



**Verified Carbon
Standard**

HOUSING DECARBONISATION IN ENGLAND AND WALES



arctica partners

Document Prepared by Arctica Partners

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1 PROJECT DETAILS

1.1 Summary Description of the Project

The project activity includes emission reduction improvements to single family dwellings using the “Methodology for Weatherization of Single and Multi-family Buildings” VM0008 Version 1.1 (VM0008 Methodology). Emission reduction improvements are made to existing dwellings. Emission reductions are generated by reductions in fossil fuel consumption in dwellings that are decarbonised compared to baseline consumption. Emission reduction improvements made to existing dwellings are referred to as “decarbonisation” throughout this document.

This project document was prepared to allow Arctica Partners as project proponent (referred to as “project proponent” throughout this document), to commit funding to the decarbonisation of housing stock in England and Wales, to quantify the resulting emission reductions and to originate voluntary carbon credits in conformance with the VM0008 Methodology. This project targets a range of individual single-family dwellings (referred to as “individual dwellings” or “project activity instances” throughout this document) all located in England and Wales. The aggregated emissions from fossil fuel consumption of dwellings in England and Wales make up a significant component of greenhouse gas (GHG) emissions; they also pose a significant opportunity to reduce real emissions.

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 England and Wales. The project proponent collects, monitors, and aggregates data necessary to demonstrate additionality and quantify GHG emission reductions. The project proponent is responsible for overseeing validation and registration of the project with the Verra Registry and managing the verification and sale of the resulting emission reduction credits.

The main project objectives are:

- To gradually group together individual dwellings located in England and Wales inside a cluster, that will achieve together a significant reduction in real emissions during the project crediting period
- To stimulate and reward dwelling owners for their efforts to reduce GHG emissions such as insulating, air sealing and improving the central heating system in existing dwellings and facilitating dwelling owners’ access to the internationally recognised voluntary carbon credits market
- To stimulate and enable investment partners to commit funding into the decarbonisation of housing stock in England and Wales and facilitating investor access to the internationally recognised voluntary carbon credits market

- To overcome the inherent challenges of aggregating small scale decarbonisation activities, simplify third party auditing and control (monitoring) as well as undertaking centralised data collection activities paramount to the quantification of emission reductions.

1.2 Sectoral Scope and Project Type

Energy Efficiency Project: This project has been developed under the VCS Sectoral Scope 3: Energy Demand. The project is an Energy Efficiency project that results from the installation of decarbonisation measures in existing dwellings (“decarbonisation”) to reduce fossil fuel consumption.

Grouped Project: This project is a grouped project. Additional individual dwellings will be added throughout the crediting period. These dwellings will meet the eligibility criteria identified in section 1.4 (Eligibility Criteria) of this document. These criteria are consistent with the VCS Standard v 4.1.

1.3 Project Eligibility

The project meets all the criteria set out in the VCS Program criteria for GHG emission reductions as supported by the VM0008 Methodology approved under the VCS Program. The project will reduce GHG emissions by facilitating decarbonisation measures such as insulating, air sealing and improving the central heating system in existing dwellings which are permanent reductions. The project activity does not include carbon footprint assessments or carbon neutrality claims. The project is eligible under the scope of the VCS Program.

1.4 Project Design

Project activity conducted according to the VM0008 Methodology includes the following categories:

Category B: The project activity includes efficiency enhancement of the building envelope and improvement or replacement of the central heating components in existing individual dwellings (category B of the VM0008 Methodology).

Grouped Project: This project is a grouped project. Individual dwellings included in this project description are known as “project activity instances”. Additional individual dwellings will be added throughout the crediting period. These dwellings will meet the eligibility criteria identified in this section of this document.

Eligibility Criteria

As called for by the VCS Standard v 4.1, regulations applicable to grouped projects and consistent with the VM0008 Methodology, this grouped project provides eligibility criteria for future project activity instances. The relevant eligibility criteria are applicable to all additional individual

dwellings added throughout the crediting period. The eligibility criteria for inclusion of new project activity instances ensure that the new dwellings:

- Meet the applicability conditions defined in section 4.1 of VM0008 Methodology
- Use and apply the decarbonisation measures described in section 1.11 (Description of the Project Activity) of this document
- Are within the physical boundaries of England and Wales, the designated geographic area, and are subject to the baseline scenario determined in this document for the project activity and geographic area
- Pass the appropriate additionality test.

See section 3.2 (Application of the methodology) for more detailed application of the eligibility criteria.

1.5 Project Proponent

Organization name	<i>Arctica Partners</i>
Contact person	<i>Housing Project Director</i>
Title	<i>Director</i>
Address	<i>41 Lothbury, London, EC2R 7HG</i>
Telephone	<i>+44 0203 926 802</i>
Email	<i><u>housing@arcticapartners.com</u></i>

1.6 Other Entities Involved in the Project

N/A

1.7 Ownership

Dwelling owners will assign to the project proponent all rights to the greenhouse gas emission reductions created by the project activity. The project proponent is not expected to be the owner of the dwellings, unless there is documentation that legally proves the opposite.

1.8 Project Start Date

Project activities start date is January 1, 2022, which is the date on which the project will begin generating GHG emission reductions or removals.

1.9 Project Crediting Period

Project crediting period start date is January 1, 2022. Dwellings generate emission reductions beginning on the date of the certificate or declaration of completed installation. The project crediting period continues for seven years to December 31, 2028 (1st crediting period), twice renewable for a total of 21 years. For each individual dwelling, VCUs may be issued for emissions avoided over a ten-year period.

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

Project Scale	
Project	X
Large project	

Ex-ante calculation (estimate) of emission reductions for the initial instances of project activity:

Year	Estimated GHG emission reductions or removals (tCO _{2e})
2022	69
2023	69
2024	69
2025	69
2026	69
2027	69
2028	69
Total estimated ERs	483
Total number of crediting years	Seven (1st crediting period), twice renewable for a total of 21 years
Average annual ERs	69

1.11 Description of the Project Activity

Emission reductions are achieved within one category of project activity defined in section 4.2 in the VM0008 Methodology. The category is **Category B**: efficiency enhancement of the building envelope through insulating and air sealing and efficiency improvements made to the central heating system in single-family dwellings.

For the initial instances of the project activity, four types of decarbonisation measure are eligible for crediting: loft insulation, cavity wall insulation, solid wall insulation and boiler replacement. Eligible decarbonisation measures are efficiency enhancements to the building envelope through insulating and air sealing and efficiency improvements made to the central heating system, for example:

- Adding insulation that increases the resistance to conductive heat loss and reduces air infiltration either singularly or in aggregate within the building envelope, e.g., loft insulation; cavity wall insulation; and/or solid wall insulation
- Improving the efficiency of, or replacing, the central heating equipment, e.g., gas boilers.

This list is not exhaustive.

This Project Document includes information regarding the first 130 individual dwellings included in the project activity between January 1, 2022, and December 31, 2022.

Achieving emission reductions within Individual dwellings

Building envelope improvements, air sealing and improving/replacing central heating systems reduces fuel consumption. Improving or adding insulation reduces the rate of conductive heat loss in the winter or heat gain in the summer. Air sealing reduces air infiltration and consequently reduces convective heat loss or heat gain. Reduced fuel use resulting from these decarbonisation measures generates fossil fuel consumption and emission reductions.

The steps required to achieve emission reductions are the same and are outlined below:

Identification of Dwellings

The project proponent identifies dwellings eligible to participate in the project activity.

Assigning Carbon Ownership

An agreement signed by the dwelling owner assigning to the project proponent all rights to the greenhouse gas emission reductions created by the project activity is maintained in the project activity files.

Baseline Determination

Baseline scenario is calculated using data stored in the centralised data repository in accordance with the approach outlined in the VM0008 Methodology and defined in section 3.4 (Baseline Scenario) of this document.

Installation of Measures

Installation of the decarbonisation measures is carried out by persons of appropriate skill and experience in accordance with nationally recognised best practice standards, building regulations and any other applicable regulations that relate to the installation of the measure.

Calculating Additionality

Additionality is calculated using data stored in the centralised data repository in accordance with the approach outlined in the VM0008 Methodology and defined in section 3.5 (Additionality) of this document and section 4.4 (Emission Reductions and Removals) of this document. The project proponent compares savings with the performance standard for all dwellings included within the project activity.

Monitoring

The project proponent oversees appropriate monitoring procedures. All necessary data are detailed in section 5 (Monitoring) of this document.

Calculating Emission Reductions

Emission reductions are calculated using data stored in the centralised data repository in accordance with the approach outlined in the VM0008 Methodology and defined in section 4.4 (Emission Reductions and Removals) of this document.

Adding Dwellings to the Grouped Project

Only dwellings that meet the eligibility criteria specified in section 1.4 (Eligibility Criteria) of this document are added.

1.12 Project Location

The project activity location is within the boundaries of England and Wales. The first individual instances are in London, England.

Project Latitude (Decimal Degrees): 51.514859

Project Longitude (Decimal Degrees): -0.087996

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 will be recorded and each dwelling in the project is assigned a unique identification number.

1.13 Conditions Prior to Project Initiation

The conditions for dwellings in the project boundary are described below. These dwellings are some of the worst in Europe for thermal insulation, fossil fuel consumption and GHG emissions intensity.¹ They are inefficient, which results in high energy use and burden. They account for around 30 per cent of energy use and around 19 per cent of greenhouse gas emissions in the United Kingdom.² When adjusting for annual temperature variation, emissions from these dwellings rose by 1% in 2017.³ Currently, the amount of decarbonisation occurring is significantly less than the amount needed.⁴

The VM0008 Methodology establishes distinct emission reduction calculations and monitoring procedures for each type of building stock. Same Building Stock is defined in the VM0008 Methodology as “dwellings 1) in the same state, province or region, 2) in the same category (single-family or multi-family) and 3) in the same income group (low-income, middle-income or high-income) as defined by a recognised authority”. Using this definition, dwellings included in the project activity fall into two distinct types of building stock:

- Single family low-income dwellings within England and Wales
- Single family middle-income dwellings within England and Wales.

The independent Climate Change Committee has said the decarbonisation of dwellings is the greatest challenge the United Kingdom faces to become a net zero carbon economy.⁵ More than the expansion of renewable electricity generation, or the electric transport revolution, the delivery of low carbon dwellings must overcome a number of consumer, technological, infrastructure and market barriers. In part, the scale of the challenge reflects the importance of heat utility in homes. Easy access to affordable heat has a profound impact in terms of health, comfort, well-being, and productivity, for people in their homes.

¹ [The decarbonisation of heat](#). Regen. 2020.

² Residential emissions were 19% of carbon emissions in 2019. BEIS. 2020. [UK Greenhouse Gas Emissions](#) provisional figures; 29% of energy use in 2019, 29.9% when temperature corrected. BEIS. 2020. [Consumption Data tables](#)

³ [Home insulation and the net zero target](#). House of Lords Library. 2020.

⁴ [UK housing: Fit for the future?](#) Climate Change Committee. 2019.

⁵ [UK housing: Fit for the future?](#) Climate Change Committee. 2019.

Emission reductions from the United Kingdom's 29 million homes has stalled.⁶ Only 10% of United Kingdom dwellings currently use electricity as their main heating source.⁷ This puts the United Kingdom towards the bottom of the league table of European countries in terms of the proportion of heat sourced from renewable sources.⁸ The predominant source of heating is natural gas which is a fossil fuel and a significant source of carbon emissions. At the point of consumption, burning natural gas in a domestic boiler releases around 222 grams of CO₂e for every kWh of fuel energy input (the full supply chain and lifecycle emissions of natural gas are even higher).⁹

Approximately 13% of United Kingdom households are living in fuel poverty.¹⁰ In other words, a significant proportion of their low income is spent on energy. To date the government's focus has been aimed at encouraging improvement in the energy cost of dwellings.¹¹ By placing focus on reducing the cost of input fuel rather than reducing emissions, a consequence is that dwelling owners have been encouraged towards the use of cheaper but higher carbon fuels such as natural gas. Many of the steps taken to reduce energy costs and address fuel poverty have revolved around continued investment in gas network expansion.¹²

It is also important to consider the state of the United Kingdom building stock. Specific standards regarding insulation were only introduced in 1999. Due to the relatively slow turnover and replacement rate for older homes, the current stock is characterised by older dwellings which were poorly built to relatively low thermal efficiency standards.¹³ ¹⁴ Even with an expected uplift in the current rate of new home building, it is expected that most of the current housing stock will still be standing in 2050 and will by then make up 80% of the total stock.¹⁵ A massive investment programme is needed to retrofit efficiency measures to the fabric of existing dwellings. Low-carbon heat cannot be deployed cost-effectively unless buildings are properly insulated.¹⁶

⁶ [Energy Efficiency of Existing Homes](#). House of Commons Environmental Audit Committee. 2021.

⁷ [The decarbonisation of heat](#). Regen. 2020.

⁸ [The decarbonisation of heat](#). Regen. 2020.

⁹ [CO₂ emission factor prescribed](#) by Part L of the Building Regulations

¹⁰ [The decarbonisation of heat](#). Regen. 2020.

¹¹ [Energy Efficiency of Existing Homes](#). House of Commons Environmental Audit Committee. 2021.

¹² [The decarbonisation of heat](#). Regen. 2020.

¹³ [Energy Efficiency of Existing Homes](#). House of Commons Environmental Audit Committee. 2021.

¹⁴ [The decarbonisation of heat](#). Regen. 2020.

¹⁵ [The decarbonisation of heat](#). Regen. 2020.

¹⁶ [Energy Efficiency of Existing Homes](#). House of Commons Environmental Audit Committee. 2021.

There is significant opportunity to increase decarbonisation in the United Kingdom and thereby improve the efficiency of the housing stock, reduce GHG emissions and reduce the financial burden of home heating for the population.

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

The project proponent affirms that no relevant laws or regulations are violated by the project activity. As part of its procedures, the project proponent undertakes to abide by all regulations while performing project activities.

1.15 Participation under Other GHG Programs

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

The project has not applied for registration under any other GHG programme.

1.15.2 Projects Rejected by Other GHG Programs

The project has not applied for registration under any other GHG programme and has not been rejected by any other GHG programme.

1.16 Other Forms of Credit

1.16.1 Emissions Trading Programs and Other Binding Limits

Emissions from fossil fuel consumption within the building envelope of dwellings in England and Wales are not subject to reduction targets pursuant to the United Kingdom emissions trading scheme.

1.16.2 Other Forms of Environmental Credit

The project is being developed solely under the VCS, with the intention of generating VCUs.

1.17 Additional Information Relevant to the Project

Leakage Management

All leakage emissions will be managed in accordance with leakage requirements identified in section 3 of the VM0008 Methodology and defined in section 4.3 (Leakage) of this document. The VM0008 Methodology requires that leakage from improper disposal of, or continued operation of replaced boilers, be included as leakage if replacing the boiler is part of the project activity. To control the risk of leakage, all boilers that are replaced as part of the project activity are required to be disposed of properly. Proof of proper disposal is a Building Regulations Compliance Certificate, a certificate of completed installation under PAS or an

equivalent or subsequent standard, or a declaration by a regulated provider of social housing or public entity.

Commercially Sensitive Information

No information has been excluded from this document on the basis that it is commercially sensitive. However, highly sensitive, highly confidential data may be collected from dwelling owners in the project. All such information is and must remain confidential.

Sustainable Development

There are a variety of reasons for investing in decarbonisation measures which mutually reinforce each other. Decarbonisation measures lead to a reduction in energy demand which feeds through directly into reduced GHG emissions. Decarbonisation measures also reduce the financial burden of home heating for the population. Easy access to affordable heat has a profound impact in terms of health, comfort, well-being, and productivity, for people in their homes.

Cold homes are recognised as a source of both physical and mental ill health.¹⁷ Decarbonising the housing stock so that homes are warm, healthy and adapted for the future will help protect the health of those most vulnerable and reduce the strain on the National Health Service.¹⁸ Investing in decarbonisation measures has the co-benefit of being an effective form of preventative healthcare.

The Committee on Climate Change has identified that improving thermal comfort would reduce the cost to the National Health Service in England by £1.4 – 2.0 billion per year.¹⁹ The impact of fuel poverty is so acute that premature mortality related to cold homes is responsible for 17,000 deaths per year.²⁰ Children living in cold housing conditions are more than twice as likely to suffer from breathing problems, including asthma and bronchitis.²¹ With 2.4 million households in fuel poverty in England today,²² there is a clear need for action on insulating, air sealing and improving the central heating system in existing dwellings given the health, comfort, well-being, and productivity implications of people living in cold homes.

¹⁷ [Heat Decarbonisation: Potential Impacts on Social Equity and Fuel Poverty](#). National Energy Action. 2017

¹⁸ [Heat Decarbonisation: Potential Impacts on Social Equity and Fuel Poverty](#). National Energy Action. 2017

¹⁹ [UK housing: Fit for the future?](#) Climate Change Committee. 2019.

²⁰ [E3G and National Energy Action](#). February 2019.

²¹ [Assessing the Health Impact of Cold Homes](#). Centre for Sustainable Energy. 2017.

²² [Heat Decarbonisation: Potential Impacts on Social Equity and Fuel Poverty](#). National Energy Action. 2017

Decarbonisation measures also have the potential to create jobs and boost existing firms (especially SMEs and their supply chains) in construction. Economy-wide, there is considerable potential to develop and extend the labour force with a full range of high value skills.²³

The project directly contributes to achieving **UN Sustainable Development Goal 7**: Ensure Access to Affordable, Reliable, Sustainable and Modern Energy, **Goal 11**: Make cities inclusive, safe, resilient and sustainable and **Goal 3**: Ensure healthy lives and promote well-being for all at all ages.

Further Information

Not applicable.

2 SAFEGUARDS

2.1 No Net Harm

No potential negative environmental and socio-economic impacts have been identified for the project.

2.2 Local Stakeholder Consultation

The project proponent has consulted with local stakeholders to inform the design of the project and maximise participation from stakeholders. The stakeholders consulted include:

- Dwelling owners
- Decarbonisation measure installers
- Data vendors
- Government and local authorities

The project aligns with objectives of the United Kingdom Government which recognises the role of voluntary carbon markets in supporting the Paris Agreement, including the importance of driving the use of voluntary carbon credits. Government policy is to encourage the development of a robust voluntary carbon market for high quality voluntary carbon credits. The United Kingdom will implement the framework recommended by the Taskforce on Scaling Voluntary Carbon Markets and establish the market architecture needed to ensure the scaling of the voluntary carbon markets.²⁴

²³ [Heat Decarbonisation: Potential Impacts on Social Equity and Fuel Poverty](#). National Energy Action. 2017

²⁴ Chancellor Rishi Sunak announced in his [March 2021 Budget](#).

The project proponent will establish mechanisms for ongoing communication with local stakeholders to allow stakeholders to raise concerns about potential negative impacts during project implementation.

2.3 Environmental Impact

Emission reductions are generated by reductions in fossil fuel consumption in dwellings that are decarbonised compared to baseline consumption. Building envelope improvements, air sealing and improving/replacing central heating systems reduces fuel consumption. Improving or adding insulation reduces the rate of conductive heat loss in the winter or heat gain in the summer. Air sealing reduces air infiltration and consequently reduces convective heat loss or heat gain. Reduced fuel use resulting from these decarbonisation measures generates fossil fuel consumption and emission reductions.

The project activity is not expected to have any adverse environmental impacts.

2.4 Public Comments

Following the procedures and guidelines established by the VCS Program this project will be up for public comment from the date on which the project is listed on the project pipeline for a 30-day public comment period.

2.5 AFOLU-Specific Safeguards

Not applicable.

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

The project uses the approved Methodology “Methodology for Decarbonisation of Single and Multi-Family Buildings” VM0008 Version 1.1.

3.2 Applicability of Methodology

The project activity includes emission reduction improvements to individual dwellings. Emission reductions are generated by reductions in fossil fuel consumption in dwellings that are decarbonised compared to baseline consumption. Specific conditions which are applicable to the methodology are shown in Table 1 below.

Table 1. Project compliance with applicability condition

No	Applicability Condition	Project Compliance
1	The dwelling is one of the types of building stock accepted into the project. Same Building Stock is defined in the methodology as Dwellings 1) in the same region, 2) in the same category, and 3) form part of the same income group as defined by a recognised authority. This project accepts individual dwellings located within the physical boundaries of England and Wales that form part of the low-income, or middle-income group, as defined by the Office of National Statistics	Documentation: <ul style="list-style-type: none"> a. the physical address and geodetic coordinates of the dwelling are obtained and checked to ensure the dwelling is within the physical boundaries of England and Wales b. the address of the dwelling is checked against the Local Authority's register of houses in multiple occupation to ensure the dwelling is an individual (single family) dwelling and not a multi-family dwelling c. the address of the dwelling is checked against the Office of National Statistics' dataset to ensure the dwelling forms part of the low-income or middle-income group Documentation is maintained in the project activity files
2	The dwelling uses fossil fuel combustion as its primary fuel source To qualify for the crediting of insulation measures, the dwelling was constructed prior to 1999	Documentation: <ul style="list-style-type: none"> a. Declaration by the dwelling owner Documentation is maintained in the project activity files
3	The condition of the dwelling is adequate for project activities according to nationally recognised best practice standards	Installation of the decarbonisation measure is carried out in accordance with Building Regulations and Publicly Available Specification (PAS) 2030 ²⁵ or an equivalent or subsequent standard

²⁵ PAS 2030 sets out minimum standards and requirements for the installation of energy efficiency measures in existing buildings. PAS includes requirements in respect of installation processes, process management and service provision and includes criteria relating to installation methods, equipment, tools, product or system and material suitability, the commissioning of installed measures and the training, skills and competence of the people undertaking such installation.

	<p>Project activities do not result in a violation of health and safety, environmental, or other relevant regulations and any boilers that are replaced as part of the project activity are disposed of properly</p> <p>The capacity of any replacement component of a central heating system satisfies the post-retrofit heat load within the dwelling</p> <p>The project activity uses and applies efficiency enhancements to the building envelope through insulating and air sealing and efficiency improvements made to the central heating system</p>	<p>Documentation:</p> <p>a. Building Regulations Compliance Certificate, a certificate of completed installation under PAS or an equivalent or subsequent standard, or a declaration by a regulated provider of social housing or public entity Documentation is maintained in the project activity files</p>
4	<p>The project activity is not mandated, or required by law or regulation</p>	<p>Documentation:</p> <p>a. Declaration by the dwelling owner</p> <p>Documentation is maintained in the project activity files</p>
5	<p>Project activity meets or exceeds the performance benchmark</p>	<p>Documentation:</p> <p>a. Reports required for demonstrating additionality for each project activity instance are generated from the centralised data repository by the project proponent in accordance with the approach outlined in section 3.5 (Additionality) of this document and section 4.4 (Emission Reductions and Removals) of this document</p> <p>Documentation is maintained in the project activity files</p>
6	<p>Proof of title of the emission reductions</p>	<p>Documentation:</p> <p>An agreement signed by the dwelling owner assigning to the project proponent all rights to the greenhouse gas emission reductions created by the project activity</p>

		Documentation is maintained in the project activity files
7	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	Documentation: Utility bills or mortgage statements relating to the dwelling or other indicators such as mortgage deeds, the existence of a lease or license (such as a tenancy agreement), or declaration by a regulated provider of social housing or public entity Documentation is maintained in the project activity files

3.3 Project Boundary

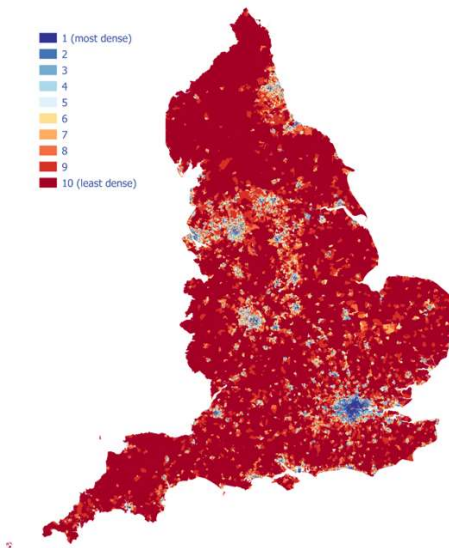
This project activity encompasses all individual dwellings within the boundaries of England and Wales. Coordinates for these countries are:

Longitude: 6°27'W to 1°46'E

Latitude: 49°51'N to 55°48'N

There are currently about 25.5 million such dwellings. Figure 1 below illustrates the spatial distribution of dwellings within England and Wales.

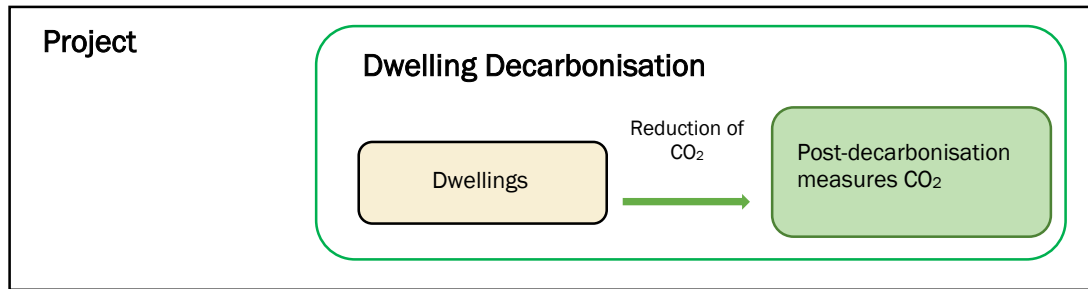
Figure 1 Distribution of all England and Wales dwellings (2020).²⁶



²⁶ Source: [BuiltPlace](#)

The flow diagram provided below, Figure 2, illustrates the systems and emissions sources and GHGs included within the project boundary.

Figure 2 Project boundary flow diagram



The project boundary is the building envelope of dwellings and the associated heating and cooling equipment. Table 2 below identifies and assesses the GHG sources in the baseline and project scenario.

Table 2 Relevant GHG sources included in the baseline and project scenario

Source	Gas	Included?	Justification/Explanation	
Baseline	Emissions from central heating fossil fuel combustion	CO ₂	Included	Source of GHG emissions
		CH ₄	Excluded	Negligible
		N ₂ O	Excluded	Negligible
		Other	Excluded	Negligible
	Emissions from grid electricity consumption for heating	CO ₂	Excluded	Currently excluded in the baseline to maintain conservativeness. This project only includes emission reductions generated by reductions in fossil fuel consumption. Currently, the purchase and consumption of fossil fuel as the source of energy for electricity generation is difficult to monitor on any reliable basis
		CH ₄	Excluded	Negligible
		N ₂ O	Excluded	Negligible
		Other	Excluded	Negligible
	Emissions for wood	CO ₂	Excluded	Currently excluded in the baseline to maintain conservativeness. Currently, the purchase and consumption of wood as fuel and emissions

Source	Gas	Included?	Justification/Explanation
combustion for heat			associated therewith are difficult to monitor on any reliable basis
	CH ₄	Excluded	Negligible
	N ₂ O	Excluded	Negligible
	Other	Excluded	Negligible
Emissions from central heating fossil fuel combustion	CO ₂	Included	Source of GHG emissions
	CH ₄	Excluded	Negligible
	N ₂ O	Excluded	Negligible
	Other	Excluded	Negligible
Emissions from grid electricity consumption for heating	CO ₂	Included	Currently excluded in the project activity to maintain conservativeness. This project only includes emission reductions generated by reductions in fossil fuel consumption. Currently, the purchase and consumption of fossil fuel as the source of energy for electricity generation is difficult to monitor on any reliable basis
	CH ₄	Excluded	Negligible
	N ₂ O	Excluded	Negligible
	Other	Excluded	Negligible
Emissions for wood combustion for heat	CO ₂	Included	Currently excluded in the project activity to maintain conservativeness. Currently, the purchase and consumption of wood as fuel and emissions associated therewith are difficult to monitor on any reliable basis
	CH ₄	Excluded	Negligible
	N ₂ O	Excluded	Negligible
	Other	Excluded	Negligible

The United Kingdom of Great Britain and Northern Ireland, commonly known as the United Kingdom (UK) or Britain, is a sovereign country in Western Europe. Lying off the north-western coast of the European mainland, the United Kingdom includes the island of Great Britain, the north-eastern part of the island of Ireland and many smaller islands. With an area of 242,500

square kilometers, the United Kingdom is the 78th-largest sovereign state in the world. It is also the 21st-most populous country, with an estimated 65.5 million inhabitants in 2016.

Figure 3 Geographical boundary of the country where the project activity is implemented



The initial project instances (individual dwellings) are 130 dwellings in London which have been retrofitted to install loft insulation and cavity wall insulation. The dwellings are all characterised by having low thermal efficiency standards. The building envelope improvements will reduce the rate of conductive heat loss in the winter or heat gain in the summer. This will generate reductions in fossil fuel consumption compared to baseline consumption generating emission reductions.

3.4 Baseline Scenario

The baseline scenario is defined as the current fossil fuel consumption that is consumed over a twelve-month period to satisfy the heat load within dwellings in the Same Building Stock. Only dwellings that use fossil fuel combustion as the primary fuel source are eligible to be included in the project.

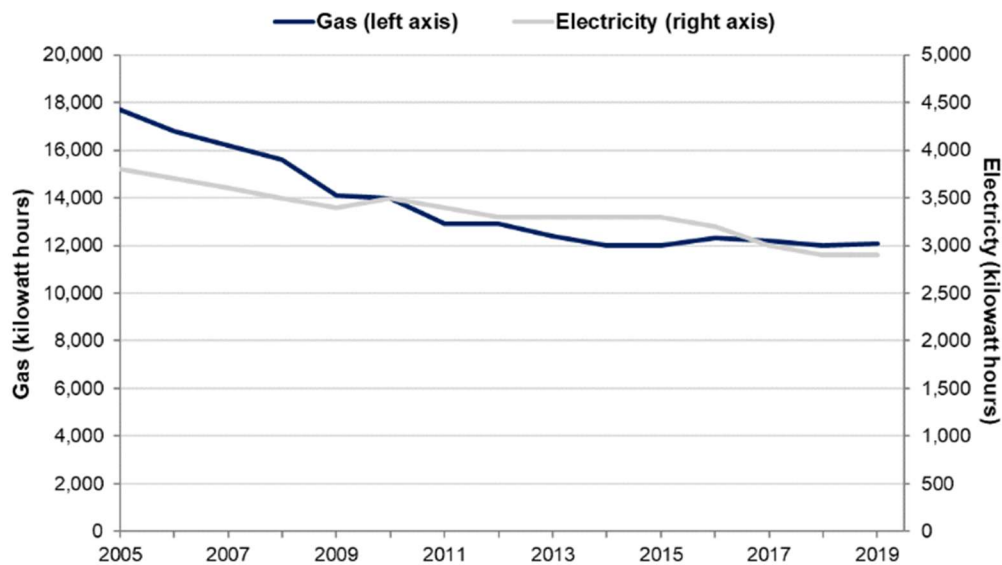
The baseline scenario does not count electricity consumption to be conservative. This is because currently the purchase and consumption of fossil fuel as the source of energy for electricity generation is difficult to monitor on any reliable basis.

The baseline includes fossil fuel consumed during the most recent twelve-month period for which data are available prior to project activity and is quantified from vendor reported meter point readings as collated and published by the Department for Business, Energy & Industrial Strategy

(BEIS) as part of the National Energy Efficiency Data Framework (NEED).²⁷ The initial baseline scenario for individual low-income dwellings within England and Wales is 11,700 kWh of natural gas annually as determined from consumption reports for around 6.7 million dwellings. The initial baseline scenario for individual middle-income dwellings within England and Wales is 14,400 kWh of natural gas annually as determined from consumption reports for around 10.4 million dwellings.

Fossil fuel consumption remains static in the initial baseline scenario. This is since historical consumption reports for the five years prior to the baseline indicate that fuel consumption either remains the same or increases (see Figure 4). For example, had the baseline scenario been calculated with data for 2014, the result for individual low-income dwellings would have also been 11,700 kWh of natural gas annually and the result for individual middle-income dwellings slightly higher at 14,500 kWh of natural gas annually.

Figure 4 Trends in median annual domestic gas and electricity consumption, England and Wales, 2005 – 2019.²⁸



Every three years, historical fuel consumption will be analysed to confirm the continuation of this trend or make the necessary modifications to the baseline if the trend changes.

3.5 Additionality

Performance Standard for individual dwelling energy efficiency improvements

Although decarbonisation of dwellings is the greatest challenge the United Kingdom faces to become a net zero carbon economy, it is severely underfunded and as a result, far from common

²⁷ Published by a government agency and designated as an official national statistic

²⁸ [National Energy Efficiency Data-Framework \(NEED\): Summary of Analysis, Great Britain. BEIS. 2021.](#)

practice.²⁹ At least 65% of existing dwellings across the United Kingdom have not had any decarbonisation steps taken.³⁰ Financial additionality from the voluntary carbon markets would be impactful for signalling the value of low carbon dwellings and an important step to incentivise dwelling owners to improve building fabric efficiencies. The contribution of voluntary carbon markets may not be sufficient to overcome all the cost barriers faced by dwelling owners but would help to rebalance cost-benefit analyses and may prove critical for mass retrofit programmes on the cusp of viability.³¹

Additionality will be demonstrated using the performance standard for dwellings in accordance with the VM0008 Methodology. The performance standard is based on the percent change in fossil fuel consumption in dwellings that are in the Same Building Stock over at least the three most recent 12-month periods for which data are available. Only project activity instances with projected energy savings that exceed the performance standard will be considered additional and therefore be included in the project activity.

Performance Standard: The performance standard under the VM0008 Methodology is based on the percent change in fossil fuel consumption within the Same Building Stock. The performance standard demarks a decrease in fossil fuel consumption that is unlikely to occur naturally, i.e., in the absence of the project activity. The performance standard is defined as a percentage decrease in fossil fuel consumption that dwellings are unlikely to reach without project activity with 90% certainty.

VM0008 Methodology requires the performance benchmark to be calculated using the standard deviation (sigma) of the percent savings in the Same Building Stock where the underlying data follows a normal distribution. For data not following a normal distribution (non-Gaussian), the Methodology requires the performance benchmark to be equal to the 90th percentile value within the numerically ordered sample.

The distribution of fossil fuel consumption by dwellings in England and Wales is non-Gaussian (as evidenced from the Property level gas and electricity consumption data published by BEIS as part of the NEED Framework). Each of the two types of building stock in the project will have a unique performance standard value. In accordance with the VM0008 Methodology, the performance standard is calculated using the percentile method for both low-income and middle-income dwellings:

- The Performance Standard is equal to the 90th percentile value within the numerically ordered sample. To calculate the 90th percentile the sample data point values ($v_1, v_2...v_N$) must be ordered from least to greatest. The 90th percentile value is equal to the value of the data point with the rank at which 90% of the data falls below.

Equation 1: The data point with the rank at which 90% of the data falls below:

- $n = \lceil P_{90}/100 \rceil + 0.05$
- $x =$ the value of the data point at rank n calculated in (a).

²⁹ [UK housing: Fit for the future?](#) Climate Change Committee. 2019.

³⁰ [Energy Efficiency of Existing Homes.](#) House of Commons Environmental Audit Committee. 2021.

³¹ [The decarbonisation of heat.](#) Regen. 2020

Where:

x = Performance Standard

n = Rank of the ordered data point falling at the 90th percentile

N = Total number of data points included in the sample

P_{90} = 90th percentile

To be additional, dwellings must satisfy the following condition:

Equation 2: For emission reductions quantified using the adjusted consumption approach:

$$\frac{EL_{pre,i} - EL_{post,i}}{EL_{pre,i}} * 100 \geq x$$

Where:

$EL_{pre,i}$ = Pre-retrofit fossil fuel consumption of Dwelling i

$EL_{post,i}$ = Post-retrofit fossil fuel consumption of Dwelling i

Equation 3: For emission reductions quantified using the control group approach:

$$D_{pct,i} \div 100 \geq x$$

Where:

$D_{pct,i}$ = Percent savings of fossil fuel consumption of Dwelling i

Calculation: In accordance with the VM0008 Methodology, the Performance Standard is calculated for at least the three most recent 12-month periods for which data are available from dwellings within the Same Building Stock. The dataset used is the Property level gas and electricity consumption data published by BEIS as part of the NEED Framework.^{32 33} The sample size is 4 million dwellings. The full range of available data for nine 12-month periods are used in the calculation.

All low-income dwellings that achieve a percent savings above the Performance Standard (x) must achieve a percent savings value of 5.0152% or greater to be considered additional. Additionality will be assessed for each dwelling included in the project activity.

All middle-income dwellings that achieve a percent savings above the Performance Standard (x) must achieve a percent savings value of 4.4992% or greater to be considered additional. Additionality will be assessed for each dwelling included in the project activity.

Low-income individual dwelling performance standard: $x = 0.050152$

Middle-income individual dwelling performance standard: $x = 0.044992$

³² Anonymised NEED data: 4 million row sample

³³ Published by a government agency and designated as an official national statistic

The analysis was conducted in accordance with the VM0008 Methodology as follows:

- The Performance Standard included all fuel types consumed by dwellings in the Same Building Stock. All fuel types were included for the performance standard analysis to be conservative when determining the percent savings of fossil fuel consumption. Similarly, dwellings decarbonised as part of the project were not excluded for the performance standard analysis to be conservative when determining the percent savings of fossil fuel consumption. By broadening the base, savings from the project are diluted.

In accordance with the VM0008 Methodology, the project uses the level of the Performance Standard metric available at project validation for each verification event for the duration of all project crediting periods.

3.6 Methodology Deviations

There is no methodology deviation.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

Baseline emissions are defined as emissions from fossil fuel consumed over twelve months to satisfy the heating and cooling load prior to project activity. Refer to section 3.4 (Baseline Scenario) of this document for explanation of how baseline emissions are determined. Once established, the baseline for a dwelling, or type of building stock remains static throughout the crediting period.

4.2 Project Emissions

Project activity emissions are defined as emissions from fossil fuel consumed over twelve months to satisfy the heat load once the project activity has occurred. In accordance with the VM0008 Methodology, emissions from the process of installation of the decarbonisation measures are negligible and need not be included. Refer to section 4.4 (Emission Reductions and Removals) of this document for explanation of how project emissions are determined.

4.3 Leakage

The only potential sources of leakage are improper disposal of boilers that have been replaced. Condensing boilers account for over 98% of the domestic boilers installed in the UK and condensate must be disposed of appropriately. Leakage from condensate or the possible continued operation of improperly disposed of boilers is accounted for by the regulatory framework in England and Wales. Proof of proper disposal is a Building Regulations Compliance Certificate, a certificate of completed installation under PAS or an equivalent or subsequent standard, or a declaration by a regulated provider of social housing or public entity.

4.4 Net GHG Emission Reductions and Removals

To determine the emission reductions, it is necessary to explain how the data required by the data parameters are collected and how they feed into the appropriate equations called for in the VM0008 Methodology. This section provides information on the monitoring necessary to calculate baseline and project activity emissions and subsequent emission reductions. Refer to section 5 (Monitoring) of this document for additional detail on the monitoring plans and parameters.

This section explains how emission reductions are quantified for project activity. Quantifying emission reductions includes establishing the baseline which is also done in accordance with the equations provided in the VM0008 Methodology. Variables (referred to as “parameters” in the monitoring tables) are identified and defined using numbers from existing data for the purpose of ex-ante calculations. Quantifying emission reductions will be described in the following order:

1. The control group consumption approach
2. The adjusted consumption approach

To be clear, the calculations quantifying emission reductions will use first instance specific data for each project year. However, the summary ex-ante emission reduction table is populated with predicted emission reductions for the entire crediting period. These tables rely on data that are not first instance specific since the tables project emission reductions for a longer period. The ex-ante projected emission reductions presented in this document may differ slightly from the reported emission reductions.

1. The Control group approach is applied according to the VM0008 Methodology as follows:

In this approach, intervention and control groups are defined for decarbonisation measures installed as part of the project. The intervention groups contain dwellings from the Same Building Stock which have received the decarbonisation measure, and no other measure in the year before, during or a year after the installation year. The intervention groups cannot be analysed in isolation since a change in consumption could be due to other factors, such as a change in energy prices. Therefore, control groups are created containing dwellings from the Same Building Stock with no record of any decarbonisation measure installed in the year before, after or during the installation year.

The difference in the fossil fuel consumption between the control group and the intervention group each year will constitute the fossil fuel consumption savings for all dwellings installing the decarbonisation measure for that year and serves as the basis for calculating emission reductions.³⁴ The project will not prevent or deny decarbonisation to any homeowner for the purpose of maintaining the control group. Instead, the control group sample may include different dwellings so long as the control group contains only non-decarbonised dwellings.

Emission reductions in the control group approach are calculated as follows:

Equation 4: Emission reductions:

³⁴ Since the fossil fuel consumed by decarbonised dwellings is directly compared to the fossil fuel consumed by non-decarbonised dwellings within the Same Building Stock and the same year, there is no need to apply heating/cooling degree day correction factors

$$ER_y = \sum_{i,j=1}^{I,J} (F_{SG,y,j,b} \times F_{CO2,j}) - L_y$$

Where:

ER_y = Emission Reduction in year y in metric tons (“t”) CO_{2e}/yr

I = Number of Dwellings

J = Number of fuel types

i = Dwelling

j = Fuel type

$F_{SG,y,j,b}$ = Average fossil fuel consumption savings resulting from a given decarbonisation measure being installed in dwellings of the Same Building Stock b year y

L_y = Leakage in year y

$F_{CO2,j}$ = The CO₂ emission factor per unit of energy of fuel type j expressed in tCO_{2e} / kWh

Leakage will be assessed for project activity as described in section 4.3 (Leakage) of this document

y = Any consecutive twelve months during the project’s crediting period, and is defined with an integer from 1 on in a consecutive manner

Leakage, L_y , is calculated as follows:

Equation 5:

$$L_y = L_{CO2,y} + L_{HFC,y}$$

The parameters to be monitored in the control group approach are listed in section 5.

Calculating ex-ante emission reductions with existing data values for **Intervention Measure: Loft Insulation** for **Same Building Stock: Middle-income Dwellings** for year 2022:

$$ER_y = \sum_{i,j=1}^{I,J} (F_{SG,y,j,b} \times F_{CO2,j}) - L_y$$

Where:

ER_y = 2022

I = 130

J = 1

i = Dwelling

j = Natural gas

$F_{SG,y,j,b}$ = 770 kWh

L_y = 0

$F_{CO2,j}$ = 0.000222 tCO_{2e} / kWh

$$ER_y = \sum_{i,j=1}^{I,J} (F_{SG,y,j,b} \times F_{CO2,j}) - L_y$$

$$ER_{2022} = 22.22 \text{ tCO}_2\text{e}$$

Calculating ex-ante emission reductions with existing data values for **Intervention Measure: Cavity Wall Insulation** for **Same Building Stock: Middle-income Dwellings** for year 2022:

$$ER_y = \sum_{i,j=1}^{I,J} (F_{SG,y,j,b} \times F_{CO2,j}) - L_y$$

Where:

$$ER_y = 2022$$

$$I = 130$$

$$J = 1$$

i = Dwelling

j = Natural gas

$$F_{SG,y,j,b} = 1,630 \text{ kWh}$$

$$L_y = 0$$

$$F_{CO2,j} = 0.000222 \text{ tCO}_2\text{e} / \text{kWh}$$

$$ER_y = \sum_{i,j=1}^{I,J} (F_{SG,y,j,b} \times F_{CO2,j}) - L_y$$

$$ER_{2022} = 47.04 \text{ tCO}_2\text{e}$$

Table 3. Ex-ante calculation (estimate) of emission reductions for the initial instances of project activity / individual dwellings

Year	Estimated number of cumulative dwellings	Estimated baseline emissions (tCO ₂ e)	Estimated project emissions (tCO ₂ e)	Estimated leakage emissions (tCO ₂ e)	Estimated net GHG emission reductions or removals (tCO ₂ e)
2022	130	415	346	0	69
2023	130	415	346	0	69
2024	130	415	346	0	69
2025	130	415	346	0	69
2026	130	415	346	0	69

2027	130	415	346	0	69
2028	130	415	346	0	69
Total	130	2,905	2,422	0	483

2. The Adjusted Consumption group approach is applied according to the VM0008 Methodology as follows:

In this approach, fossil fuel consumption pre-retrofit, the baseline consumption, is measured for an intervention group of dwellings for decarbonisation measures installed as part of the project. The intervention groups contain dwellings from the Same Building Stock which have received the decarbonisation measure, and no other measure in the year before, during or a year after the installation year.

Fossil fuel consumption post-retrofit, the project consumption, is subtracted from the baseline consumption. The difference between the baseline consumption and the project consumption will constitute the fossil fuel consumption savings for all dwellings installing the decarbonisation measure for that year and serves as the basis for calculating emission reductions. For subsequent years the baseline consumption is adjusted for heating/cooling degree days using Heating/Cooling Degree Day Correction Factors (“HDDCF” or “CDDCF” as applicable).

A control group of dwellings with no record of any decarbonisation measure installed in the year before, after or during the installation year is monitored as a quality assurance measure.

Emission reductions in the adjusted consumption approach are calculated as follows:

Equation 6:

$$ER_y = \sum_{i,j=1}^{I,J} (F_{b,j,i} \times HDDCF_y - F_{p,y,i,j}) * F_{CO2,j} - L_y$$

Where:

ER_y = Emission Reduction in year y in metric tons (“t”) CO₂e/yr

CDDCF _{y} = Cooling Degree Days Correction Factor for year y

HDDCF _{y} = Heating Degree Days Correction Factor for year y

$F_{b,i,j}$ = Fuel type j consumed in the year prior to project implementation for dwelling i (baseline consumption)

$F_{p,y,i,j}$ = Fuel type j consumed by the project in year y for dwelling i (project consumption)

$F_{CO2,j}$ = The CO₂ emission factor per unit of energy of fuel type j expressed in tCO₂e / kWh

Leakage will be assessed for project activity as described in section 4.3 (Leakage) of this document

L_y = Leakage in year y

I = Number of Dwellings

J = Number of fuel types

i = Dwelling

j = Fuel type

y = Any consecutive twelve months during the project's crediting period, and is defined with an integer from 1 on in a consecutive manner

The HDDCF and CDDCF factors are used to update the baseline energy consumption annually based on changes in temperature. These factors are determined based on data published by the Department for Business, Energy & Industrial Strategy (BEIS).

The Heating Degree Day Correction Factor is calculated as follows:

Equation 7:

$$HDDCF_y = \frac{HDD_b}{HDD_b}$$

The Cooling Degree Day Correction Factor is calculated as follows:

Equation 8:

$$CDDCF_y = \frac{CDD_b}{CDD_b}$$

Where:

HDD_y = Heating degree days for year y after installation

HDD_b = Heating degree days for one year before installation

CDD_y = Cooling degree days for year y after installation

CDD_b = Cooling degree days for one year before installation

Leakage, L_y , is calculated as follows:

Equation 9:

$$L_y = L_{CO2,y} + L_{HFC,y}$$

The parameters to be monitored in the adjusted consumption approach are listed in section 5.

5 MONITORING

5.1 Data and Parameters Available at Validation

Methodology reference	Table 3
Data / Parameter	Performance Standard (a)
Data unit	Percent
Description	Average performance, defined as the annual average percent savings in weather normalised fossil fuel consumption in dwellings within the Same Building Stock
Source of data	National data published by the Department for Business, Energy & Industrial Strategy (BEIS) as part of the National Energy Efficiency Data Framework (NEED). ³⁵ The dataset used is the Property level gas and electricity consumption dataset ³⁶
Value applied	<p>Low-income individual dwelling Performance Standard: x= 5.0152</p> <p>Middle-income individual dwelling Performance Standard: x= 4.4992</p> <p>In accordance with the VM0008 Methodology, the project uses the level of the Performance Standard metric available at project validation for each verification event for the duration of all project crediting periods</p>
Justification of choice of data or description of measurement methods and procedures applied	<p>Calculated for at least the three most recent 12-month periods for which data are available from dwellings within the Same Building Stock. A sample of dwellings may be used. Percent savings are calculated by comparing year 1 to year 2 and year 2 to year 3, etc</p> <p>Calculation conducted in accordance with the VM0008 Methodology as set out in section 3.5 (Additionality) of this document</p> <p>Source data is published by a government agency and designated as an official national statistic meaning the dataset meets the highest standards of trustworthiness, quality, and public value</p>

³⁵ Published by a government agency and designated as an official national statistic

³⁶ Anonymised NEED data: 4 million row sample

Frequency	Once per project crediting period, the level of the Performance Standard metric available at project validation is used for each verification event
Purpose of Data	Calculation of performance standard
Comments	N/A

Methodology reference	Table 3
Data / Parameter	Performance Standard (σ)
Data unit	N/A
Description	Standard Deviation of the annual percent savings
Source of data	N/A
Value applied	N/A
Justification of choice of data or description of measurement methods and procedures applied	<p>VM0008 Methodology requires the performance benchmark to be calculated using the standard deviation (sigma) of the percent savings in the Same Building Stock where the underlying data follows a normal distribution (non-Gaussian)</p> <p>For data not following a normal distribution, the Methodology requires the performance benchmark to be equal to the 90th percentile value within the numerically ordered sample</p> <p>As set out in section 3.5 (Additionality) of this document, the distribution of fossil fuel consumption by dwellings in England and Wales is non-Gaussian (as evidenced by the Property level gas and electricity consumption data published by BEIS) and accordingly the standard deviation is not calculated</p>
Frequency	N/A
Purpose of Data	N/A
Comments	N/A

Methodology reference	Table 5
Data / Parameter	EleCco2

Data unit	tCO _{2e} / kWh
Description	Grid emission factor for the regional electricity source
Source of data	N/A
Value applied	N/A
Justification of choice of data or description of measurement methods and procedures applied	Currently excluded in the baseline to maintain conservativeness. This project only includes emission reductions generated by reductions in fossil fuel consumption. Currently, the purchase and consumption of fossil fuel as the source of energy for electricity generation is difficult to monitor on any reliable basis
Frequency	N/A
Purpose of Data	N/A
Comments	N/A

Methodology reference	Table 5
Data / Parameter	Cal _j
Data unit	GJ/mass or GJ/volume
Description	Calorific value of fuel type <i>j</i>
Source of data	N/A
Value applied	N/A
Justification of choice of data or description of measurement methods and procedures applied	This project does not provide credit for heating types that require calorific value such as wood combustion for heat
Frequency	N/A
Purpose of Data	N/A
Comments	N/A

Methodology reference	Table 5
Data / Parameter	F _{CO_{2j}}

Data unit	tCO _{2e} / kWh
Description	CO ₂ emission factor for fuel type j
Source of data	National data used to assess the energy and environmental performance of dwellings. CO ₂ emission factor prescribed by Part L of the Building Regulations: Source: http://www.bre.co.uk/filelibrary/SAP/2012/Emission-and-primary-factors-2013-2027.pdf
Value applied	Natural Gas: 0.000222 tCO _{2e} / kWh. In accordance with the VM0008 Methodology, the project uses the CO ₂ emission factor per unit of energy of fuel available at project validation for each verification event
Justification of choice of data or description of measurement methods and procedures applied	Greenhouse gas (GHG) emission values of the specified fuel types are well established and remain constant per unit volume of fuel. These values are acceptable under the VM0008 Methodology as established emission factors of various fuel types
Frequency	Once per project crediting period
Purpose of Data	Calculation of emission reductions and removals
Comments	N/A

5.2 Data and Parameters Monitored

Methodology reference	Table 7
Data / Parameter	EL _{pre,i} (Adjusted consumption approach) EL _{post,i} (Adjusted consumption approach) D _{pct,i} (Control group approach)
Data unit	kWh/yr Percent
Description	Pre-retrofit energy load of dwelling <i>I</i> (EL _{pre,i}) calculated from the intervention group Post-retrofit energy load of dwelling <i>I</i> (EL _{post,i}) calculated from the intervention group

	Percent savings of fossil fuel consumption for each project activity instance dwelling $I (D_{pct,i})$ calculated from national statistics
Source of data	<p>Pre-retrofit energy load of dwelling $I (EL_{pre,i})$ calculated from the intervention group</p> <p>Post-retrofit energy load of dwelling $I (EL_{post,i})$ calculated from the intervention group</p> <p>Percent savings of fossil fuel consumption for each project activity instance dwelling $I (D_{pct,i})$ calculated for initial project activity instances from national data published by the Department for Business, Energy & Industrial Strategy (BEIS) as part of the National Energy Efficiency Data Framework (NEED)³⁷</p>
Description of measurement methods and procedures to be applied	The analysis was conducted in accordance with the VM0008 Methodology as set out in section 4.4 (Emission Reductions and Removals) of this document
Frequency of monitoring/recording	Annually
Value applied	<p>$EL_{pre,i}$:</p> <p>Not applied for initial project activity instances</p> <p>$EL_{post,i}$:</p> <p>Not applied for initial project activity instances</p> <p>$D_{pct,i}$:</p> <p>Same Building Stock: Low-income Dwellings:</p> <ul style="list-style-type: none"> - Intervention Measure: Loft Insulation: 3.07 - Intervention Measure: Cavity Wall Insulation: 8.37 - Intervention Measure: Solid Wall Insulation: 21.70 - Intervention Measure: Boiler Replacement: 6.23 <p>Same Building Stock: Middle-income Dwellings:</p> <ul style="list-style-type: none"> - Intervention Measure: Loft Insulation: 5.34 - Intervention Measure: Cavity Wall Insulation: 11.31 - Intervention Measure: Solid Wall Insulation: 22.63 - Intervention Measure: Boiler Replacement: 5.20

³⁷ Published by a government agency and designated as an official national statistic

	These values are used for ex-ante calculations for initial project activity instances
Monitoring equipment	For initial project activity instances, $D_{pct,I}$ source data is retrieved from the intervention and control groups and for initial project activity instances from Department for Business, Energy & Industrial Strategy (BEIS)
QA/QC procedures to be applied	For initial project activity instances, $D_{pct,I}$ source data is published by a government agency and designated as an official national statistic meaning the dataset meets the highest standards of trustworthiness, quality, and public value. Details of how the NEED gas consumption data are produced is set out in the BEIS 2021 Methodology Note: Domestic NEED 2021 Annex D: Methodology Note, Department of Business, Energy and Industrial Strategy
Purpose of data	Calculation of performance standard
Calculation method	<p>For initial project activity instances, $D_{pct,I}$ uses a difference in difference approach to calculate the impact of installing decarbonisation measures on the fossil fuel consumption of a dwelling. A difference in difference approach works by comparing the consumption in dwellings before and after a decarbonisation measure has been installed.</p> <p>The change in consumption for a dwelling which has had a given decarbonisation measure installed (a dwelling in the Intervention Group) is compared with a similar dwelling which had no measures installed (a dwelling in the Control Group).</p> <p>Formation of the Intervention and Control Groups for each decarbonisation measure, calculation of the savings for each individual dwelling in the Intervention Group and pooling of the savings across dwellings to calculate the average impact of the decarbonisation measure being installed is undertaken by BEIS.</p> <p>Details of how BEIS produces the NEED Impact of measures data tables are set out in the BEIS 2021 Methodology Note³⁸</p>
Comments	N/A

Methodology reference	Table 9
Data / Parameter	$EleC_{b,I}$ $EleC_{p,y,I}$
Data unit	kWh/yr
Description	Electricity consumed in the year prior to Project implementation in Dwelling I (baseline consumption)

³⁸ [Domestic NEED 2021 Annex D: Methodology Note, Department of Business, Energy and Industrial Strategy](#)

	Electricity consumed by the Project in year y for Dwelling I
Source of data	N/A
Description of measurement methods and procedures to be applied	Currently excluded in the baseline to maintain conservativeness. This project only includes emission reductions generated by reductions in fossil fuel consumption. Currently, the purchase and consumption of fossil fuel as the source of energy for electricity generation is difficult to monitor on any reliable basis
Frequency of monitoring/recording	N/A
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	N/A
Calculation method	N/A
Comments	N/A

Methodology reference	Table 9
Data / Parameter	$F_{b,l,j}$ $F_{b,l,j}$
Data unit	kWh/yr
Description	Fuel type j consumed in the year prior to project implementation ($F_{b,j,j}$) for dwelling I (baseline consumption) Fuel type j consumed by the project in year y ($F_{p,y,j,j}$) for dwelling I (project consumption)
Source of data	Fuel type j consumed in the year prior to project implementation ($F_{b,j,j}$) calculated from the intervention group Fuel type j consumed by the project in year y ($F_{p,y,j,j}$) is calculated from the intervention group

Description of measurement methods and procedures to be applied	The analysis was conducted in accordance with the VM0008 Methodology as set out in section 4.4 (Emission Reductions and Removals) of this document
Frequency of monitoring/recording	Once
Value applied	$F_{b,j,j}$: Not applied for initial project activity instances $F_{p,y,j,j}$: Not applied for initial project activity instances
Monitoring equipment	Data retrieved from the intervention group
QA/QC procedures to be applied	A control group is created containing dwellings with no record of any decarbonisation measure installed in the year before, after or during the installation year as a quality assurance measure
Purpose of data	Calculation of emission reductions for adjusted consumption approach
Calculation method	<p>Fossil fuel consumption pre-retrofit, the baseline consumption, is measured for an intervention group of dwellings for decarbonisation measures installed as part of the project</p> <p>The intervention group contains dwellings which have received the decarbonisation measure, and no other measure in the year before, during or a year after the installation year. Fossil fuel consumption post-retrofit, the project consumption, is subtracted from the baseline consumption</p> <p>The difference between the baseline consumption and the project consumption will constitute the fossil fuel consumption savings for all dwellings installing the decarbonisation measure for that year</p> <p>For subsequent years the baseline consumption is adjusted for heating/cooling degree days using Heating/Cooling Degree Day Correction Factors (“HDDCF” or “CDDCF” as applicable)</p>
Comments	N/A
Methodology reference	Table 9
Data / Parameter	ECF_y
Data unit	N/A

Description	Electricity correction factor for year y . The ECF is only to be applied in the equation if it is negative
Source of data	N/A
Description of measurement methods and procedures to be applied	Currently excluded in the baseline to maintain conservativeness. This project only includes emission reductions generated by reductions in fossil fuel consumption. Currently, the purchase and consumption of fossil fuel as the source of energy for electricity generation is difficult to monitor on any reliable basis
Frequency of monitoring/recording	N/A
Value applied	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	N/A
Calculation method	N/A
Comments	N/A

Methodology reference	Table 9
Data / Parameter	CDD _{y} CDD _{b} HDD _{y} HDD _{b}
Data unit	Degree days
Description	Cooling degree days for year y after installation (CDD _{y}) Cooling degree days for one year before implementation (CDD _{b}) Cooling degree days for year y after installation (HDD _{y}) Cooling degree days for one year before implementation (HDD _{b})
Source of data	National data published by the Department for Business, Energy & Industrial Strategy (BEIS) as part of the 'Energy Trends' ³⁹ quarterly bulletin containing statistics on weather patterns, including

³⁹ Table ET7: Average temperatures and heating degree days and deviations from the long-term mean

	temperature, heating degree days, wind speeds, sun hours and rainfall ⁴⁰
Description of measurement methods and procedures to be applied	The analysis was conducted in accordance with the VM0008 Methodology as set out in section 4.4 (Emission Reductions and Removals) of this document
Frequency of monitoring/recording	Annually (CDD _y) Once (CDD _b) Annually (HDD _y) Once (HDD _b)
Value applied	CDD _y : Not applied for initial project activity instances CDD _b : Not applied for initial project activity instances HDD _y : Not applied for initial project activity instances HDD _b : Not applied for initial project activity instances
Monitoring equipment	Data retrieved from the Department for Business, Energy & Industrial Strategy (BEIS)
QA/QC procedures to be applied	Source data is published by a government agency and designated as an official national statistic meaning the dataset meets the highest standards of trustworthiness, quality, and public value
Purpose of data	Calculation of emission reductions for adjusted consumption approach
Calculation method	Degree days are calculated from the maximum and minimum daily temperature as recorded at 17 meteorological stations, selected as representative of fuel consumption in Britain with 2 in Scotland, 2 in Wales and 13 in England, 4 of which are counted twice. Data on temperatures recorded are provided by the Meteorological Office ⁴¹
Comments	N/A

⁴⁰ Published by a government agency and designated as an official national statistic

⁴¹ [Data on annual trends in temperatures and heating degree days produced as part of DUKES](#)

Methodology reference	Table 9
Data / Parameter	<i>J</i>
Data unit	N/A
Description	Number of fuel types
Source of data	Project database
Description of measurement methods and procedures to be applied	The analysis is conducted in accordance with the VM0008 Methodology as set out in section 4.4 (Emission Reductions and Removals) of this document
Frequency of monitoring/recording	Annually
Value applied	There is one fuel type for initial project activity instances (natural gas). As dwellings are added to the grouped project the values are updated
Monitoring equipment	Data retrieved from the project database
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of emission reductions and removals for adjusted consumption approach
Calculation method	N/A
Comments	N/A

Methodology reference	Table 9
Data / Parameter	<i>I</i>
Data unit	N/A
Description	Number of retrofitted dwellings
Source of data	Project database

Description of measurement methods and procedures to be applied	The analysis is conducted in accordance with the VM0008 Methodology as set out in section 4.4 (Emission Reductions and Removals) of this document
Frequency of monitoring/recording	Annually
Value applied	There are 130 initial project activity instances. As dwellings are added to the grouped project the values are updated
Monitoring equipment	Data retrieved from the project database
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of emission reductions and removals for adjusted consumption approach
Calculation method	N/A
Comments	N/A

Methodology reference	Table 11
Data / Parameter	$Elec_{SG,y,b}$ $Elec_{CG,y,b}$
Data unit	kWh/yr
Description	Mean electricity consumed by the sample group dwellings in building stock b in year y ($Elec_{SG,y,b}$) Mean electricity consumed by the control group dwellings in building stock b in year y ($Elec_{CG,y,b}$)
Source of data	N/A
Description of measurement methods and procedures to be applied	Currently excluded in the baseline to maintain conservativeness. This project only includes emission reductions generated by reductions in fossil fuel consumption. Currently, the purchase and consumption of fossil fuel as the source of energy for electricity generation is difficult to monitor on any reliable basis
Frequency of monitoring/recording	N/A
Value applied	N/A

Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	N/A
Calculation method	N/A
Comments	N/A

Methodology reference	Table 11
Data / Parameter	$F_{SG,y,j,b}$ $F_{CG,y,j,b}$ $D_{SG,y,j,b}$
Data unit	kWh/yr
Description	<p>Mean fuel type j consumed by the sample group dwellings in building stock b in year y ($F_{SG,y,j,b}$)</p> <p>Mean fuel type j consumed by the control group dwellings in building stock b in year y ($F_{CG,y,j,b}$)</p> <p>Average fossil fuel consumption savings resulting from the decarbonisation measure being installed in dwellings of the Same Building Stock b year y ($D_{SG,y,j,b}$)</p>
Source of data	<p>Fuel type j consumed in the year prior to project implementation ($F_{SG,y,j,b}$) calculated from the intervention group</p> <p>Fuel type j consumed by the project in year y ($F_{CG,y,j,b}$) is calculated from the intervention group</p> <p>National data published by the Department for Business, Energy & Industrial Strategy (BEIS) as part of the National Energy Efficiency Data Framework (NEED).⁴² The datasets used are Table 6 of the Impact of measures data tables ($D_{SG,y,j,b}$)</p>
Description of measurement methods and procedures to be applied	The analysis was conducted in accordance with the VM0008 Methodology as set out in section 4.4 (Emission Reductions and Removals) of this document

⁴² Published by a government agency and designated as an official national statistic

Frequency of monitoring/recording	Annually
Value applied	<p>$D_{pct,i}$:</p> <p>Same Building Stock: Low-income Dwellings:</p> <ul style="list-style-type: none"> - Intervention Measure: Loft Insulation: 360 - Intervention Measure: Cavity Wall Insulation: 980 - Intervention Measure: Solid Wall Insulation: 2,540 - Intervention Measure: Boiler Replacement: 730 <p>Same Building Stock: Middle-income Dwellings:</p> <ul style="list-style-type: none"> - Intervention Measure: Loft Insulation: 770 - Intervention Measure: Cavity Wall Insulation: 1,630 - Intervention Measure: Solid Wall Insulation: 3,260 - Intervention Measure: Boiler Replacement: 750 <p>These values were used for ex-ante calculations for initial project instances. As dwellings are added to the grouped project, consumption savings are monitored, and values are updated</p>
Monitoring equipment	For initial project activity instances, $D_{pct,i}$ source data is retrieved from the Department for Business, Energy & Industrial Strategy (BEIS)
QA/QC procedures to be applied	For initial project activity instances, $D_{pct,i}$ source data is published by a government agency and designated as an official national statistic meaning the dataset meets the highest standards of trustworthiness, quality, and public value. Details of how the NEED gas consumption data are produced is set out in the BEIS 2021 Methodology Note: Domestic NEED 2021 Annex D: Methodology Note, Department of Business, Energy and Industrial Strategy
Purpose of data	Calculation of emission reductions and removals for control group approach
Calculation method	<p>For initial project activity instances, a difference in difference approach is used to calculate the impact of decarbonisation measures on the fossil fuel consumption of a dwelling. A difference in difference approach works by comparing the consumption in dwellings before and after a decarbonisation measure has been installed</p> <p>The change in consumption for a dwelling which has had a given decarbonisation measure installed (a dwelling in the Intervention Group) is compared with a similar dwelling which had no measures installed (a dwelling in the Control Group)</p>

	<p>Formation of the Intervention and Control Groups for a given decarbonisation measure, calculation of the savings for each dwelling in the Intervention Group and pooling of the savings across dwellings to calculate the average impact of the decarbonisation measure is undertaken by BEIS</p> <p>Details of how BEIS produces the NEED Impact of measures data tables are set out in the BEIS 2021 Methodology Note⁴³</p>
Comments	N/A

Methodology reference	Table 11
Data / Parameter	<i>J</i>
Data unit	N/A
Description	Number of fuel types
Source of data	Project database
Description of measurement methods and procedures to be applied	The analysis is conducted in accordance with the VM0008 Methodology as set out in section 4.4 (Emission Reductions and Removals) of this document
Frequency of monitoring/recording	Annually
Value applied	There is one fuel type for initial project activity instances (natural gas). As dwellings are added to the grouped project the values will be updated
Monitoring equipment	Data retrieved from the project database
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of emission reductions and removals for adjusted consumption approach
Calculation method	N/A
Comments	N/A

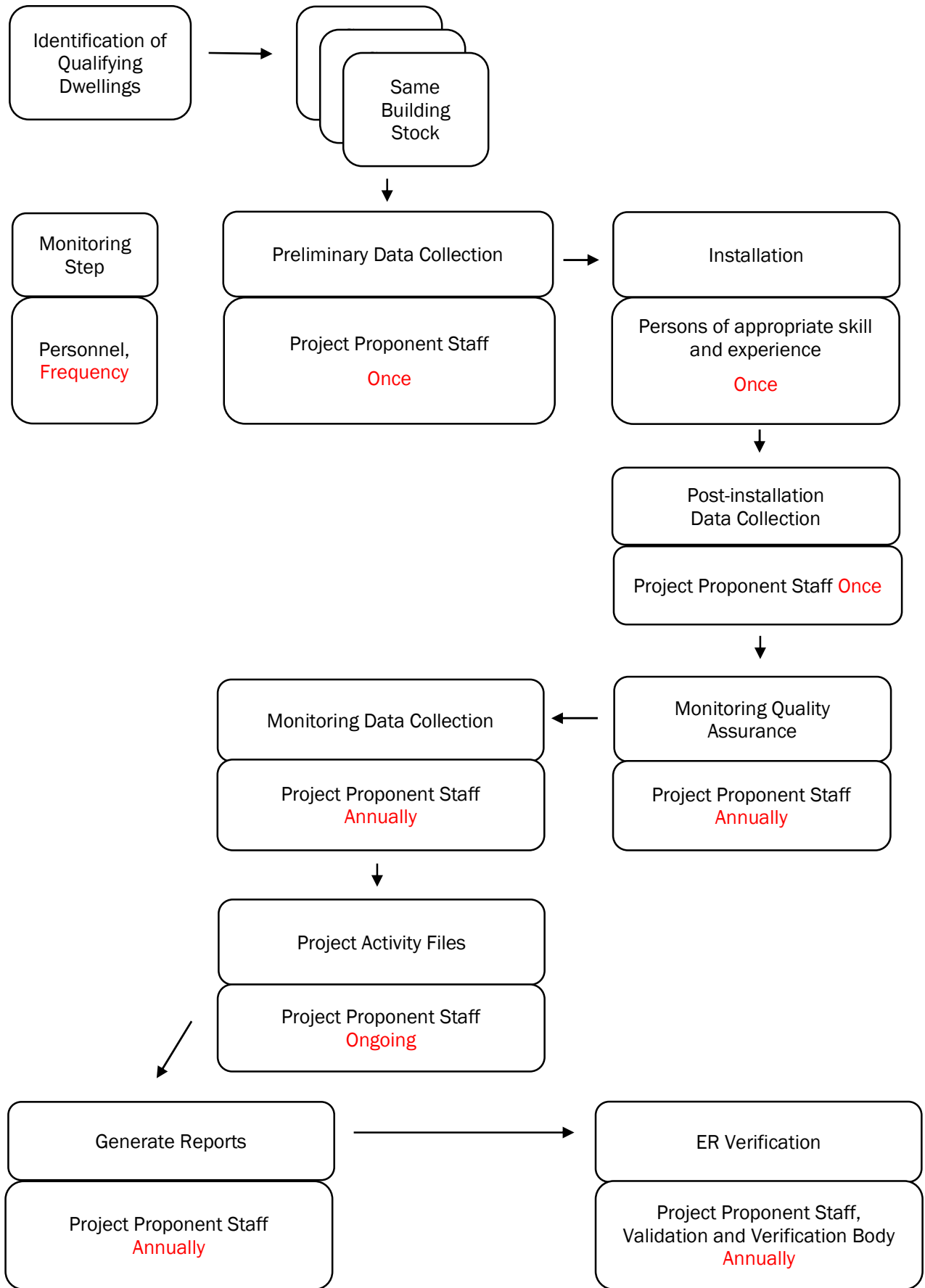
⁴³ [Domestic NEED 2021 Annex D: Methodology Note, Department of Business, Energy and Industrial Strategy](#)

Methodology reference	Table 11
Data / Parameter	/
Data unit	N/A
Description	Number of retrofitted dwellings
Source of data	Project database
Description of measurement methods and procedures to be applied	The analysis is conducted in accordance with the VM0008 Methodology as set out in section 4.4 (Emission Reductions and Removals) of this document
Frequency of monitoring/recording	Annually
Value applied	There are 130 initial project activity instances. As dwellings are added to the grouped project the number of dwellings will be updated
Monitoring equipment	Data retrieved from the project database
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of emission reductions and removals for adjusted consumption approach
Calculation method	N/A
Comments	N/A

5.3 Monitoring Plan

Monitoring plans for the project activity follow the approach outlined in the VM0008 Methodology.

Figure 5 Line diagram outlining the key monitoring steps, as well as the key personnel responsible for obtaining the relevant data or generating the reports necessary for verification.



Monitoring is conducted primarily by project proponent staff, or by designated personnel who participate in decarbonisation project activity. Dwelling specific data is collected in accordance with the project description.

These data include the items specified for determining project eligibility, including address validation, geographical coordinates, documents assigning ownership of GHG emission reductions, details of decarbonisation measures installed, certificate or declaration of installation and evidence of dwelling occupation. Each dwelling decarbonised within the project activity has a file that contains all relevant documentation and data. These files are maintained as part of the project activity files.

Data obtained from an outside source are collected in accordance with the project description. These include data for F_{CO_2j} , performance standard, $D_{pct,i}$, $F_{SG,y,j,b}$, i . These data are maintained in a centralised data repository. All necessary calculations and generated reports, based on data maintained in the centralised data repository, are produced by project proponent staff, or by designated personnel who participate in decarbonisation project activity.

Sampling Procedure

Sampling meets the requirements of the VM0008 Methodology as follows:

- The source data used for the initial project activity instances come from an approved source, being national statistics published by the Department for Business, Energy & Industrial Strategy (BEIS) as part of the National Energy Efficiency Data Framework (NEED).⁴⁴ Consumption data are from energy suppliers' administrative systems and cover all domestic meters (dwellings) in England and Wales.
- From 2019, the data used for calculating the baseline scenario and emission reductions and removals comprises the full dataset of all domestic properties in England and Wales (which was 31.3 million consuming electricity meters and 24.4 million consuming gas meters in 2019). Prior to 2019, the data comprised a stratified random sample of 15% of dwellings (approximately 4 million records). Sampling was undertaken by BEIS.
- In accordance with the VM0008 Methodology, the size of the Control Group will be (\sqrt{i}) , where i is the total number of dwellings, of the Same Building Stock b , decarbonised as part of the project activity, but need not exceed 100 dwellings. Project proponent staff, or designated personnel who participate in decarbonisation project activity, oversees monitoring of the size of the Control Group.

Identification of Qualifying Dwellings

Project proponent staff, or designated personnel who participate in decarbonisation project activity, select eligible dwellings to include in the project activity. The project instances will meet the criteria set out in section 1.4 (Eligibility Criteria) of this document. Documentation is maintained in the project activity files.

⁴⁴ Published by a government agency and designated as an official national statistic meaning the dataset meets the highest standards of trustworthiness, quality, and public value. Details of how the NEED gas consumption data are produced is set out in the BEIS 2021 Methodology Note: [Domestic NEED 2021 Annex D: Methodology Note, Department of Business, Energy and Industrial Strategy](#)

Preliminary Data Collection

Project proponent staff, or designated personnel who participate in decarbonisation project activity, obtain for each project activity instance the documentation to evidence criteria 1, 2, 4, 5, 6 & 7 set out in section 1.4 (Eligibility Criteria) of this document: 1) The physical address and geodetic coordinates of the dwelling; 2) The declaration that the dwelling uses fossil fuel combustion as its primary fuel source; 4) The declaration that project activity is not mandated, or required by law or regulation; 5) The report demonstrating additionality for the project activity instance generated using data from the centralised data repository; 6) The agreement assigning to the project proponent rights to the greenhouse gas emission reductions created by the project activity; 7) The indicators of occupancy relating to the dwelling at the time of project activity. Documentation is maintained in the project activity files.

Post-installation Data Collection

Following installation of the decarbonisation measures, project proponent staff, or designated personnel who participate in decarbonisation project activity, obtain for each project activity instance the documentation to evidence criteria 3 set out in section 1.4 (Eligibility Criteria) of this document: 3) The certificate or declaration issued to the dwelling owner, or by the dwelling owner. Documentation is maintained in the project activity files.

Monitoring Quality Assurance

Project proponent staff, or designated personnel who participate in decarbonisation project activity, obtain for each year, or for the duration of the verification period, confirmation of the official designation of the relevant source data. Where a dataset ceased to be designated, the project proponent would undertake a statistical evaluation to determine if the approach to calculation of emission reductions and removals remained statistically valid.

Monitoring Data Collection: Control Group

Project proponent staff, or designated personnel who participate in decarbonisation project activity, obtain for each year, or for the duration of the verification period, the documentation to evidence the size of the Control Group of the Same Building Stock. Documentation is maintained in the project activity files.

Monitoring Data Collection: Leakage

Proof of proper disposal is a Building Regulations Compliance Certificate, a certificate of completed installation under PAS or an equivalent or subsequent standard, or a declaration by a regulated provider of social housing or public entity. Certificates and declarations are maintained in the project activity files. Project proponent staff, or designated personnel who participate in decarbonisation project activity, generate leakage reports for each year, or for the duration of the verification period, using data from the centralised data repository. In the case of the installation, repair, or removal of a gas appliance that does not have proof of proper disposal, emission reductions from that dwelling are omitted from the aggregate annual emission reductions for the period for which documentation is not available.

Calculating Emission Reductions

Project proponent staff, or designated personnel who participate in decarbonisation project activity, generate the emission reductions report for each year, or for the duration of the verification period, using data from the centralised data repository. Emission reduction calculations are made in accordance with section 4.4 (Emission Reductions and Removals) of this document using data stored in the centralised data repository.