding of 'reasonable level of assurance'.

The assessment team thus confirms the quality of evidence to determine the GHG reductions are satisfactory and the detailed information regarding the roles and responsibilities have been provided in the monitoring report.

4.6 Non-Permanence Risk Analysis

Not applicable for this grouped project activity.

5 VERIFICATION OPINION

Earthood as contracted by Arctica Partners, has performed the independent verification of the emission reductions for the VCS project activity (VCS ID- 2649) "*Housing Decarbonisation in the United Kingdom*" for the monitoring period 01/07/2022 to 31/12/2022 (inclusive of both days) as reported in Monitoring Report version 1.2 dated 28/09/2023. Arctica Partners is responsible for the collection of data in accordance with the monitoring plan and the reporting of GHG emission reductions from the project activity.

It is our responsibility to express an independent verification statement on the reported GHG emission reductions from the project activity. Earthood commenced the verification based on the baseline, monitoring methodology VM0008 version, and the monitoring plan mentioned in the registered VCS PD.

Earthood's verification approach is based on the understanding of the risks associated with reporting of GHG emission data and the controls in place to mitigate these. Earthood planned and performed the verification by obtaining evidence and other information and explanations that Earthood considered necessary to give reasonable assurance that reported GHG emission reductions are fairly stated.

In our opinion the GHG emission reductions reported for the project activity for the period 01/07/2022 to 31/12/2022 (inclusive of both days) are fairly stated in the final Monitoring report version 1.2 dated 28/09/2023. The GHG emission reductions were calculated correctly based on the approved baseline and monitoring methodology VM0008, Version 1.1 and the VCS Standard, version 4.4.

The current monitoring period is from 01/07/2022 to 31/12/2022 (inclusive of both days), so all the emission reductions achieved during the monitoring falls under the vintage year of 2022.

Verification period: From 01/07/2022 to 31/12/2022

Verified GHG emission reductions and removals in the above verification period, broken down by calendar year:

Year	Baseline emissions or removals (tCO_2e)*	Project emissions or removals (tCO_2e)*	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)

Year 1 2022 (01/07/2022 to 31/12/2022)	-	-	0	1,481
Total	-	-	0	1,481

* According to both the registered PDD and the applied methodology "*Emission reductions are calculated directly under each approach; in other words, baseline and project emissions are not calculated separately under the methodology. This results in a simplified and accurate estimation of project emissions normalised for weather and electricity correction factors. Leakage is calculated separately under each approach*". Therefore, the table above only indicates Net GHG emission reductions.

Year	*Ex-ante emissions reductions/removals*	*Achieved emissions reductions/removals*	*Percent difference*	*Justification for the difference*
Year 1 2022	2.928 per PAI	0.220 per PAI	-92.471%	See below
Total	2.928 per PAI	0.220 per PAI	-92.471%	See below

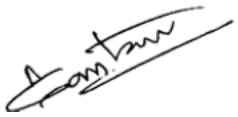
This project is a Grouped Project. The registered PD only reflected the emission reductions that were anticipated from the initial 28 PAIs and was therefore, not a reflection of the emission reductions that will be achieved during the verification periods. Additional PAIs will continue to be added throughout the crediting period.

As per the registered PD and validation report, the project initially estimated achieving ex-ante average net GHG emission reductions per PAI of 2.928 tCO2e per year based on an initial 28 PAIs. However, since validation of the PD commenced, additional PAIs have been added and the MR includes information regarding the first 6,717 PAIs included in the project activity during the six-month monitoring period. The achieved ex-post average net GHG emission reductions per PAI for this monitoring period was 0.220 tCO2e. The achieved net GHG emissions reductions were significantly less than estimated (even before considering the monitoring period was half the length of the estimated monitoring period). The estimated net GHG emission reductions were based on 'deep retrofits' that being decarbonisation activity to retrofit a home to the highest levels of energy efficiency. Whereas the proportion of deep retrofits is less than expected, and consequently, the achieved net GHG emission reductions are less than

estimated per PAI.

Since the actual achieved net GHG emission reductions for the 6,717 PAIs (per PAI) is much lower than the estimated value for this number of PAIs, no further justification is required.

Approved by



Ashok K Gautam

Director Date: 29/09/2023

Earthood Services Private Limited Place: Gurgaon, Haryana, IN

APPENDIX I: REFERENCES

Sr No	Title and details of the document/information referred
/1/	VCS Standard V4.4
/2/	VCS Program Guide V4.3
/3/	Applied methodology "Weatherization of Single-Family and Multi-Family Buildings" V1.1
/4/	VCS PD Version 10.1 Dated 25/11/2022
/5/	Validation report
/6/	Records of UPRN of PAIs
/7/	Office of National Statistics and Ordnance Survey data (https://uprn.uk) for the verification of UPRN
/8/	Records of the Registers of Licenses of Houses in Multiple Occupation
/9/	https://www.gov.uk/house-in-multiple-occupation-licence
/10/	Housing and Regeneration Act 2008, c. 17, section 68
/11/	UK Living Wage for a household with two adults and two children aged 3-4 and 5-11 for 2020/21. See, N Cominetti, Calculating the Real Living Wage for London and the Rest of the UK: 2020-21, Resolution Foundation, November 2021. Upper earnings threshold for a household to receive financial support for full-time education for 2020/21.
/12/	EPC Certificates for all sampled PAIs
/13/	Participant contracts for Provision of Verified Carbon Unit Services (agreement to be signed between PP and holders of the statutory, property or contractual right in the plant, equipment or process that generates GHG emission reductions)
/14/	T-test function step by step approach in ER calculation sheet
/15/	Sample size calculator http://www.raosoft.com/samplesize.html
/16/	Regulator of Social Housing Register, UK
/17/	Standard Assessment Procedure (SAP): National Calculation Methodology for assessing the energy performance of dwellings
/18/	List of the initial dwellings to be included as PAIs
/19/	Energy and gas consumption reports by Department of Business Energy and Industrial Strategy UK as part of the National Energy Efficiency Data Framework (NEED)
/20/	Declaration from PP for not claiming any other carbon benefits 22/03/2022
/21/	Published Indices of Deprivation 2019 for England, Ministry of Housing, Communities and Local Government; for Wales, Welsh Government or for Scotland, Scottish Government.
/22/	Complete project dataset
/23/	Source data of the SAP Assessments for 50 samples
/24/	Monitoring Report version 1.2 dated 28/09/2023
/25/	Emission Reduction Calculation Sheet for MP1
/26/	Sampling and Surveys for CDM Project Activities and Programmes of Activities' v09.0
/27/	Guideline: Sampling and surveys for CDM project activities and programme of activities v.4.0

APPENDIX II: ABBREVIATIONS

Abbreviations	Full texts
BE	Baseline Emission
BEIS	Department for Business, Energy & Industrial Strategy

CAR	Corrective Action Request
CL	Clarification Action
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
DVR	Draft Verification Report
EF	Emission Factor
EPC	Energy Performance Certificate
ER	Emission Reduction
FAR	Forward Action Request
GHG	Greenhouse gas(es)
GP	Grouped Project
HACT	Housing Associations' Charitable Trust
HDD	Heating Degree Days
MP	Monitoring Plan
MR	Monitoring Report
NA	Not Applicable
PA	Project Activity
PD	Project Description
PE	Project Emission
PP	Project Proponent
QA/QC	Quality Assurance / Quality Control
QMS	Quality Management System
SAP	Standard Assessment Procedure
TR	Technical Review
VCS	Verified Carbon Standard
VCS PD	VCS – Project Description

VCU	Verified Carbon Unit
VVB	Validation/verification Body

APPENDIX III: COMPETENCY STATEMENTS

Competence Statement			
Name	Shifali Guleria		
Education	M.Sc. (Environmental Studies and Resource Management), TERI University		
Experience	3+ year		
Field	Climate Change		
Approved Roles			
Team Leader	YES		
Validator	YES		
Verifier	YES		
Methodology Expert	YES (AMS-I.A., AMS-II.G., AMS-II.E., AMS-III.A.V., AMS-I.D, ACM0002)		
Local expert	YES		
Financial Expert	NO		
Technical Reviewer	YES		
TA Expert	YES (1.2, 3.1)		
Reviewed by	Deepika Mahala	**Date**	18/02/2022
Approved by	Ashok Gautam	**Date**	18/02/2022

Competence Statement	
Name	Kaviraj Singh
Education	Ph.D. (Environmental Engineering), IIT Delhi Masters (Energy & Environmental), DAVV Indore
Experience	15 Years +
Field	Climate Change & Environment
Approved Roles	
Team Leader	YES
Validator	YES
Verifier	YES
Methodology Expert	AMS-I.D., AMS-II.D., ACM0006, AMS-I.A., AMS-I.C., AMS-II.B., AMS-III.H, ACM0002, ACM0001, AM0080, ACM0018, AM0056, AM0073 VM0042, AMS-III.G, AMS-III.AF., VM0032, VM0018, ACM0010, ACM0022, AMS-III.D, AMS-III.F and AMS-III.A.Q
Local expert	YES (India)
Financial Expert	YES

Technical Reviewer	YES		
TA Expert (X.X)	YES (TA 1.1, TA 1.2, TA 3.1, TA 13.1, TA 13.2)		
Reviewed by	Shifali Guleria (Quality Manager)	**Date**	02/02/2023
Approved by	Deepika Mahala (Technical Manager)	**Date**	02/02/2023

Competence Statement			
Name	Zacc Farodoye		
Education	BA(Hons) Economics		
Experience	5 Years		
Field	Renewable Energy, Utilities, Property, and Finance.		
Approved Roles			
Team Leader	NO		
Validator	NO		
Verifier	NO		
Methodology Expert	NO		
Local expert	YES (United Kingdom)		
Financial Expert	NO		
Technical Reviewer	NO		
TA Expert (X.X)	NO		
Trainee	YES		
Reviewed by	Shifali Guleria (Quality Manager)	Date	30/03/2023
Approved by	Deepika Mahala (Technical Manager)	Date	30/03/2023

Competence Statement	
Name	Ashok Gautam
Country	India
Education	M. Sc. (Environmental Sciences) M. Tech. (Energy & Environmental Management)
Experience	16 Years +
Field	Energy, Climate Change & Environment
Approved Roles	
Team Leader	YES
Validator	YES
Verifier	YES
Methodology Expert	AMS-I.D., AMS-I.A., AMS-I.C., AMS-I.E, AMS-II.D., AMS-II.G., AMS-III.E., AMS-III.H., AMS-III.Q, AMS-III.Z., AMS-III.AV., AMS III.AR, AM0029, AM0025, AM0056, ACM0001, ACM0002, ACM0004, ACM0012, ACM0006, AM0018, ACM0017, ACM0009, AM0034, AMS.I.B, ACM0016, AMS-III.BL, AMS-II.L, AMS-I.I., AMS-III.A.O., ACM0010, ACM0025

Local expert	YES (India)		
Financial Expert	YES		
Technical Reviewer	YES		
TA Expert	YES (TA 1.1, TA 1.2, TA 3.1, TA 13.1)		
Reviewed by	Shifali Guleria	Date	06/03/2023
Approved by	Deepika Mahala	Date	06/03/2023

APPENDIX 4: FINDINGS

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

FAR ID	01	**Date :** 03/04/2023
Description of FAR		
FAR- 01: A FAR has been raised to check the exact year of construction of the dwelling, from the declaration provided by dwelling owner, at the time of first verification for the 28 initial PAIs. FAR-02: A FAR has been raised to check compliance with national best practice standards and the certificates or declarations will be checked at the first verification. FAR-03: A FAR has been raised to check the declaration of the replacement of functioning appliances at the time of first verification. FAR-04: A FAR has been raised to check at the time of first verification that capacity of any replacement appliance or replacement component of a central heating system satisfies the energy load. Also, the replaced appliances/boiler, are disposed in compliance with applicable laws and a proper disposal of such appliances will be recorded by the PP and made available to the VVB at the time of verification. And if a boiler is not disposed as per the law, that shall be accounted for leakages. FAR-05: A FAR has been raised to verify that the implemented energy efficiency measures for all 28 initial PAIs fall into either category A or category B as defined by the methodology and PD. FAR-06: A FAR has been raised to validate and confirm the start date of the project at the time of first verification. PP is requested to provide responses and evidence for the assessment of above raised FARs from validation.		
Project participant response		**Date :** 17/04/2023
FAR- 01: A FAR has been raised to check the exact year of construction of the dwelling, from the declaration provided by dwelling owner, at the time of first verification for the 28 initial PAIs.		

As called for by the VCS Standard, regulations applicable to grouped projects and consistent with the VM0008 Methodology, this grouped project provides applicability criteria for project activity instances. These criteria ensure that project activity meets the applicability conditions set out in the methodology.

In the PDD prepared for Pipeline Listing, an applicability condition was included regarding the year of construction of the dwelling. A FAR was raised during the Validation audit to check the year of construction of the project activity.

Verra's project review identified that the year of construction of the dwelling is not an applicability criterion prescribed by the VM0008 methodology. As such, the year of construction was not included in the registered PDD (VCS_PRR_2649_25_August_2022). This FAR is no longer applicable.

FAR-02: A FAR has been raised to check compliance with national best practice standards and the certificates or declarations will be checked at the first verification.

As called for by the VCS Standard, regulations applicable to grouped projects and consistent with the VM0008 Methodology, this grouped project provides applicability criteria for project activity instances. These criteria ensure that project activity meets the applicability conditions set out in the methodology.

In the registered PDD, an applicability condition was included regarding the adequacy of the project activities. The PDD provides several routes for this criterion to be demonstrated, including, at minimum, through a declaration from the holder of the statutory, property or contractual right in the plant, equipment or process that generates GHG emission reductions, as defined in VCS Standard 4.4, section 3.7.1. This declaration is included in Schedule 2(4)(d) of the Participant Contract (for social housing providers) and Schedule 2(4)(c) of the Participant Contract (for non-social housing providers). Completed declarations are provided for all homes in the Quality Assurance sample group and those included in the Site Visit. Please use the 'Provider Reference' to link the records in the VCS2649 - Emission Reduction Worksheet - FOR VVB 20230424 (Site Visit and QA Group tabs) with Schedule 5 of the relevant Participant Contract.

FAR-03: A FAR has been raised to check the declaration of the replacement of functioning appliances at the time of first verification.

As called for by the VCS Standard, regulations applicable to grouped projects and consistent with the VM0008 Methodology, this grouped project provides applicability criteria for project activity instances. These criteria ensure that project activity meets the applicability conditions set out in the methodology.

An applicability condition was included in the registered PDD regarding the replacement of functioning appliances. The PDD provides several routes for this criterion to be demonstrated, including, at minimum, through a declaration from the holder of the statutory, property or contractual right in the plant, equipment or process that generates GHG emission reductions, as defined in VCS Standard 4.4, section 3.7.1. This declaration is included in Schedule 2(4)(f) of the Participant Contract (for social housing providers) and Schedule 2(4)(e) of the Participant Contract (for non-social housing providers). Completed declarations are provided for all homes in the Quality Assurance sample group and those included in the Site Visit. Please use the 'Provider Reference' to link the records in the VCS2649 - Emission Reduction Worksheet - FOR VVB 20230424 (Site Visit and QA Group tabs) with Schedule 5 of the relevant Participant Contract.

FAR-04: A FAR has been raised to check at the time of first verification that capacity of any replacement appliance or replacement component of a central heating system satisfies the energy load.

As called for by the VCS Standard, regulations applicable to grouped projects and consistent with the VM0008 Methodology, this grouped project provides applicability criteria for project activity instances. These criteria ensure that project activity meets the applicability conditions set out in the methodology.

In the registered PDD, an applicability condition was included regarding the capacity of any replacement appliance or component of a central heating/cooling system. The PDD provides several routes for this criterion to be demonstrated, including, at minimum, through a declaration from the holder of the statutory, property or contractual right in the plant, equipment or process that generates GHG emission reductions, as defined in VCS Standard 4.4, section 3.7.1. This declaration is included in Schedule 2(4)(h) of the Participant Contract (for social housing providers) and Schedule 2(4)(g) of the Participant Contract (for non-social housing providers). Completed declarations are provided for all homes in the Quality Assurance sample group and those included in the Site Visit. Please use the 'Provider Reference' to link the records in the VCS2649 - Emission Reduction Worksheet - FOR VVB 20230424 (Site Visit and QA Group tabs) with Schedule 5 of the relevant Participant Contract.

Also, the replaced appliances/boilers are disposed of in compliance with applicable laws and proper disposal of such appliances will be recorded by the PP and made available to the VVB at the time of verification. And if a boiler is not disposed of as per the law, that shall be accounted for leakages.

As called for by the VCS Standard and consistent with the VM0008 Methodology, this grouped project provides leakage criteria for project activity instances. These criteria ensure that project activity meets the leakage conditions set out in the methodology.

In the registered PDD, the potential for leakage is identified as coming from the improper disposal of boilers that have been replaced. The PDD provides several routes for this criterion to be demonstrated, including, at minimum, through a declaration from the holder of the statutory, property or contractual right in the plant, equipment or process that generates GHG emission reductions, as defined in VCS Standard 4.4, section 3.7.1.

This declaration is included in Schedule 2(4)(m) of the Participant Contract (for social housing providers) and Schedule 2(4)(l) of the Participant Contract (for non-social housing providers). Completed declarations are provided for all homes in the Quality Assurance sample group and those included in the Site Visit. Please use the 'Provider Reference' to link the records in the VCS2649 – Emission Reduction Worksheet – FOR VVB 20230424 (Site Visit and QA Group tabs) with Schedule 5 of the relevant Participant Contract.

FAR-05: A FAR has been raised to verify that the implemented energy efficiency measures for all 28 initial PAIs fall into either category A or category B as defined by the methodology and PD.

The VM0008 Methodology applies to the 'Weatherization' of whole buildings (Category A), implementing individual Weatherization measures within existing Dwellings (Categories B and C) and replacing mobile homes (Category D).

The VM0008 Methodology defines eligible Weatherization measures as those admissible under the U.S. Department of Energy Weatherization Assistance Program, that is, measures admissible under the Energy Conservation in Existing Buildings Act of 1976 Title IV of the Energy Conservation and Production Act, Public Law 94-385, August 14, 1976; Human Services Reauthorization Act of 1984, Public Law 98-558, October 30, 1984; State Energy Efficiency Programs Improvement Act (SEEPIA), Public Law 101-440, October 18, 1990; Energy Policy Act of 2005, Public Law 109-58, August 8, 2005 (as summarized in the Weatherization Assistance Program Briefing Book https://www.energy.gov/sites/prod/files/2020/01/f70/wap_briefing_book_v2.4_01.2020.pdf).

VM0008 Methodology defines several categories of Weatherization intervention:

Category A: Weatherization measures directed at enhancement of the Building Envelope, improving the efficiency of the central heating/cooling system, and reducing the energy consumption of Appliances.

Category B: Weatherization measures directed at enhancement of the Building Envelope, and/or improving the efficiency of the central heating/cooling system.

Category C: Replacement of Appliances. Category D: Replacement of mobile homes.

In this project, the Project Activity involves installing Weatherization measures directed at enhancement of the Building Envelope, improving the efficiency of the central heating/cooling system, and reducing the energy consumption of Appliances (Category A) or involves installing Weatherization measures directed at enhancement of the Building Envelope, and/or improving the efficiency of the central heating/cooling system (Category B).

As called for by the VCS Standard, regulations applicable to grouped projects and consistent with the VM0008 Methodology, this grouped project provides applicability criteria for project activity instances. These criteria ensure that project activity meets the applicability conditions set out in the methodology.

In the registered PDD, an applicability condition was included regarding categorising project activities. The PDD provides several routes for this criterion to be demonstrated, including, at minimum, through a declaration from the holder of the statutory, property or contractual right in the plant, equipment or process that generates GHG emission reductions, as defined in VCS Standard 4.4, section 3.7.1. This declaration is included in Schedule 2(4)(k) of the Participant Contract (for social housing providers) and Schedule 2(4)(j) of the Participant Contract (for non-social housing providers). Completed declarations are provided for all homes in the Quality Assurance sample group and for all homes included in the Site Visit. Please use the 'Provider Reference' to link the records in the VCS2649 - Emission Reduction Worksheet - FOR VVB 20230424 (Site Visit and QA Group tabs) with Schedule 5 of the relevant Participant Contract.

FAR-06: A FAR has been raised to validate and confirm the start date of the project at the time of first verification.

As called for by the VCS Standard, regulations applicable to grouped projects and consistent with the VM0008 Methodology, the project crediting period start date is when the project activity instances begin reducing GHG emissions. Dwellings generate emission reductions starting on the date of the completed installation of the plant, technologies, measures, or processes that generate GHG emission reductions.

At the time of Validation, the project crediting period start date was expected to be July 1, 2022. The first project activity instances with completed installation of plant, technologies, measures or processes that generate GHG emission reductions were completed on July 1, 2022. This is demonstrated through a declaration from the holder of the statutory, property or contractual right in the plant, equipment or process that generates GHG emission reductions, as defined in VCS Standard 4.4, section 3.7.1. This declaration is included in Schedule 5 of the Participant Contract. Four homes included in the Site Visit were completed on July 1, 2022; these are PAI Numbers: 24013, 24014, 24015 and 24145. Completed declarations have been provided for these homes.

Documentation provided by project participant

VCS2649 – Emission Reduction Worksheet – FOR VVB 20230424 *Participant Contract for all homes in the Quality Assurance sample group and those homes included in the Site Visit*

VVB assessment	**Date:** 15/05/2023

FAR 01: It has been concluded based on review of the methodology that year of construction of dwelling is not relevant to the registration or monitoring of the project parameters and is not an applicability condition for the methodology. The applicability condition based on which this FAR was raised was later removed from the final registered PDD. Therefore, the FAR is not applicable. Closed.

FAR 02: Sample contracts between the project proponents and the Project Proponents have been reviewed, specifically schedule 2(4)(d) (for social housing providers) and Schedule 2(4)(c) (for non-social housing providers), by the verification team and it could be concluded that appropriate best practices have been followed and declarations have been obtained as necessary by the Project Proponent to meet the compliances, both national and that of Verra. FAR is closed.

FAR 03: Sample contracts between the project proponents and the Project Proponents have been reviewed, specifically schedule 2(4)(f) (for social housing providers) and Schedule 2(4)(e) (for non-social housing providers) by the verification team and it could be concluded that the project proponents have agreed to the replacement of functional appliances, to meet the compliances, both national and that of Verra. FAR is closed.

FAR 04: Sample contracts between the project proponents and the Project Proponents have been reviewed, specifically schedule 2(4)(h) (for social housing providers) and Schedule 2(4)(g) (for non-social housing providers) by the verification team and it could be concluded that the project proponents have agreed to the meet the energy load requirements of the end-users while replacing the appliances, to meet the compliances, both national and that of Verra. This FAR is closed.

FAR 05: As explained above by the PP, the methodology VM0008 identifies Category A as “Weatherization measures directed at enhancement of the Building Envelope, improving the efficiency of the central heating/cooling system, and reducing the energy consumption of Appliances” and Category B as “Weatherization measures directed at enhancement of the Building Envelope, and/or improving the efficiency of the central heating/cooling system”. The verification team confirmed during the assessment that all measures applied in the grouped project activity fall under one of these categories, thus complying with the PDD requirements. This information was cross-checked from the project database and during rh site visit by verification team to sample households, where the project measures were inquired and confirmed. The FAR is closed.

FAR 06: In line with VCS standard v4.4, the start date of a project is considered from the day it started GHG emission reductions. During the verification, it was checked from review of the project contract and cross-checked during site visit that the first few installations were completed on 01/07/2022. The date has been appropriately considered the start date of the project in line with VCS requirements. FAR is closed.

Table 2. CL from this verification

CL ID	01	**Date :** 31/03/2023
Description of CL		

Following observations are made in the section 1 of Monitoring report (MR): 1. In the section 1.1. “Summary Description of the Implementation Status of the Project” of the MR, the date of issuance of the Validation report is 12/06/2022. However, the issuance date of Validation report is reflected as 13/06/2022 on Project webpage. “https://registry.verra.org/app/projectDetail/VCS/2649”. 2. In the section 1.11 “Sustainable Development Contributions”, under table 1 “Sustainable Development Contribution”, there is no indication of SDG 7, 8 & 10. However, SDG 7, 8 & 10 is mentioned in the Appendix 1 “SDG Contribution”. 3. In the section 1.11 “Sustainable Development Contributions”, under table 1 “Sustainable Development Contribution”, SDG target 6.1 is mentioned. However, there is no indication reported in the registered PDD as well as in the Appendix 1 “SDG Contribution” of the MR. PP is requested to clarify on what basis this SDG indicator has been included in the Table 1.
Project proponent response **Date :** 17/04/2023
1. MR amended to reflect 13/06/2022 2. MR amended to align Appendix 1 with Table 1 (Section 1.11) 3. MR amended to correct the reference in Table 1 (Section 1.11) to SDG Target 7.1
Documentation provided by project proponent
VVB assessment **Date :** 15/05/2023
1. Closed. Amendment has been made to MR reflecting 13/06/2022. 2. Closed. Amendment has been made to MR to align Appendix 1 with Table 1 (Section 1.11). 3. Closed. Amendment has been made to MR updating the reference in Table 1 (Section 1.11) to SDG Target 7.1.

CL ID	02	**Date :** 31/03/2023
Description of CL		

1. In the section 4.2 “Data and Parameter monitored” of the MR, The source of the data & Monitoring equipment for the parameter “HDD_y” & “HDD_b” is mentioned as “national data published by the UK Meteorological Office containing statistics”, “Data retrieved from the Meteorological Office”. However, In the registered PDD The source of the data & Monitoring equipment’s are mentioned as “National data published by the Department for Business, Energy and Industrial Strategy (BEIS)” & “Data retrieved from the Department for Business, Energy and Industrial Strategy (BEIS)”. PP is requested to further clarify the updated source.

2. In the section 4.2 “Data and Parameter monitored” of the MR, it is observed that the some of the parameters from table 9 of applied methodology have also been monitored, while the approach applied for ER calculations is based on pre- and post-retrofit audit approach. PP shall clarify how parameters from table 10 i.e., adjusted consumption approach applicable.

Project proponent response	**Date :** 17/04/2023

1. In the registered PDD, the source of the “HDDy” and “HDDb” parameters is the Digest of UK weather statistics (DUKES). In the registered PDD the calculation method for the “HDDy” and “HDDb” parameters is stated as data provided by the Meteorological Office. The statement in the MR is correct but has been amended to reflect the description from the registered PDD.

2. This project is accredited to use three approaches to calculating emission reductions and related monitoring parameters. They are 1) the Adjusted consumption approach, 2) the Pre- and post-retrofit energy assessment approach and 3) the Control group approach. During the Monitoring Period, the project used only the pre- and post-retrofit energy assessment approaches.

   In section 4.2 of the MR, the monitored parameters in Table 9 are those applicable to the adjusted consumption approach, and those in Table 11 are those applicable to the control group approach.

   These were included in the MR because of an audit finding from the VBB during project validation. Initially, where a parameter was not applicable, it was excluded from the draft PDD. Finding CL ID 16 of the validation required that even where a parameter was not applicable, it should be included in the PDD. This approach was followed when preparing the MR.

   To ensure that both findings (this finding CL ID 02 and the validation finding CL ID 16), the MR has been amended as follows:

   - All parameters included in PDD have been included in the MR
   - Where a parameter was not applicable during the monitoring period, the ‘Value Applied’ field has been updated to state ‘Not applicable during this monitoring period’.

Documentation provided by project proponent

VVB assessment	**Date:** 15/05/2023

1. The statement contained within the MR has been amended to reflect the description from the registered PDD and the actual scenario appropriately.

2. The verification team confirms that the monitoring period under verification applies the approach of pre- and post-retrofit energy assessment approach alone. Therefore, the parameters which are not relevant to this approach have been marked as ‘Not Applicable during this monitoring period’.

The revisions are found appropriate for addressing the raised CL.

CL#02 is closed.

CL ID	03	Date : 31/03/2023

Description of CL

Quality Assurance sampling: The assessment has indicated that the database from which samples have been picked for the quality assurance assessment only consist of dwelling types with single measures implemented, while the dwellings with multiple measures which form majority of the database, have not been considered as part of this assessment. PD is requested to clarify the approach and also justify how the approach is ensuring representativeness in sampling.

Project participant response	Date : 17/04/2023

Quality Assurance monitoring in the VM0008 Methodology allows for correcting the HLF and EDF for all dwellings and decarbonisation measures where a significant discrepancy occurs between the calculated reduction in energy load as shown in the post-retrofit energy assessment for a sample of dwellings of the Same Building Stock and the actual reduction in consumption calculated from directly metered energy data.

The Quality Assurance sample has been redrawn from all dwellings included in the project activity (the dataset provided in file VCS2649 - Emission Reduction Worksheet - FOR VVB 20230424 (MR Jul-Dec 22 tab)). The sample group includes those dwellings with multiple measures.

In compiling the sample group, the following conditions Applicability Conditions from Section 4.2 of the VM0008 Methodology have been applied:

1) *The sample is statistically valid, and may be one of the following:*
    a. *Simple random sample*
    b. *Systematic sampling*
    c. *Stratified sampling within the Same Building Stock*
    d. *Cluster sampling.*

The sample group is a simple random sample.

2) *The sample must be representative of the population.*

The sample group is representative of the population. Sampling includes dwellings that are dispersed geographically (see sub-condition four below).

3) *The data must come from an approved source, i.e. a certified energy auditor, or a nationally recognized data source.*

Pre- and post-retrofit energy assessments are undertaken by accredited energy assessors certified by a public authority, or a private certification program recognized by a public authority.

4) Actions that may bias the sample shall be avoided. Sampling shall include Dwellings that are dispersed geographically. For each defined Building Stock included in the Project activity, sampling shall occur.

The sample group is statistically valid. Sampling includes dwellings that are dispersed geographically:

Figure 1. Geographical distribution of the sample group dwellings[3]

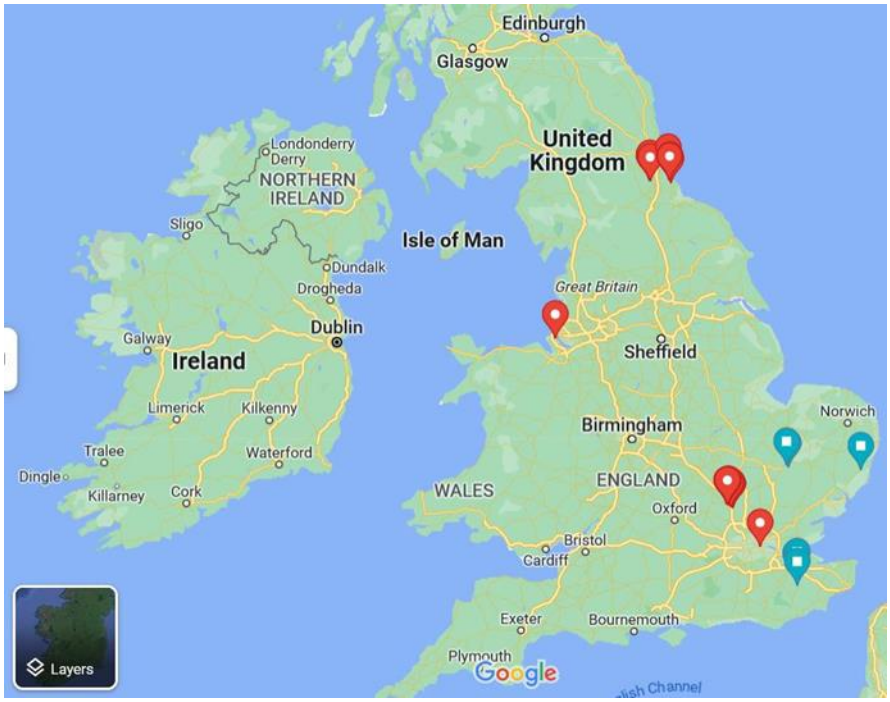


Figure 2. Sub-geographical distribution of the sample group dwellings (south)[4]

[3] Source: Google LLC
[4] Source: Google LLC

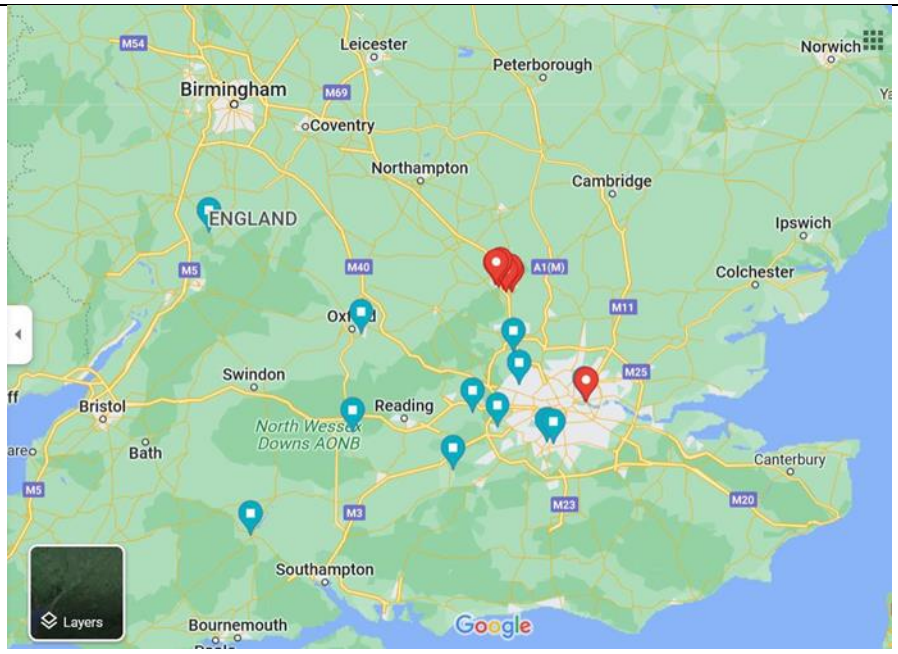
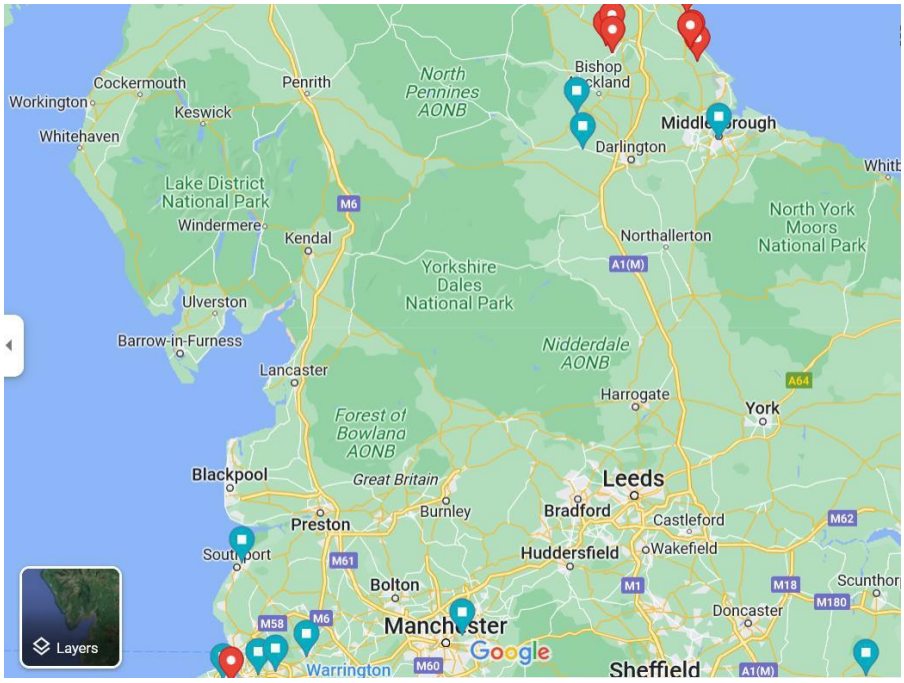


Figure 3. Sub-geographical distribution of the sample group dwellings (north)[5]



The Quality Assurance sample has been drawn from all dwellings included in the project activity.

Documentation provided by project participant

[5] Source: Google LLC

VCS2649 - Emission Reduction Worksheet - FOR VVB 20230424 (see QA Group tab)	
VVB assessment	**Date:** 15/05/2023
The verification team has assessed the revised QA samples and it is noted that the database from which samples have been picked covers all types of measures and categories of dwellings. PD has justified and given clear explanation and justification for the approach taken and how it ensures representativeness in sampling, along with visual representation of the properties' dispersion throughout the project activity boundary. The justification is found appropriate and sufficient for closure of the finding. Therefore, the finding is closed.	

Table 3. CAR from this verification

CAR ID	01	**Date :** 31/03/2023
Description of CAR		

1. The Project Proponent has provided the excel file “VCS 2649 MRAppendix 2 Dataset v2” which indicates the emission reductions from each dwelling part of the monitoring period. However, the calculation sheet does not indicate the total calculated Emission reductions obtained from this monitoring period.

2. The parameters and data recorded have been presented in the above mentioned calculation sheet. However, some of the calculated values are not traceable to their source data. Project Proponent is requested to clarify how all included values in the sheet are calculated/ sourced from.

3. The template guidance of the MR template version 4.2 indicates “*For all projects, state the estimated ex-ante GHG emission reductions and removals and the achieved emission reductions and removals for this monitoring period. Report the percentage difference and justify the difference.”*

   In accordance with the above-mentioned requirement, Project Proponent is requested to provide the comparison between estimated emission reductions and actual reductions, followed by a justification for the difference observed and its impact on additionality of the project, if any.

Project proponent response	**Date :** 17/04/2023

1. A calculation spreadsheet for the emission reduction calculations forms part of the registered PDD. This calculation spreadsheet has now been provided for the PAIs in this monitoring period. Please see VCS2649 - Emission Reduction Worksheet - FOR VVB 20230424. This calculation sheet indicates the total emission reductions for this monitoring period – see the ‘MR Jul-Dec 22’ tab, column ‘W’, row 6,721.

2. A calculation spreadsheet for the emission reduction calculations forms part of the registered PDD. The calculation spreadsheet has now been provided for the PAIs in this monitoring period. Please see VCS2649 - Emission Reduction Worksheet - FOR VVB 20230424. The calculated values are now traceable to their source data – see the ‘MR Jul-Dec 22’ tab.

3. In section 1.10 of the registered PDD, the estimated ex-ante GHG emission reductions and removals for the initial 28 PAIs were 82 tCO2e. The PDD included only those PAIs planned to a sufficient level of detail to enable their assessment at the time validation commenced in 2021.

   This project is a Grouped project. Additional PAIs have been added since validation commenced and will continue to be added throughout the crediting period. This MR includes information regarding the first 6,717 PAIs in the project activity. The achieved ex-post GHG emission reductions and removals for this monitoring period were 1,481 tCO2e.

   The United Kingdom has more than 28.6 million dwellings. The number of PAIs included in the project activity during the monitoring period is 0.023% of the UK housing stock.

   Direct emissions from the housing stock were 67.76 MtCO2e in 2019. The achieved ex-post GHG emission reductions and removals for this monitoring period were 0.002% of the direct emissions of the UK housing stock.

   Due to the relatively slow turnover and replacement rate for older dwellings, the current

housing stock is characterised by older dwellings which were poorly built to relatively low thermal and energy efficiency standards. Although decarbonisation of dwellings is the greatest challenge the UK faces to become a net zero carbon economy, it is severely underfunded and, as a result, far from standard practice. Decarbonisation activity has declined since 2012, and direct emissions from the housing stock have not materially improved. The pilot of this project has demonstrated that carbon finance can play a significant role in helping to expedite the pace and scale of housing retrofit by enabling social housing providers, local authorities and homeowners to overcome the financial barriers that currently prevent the widescale implementation of this vital decarbonisation activity Through this project, there is a significant opportunity to increase the decarbonisation rate of the UK housing stock and thereby reduce GHG emissions. To achieve maximum impact, the project proponent expects to continue adding additional PAIs throughout the crediting period.
Documentation provided by project proponent
VCS2649 – Emission Reduction Worksheet – FOR VVB 20230424
VVB assessment **Date:** 15/05/2023
1. Closed. ER Total is present in MR Jul-Dec 22' tab, column 'W', row 6,721. And the formula is functioning. 2. Closed. Calculated values formulas are working, and source equations quoted in row 1. 3. Closed. Sufficient explanation given as to why the estimated ex-ante GHG emission reductions and removals for the initial 28 PAIs were 41 tCO2e for a six-month monitoring period (a rough average) but due to this being a grouped project and additional PAIs having since been added, this MR contains information on justifying why the achieved ex-post GHG emission reductions and removals for this monitoring period were 1,481 tCO2e. The registered PDD only reflected the emission reductions that were anticipated from the initial 28 PAIs and is therefore, not a reflection of the emission reductions that will be achieved during the verification periods. Further, considering that 28 PAIs were expected to generate 41 tCO2e emission reductions for a six-month monitoring period (as a rough average), 6,717 PAIs (the number of PAIs in this monitoring period) can be assumed to result in 9,835 tCO2e emission reductions for a six-month monitoring period (as a rough average). Since the actual achieved value for 6,717 PAIs is much lower than the estimated value for the same number of PAIs, no further justification is required.

Table 4. FAR from this verification

FAR ID	00	**Section No.**		**Date :** DD/MM/YYYY
Description of FAR				
N/A				
Project proponent response				**Date :** DD/MM/YYYY
N/A				
Documentation provided by project proponent				
N/A				
VVB assessment				**Date:** DD/MM/YYYY
N/A				