UK Government

RAF063/2223: Social Housing Decarbonisation Fund (SHDF) Wave 1

Impact evaluation report

Department for Energy Security and Net Zero (2026)

Authors

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Contents

Glossary 5

Executive summary 7

1. Introduction 12

Introduction to the Social Housing Decarbonisation Fund 12

Evaluation aims and objectives 13

2. Methodology 15

Introduction to approach 15

Primary data collection 18

Secondary data sources 20

Research limitations 23

3. Building Social Housing Landlord capability and capacity 25

Additionality of Wave 1 Funding 26

Learnings, capabilities and capacities 28

Future plans for retrofit 32

Housing stock benefits 34

Unintended or negative impacts for SHLs 35

4. Development of the supply chain 36

Building capacity in the supply chain 36

Upskilling in the supply chain 38

Capability and capacity barriers 39

Coordination with other DESNZ energy efficiency schemes 42

Unintended or negative impacts of Wave 1 on the supply chain 43

5. Energy, bill and carbon savings 44

Data sources used for analysis of energy, bill and carbon savings 44

Change in energy consumption 46

Change in energy bills 48

Reduction in carbon emissions 49

Preparation of social homes for future clean heat installations 50

6. Resident outcomes and impacts ____ **52**
Resident satisfaction ____ 53
Energy use and bills ____ 55
Comfort and pride in the home ____ 59
Change in proportion of households classified as fuel poor ____ 65
Health impacts ____ 66
Confidence in using the equipment ____ 68
Views on further energy saving measures ____ 72
7. Value for money ____ **75**
Total scheme costs ____ 75
Property and measure costs ____ 76
Cost increases during Wave 1 ____ 78
Variation in measure costs ____ 81
Variation in costs by property and project characteristics ____ 83
Economies of scale: variation between projects ____ 85
Hardest to treat stock ____ 88
The role of innovation in contributing to value for money ____ 90

Glossary

Term	Description
Co-funding	Co-funding refers to the financial contribution that applicants themselves made alongside their grant funding. There was a co-funding requirement to maximise the number of properties that can be retrofitted with the funds available. DESNZ required grant recipients to provide co-funding of at least one third of the total fund requested.
Cost caps	A cost cap is a limit or ceiling placed on the amount of money that can be spent on a particular project, activity, or in a specific area. To maximise value for money across Wave 1, cost caps were implemented for each home, varying depending on the EPC of a particular property.
Delivery Partner (DP)	The DP (environmental consulting services company Ricardo) acted as a first point of contact for all social housing landlords (SHLs) that received funding. Responsibilities included frontline engagement with projects, monitoring progress and risks and providing expert support and assurance where necessary.
Energy Company Obligation (ECO)	SHDF is one of many government schemes aimed at improving energy efficiency of homes. ECO is a government energy efficiency scheme in Great Britain designed to tackle fuel poverty and help reduce carbon emissions.
Energy Performance Certificate (EPC)	EPCs provide information on how energy efficient a building is, using a rating from A (very efficient) to G (inefficient). An objective of Wave 1 was to improve social homes with an EPC rating of D or below to at least EPC C.
Fuel poverty	A household is classified as fuel poor when the property has an energy efficiency rating of band D or below and cannot be kept warm at reasonable cost without bringing the household's residual income below the poverty threshold. Fuel poverty in England is measured using the Low Income Low Energy Efficiency method (LILEE).[1]
Supply chain stakeholders	The term given to individuals in this evaluation who had responsibility for the installation of measures. This included individual installers responsible for fitting measures, managers of installation teams, senior managers at principal contractors, and retrofit coordinators.

[1] DESNZ (2026) 'Fuel poverty statistics methodology handbooks'

Term	Description
Integrated Delivery Team at DESNZ (IDT)	The Integrated Delivery Team (IDT) at DESNZ managed the SHDF programme, including designing the policy and ensuring each scheme delivered against agreed key performance indicators and programme benefits.
PAS 2035:2019	To be eligible for funding all projects had to be compliant with PAS 2035:2019 requirements, the British standard for retrofitting dwellings.
Scheme delivery representatives	The term given to individuals from the DESNZ Integrated Delivery Team, Delivery Partner and Technical Assistance Facility who took part in qualitative interviews and focus groups for this evaluation.
Social Housing Landlords (SHLs)	Organisations in receipt of Wave 1 funding, i.e. registered providers of social housing, including private and local authority providers.
Social Housing Retrofit Accelerator (SHRA)	The Social Housing Retrofit Accelerator (SHRA) was established to provide technical support to all SHLs interested in applying for Wave 1 funding. It ensured applications to the scheme were fit for purpose and SHL knowledge of retrofit delivery was sufficient. Also known as the Technical Assistance Facility (TAF). Turner & Townsend were the third party organisation appointed to deliver the SHRA support for Wave 1.
Tenant Liaison Officers (TLOs)	TLOs are individuals employed by SHLs to liaise with residents. They helped ensure residents were informed and supported throughout the installation of measures.
TrustMark	TrustMark is the government endorsed Quality Scheme for works that consumers choose to have carried out in or around their home. Installers delivering work as part of Wave 1 had to be approved by TrustMark or equivalent.

Executive summary

Introduction

The government is aiming to achieve Net Zero emissions in the UK by 2050. This includes decarbonising homes due to their poor energy efficiency.

The Social Housing Decarbonisation Fund (SHDF), now replaced by the Warm Homes: Social Housing Fund (WH:SHF), is administered by the Department for Energy Security and Net Zero (DESNZ). The SHDF aims to improve the energy efficiency of social housing in England currently below Energy Performance Certificate (EPC) Band C up to that standard through the installation of energy efficiency measures and low carbon heating.

The primary aims of SHDF are to help deliver warm and energy efficient homes, reduce carbon emissions and energy bills, tackle fuel poverty, and improve the comfort, health and wellbeing of social housing residents. The scheme also aims to build the social housing sector's capacity and capability to deliver retrofit, support green jobs, and improve value for money in the sector overall.

SHDF was launched in 2020 with the Demonstrator and has since taken a waved approach to delivery. SHDF Wave 1 (delivered between March 2022 and July 2024) awarded £179 million to successful Local Authorities (LAs).

A total of 31,693 energy efficiency measures were installed in 16,056 households under SHDF Wave 1. Loft Insulation was the most common measure to be installed (7,410, or 23% of all measures), followed by External Wall Insulation (EWI; 6,783, 21%), double or triple glazing (4,764, 15%), Cavity Wall Insulation (CWI; 3,307; 10%) and Solar PV (3,140, 10%).[2]

This impact evaluation report assesses to what extent, and how, SHDF Wave 1 has delivered benefits for social housing residents including energy, carbon and bill savings, delivered high quality retrofit installations and improved social housing landlords' (SHLs) capacity and capability to decarbonise their housing stock. The findings will help ensure accountability for the spending of this scheme and provide evidence to improve future design and delivery.

The SHDF Wave 1 process evaluation report assessed how Wave 1 was set up and delivered and how learnings could inform future retrofit schemes, and has been published separately.[3]

[2] DESNZ (2025) '[Social Housing Decarbonisation Fund statistics: April 2025]'
[3] DESNZ (2024) '[Social Housing Decarbonisation Fund Wave 1 Evaluation]'

Methodology

The evaluation adopted a theory-based approach, with a Theory of Change (ToC) informing evaluation questions and the design of relevant methodological activities. As part of this, the evaluation team engaged an expert panel to provide scrutiny and quality assure the approach.

The evaluation used a mixed methods approach to analyse key scheme outcomes and assess impacts and value for money. This impact evaluation report draws on surveys and interviews with stakeholders and beneficiaries, and secondary data.

The evaluation approach also incorporated a case study methodology to explore projects and themes of particular note. This informed the sampling for interviews with SHLs, supply chain stakeholders and residents. This resulted in nine Wave 1 case studies covering six projects and three thematic areas (implementing PAS 2035, installing measures in hard-to-treat properties and assessing retrofit activity of SHLs not participating in Wave 1). Separate reports have been published on each case study.

The evaluation used Contribution Analysis (CA) to assess the contribution that Wave 1 has made to the impacts identified in the ToC. CA provides conclusions about whether there is strong, moderate, limited or no evidence for the contribution of Wave 1 to specific impacts, and for the contribution of other external factors to these same impacts.

Building Social Housing Landlord (SHL) capability and capacity

There is moderate strength evidence (i.e. there is some inconsistent evidence in support of findings)[4] to suggest that **energy efficiency retrofit would have occurred in social housing in the absence of Wave 1 funding**. This was achieved through use of other government schemes such as ECO, or through use of internal investment.

However, moderate strength evidence suggests that **Wave 1 has resulted in a higher number of properties reaching EPC C** than would have occurred otherwise, as it **allowed SHLs to expand the scale, scope, and quality** of their retrofit projects.

There is strong evidence that SHL participation in Wave 1 was essential to the development of SHL capability and capacity to undertake future retrofit projects. **SHLs gained specific skills and learnings** related to scheme applications and processes, retrofit project planning and technical skills (including relating to PAS 2035), supply chain management, and resident engagement.

SHLs have also expanded their internal teams and networks with the supply chain. The majority of participating **SHLs have plans to conduct future energy efficiency retrofits**, with some stating that Wave 1 experiences have enabled them to increase the scale of their plans, and/or improve the quality of their plans.

[4] The strength of evidence was assessed using a specific framework developed by Delahais and Toulemounde (2017). More details are found in the methodology chapter of this report and in the Technical Annex.

Development of the supply chain

There is strong evidence that **Wave 1 projects have directly resulted in improvement to retrofit processes**, as a result of PAS 2035 requirements. **Installers attended training programmes and gained new qualifications and accreditations**. There is also strong evidence that Wave 1 projects have made an essential contribution to the development of the supply chain's capacity to undertake retrofit work.

Companies diversified the range of measures they installed, and Wave 1 significantly boosted job creation in the retrofit sector by providing valuable, long-term contracts that instilled confidence in supply chain stakeholders. There is evidence that the supply chain stakeholders interviewed also took part in other schemes. However, they felt that impacts were mostly attributable to Wave 1 as this was larger in scale and in value of contracts.

Whilst development of the supply chain was mostly positive, **stakeholders did report challenges**. **These included the high cost and duration of training for advanced roles**, business sustainability concerns, and dissatisfaction among older workers with continuous upskilling and digital requirements.

Despite often being at, or near, capacity during the Wave 1 delivery window, stakeholders involved in Wave 1 and other government schemes tended **not to view taking part in multiple DESNZ energy efficiency schemes as a barrier to delivery**.

Energy, bill and carbon savings

There is strong evidence that the Wave 1 installation of retrofit measures directly led to reductions in gas consumption. On average, **Wave 1 homes saved an additional 1,079.9 kWh in annual gas consumption compared to similar homes not involved in Wave 1**.

However, evidence from the resident survey and interviews suggests that some residents did not reduce their energy use as it now costs less to heat their homes, potentially reducing the impacts of Wave 1 installations on gas consumption. Evidence on changes in electricity consumption after the installation of measures under Wave 1 was inconclusive.

There is strong evidence that Wave 1 retrofits resulted in reductions in fuel bills through lower gas consumption. Quantitative analysis found that **the reduction in gas consumption in properties involved in Wave 1 corresponded, on average, to a £97 saving in energy bills per year**.

However, there is also moderate strength evidence that **this effect was limited by wider energy price inflation**, as well as by the choice of some residents not to reduce energy consumption. Only a third (33%) of surveyed residents said that they have seen a reduction in their energy bills since measures were installed in their home.

There is strong evidence that installation of measures as part of Wave 1 resulted in a reduction in carbon emissions through reduced gas consumption and, in some cases, through installation of a new lower carbon heating system or renewable energy generator (i.e. Solar PV). Based on the estimated reduction in gas consumption, Wave 1 was estimated to have **generated carbon emission savings of 0.20 tonnes per property per year**.

There is also strong evidence that the installation of Wave 1 measures is likely to contribute to facilitating future carbon emissions reductions. This is because **the fabric of social homes has been improved, making these properties more suitable for future clean heat installations**. Many SHLs reported they have plans for clean heat installations in the future.

Resident outcomes and impacts

There is strong evidence that the installation of Wave 1 measures made an essential contribution to reductions in the number of residents in fuel poverty because the majority of properties were improved to EPC C or above. Nearly all (97%) households classified as fuel poor prior to Wave 1 (and that had a post-installation EPC rating) were taken out of fuel poverty as a result of the energy saving measures installed, as their properties' EPC rating was improved to band C or above.

Analysis of fuel poverty status was only possible for 293 households (those who completed the resident surveys, provided information about their household income and for whom pre- and post-installation EPC data was available). In addition, it is worth noting that an increase in the energy efficiency of homes to EPC C or above may have not led to a reduction in energy bills for these households (as noted in the 'Energy, bill and carbon savings' section above).

There is also strong evidence that the installation of Wave 1 measures improved the ability of residents to heat their homes to a comfortable temperature. However, there was some moderate strength evidence that these benefits have been limited for some residents by rising energy prices and the cost of living. This may have affected residents' perceptions of bill reductions following the installation of measures.

Around half (54%) of residents suggested it was more affordable to maintain a comfortable temperature in their home now than it would be without energy saving measures. A fifth (21%) neither agreed nor disagreed that it was more affordable to maintain a comfortable temperature.

The majority of residents were satisfied with the quality of the energy saving measures installed in their homes (65%). A small proportion of residents (14%) were neither satisfied nor dissatisfied with the quality of measures.

Just over two in five residents (45%) reported they were likely to consider having other energy saving measures installed in the future or that they had already had these installed. A fifth (20%) reported they were neither likely or unlikely to consider future energy saving measures, whilst 10% did not know or preferred not to say.

In terms of health and comfort, residents reported improvements in their home across a broad range of issues they had experienced before measures were installed, such as condensation and draughts. Overall, there was a limited impact on physical or mental health reported among residents. However, there were individual reports of improvements in long term health conditions and reduced anxiety. The latter was attributed to the easing of bill pressures.

Value for money

Wave 1 offered value for money in retrofit by enabling SHLs and supply chain contractors to **take advantage of economies of scale** through delivering larger scale projects than they would otherwise have undertaken at this time. Wave 1 also **improved the energy efficiency of some of the poorest performing social housing stock** with EPC ratings of E to G. Fuel bill and carbon savings were identified.

However, the **costs of retrofit under the scheme rose significantly over time** and to a greater extent than broader economic and construction inflation levels. **Rising costs and other delivery challenges led to descoping of projects** meaning that fewer properties had measures installed than originally intended. Average spending per home increased substantially compared to original projections.

1. Introduction

Introduction to the Social Housing Decarbonisation Fund

The UK has legislated to reduce greenhouse gas emissions to Net Zero by 2050. The UK has some of the oldest and least energy efficient homes in Europe and to reach Net Zero it is necessary to almost entirely decarbonise homes.

The Social Housing Decarbonisation Fund (SHDF), now replaced by the Warm Homes: Social Housing Fund (WH:SHF), is administered by the Department for Energy Security and Net Zero (DESNZ).

SHDF aims to upgrade a significant amount of the social housing stock in England currently below Energy Performance Certificate (EPC) Band C up to that standard through the installation of energy efficiency and low carbon heating measures.

The SHDF Demonstrator was announced in the 2020 Summer Economic Update and awarded £62 million to Social Housing Landlords (SHLs) to test innovative approaches to retrofitting at scale.

Building on the Demonstrator, the SHDF has since taken a waved approach to delivery. Wave 1 was launched in August 2021 and was delivered between March 2022 and July 2024, awarding £179 million to successful SHLs.

SHDF Wave 2.1 launched in September 2022, awarding £778 million of funding from March 2023, and is due to close in March 2026. The SHDF Wave 2.2 'top-up' competition allocated a further £75 million of funding in April 2023, and is also due to close in March 2026.

WH:SHF Wave 3 launched in September 2024, awarding £1.29 billion of funding in March 2025 across 144 projects, and is due to close in September 2028.

At bid award stage, 43,763 measures were planned to be installed in 20,229 properties as part of Wave 1. A total of 31,693 measures were installed in 16,056 households under Wave 1.[5]

[5] DESNZ (2025) 'Social Housing Decarbonisation Fund statistics: April 2025'

Evaluation aims and objectives

Aims of the evaluations

DESNZ commissioned separate process and impact evaluations of both Wave 1 and Wave 2.1. The overall aim of the evaluations is to evaluate delivery and assess how successful the schemes have been in working towards their objectives. In addition, the evaluations aim to:

1. Provide accountability for public spend on the SHDF.
2. Improve the design and delivery of future waves of the SHDF.
3. Provide case-related insights into key barriers and drivers to effective delivery and impact.
4. Provide an evidence-based narrative and summary of the impact of the SHDF.

The evaluations cover nine overarching research questions, each with a number of subsidiary questions; these are presented in the Technical Annex accompanying this report.

Purpose of this evaluation report

This is the report for the impact evaluation of Wave 1, which assesses the extent to which, and how, Wave 1 has met its objectives. This report primarily responds to the following five research questions:

- RQ5. To what extent, and how, has Wave 1 delivered benefits for social housing tenants, including delivering warm, energy-efficient homes, improved tenant health and wellbeing outcomes, and reduced risk of fuel poverty?
- RQ6. To what extent, and how, has Wave 1 improved social housing landlords' capacity and capability to decarbonise their housing stock?
- RQ7. How effectively has Wave 1 delivered intended environmental and cost benefits, specifically energy, carbon and bill savings?
- RQ8. To what extent and how did Wave 1 deliver retrofit installations which were high quality and represent good value for money for DESNZ?
- RQ9. To what extent and how has Wave 1 contributed towards intended wider impacts, including supporting the green economy and supply chain for retrofitting social housing?

This report draws on primary data collection with residents living in retrofitted properties, SHLs (successful, unsuccessful and those who initially expressed interest but ended up not applying to Wave 1), scheme delivery representatives, and supply chain stakeholders, as well as analysis of scheme data.[6]

Data on electricity and gas consumption was sourced from the National Energy Efficiency Data-Framework (NEED) for analysis of changes in energy consumption following the installation of measures as part of Wave 1.

[6] Official statistics published in March 2025, covering data up to 28th February 2025 (end of the scheme). Risk Register data was last updated in May 2024.

The report includes the following chapters:

- Chapter 2: Methodology
- Chapter 3: Building Social Housing Landlord capability and capacity
- Chapter 4: Development of the supply chain
- Chapter 5: Energy, bill and carbon savings
- Chapter 6: Resident outcomes and impacts
- Chapter 7: Value for money
- Appendices

The Wave 1 Process Evaluation Report assesses how Wave 1 was set up and delivered, and how learnings could inform future retrofit schemes, and has been published separately.[7]

[7] DESNZ (2024) 'Social Housing Decarbonisation Fund Wave 1 Evaluation'

2. Methodology

This chapter summarises the methodological approach underpinning this evaluation. The full methodology is available within the Technical Annex accompanying this report.

Introduction to approach

The Wave 1 evaluation took a mixed methods approach to analyse key scheme outcomes and assess impacts and value for money. This impact evaluation report draws on surveys and interviews with stakeholders and beneficiaries and secondary data, as described later in this section. The evaluation approach also incorporated a case study methodology to explore projects and themes of particular note.

This informed the sampling for interviews with SHLs, supply chain stakeholders and residents, and resulted in nine Wave 1 case studies covering six projects and three thematic areas (implementing PAS 2035, installing measures in hard-to-treat properties and assessing retrofit activity of SHLs not participating in Wave 1). Separate reports have been published on each case study.

In an initial scoping phase, the evaluation team first developed a Theory of Change (ToC), from which evaluation questions (EQs) and a methodological approach, incorporating both primary and secondary data, was established. As part of this, the evaluation team engaged an expert panel to provide scrutiny and quality assure the approach. The analytical approach is described in the next section.

Contribution Analysis (CA)

The evaluation used Contribution Analysis (CA) to assess the contribution that Wave 1 has made to the impacts identified in the ToC. This involved developing hypothesised ‘contribution claims’ about what effect Wave 1 might have had on intended impacts. These are formulated using the following structure: X intervention leads to Y scheme impact because of Z underlying scheme mechanism.

CA recognises that interventions exist within a wider context where external factors influence the achievement of outcomes and impacts. External factors may contribute to, or even limit, the intervention’s impact. As such, ‘alternative explanations’ have also been formulated alongside the contribution claims to assess how external factors contribute to outcomes. These are set out in the Technical Annex.

The evaluation then assessed the strength of the evidence against each contribution claim and alternative explanation, using a specific framework developed by Delahais and Toulemonde (2017).[8]

[8] Thomas Delahais & Jacques Toulemonde (2017) ‘Making rigorous causal claims in a real-life context: Has research contributed to sustainable forest management?’, Evaluation, Volume 23, Issue 4, pages 370-388

This framework considers the type of evidence collected in terms of:

- Whether a source has passed a thorough test of quality as in the case of official statistics.
- Whether different pieces of evidence triangulate i.e. confirm a view or contradict each other.
- The timing of evidence and consistency of this with Wave 1 timeframes.
- The existence of clear, illustrative examples of changes made by Wave 1.

These criteria are used to conclude whether there is strong, moderate, limited/weak or no evidence in support of a contribution claim or alternative explanation in a systematic manner.

Once we reached conclusions for each contribution claim and related alternative explanations, we then assessed the overall contribution of Wave 1 and the extent to which this was sufficient and/or necessary.

In summary, a 'sufficient' condition is a causal factor with enough explanatory power to cause the outcome on its own. A necessary condition is one that must be present for the outcome to occur, but that may be part of a wider causal package of influencing factors that work in combination to produce an outcome.

Conclusions from the Contribution Analysis are shown in the blue shaded boxes throughout the report chapters. Each heading starts with "CA conclusion:".

Quasi-Experimental Analysis (QEA)

DESNZ analysts undertook a staggered Difference-in-Differences (D-in-D) analysis to examine the changes in household energy consumption, carbon emissions and energy bills in a sample of Wave 1 properties, compared to a matched control group.

The primary data source for this analysis was the National Energy Efficiency Data-Framework (NEED),[9] a comprehensive dataset established to collect and analyse yearly meter point data related to gas and electricity consumption for all households in the UK.

DESNZ assessed changes in gas consumption for properties that received measures between March 2022 and May 2024 based on the latest available data at the time of analysis.

In total, the sample included 46% of all properties retrofitted as part of Wave 1. Full details of the method used can be found in the Technical Annex.

[9] DESNZ, 'National Energy Efficiency Data-Framework (NEED)'

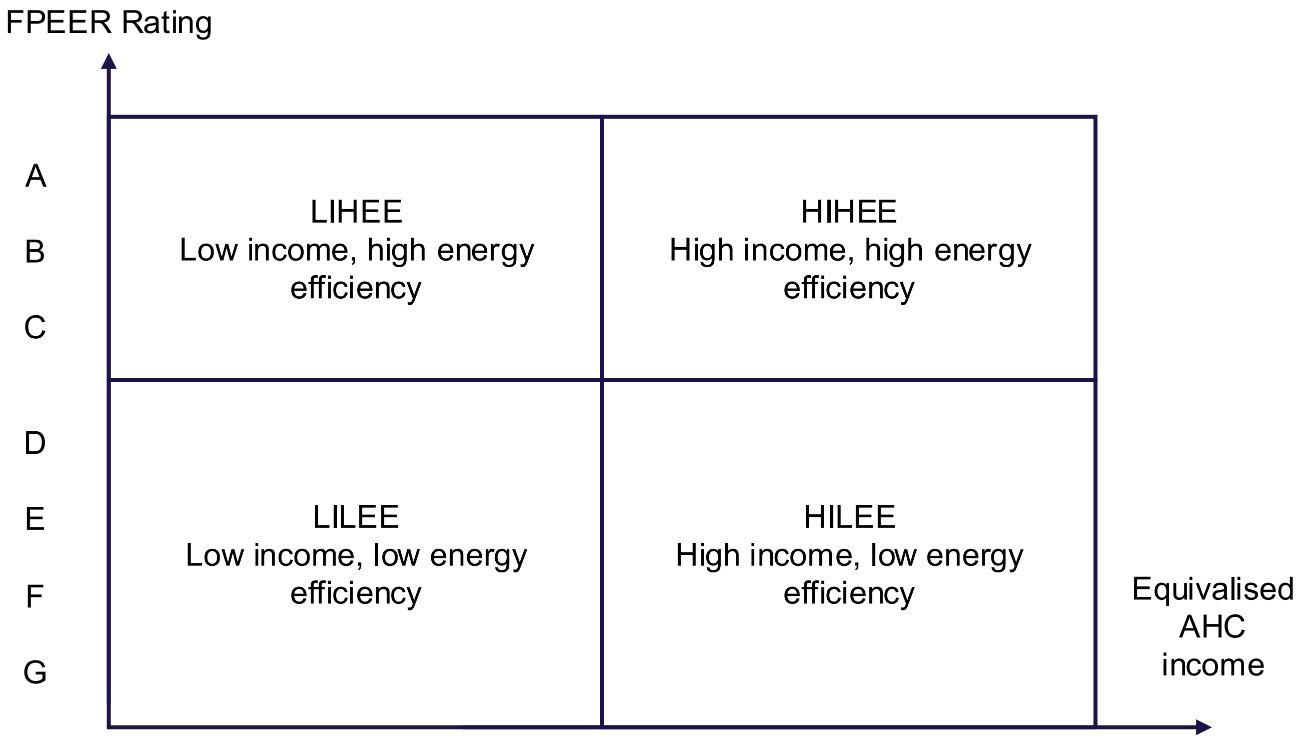
Fuel Poverty Analysis

Fuel poverty analysis was conducted to estimate the proportion of households (identified as fuel poor prior to the scheme installations) who were moved out of fuel poverty as a direct result of participating in Wave 1. This analysis assessed the change in the energy efficiency of homes following installation of measures by looking at the EPC ratings of the homes before and after installations.

The analysis used the after-housing-cost (AHC[10]) income and home EPC ratings to estimate the fuel poverty status of participating households. Income data was collected from the resident survey, whilst the pre- and post-installation EPC ratings were obtained via scheme data.

The fuel poverty analysis methodology was based on the ‘Low Income, Low Energy Efficiency’ (LILEE) definition of fuel poverty. Households classed as ‘low income’ based on their reported AHC income and with EPC (FPEER rating) D or below were classified as fuel poor (i.e. those in the bottom left quadrant in Figure 1).[11]

Figure 1: LILEE method associated quadrants



Homes that were improved from EPC band D or below to EPC band C or above following scheme installations were classed as having moved from having low energy efficiency to high energy efficiency, and therefore out of fuel poverty.

[10] DESNZ (2026) '[Fuel poverty methodology handbook 2026: Low Income Low Energy Efficiency (LILEE)](#)', chapters 3 and 6 provide more detail on the national methodology.
[11] EPC bands were used as a proxy for Fuel Poverty Energy Efficiency Rating (FPEER) bands when estimating the likely fuel poverty status of the households. More details about this can be found in the Technical Annex.

To quantify the impact of Wave 1 on the fuel poverty status of participating households, the AHC income and demographic makeup of the households were kept constant and assumed not to have changed post-installation. Whilst these could have changed by the time measures were installed, Wave 1 had no influence on any of these potential changes. As the objective of the analysis was to evaluate the direct impact of the measures installed under Wave 1 on fuel poverty status, post-installation income and demographic data was not collected. Further details on the method used can be found in the Technical Annex.

Value for money analysis

The evaluation has used a targeted analysis to consider specific evaluation questions relating to value for money of the scheme. In particular, the analysis explored the variation in costs by measure, property and project types, the extent to which Wave 1 contributed to greater value for money through economies of scale, and how effectively Wave 1 delivered energy, carbon and bill savings. This has primarily involved analysis of scheme costs data from several sources.[12] Some supporting SHL and supply chain qualitative data has also been used.

Primary data collection

The impact evaluation drew on primary data collected among participating residents, scheme delivery representatives, SHLs and supply chain stakeholders. Fieldwork occurred between May 2023 and March 2025. Table 1 summarises fieldwork activities with each audience. A detailed summary of all methodological strands is included within the Technical Annex.

Table 1: Primary data sources used within this report

Data source	Description	Timings
Participating residents	Survey conducted during the installation of measures or shortly after. 1,498 responses via an online and telephone survey, from an issued sample of 5,235 (28% response rate). The sample covered 45 out of 65 projects and was weighted to ensure representativeness of all Wave 1 projects.	Tranche 1: May-June 2023 Tranche 2: July-Aug 2023 Tranche 3: Jan-Feb 2024
Participating residents	Interviews conducted during or shortly after the installation of measures. 150 in-depth interviews with residents from 40 projects who took part in the survey. Conducted on an opt-in basis.	Tranche 1: July 2023 Tranche 2: Sept 2023 Tranche 3: Jan-Feb 2024

[12] Project bid data, project baseline data, DESNZ monthly delivery data, Change Control data, SHDF Official Statistics.

Data source	Description	Timings
Participating residents	Survey conducted at least one winter season after the installation of measures. 537 responses via an online and telephone survey, from an issued sample of 1,124 respondents who completed the during-installation survey referenced above (48% response rate based on sample invited to complete the post-installation survey; 10% response rate based on original sample invited to complete the during-installation survey). The sample covered 45 out of 65 projects and was weighted to ensure representativeness of all Wave 1 projects.	February 2025
Participating residents	Interviews conducted at least one winter season after the installation of measures. 5 focus groups with a total of 20 residents from 13 projects who took part in the survey. Conducted on an opt-in basis.	March 2025
Non-participating residents	3 in-depth interviews with residents who opted to not take part in Wave 1.	June 2023
Scheme delivery representatives	4 individual interviews with 4 DESNZ senior officials.	October 2023
Scheme delivery representatives	4 focus groups: 1 with DESNZ Integrated Delivery Team (IDT) 1 with Technical Assistance Facility (TAF) representatives 2 with Delivery Partner (DP) representatives	TAF and first DP group: July 2023 IDT and second DP group: October 2023
Participating SHLs (sampled from projects selected to be case studies)	14 semi-structured interviews with representatives of 6 projects.	Tranche 1: May 2023 Tranche 2: Oct 2023

Data source	Description	Timings
Participating SHLs (sampled from projects not selected to be case studies)	15 semi-structured interviews with project leads from 15 SHLs.	Tranche 1: May 2023 Tranche 2: Oct 2023
Participating SHLs (sampled from projects not selected to be case studies)	1 focus group with 5 representatives of 3 projects.	October 2023
Unsuccessful SHL applicants	2 in-depth interviews with SHLs who were not successful in their application.	May-June 2023
Non-applicant SHLs	3 in-depth interviews with SHLs who engaged with the Social Housing Retrofit Accelerator (SHRA) but did not apply to Wave 1.	May-June 2023
Supply chain stakeholders	37 in-depth interviews with installers, installation managers, senior managers at principal contractors and retrofit coordinators. They represented 23 projects, and 9 were from 3 case studies.	Tranche 1: July-Sept 2023 Tranche 2: Sept 2023 - Jan 2024

Secondary data sources

The evaluation also made use of extensive secondary data, including bid data, scheme monitoring data, and statutory data, as shown in Table 2.

Table 2: Secondary data sources used within this report

Data source	Description	Content
SHDF Wave 1 Business Case	Overall scheme approach	Sets out the environmental and economic rationale for the scheme, the scheme's aims, proposed approach to delivery and rationale.
Project Bid Data	Bid data at point of application	Data on project plans (properties and measures planned to be installed and expected costs) submitted for application, including unsuccessful bids.

Data source	Description	Content
Project Baseline Data	Bid data, as modified after contract award	Data on project plans (properties and measures to be installed, and expected costs), modified after the contract award process. Includes successful bids only.
DESNZ monthly delivery data (from the Data Management System[13])	Property and measure details. Risk register; activities and plans; total number of installers; project spending and grant drawdown	Provides details of each property retrofitted, including costs and measures installed, where projects submitted this data. Project summaries include details of risks, project spending and grant drawdown, activities undertaken by individual projects each month and number of apprentices trained, or installers recruited (where projects submitted data).
Statutory data	Statistical Data Return (SDR) and Local Authority Data Return (LADR)	Background data on SHLs and their housing stock.
Statutory data	English Housing Survey (EHS)	Background data on SHL housing stock.
DESNZ project performance management data	Lessons Learnt Log (end March 2025)	Detail of issues experienced by projects and solutions throughout delivery.
DESNZ project performance management data	Change Control register (end March 2025)	Summary of project plans, and changes to individual project timelines, scale and scope.
Delivery Partner summaries of activity	Monthly project reports	Summary of monthly issues experienced by projects and relevant solutions, from the point of view of Monitoring and Delivery Officers (MDOs) from the Delivery Partner.

[13] Updated to 28 February 2025, compiled March 2025. This data was used to produce SHDF Official Statistics as published in April 2025.

Data source	Description	Content
SHDF Official Statistics (published in April 2025 and presenting latest statistics to the end of February 2025)	Monthly releases of SHDF statistics	Provides number of properties retrofitted and number of measures installed up to the end of the scheme in July 2024.
SHRA Impact Report	A review of SHRA support up to March 2022	Provides information on number of bids supported, and the type and number of resources produced.
The National Energy Efficiency Data-Framework (NEED)	National dataset of energy consumption	Provides annual data on electricity and gas consumption at a household level, as well as property characteristics, demographics, and details of energy efficiency measures installed.
Other official statistics (listed in full in the Technical Annex)	Official statistics	Information on relevant contextual information such as retrofit of social housing via other government schemes, EPC ratings of the social housing stock, and price inflation for the period covered by Wave 1.
Project closure reports	Reports completed by Wave 1 project leads following completion works.	Details on the completed projects including measures installed, properties treated, costs, reasons for changes, unintended consequences during, or as a result of retrofit works and lessons learnt.

Research limitations

Although this report draws on multiple sources of primary and secondary data, it is still subject to some limitations:

- **Representativeness of resident survey**. The volume of contact details for Wave 1 residents supplied to the evaluation team was lower than anticipated, which led to a lower achieved sample size than planned in the during-installation survey (1,498 compared to a target of 2,000). This, in turn, meant we had a smaller sampling frame than anticipated to recruit from for the post-installation survey, leading to a smaller sample size than planned (527 compared to 800). This reduces the statistical robustness of the survey. Furthermore, 20 of the 65 projects are not represented in the resident survey, while other projects are under-represented relative to the number of properties they retrofitted. We have applied weighting to the survey data to mitigate this issue.
- **Self-selecting nature of qualitative research with residents**. Residents opted in to interviews and focus groups following each resident survey. It is likely these may be 'engaged' residents and may have had motivations to take part in voluntary research, potentially introducing bias. To help mitigate against this, residents with different personal and property characteristics were selected.
- **Interviews with unsuccessful SHLs and those who originally expressed interest in the scheme but ended up not applying form a small sample** and so are not necessarily representative. In addition, only three interviews took place with residents who opted to not take part in Wave 1. This limits the strength of the evidence from these groups used within the Contribution Analysis framework.
- **There are a number of limitations to the Difference-in-Difference analysis to assess energy savings as a result of Wave 1**. Total energy and carbon savings may be underestimated as off-gas grid households are not included in the analysis. Off-gas grid households represented just under a quarter (23%) of Wave 1 properties and so constitute a significant part of the scheme. It was also not possible to track changes in energy consumption in properties that switched from gas to electricity as a result of Wave 1. Yet, given clean heat measures only accounted for 4% of all measures installed as part of Wave 1, the effect of excluding these properties is not expected to have been very large on findings overall. Lastly, although Wave 1 installations completed in 2024, this analysis only includes properties that received measures in 2022 and 2023.

- **Quality of delivery data**, while much improved from early monitoring, was a limiting factor on some analyses. Data was available for 68 projects, including three of the four projects that dropped out of the scheme. Some projects did not submit enough details about measures installed, measure costs or installation dates. The report flags instances where missing data was expected to have affected the quality of analysis. In addition, data on employment of installers and apprentices appeared inconsistent from project to project,[14] affecting the extent of the analysis possible and therefore resulting in less meaningful findings.
- **Use of scheme data and official statistics**. Throughout the report we have used published official statistics to assess delivery where available, including number of properties retrofitted and measures installed. Where official statistics were not available (e.g. for sub-group analysis of properties retrofitted, or planned to be retrofitted), we used delivery data compiled monthly by projects. While delivery data is the source used for official statistics[15], any discrepancies between totals in analyses are due to a different data cleaning process used to produce official statistics which could not be identically replicated. Information on project plans as of March 2025 (referred to in the report as ‘properties retrofitted or planned to be retrofitted’, or ‘measures installed or planned to be installed’) was taken from Change Control data, as this did not feature in official statistics.
- **Fuel Poverty proxy methodology**. For a standard fuel poverty assessment (upon which the national fuel poverty statistics are based) a large amount of detailed information regarding the household is required.
    - This includes their income (via the EHS householder survey[16] for example), their energy costs (including fuel prices) and the energy efficiency of the dwelling they live in (via a detailed building survey).
    - For the Wave 1 evaluation it was not possible to collect this level of detailed information for each participating household and therefore BRE developed a proxy fuel poverty status. This was based on the same LILEE method used for the national fuel poverty statistics, but using the limited available data.
    - The household’s AHC income was estimated based on fewer demographic and income survey questions than would be included in the national housing surveys. EPC bands were used as a proxy for Fuel Poverty Energy Efficiency Rating (FPEER)[17] bands when estimating the likely fuel poverty status of households.
    - Further detail on the proxy method used and its potential limitations can be found in the Technical Annex accompanying this report.

[14] i.e., definitions of ‘installer’ appeared to vary from numbers of individuals to numbers of main contractors. Data on apprentices was unaffected by this, but it only measured the number of apprentices working in a given month, rather than a cumulative number of those who started apprenticeships or successfully completed them.
[15] Figures differ since the cleaning process is different. In the few cases where delivery data was used instead of official statistics (three tables in the report) this was clearly signalled and explained in the footnote to the table.
[16] English Housing survey: https://www.gov.uk/government/collections/english-housing-survey
[17] The fuel poverty energy efficiency rating (FPEER) methodology is based on the government’s Standard Assessment Procedure (SAP) for assessing the energy performance of domestic properties while taking into account the impact of policy interventions (e.g., Warm Homes Discount) that directly affect household energy costs. Like SAP, the methodology gives an energy efficiency rating from 0 (lowest) to 100 (highest), which can be translated into an energy efficiency ‘Band’ from G (lowest) to A (highest). The Warm Homes Discount (WHD) is applied directly to an eligible household’s electricity bill.

3. Building Social Housing Landlord capability and capacity

This chapter covers impacts of Wave 1 relating to Social Housing Landlords (SHLs). This includes lessons learnt through project delivery, lesson sharing, capabilities and capacities built, and how these relate to future plans for retrofit. It also covers outcomes related to building stock, and any unintended, negative outcomes for SHLs.[18]

The chapter begins by assessing the additionality of Wave 1 funding. It draws on various evidence sources, including interviews with SHLs and scheme delivery representatives, as well as secondary data. Findings reported from SHLs are based on data from interviews with a sample of Wave 1 funded SHLs, unless otherwise specified.

Key findings

Evidence suggests that retrofit would have occurred in social housing in the absence of Wave 1 funding, through use of other public or internal funding. However, **Wave 1 has likely resulted in a higher number of properties reaching EPC C than would have otherwise occurred**, as it allowed SHLs to expand the scale, scope, and quality of their retrofit projects.

Most SHLs gained learnings from their Wave 1 projects, relating to scheme applications and processes, retrofit project planning, supply chain management, and resident engagement. **The majority of SHLs also reported gaining technical skills**, such as compliance with PAS 2035. Evidence also suggests that SHLs' capacity for retrofit has grown as a result of Wave 1.

Most SHLs have plans to conduct future energy efficiency retrofits on their housing stock. For some SHLs, Wave 1 has enabled them to increase the scale, scope and/or the quality of their plans.

The main unexpected or negative outcomes highlighted by SHLs and scheme delivery representatives were project delays and the additional cost and resources needed to deliver projects.

[18] Contribution claims addressed in this chapter: CC1, CC2, and CC4. Evaluation questions addressed in this chapter: 5.9, 6.2, 6.3, 6.4, 6.5, 6.6, 7.7, 8.9 and 8.10.

Additionality of Wave 1 Funding

The provision of Wave 1 funding was intended to stimulate and enable SHLs to deliver larger scale retrofits. A total of 16,056 properties received installations through Wave 1.[19]

As detailed further in the Wave 1 Process Evaluation Report[20], evidence suggests that while SHLs would have conducted energy efficiency retrofits in the absence of Wave 1 funding, the scheme enabled many SHLs to increase the scale, scope, and/or the quality of the works. For example, SHLs reported that Wave 1 enabled them to retrofit a higher number of properties, implement measures they had not installed before (for example, EWI and Flat Roof Insulation), and improve the quality of installations through scheme requirements such as PAS 2035 compliance and using a whole house approach.

Further analysis (summarised in a case study published alongside this report), found that some landlords that did not participate in Wave 1 used internal funds to conduct retrofit works on their housing stock, in some cases to a similar scale to what they had planned for Wave 1. Of 12 non-participating landlords researched as part of this evaluation, over half had accessed funding from other government retrofit schemes, which could have been used to install measures in social homes at the same time as Wave 1.

These included the Energy Company Obligation (ECO) 3 & 4, the Local Authority Delivery Scheme (LAD) 3, and the Home Upgrade Grant (HUG) 1. Overall, ECO[21] was used to install energy efficiency measures in a slightly larger number (22,378) of social housing properties than Wave 1 during the same delivery period (January 2022 to April 2024). However, while Wave 1 was only delivered in England, ECO was delivered across Great Britain, suggesting Wave 1 may have delivered retrofits at a large scale within England.

These findings suggest retrofit works would have occurred in the absence of Wave 1 funding to some extent, through landlords accessing other government funding or using internal funding.

Future regulation on minimum energy efficiency standards for social housing may be introduced in coming years as part of the Decent Homes Standard.[22] As described in the Wave 1 Process Evaluation Report,[23] SHLs were motivated to retrofit social homes to achieve decarbonisation and Net Zero targets, as well as to meet their regulatory obligations. Scheme delivery representatives noted that anticipation of future regulatory change in relation to energy performance of social housing may sometimes have played a role in this. Regardless of motivations for retrofit, scheme delivery representatives and many SHLs highlighted the need for financial support from central government, as many SHLs lacked the necessary funding to undertake large-scale retrofits.

[19] Source: DESNZ (2025) 'Social Housing Decarbonisation Fund statistics: April 2025'
[20] DESNZ (2024) 'Social Housing Decarbonisation Fund Wave 1 Evaluation'
[21] Source: DESNZ (2025) 'Household Energy Efficiency Statistics, headline release January 2025'
[22] DLUHC (2023) 'September 2023 - update on government's work to improve the quality of social housing'
[23] As described in the Wave 1 report, DESNZ (2024) 'Social Housing Decarbonisation Fund Wave 1 Evaluation'

Evidence from scheme delivery representatives and SHLs therefore suggests that anticipated future regulatory changes were not the sole motivation for participation in Wave 1 and the scheme was necessary to achieve its intended objective to stimulate and enable SHLs to deliver larger scale retrofits, in addition to what would have been implemented in the absence of Wave 1.

CA conclusion: Additionality of Wave 1 funding

Based upon triangulation of evidence across sources through Contribution Analysis,[24] there is moderate strength evidence that Wave 1 funding stimulated and enabled SHLs in England to deliver retrofits at a larger scale than would otherwise have been the case.

Similarly, there is moderate strength evidence that retrofits were delivered in social homes at a larger scale through Wave 1 funding than would otherwise have been the case (e.g. through other government retrofit schemes such as ECO, or internal funding).

There was also evidence that Wave 1 scheme support, including the Technical Assistance Facility (TAF) and Delivery Partner (DP), supported SHLs in developing their Wave 1 application, engaging with residents and delivering their retrofit projects. Evidence for TAF support was strong, while evidence for DP support was of moderate strength. Further details on this can be found in the Wave 1 Process Evaluation Report.

Thus, overall, evidence indicates that Wave 1 has contributed to delivering energy efficiency retrofit in social housing, alongside other initiatives.

[24] The full Contribution Analysis framework and evidence collected for this is given in the Technical Annex. This reaches conclusions about the strength of evidence (strong, moderate, limited/weak, none) about the contribution of Wave 1 (and other factors) to outcomes and impacts.

Learnings, capabilities and capacities

Lessons learnt through Wave 1 project delivery

Wave 1 aimed to offer SHLs an opportunity to develop their capability and capacity to undertake future retrofit projects. Most interviewed SHLs and scheme delivery representatives highlighted that SHLs acquired a number of learnings from Wave 1 that have informed or will inform their future plans for retrofit. Specific learnings highlighted by SHLs related to different aspects as discussed below, including: scheme applications and monitoring processes; project planning; contractor and supply chain management; and resident engagement.

- **Scheme applications:** Both unsuccessful applicants that were interviewed as part of the evaluation reported learning from the application process, which has helped them to be more prepared to apply for future waves. A small number of successful SHLs identified limitations in housing stock data. Making improvements to data availability and accuracy was expected to improve their ability to apply to future waves. One SHL faced challenges with retrofit assessment surveys misidentifying wall construction characteristics, which affected the suitability of measures proposed. Another SHL mentioned they should have spent resources on external consultants earlier in the process for expertise on PAS 2035 requirements.
- **Scheme monitoring processes:** One SHL that led a consortium with one of the largest numbers of properties across Wave 1 reported facing challenges in collating data from multiple consortium members for monthly reporting. Harnessing their experience of this process, they were looking to implement a more efficient system to collate data. Another SHL gained valuable knowledge on reporting and change request processes, which helped them prepare for future SHDF waves and other schemes with similar requirements like LAD.
- **Project planning:** Interviewed SHLs reported lessons around retrofit planning, in particular how to plan their retrofit to take account of weather conditions, how to plan for EWI installation and how to navigate party wall issues. One SHL also reflected on the importance of planning to improve the overall quality of general works. When replacing a roof, they made sure to upgrade the insulation to a high standard before installing Solar Photovoltaic (PV) systems. They also took advantage of scaffolding to carry out additional improvements at the same time. Some SHLs highlighted the need for early retrofit assessments, procurement, pre-planning, and engagement with designers and suppliers. Further, data in SHL project closure reports[25] show that 46 of 52 SHLs reported learnings related to project planning and property selection.

  "We have had issues with weather because when you're doing external wall insulation, it's quite weather dependent. So, there's been quite a few lessons learnt about planning when the work is going to be done and being realistic about those timescales."
  Successful SHL

[25] These are self-completed reports returned by Wave 1 projects upon project completion. 17 of 69 SHLs had not submitted project closure reports at the time of this analysis. These reports did not undergo a formal quality assurance process by DESNZ or the DP. However, they provide an indication of projects' self-assessment of learnings.

- **Contractor and supply chain management:** Some interviewed SHLs learnt key lessons around working with contractors and how best to structure their supply chain. 47 of 52 SHLs who submitted a closure report mentioned learnings related to procurement processes and the supply chain in their closure report. In terms of structuring the supply chain, one interviewed SHL found that using a third party to ensure PAS 2035 compliance had been valuable and were taking this forward for Wave 2. Another SHL concluded that independent retrofit coordinators offered more control than turnkey suppliers.[26] The quote below illustrates an example of more general learning about contracts:

  "If we were to have a contract with [our contractor] again, we've already ironed out what we can and can't do as a council with them. So, in terms of legal costs and time saving, we wouldn't need to go through the whole rigmarole of legal teams speaking to each other for weeks on end. So, I would say Wave 1 has taught us a lot in terms of what we can and can't do and I think for the service area as well, there's been quite a lot of improvement." Successful SHL

- **Resident engagement:** In project closure reports, 49 of 52 SHLs who submitted one reported learnings related to resident engagement. Some interviewed SHLs emphasised the importance of early resident engagement, including providing upfront information, contacts, and using void properties for demonstrations of how measures work. One SHL noted the value of having a tenant liaison officer to boost confidence in the scheme, which they will be using going forward.

  "We want to introduce the project/concept to tenants at the beginning, we're planning to talk to them about what's happening about the designs, about what we're proposing and keeping people really well updated and informed. It kind of feels challenging… but it's so important and once you get into it, it's not that difficult… So, that's been a massive learning for us about resident engagement." Successful SHL

One scheme delivery representative reported that **SHLs with no prior experience saw the most growth and learning**. Evidence from SHLs also supported this point. A consortium lead reported supporting some of their less experienced partners in retrofit. Two of these registered providers (RPs) said they found the support effective, boosting their confidence, skills, and commitment to housing decarbonisation. Another interviewed SHL echoed this, noting SHDF was a new workstream and that they had learnt a lot, especially about resident engagement, which had improved significantly since the start of Wave 1.

> *"Those who've done it before have still probably grown and learnt, but those who haven't done it before have grown and learnt more from a standing start almost. But we still struggle, I would say with some capacity, particularly in local authorities."* Scheme delivery representative

[26] A turnkey supplier is a company or contractor that provides a complete solution for a project, delivering everything needed so the client can 'turn the key' and start using it right away with minimal effort on their part.

SHLs reported learnings related to undertaking retrofit on specific property types. The case study on Norwich City Council's project describes learnings arising from installing EWI in Wimpey No-Fines properties.[27] An extract from the Wave 1 thematic case study on retrofitting hard-to-treat properties[28] also includes learnings, as summarised in the box below.

Case Study: Installing measures in hard-to-treat properties

Hard-to-treat properties include those with low EPC ratings (F or G), bungalows, high-rise flats, non-traditional archetypes (such as Wimpey No-Fines), rural properties, properties off the gas grid, and older properties (built pre-1945). SHLs reported the following learnings from installing measures in hard-to-treat properties:

Dedicated, in person engagement with residents may be supportive of successful delivery. While this may be true of all retrofit activity, two SHLs indicated that residents living in hard-to-treat properties were less willing to accept measures. One SHL suggested this may explain why some hard-to-treat properties had not received retrofit works before Wave 1.

There was also some evidence of disruption sometimes being a particular problem for residents of flats. For example, one SHL stated that resident disruption was an issue when installing ground source heat pumps in densely populated flats as substantial external infrastructure work was required, including over 110 boreholes (each down to 300 metres) within car parks at the site.

Costs are likely to be higher for hard-to-treat properties because they may have particular structural issues, previous work undertaken may be of poor quality, or because of specific planning considerations. For example, a supply chain stakeholder reported that bungalows did not have proper rafters and had to be propped up from underneath with Acrow props.[29] In another example, supply chain stakeholders reported planning permissions to be stricter in rural areas. For example, they needed to use rendering to make the wall finish look like stonework, in line with the local environment, which was also more expensive.

Learning from other sources

The evaluation also aimed to consider any interaction between SHL participation and capability development through Wave 1 and other initiatives or private investment. Some SHLs indicated they had learnt lessons from other government retrofit schemes or through external resources such as events and online resources. Most successful SHLs had accessed other government retrofit schemes prior to Wave 1. Some SHLs reported learning lessons from their involvement in these other government schemes, including the Public Sector Decarbonisation scheme and the Local Authority Delivery (LAD) scheme. There was also limited evidence of some SHLs learning through undertaking internally funded retrofit projects. These learnings were used for their Wave 1 projects.

[27] DESNZ (2024) 'Social Housing Decarbonisation Fund Wave 1 case study: Norwich'
[28] DESNZ (2024) 'Social Housing Decarbonisation Fund Wave 1: thematic case study (installing measures in hard-to-treat properties)'
[29] Acrow props are a temporary vertical support system to support overhead loads including ceilings.

"The LAD scheme has been a massive learning curve and that has been our biggest project to date. We took a lot of learning from that, and we can use it for SHDF." Successful SHL

As detailed earlier in the chapter, most SHLs built on this with further learnings from Wave 1 delivery.

Lesson sharing

Evidence shows that lessons learnt during Wave 1 delivery have been shared more widely within project teams and the wider sector. This suggests a spillover benefit within the sector.

Some SHLs highlighted evidence of sharing lessons from their experiences in Wave 1 within their project teams and organisations.

For example, one SHL said they have upskilled in PAS 2035 requirements on construction projects, architectural details and retrofit assessments, which has resulted in the knowledge and skills being spread through their wider team. They have some apprentices working through retrofit assessment documentation and the Standard Assessment Procedure (SAP) calculations used to help determine a property's energy efficiency rating, resulting in blending of information and skills throughout their organisation.

Another SHL shared lessons from Wave 1 with their wider teams via workshops, to inform the Wave 2.1 bidding process. They have also held spreadsheet training sessions for Wave 2.1, which was an area they struggled with during Wave 1. Another SHL also noted sharing lessons internally in their departmental intersection meetings, including knowledge on carbon reduction techniques.

Some SHLs shared lessons learnt within and between Wave 1 projects and consortia in different ways, for example:

- One SHL visited other councils' projects to compare experiences on construction sites, applying these lessons to their own heat pump and Solar PV installations.
- Another SHL learnt from their Registered Providers (RPs) about selecting contractors and procurement processes.
- Another SHL noted informal discussions between Wave 1 and Wave 2.1 consortia to share insights, though they emphasised that lessons from Wave 1 could not always be applied to Wave 2.1 due to policy and reporting changes.
- Another SHL reported learning across different projects as illustrated in the quote below.

  "Some members of the consortium were also working as part of another consortium. So, it's possible that they've gained information from there because I have had questions where people said, well, they are doing it this way and you're asking for this, and it's raised questions between what we are doing and they are doing." Successful SHL

A small number of SHLs also reported sharing lessons externally beyond Wave 1, for example at major conferences and exhibitions and in forums such as those associated with TrustMark. In project closure reports, 33 projects reported that they had engaged with or shared lessons with regional organisations such as other LAs, forums, and sector working and advisory groups who were also undertaking retrofit activities. The quote below illustrates how this might also lead to broader discussions about retrofit.

> *"The collaboration with other councils and local net zero events were useful for sharing learnings. They provided an opportunity to share learnings, best practice, but then also wider than that is talking about how to increase skills capacity as a region and how it would be good to plan out the retrofit programmes as a region, so different things are at different times."* Successful SHL

Capabilities and capacities built

As well as learning lessons through project delivery, many SHLs highlighted training undertaken in domestic energy assessments, retrofit coordination, assessment and skills, PAS, and building assessment. Some improved skills in modelling, building pathology, and computer-aided design (CAD). One SHL noted upskilling through SHRA workshops. A scheme delivery representative noted that SHLs were training staff to collaborate more with retrofit assessors.

> *"I would say we did need a lot more understanding and learning of PAS 2035 and that's why we took the option up for myself and others to get qualified and I'm trying to push others down that route as well." Successful SHL*

> *"I think because of Wave 1, we had internal resource put together so that two of our original stock surveyors got the qualifications to be retrofit assessors so they're now permanently in our team and will be on future projects as well."* Successful SHL

However, one SHL and one scheme delivery representative reported challenges with building capacity. The scheme delivery representative noted that many LAs struggled to recruit project managers due to market conditions and higher salary expectations, which are hard to meet given funding constraints. The SHL (an LA) also noted challenges with retaining highly skilled staff given they were in high demand.

Some SHLs also reported building collaborations and relationships with contractors, assessors, and building control teams. Some said these enabled SHLs to apply for Wave 2.1.

Future plans for retrofit

Many of the Wave 1 funded SHLs reported involvement in subsequent waves of SHDF, or having plans for future involvement. Some scheme delivery representatives also added that a number of SHLs they had spoken to had plans for further works and were keen to deliver further retrofit under Wave 2.1. As such, they believe SHLs view retrofit as a long-term journey and are using SHDF funding to help them achieve this.

Many SHLs stated their future plans for retrofit have increased in scale compared to their work under Wave 1. Some SHLs noted the specific number of properties they were retrofitting under Wave 2.1, which has increased in scale since Wave 1. For example, one said they are aiming to work with 161% more homes in Wave 2.1 compared to Wave 1. Another SHL commented on plans across their consortium:

> *"I think all of the rest of the consortium, all of the RPs, have accessed Wave 2 funding or have applied for Wave 2… I think for one RP, they've got a large number of properties for Wave 2… and they've been quite ambitious in their plans for future schemes."* Successful SHL

Some SHLs shared how the experience they gained in Wave 1 has influenced the quality of their future plans. One SHL noted in interviews that through undertaking housing surveys as part of Wave 1 they have developed a strong knowledge of their stock which would help inform future plans. Two SHLs noted they were going to use a 'whole building approach' in their future retrofit as they have learnt that this is more effective than just implementing one measure. Another said their future strategy for retrofit was to get properties achieving EPC B, so they would be more suitable for clean heat measures such as air source heat pumps. The lessons and skills learnt by SHLs discussed previously would also be expected to contribute to the quality of future retrofit projects.

Despite having future plans for retrofit, other SHLs reported that these would not be as extensive as Wave 1. One SHL reported this was because most of their properties were already at EPC C, and another said their future installations would be lighter touch, for example to get properties from EPC D to C, due to internal budget restrictions. Another SHL said they were using learnings from Wave 1 to start retrofitting sheltered housing within their stock, but the scale of the works was restricted because of match funding requirements and limited internal resource.

Case Study: Crawley Borough Council

Crawley Borough Council took part in several national and local retrofit schemes and funded insulation works internally prior to Wave 1, through which they gained valuable retrofit experience. In interviews, the Council reported having a network of long-standing relationships with contractors, which enabled them to quickly mobilise the supply chain for project delivery.

The project team reported various factors that facilitated successful installation of EWI in non-traditional homes that they learnt through their Wave 1 project. This included leveraging local contractors familiar with the properties. Another was identifying further supplier expertise and capacity where a larger contractor was brought in that had completed several retrofits on similar properties.

A key outcome of the project was the Council's improved approach to resident engagement. Stronger communication and trust-building became a focus, and the Council plans to use empty homes in future projects to demonstrate retrofit works to residents beforehand. They also identified the value of having a dedicated resident liaison officer to support consistent, clear engagement throughout delivery.

Although the project faced installation and supply chain challenges that led to a 10-month extension, the Council gained important insights that will inform their approach to SHDF Wave 2.1 and other future retrofit schemes.

Conclusion on SHL capability and capacity building

Based upon Contribution Analysis, there is strong evidence that SHLs' participation in Wave 1 was essential to the development of their capability and capacity to undertake future retrofit projects.

There was limited evidence that some SHLs have gathered learnings outside of Wave 1, for example through other government retrofit schemes or through projects carried out using internal funds.

Housing stock benefits

Some SHLs said that the scheme has improved the financial value of their stock. For example, one SHL stated that installing EWI improved their properties' EPC bands by two levels, which increased the value of the property. They added that Solar PV measures could improve a property's visual appearance, but they were uncertain about their impact on financial value. Another SHL said that Wave 1 has helped improve the desirability of their properties, rather than the financial value, as explained in the quote:

> *"I think the SHDF would still improve the desirability of the properties because obviously in the current climate, everyone wants cheaper bills and that's what they've been able to get." Successful SHL*

In some cases, scheme delivery representatives and some SHLs noted that installations improved building safety. For example, a SHL reported that one of their properties experienced a fire that was successfully contained to a single room thanks to improvements made under the scheme. Two SHLs said that Wave 1 has helped make homes safer in terms of being less prone to damp and mould. A scheme delivery representative also highlighted that improvements like ventilation alongside energy efficiency measures have helped address issues such as mould and damp. This was supported by evidence from the resident survey which found that 52% of residents reported improvements in mould and mildew issues since receiving measures[30] and 54% reported improvements in damp issues.[31] One SHL also highlighted this benefit:

> *"We've worked in a context of social housing over the last twelve months or so where it's really begun to focus on damp and mould in a very deep way, and the work we've done on SHDF has really supported that."* Successful SHL

However, 16% of surveyed residents that had issues with mould and mildew before receiving measures said these had worsened since installations. This is explored further in Chapter 6.

[30] 45% of residents previously experienced issues with mould and mildew.
[31] 36% of residents reported experiencing damp prior to installations.

Unintended or negative impacts for SHLs

The evidence suggests that the main unintended negative impact of Wave 1 for SHLs has been project delays and unanticipated resource requirement in terms of staff time and budget. The reasons for this, including inflation, supply chain challenges, and PAS 2035 requirements, are explained in detail in the Wave 1 Process Evaluation Report (from page 64 onwards).[32]

"The big unintended outcome really has been the cost; it's been a lot more expensive than we planned. We designed this project to massively increase the scale compared to Demonstrator and that's just been such a huge challenge. It's been a bigger challenge than we expected it to be for financial reasons." Successful SHL

[32] DESNZ (2024) 'Social Housing Decarbonisation Fund Wave 1 Evaluation'

4. Development of the supply chain

This chapter examines supply chain outcomes and impacts, focusing on upskilling, capacity building, coordination with other schemes, remaining barriers, and unintended impacts.[33] The chapter predominantly draws on evidence from supply chain stakeholder interviews, with supporting evidence from interviews with SHLs and secondary sources.

Key findings

Both the value and security of Wave 1 contracts in the supply chain helped to stimulate job creation and upskill the workforce. This confidence led to efforts in accreditation, training, and upskilling to future-proof supply chains and enhance efficiencies.

However, stakeholders reported challenges such as the high cost and duration of training for advanced roles, business sustainability concerns, and dissatisfaction among older workers with continuous upskilling and digital requirements. Despite operating at capacity, supply chain stakeholders involved in Wave 1 noted that taking part in other government retrofit schemes at the same time did not pose a significant barrier to delivery.

Building capacity in the supply chain

Creation of jobs

When asked to assess the extent to which Wave 1 contributed to job creation in the retrofit industry, supply chain stakeholders and SHLs felt that the baseline number of companies and jobs in the sector had reduced prior to the start of Wave 1. They explained how the workforce historically relied heavily upon installers from Eastern Europe, and many had experienced this segment of their workforce leaving the country owing to the United Kingdom's exit from the European Union and the COVID-19 pandemic. These employment trends are well documented, with the construction sector being one of the worst affected industries by changes in migration.[34] Scheme delivery representatives noted that the demand from overseas markets (predominantly Europe) had increased the pressure on the domestic supply chain. One SHL reported that the green new deal in Europe[35] had been pushing domestic labour away from the UK market. In considering the following findings, it is therefore important to consider that capacity issues already existed prior to Wave 1.

Owing to existing capacity issues, supply chain stakeholders welcomed Wave 1 funding, as it provided them the opportunity to reinvest in their workforce. Whilst it is not possible to estimate exact figures on job creation from the scheme monitoring data, qualitative interviews with supply chain stakeholders, SHLs, and scheme delivery representatives provided numerous

[33] Contribution claims addressed in this chapter: CC4, CC5, CC6, and CC7. Evaluation questions addressed in this chapter: 8.10, 9.1, 9.2, 9.3, 9.4 and 9.5.
[34] Construction Industry Training Board (CITB), 'Migration and UK Construction' (Last modified June 2023)
[35] European Commission, 'A European Green Deal' (Last modified 14 October 2020)

examples of employers recruiting in large numbers, either directly, or by sub-contracting additional companies to deliver Wave 1 projects. The estimate number of additional jobs reported by supply chain stakeholders varied significantly based on factors such as company size, existing capacity, and the nature of the contracts secured through Wave 1. Smaller firms generally reported lower job additions, while larger organisations and those involved in multiple projects tended to indicate more substantial increases (such as the example below).

> *“The creation of 400 full time jobs across 12 projects [six Wave 1 and six Wave 2 projects] is really the main benefit of the scheme.”* Supply chain stakeholder

The length and size of Wave 1 contracts provided employers with the confidence they needed to hire new staff.

> *“It has been fantastic for us. We are really stable at a time when architects quite often are not. It has been a springboard for us to meet lots of social housing clients who we are providing other services for now."* Supply chain stakeholder

> *“Now you can be doing 1,000 houses over two years, you have a clear vision, and also know that you have that funding for two years."* Supply chain stakeholder

The security afforded to the supply chain by Wave 1 contracts also positively affected the supply chain stakeholders’ ability to deliver the projects by offering a more stable employment landscape for employees. Traditionally, relying on the extensive use of subcontractors is safer as a business model for supply chain stakeholders. This is because when funding is no longer available, they are not required to continue paying the salaries for benched employees. Whilst this system usually incurs less risk for these companies, supply chain stakeholders considered that sub-contracting tended to result in:

- More issues caused by working with new teams on each project
- Higher costs compared with a more direct employment model
- Lack of accountability for poor performance and installations
- Less flexibility when issues are encountered

Supply chain stakeholders highlighted how the security of the Wave 1 contracts had allowed them to move towards a more direct employment model. Supply chain stakeholders transitioned to this employment model due to their strong confidence in the availability of similar retrofit projects following Wave 1. They anticipated that a more direct employment approach would facilitate smoother delivery and increase their competitiveness for future schemes. Having a directly employed workforce enabled:

- Learnings to be more effectively shared, improving efficiency and bringing down costs
- Greater accountability for work being delivered
- Greater incentives for employers to pay to upskill their workforce (including apprenticeships)
- More control over resource to get work reassigned where it is needed
- Better prioritisation when facing competing demands

Upskilling in the supply chain

Standards and accreditations

As referenced above, supply chain stakeholders were confident that more government energy efficiency retrofit schemes would be created after Wave 1, incentivising them to invest in their own training processes. Typically, supply chain stakeholders reported that they were either in the process of, or had existing systems in place for, developing accreditation training processes as a result of Wave 1.

Supply chain stakeholders indicated that while many projects involved organisations and staff that were already TrustMark accredited and had experience with PAS 2035 standards, they also required training for contractors, suppliers, and personnel who had not previously worked with these standards. Retrofit coordinators and senior managers at principal contractors actively promoted and, in some instances, supported the process of obtaining accreditations among their workforce and the contractors they engaged before their involvement in Wave 1.

Interviews with SHLs and scheme delivery representatives also reflected that Wave 1 has resulted in upskilling, training and accreditation, particularly related to PAS 2035 standards, within the supply chain.

Many supply chain stakeholders said they adopted a strategy aimed to 'future proof' their organisations, allowing them to utilise newly accredited contractors for future installation work. They described the challenges of delivering the projects as a 'learning curve' and a 'leap of faith' which they hoped would lead to cost reductions and increased efficiencies in the future. Some described how the security of Wave 1 contracts encouraged them to develop training programmes or 'boot camps' for their own employed installers, preferred contractors, and suppliers, which were intensive short courses for obtaining accreditations.

> *"We provide continuous professional development within the business, not just externally, so we're constantly improving the understanding of energy efficiency with our co-ordinators and assessors."* Supply chain stakeholder

The administrative and management aspects of standards compliance and accreditations needed to deliver Wave 1 also required supply chain stakeholders to upskill and build capacity. There were several examples in interviews of supply chain stakeholders employing additional staff to manage the increased paperwork requirements associated with PAS 2035 evidencing requirements. One supply chain stakeholder stated they had put their entire team through training on the administration side and employed six administrative roles to deal with their evidence requirements in Wave 1. Supply chain stakeholders were confident that their Wave 1 training and accreditation efforts would lead to efficiency savings on future government energy efficiency schemes.

> *"Since PAS 2035 has come into place and was used on a lot of these projects… we have gone through a massive recruitment for administration staff and retrofit assessors."* Supply chain stakeholder

Expanding capability to install different measure types

In direct response to the assurance of more SHDF waves in the near future, there was also evidence that supply chain stakeholders were considering expanding their capabilities beyond the measures their organisation delivered at the time, particularly in clean heat technologies.

In interviews, there were instances of supply chain stakeholders in the process of getting the Microgeneration Certification Scheme (MCS) accreditation to install Solar PV and Air Source Heat Pumps (ASHP), enabling them to expand their work. While there was growing interest regarding clean heat installations, some supply chain stakeholders wanted to see further development of the industry before investing in relevant training and accreditation. One supply chain stakeholder highlighted how the focus on ‘fabric first’ for the current schemes meant they would not focus on diversification yet.

> *"PV solar, ASHPs, well... my opinion on those is I think we need to see how the market plays out first. I am not convinced that they are fit for purpose yet.”* Supply chain stakeholder

CA conclusion: Improvement in retrofit processes

Based upon the Contribution Analysis, there is strong evidence that Wave 1 projects have directly resulted in improvements to retrofit processes within some of the participating supply chain, as a result of PAS 2035 requirements. Consistent evidence from the supply chain, as well as from SHLs and scheme delivery representatives, indicates their processes have improved, and many stakeholders reported learnings.

Capability and capacity barriers

Industry labour shortages were commonly raised as barriers to delivery in interviews with supply chain stakeholders, SHLs, and scheme delivery representatives. Whilst in some cases supply chain stakeholders reported it was relatively easy to subcontract, recruit, or train new workers, there were certain roles or measures where it proved harder to meet capacity issues. Training timelines for more advanced roles were longer and more expensive. In particular, issues with obtaining experienced retrofit coordinators, ventilation staff, designers, and clean heat installers were all mentioned in the interviews with supply chain stakeholders, SHLs, and scheme delivery representatives.

> *“We have gone through a massive recruitment drive for primarily administration staff and retrofit assessors... It has been quite hard to get to where we are now.”* Supply chain stakeholder

Role of the supply chain in project timescales

The development of the supply chain took several months for most projects and was often flagged as a key risk: 27 projects reported a red supply chain risk,[36] accounting for 75% of all projects that reported any red risk, and 39% of all projects[37] in the scheme. The period from the start of the Wave 1 scheme (1 March 2022) to the completion of supply chain procurement[38] accounted, on average, for nearly half of the length of projects[39] (42%, or 255 days).[40] On average, it took 350 days (or 58% of the average project length) for projects to complete installations (Milestone 7) from the date procurement was completed (Milestone 5).[41]

For the 14 projects that installed clean heat measures, it took an average of 221 days to complete supply chain procurement[42] from the scheme start (38% of average project length). This indicates that procurement was not substantially more time-consuming for projects installing clean heat measures compared to those installing other measures. No other differences were noted in the time it took to procure the supply chain by the type of project lead, the size of the project, or whether the project was a consortium.

Building capacity sustainably

Many supply chain stakeholders reported a large increase in jobs and upskilling within their organisations, a trend that scheme delivery representatives also reported being aware of. However, supply chain stakeholders also highlighted how they wanted to ensure this was done sustainably from a financial perspective. Supply chain stakeholders recalled how they have seen funding streams be available for fixed terms previously and, when they ended, the government introduced a new standard requirement for the next round of schemes. This previous experience held back some supply chain stakeholders from investing more substantially into training for the new standards regime, with one supply chain stakeholder explaining how they have put a cap on how much grant-funded work they could do as a proportion of their overall work so they could reduce the risk of government changes in direction.

> *"We have secured a certain amount of work and are delivering a run rate of 16 million worth of energy efficient measures this year and will move onto 18-20 million next year, but can't develop any further than that".* Supply chain stakeholder

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[36] Project risks were rated on a scale from red to green, with red being the highest category of risk available.
[37] Analysis includes 65 completed projects and 4 projects that dropped out of Wave 1.
[38] Data includes 60 projects. Those reporting implausible dates (e.g. prior to the scheme start date of 1st March 2022, or after the end of installations (i.e., Milestone 7) were excluded.
[39] From the start of the scheme (1 March 2022) to the date of the last installation (as reported by SHLs in scheme monitoring data as of the end of February 2025).
[40] Ideally, this calculation would have excluded the period before the project team was established (Milestone 1) but this data is of poor quality. Of the 33 projects with plausible Milestone 1 data (i.e. project team established prior to installations and procurement completion, but after the scheme start date), the average time taken for supply chain procurement was 76 days.
[41] Based on data available from 60 projects. Those reporting implausible dates (e.g. prior to the scheme start date of 1 March 2022, or procurement completion after the end of installations (i.e., Milestone 7) were excluded.
[42] These figures relate to the whole of each project involving Clean Heat installations, not solely to the Clean Heat installation. The wider project will have involved measures other than Clean Heat, and included discussion of general contractual matters and procurement of generic activities (e.g., scaffolding, waste disposal, plastering, decorating) which are involved in many construction projects.

However, it is clear that sustainability concerns did not restrict the activities of all supply chain stakeholders, with some reporting a financial loss on their Wave 1 activities. These losses were primarily attributed to investments in training and learning as an organisation. Furthermore, three SHLs reported they had some subcontractors enter administration during Wave 1 delivery. Whilst instances of administration were partly caused by subcontractors being tied to pre-inflation rates in their contracts with SHLs, the small margins built into many bids owing to training and upskilling costs early in the process also likely played a factor. This demonstrates the importance of consistency, or incremental improvements, in quality standards imposed on retrofit schemes, to reduce the financial risks that can impact the robustness of the supply chain.

Barriers to entry for start ups

Whilst Wave 1 has reportedly created numerous job opportunities, supply chain stakeholders highlighted how the scheme's requirement for companies to be PAS 2035 compliant and TrustMark accredited created barriers to entry for new companies. These presented barriers due to their complexity and the high costs associated with obtaining accreditations. In addition to the high costs, the requirements also imposed administrative demands, including detailed documentation and reporting, which required additional resources to be shifted from core business activities like installation. These barriers highlight the additional hurdles that new companies without existing certifications had to overcome in obtaining Wave 1 contracts, making it challenging for new entrants to compete effectively.

Issues specific to the age of the workforce

Another barrier to capability and capacity of the supply chain was the higher dissatisfaction amongst older and more experienced workforce with the direction of the industry, some of whom did not want to continuously train and upskill. There was also a separate issue with some struggling with the digital equipment and software required for evidence gathering purposes.

> *"I think the [PAS2035 and TrustMark requirements] can be a barrier in some instances if you have tradesmen who have 30 years' experience and then you're asking them to get qualified to NVQ level 5 before they can do a piece of work that they have been doing for the last 30 years."* Supply chain stakeholder

Coordination with other DESNZ energy efficiency schemes

Almost all supply chain stakeholders interviewed had prior experience of working on previous government-funded retrofit energy efficiency schemes.[43] They were most likely to report working on projects funded through the ECO scheme alongside Wave 1. Two supply chain stakeholders reported that the skills and lessons learnt on their involvement in ECO transferred well into their SHDF responsibilities, especially with regards to the standards, compliance and paperwork requirements.

While the capacity of the retrofit supply chain was a key barrier to delivery, as noted in the Wave 1 Process Evaluation Report,[44] supply chain stakeholders undertaking Wave 1 installations did not consider their own capacity as a barrier to delivering to schedule.[45] Many reported that Wave 1 work occupied a significant proportion of their working time due to its scale, resulting in them operating at full capacity and being unable to pursue additional contracts during its delivery. One supply chain stakeholder discussed how the larger scale of the SHDF work compared to their other workstreams meant they prioritised accommodating the demands and changing timescales of SHDF at the expense of other contracts (which were smaller in scale and considered to be more flexible).

> *"Capacity hasn't been a problem. You will find that each scheme has a target audience or a target technology that they're trying to support, so we have chosen SHDF and ECO. That's down to choice, the client, and the work, rather than capacity."* Supply chain stakeholder

It was rare for supply chain stakeholders to report turning down non-SHDF contracts to work on Wave 1 projects, with only one organisation reporting they had paused working on ECO to focus on SHDF.

CA conclusion: Development of supply chain capacity and capability

Based upon the Contribution Analysis, there is strong evidence that Wave 1 projects have made an essential contribution to the development of the participating supply chain's capability and capacity to undertake this type of retrofit work. There is evidence that the supply chain stakeholders consulted also took part in other schemes. However, they felt that impacts were mostly attributable to Wave 1 as this was larger in scale and in value of contracts.

[43] Schemes cited included Energy Company Obligation (ECO), Home Upgrade Grant, Green Homes Grant, Green Deal Homes Improvement Fund and the Boiler Upgrade Scheme.
[44] DESNZ (2024) 'Social Housing Decarbonisation Fund Wave 1 Evaluation'
[45] It is worth noting that the evaluation did not capture the views of supply chain stakeholders who did not engage with SHDF Wave 1, for whom capacity issues may have been a reason not to participate.

Unintended or negative impacts of Wave 1 on the supply chain

The evaluation identified only two unintended negative impacts of Wave 1 on the supply chain. These were:

- **Retention issues as a result of improved company reputation:** Some supply chain stakeholders reported that involvement in Wave 1 enabled them to win more work on non-SHDF projects owing to the reputation of the scheme across the industry. However, this improved reputation also led to challenges, as trained workers became more attractive to other companies, causing retention issues for supply chain organisations that worked on Wave 1.
- **Concerns that delivery challenges would impact the scheme reputation:** There were concerns from supply chain stakeholders and SHLs that the challenges of Wave 1, including increased costs and project descoping, might tarnish the scheme's reputation and affect the number of SHLs applying to, and supply chain stakeholders working on, Wave 2.1 projects. It is important to note that this concern was ultimately unfounded, as demonstrated in the Wave 2.1 Process Report which shows increased engagement from supply chain stakeholders and SHLs.

5. Energy, bill and carbon savings

This chapter covers the environmental outcomes of Wave 1: energy consumption savings and related carbon savings. It also considers any subsequent effect on energy bill savings. The findings are primarily based on a Difference-in-Differences analysis conducted by DESNZ analysts on a sample of Wave 1 properties, triangulated with evidence from surveys and qualitative fieldwork with residents and SHLs.

Key findings

The evaluation found that on average, Wave 1 homes saved an additional 1,079.9 kWh in annual gas consumption compared to a group of similar homes not involved in Wave 1. Findings on changes in electricity consumption were inconclusive. Evidence from the survey and interviews with residents suggests that some did not reduce their energy use and instead used the same amount of energy or more since they received measures.

Quantitative analysis found **that the reduction in gas consumption in properties involved in Wave 1 equated, on average, to a £97 saving in energy bills per year**. However, only a third (33%) of surveyed residents said that they have seen a reduction in their energy bills since energy saving measures were installed in their home. This may be because of energy price inflation and variation in energy use amongst residents.

Based on the estimated reduction in gas consumption, **Wave 1 was estimated to have generated carbon emission savings of 0.20 tonnes per property per year**.

Wave 1 is also expected to contribute to future carbon savings, as many homes have had fabric improvements meaning they are now more suitable for clean heat measures. Many SHLs reported they have future plans to install clean heat measures.

Data sources used for analysis of energy, bill and carbon savings

The findings from this chapter are primarily based on a Difference-in-Differences analysis conducted by DESNZ analysts. This was used to estimate the energy, energy bill and carbon savings in a sample of Wave 1 properties compared to a counterfactual group of properties that did not receive measures as part of Wave 1. Data was sourced from the National Energy Efficiency Data-Framework (NEED) which contains data on annual electricity and gas consumption at a household level (for properties on the gas grid), as well as property characteristics and demographics, and details of energy efficiency measures installed as reported in Wave 1 monitoring data.

Separate analyses on changes in gas and electricity consumption were carried out. The analysis on changes in electricity consumption gave inconclusive results, as electricity consumption patterns differed significantly between the intervention group (i.e. made of Wave 1 properties) and the control group in the years before Wave 1 installations occurred. Given the majority of measures installed as part of Wave 1 were insulation measures, these are expected to have had greater impact on gas rather than electricity consumption.

A total of 7,449 properties were included in the intervention group for the analysis on changes in gas consumption (46% of all Wave 1 properties). The intervention group was compared to a matched control group, which included social housing properties in England that had not received any measures from government schemes. Properties in the intervention group were matched with properties in the control group based on characteristics which were expected to influence energy consumption, including type and age of a property, region, floor area, and tenure type. In total, there were 37,245 properties in the control group.

Properties were excluded from the intervention group for different reasons:

- 939 properties did not have an associated UPRN, and therefore no associated gas consumption data was available for these properties.
- 3,463 properties were off the gas grid and therefore excluded from the analysis, as they had no metered gas consumption data.
- 49 properties had no gas consumption data for the entire period of the analysis (2015 to 2024), and 452 properties had missing data for one or more years between 2015 and 2024.
- 3,609 properties received measures outside Wave 1 and were therefore excluded from the analysis. These were mostly properties that had new boilers installed. Including these properties in the analysis would have likely overestimated the effect of Wave 1 installations on gas consumption.
- 95 properties were missing for unknown reasons.

More information on the Difference-in-Differences analysis can be found in the Technical Annex, while a summary of limitations can be found in the Methodology chapter.

Change in energy consumption

Change in gas consumption

The majority of measures installed in Wave 1 were designed to improve the fabric of properties (different types of insulation, ventilation, double glazing and draughtproofing) and were expected therefore to lead to a lower energy requirement for property heating. This could lead to a reduction in electricity or gas consumption depending upon the type of heating system used. The exceptions to this were the installation of Solar PV (not expected to affect gas consumption) and clean heat measures. Where clean heat measures (i.e. heat pumps or electric storage heaters) replaced gas heating, they would be expected to reduce gas consumption. Properties which switched from gas to electric heating as a result of Wave 1 were not included in the Difference-in-Differences analysis because of the nature of the data, however these are expected to be a small number given clean heat measures only represented 4% of all measures installed.[46]

The Difference-in-Differences analysis first looked at the impact of Wave 1 on gas consumption in households that took part in the scheme compared to a matched control group. The analysis found that, as of May 2024, households that received energy efficiency measures as part of Wave 1 saved, on average, an additional 1,079.9 kWh[47] in annual gas consumption compared to the matched control group.

These findings are supported to an extent by evidence from the resident survey conducted as part of this evaluation. One in three (33%) surveyed residents (who reported having gas central heating with no change in heating system following Wave 1) felt that they now use their heating less often since measures were installed, as set out in the 'Changes in heating methods section' in Chapter 6. The majority of residents (76%) reporting this explained that this was the result of their home feeling warmer because of the energy saving measures. Some interviewed residents also reported that since they have received measures they do not have to have their heating on for as long to maintain a comfortable temperature.

The Difference-in-Differences analysis presents an average effect. Underlying this, there may be variation in change in energy use with some residents saving energy but others increasing energy use. The survey also showed that over a third of residents (35%) use their heating as much as they would like. Some interviewed residents said they were no longer worried about their energy usage as their bills had become cheaper (further data related to these findings can be viewed in Figure 6). It is possible that some residents may be using the same amount of energy, or more, to increase the warmth of their home compared to previous periods when the cost of this may have limited their use. For other surveyed residents, their perception of energy use may have been inaccurate as it may have been too soon to see a difference in energy use since the installation, or there may have been other reasons why their energy use has not decreased, for example if they are spending more time at home.

[46] Properties were included if the gas meter had not been disconnected at the properties following the switch. The number of these is unknown.
[47] 95% confidence intervals: -1,325.2, -834.6. The "-" sign indicates savings in gas consumption.

The resident survey indicates that those living in houses (20%) were slightly more likely, and those in bungalows (8%) slightly less likely, than those across the whole sample (17%), to use gas central heating more often after the installation of measures.

Change in electricity consumption

As explained earlier, the analysis on changes in electricity consumption in Wave 1 properties compared to a control group gave inconclusive results, as electricity consumption patterns differed significantly between the intervention and control group in the years before Wave 1 installations occurred. However, given the majority of measures installed as part of Wave 1 were insulation measures, these are expected to have had greater impact on gas rather than electricity consumption.

Following Wave 1 installations, it might be expected that electricity consumption would decrease in properties where:

- Less efficient storage heaters were replaced with more efficient electric heating (storage heaters or heat pumps)
- Installation of fabric measures (insulation, draughtproofing and double glazing) led to reduced energy demand on electric heating systems for equivalent warmth
- Solar PV was installed reducing the demand on grid electricity

Installation of heat pumps may be expected to increase electricity use substantially where these replaced gas boilers. Yet, given low carbon heat measures (heat pumps and electric storage heating) only accounted for 4% of all measures installed as part of Wave 1, the effect of excluding these properties is not expected to have been very large on findings overall.

CA conclusion: Energy consumption change

Based upon the Contribution Analysis, there is strong evidence that installations resulted in a reduction of gas consumption in a sample of Wave 1 households. However, evidence from the resident survey shows some did not reduce their energy use, potentially limiting the impact of the scheme on energy savings. Findings on changes in electricity consumption were inconclusive.

Change in energy bills

Gas consumption savings identified in the Difference-in-Differences analysis were multiplied by energy retail cost (in £ per kWh of energy) to estimate annual energy bill savings from households that received measures as part of Wave 1. Using gas retail cost from 2025, the analysis found that, on average, properties that received measures as part of Wave 1 saved £97 on gas bills annually. While this is true for the year 2025, energy bill savings may vary over time due to changes in gas retail cost and is likely they would have been slightly higher in 2023.

However, residents themselves may not have seen a direct reduction in their energy bills if these have been rising for other reasons such as energy price inflation during the same period. Office for National Statistics data shows a large increase in gas and electricity retail prices both in 2022 and 2023.[48] Therefore, it is not surprising that only a third (33%) of surveyed residents said that they have seen a reduction in their energy bills since energy saving measures were installed in their home, as shown in the 'Changes in energy use and bills' section in Chapter 6. This is less than the proportion (44%) who said they used less gas or electricity to heat their home since measures were installed, suggesting that the wider influence of rising bills may have negated some of the benefits of the scheme. In turn, this suggests that if energy costs were to reduce, the benefits of the scheme may increase.

Additionally, as discussed earlier, reduction in energy consumption may not have applied to all residents and hence to energy bill savings. Some residents may have chosen to increase energy use following the installation of measures, for example if they found it cheaper to heat their home.

The survey revealed that residents living in a flat, apartment, or bedsit were more likely to report a reduction in their energy bills (49%), compared with residents living in other property types (houses, maisonettes and bungalows).

CA conclusion: Fuel bill change

Based upon the Contribution Analysis, there is strong evidence that the Wave 1 retrofits directly led to reductions in fuel bills through lower gas consumption. However, there is also moderate strength evidence that this effect was limited by wider energy price inflation, and in some cases by the choice of residents not to reduce energy consumption.

[48] Office for National Statistics (ONS), 'RPI:Percentage change over 12 months – Electricity' and 'RPI: Percentage change over 1 month – Gas'

Reduction in carbon emissions

Gas consumption savings identified in the Difference-in-Differences analysis were multiplied by carbon intensity (kilograms of CO_2 emissions produced per kWh of gas consumed) to estimate annual carbon savings from households that received measures as part of Wave 1. The analysis found that, on average, properties that received measures as part of Wave 1 saved 0.20 tonnes of carbon annually.

If this applied to all properties treated (16,056), the total saving would be 2,408 tonnes of carbon per year.

The clean heat measures which were installed will have resulted in a reduction in carbon emissions where they have replaced more carbon intensive heating systems including gas boilers. Furthermore, 3,140 Solar PV measures were installed under Wave 1. As of 2021, around 45% of grid electricity was generated from fossil fuels.[49] Therefore, it is likely the addition of Solar PV will result in further carbon reductions where residents were previously relying on grid electricity.

DESNZ internal modelling of carbon savings suggested that by the end of the scheme these would have been lower than originally anticipated based on the measures planned within Wave 1 applications. This may be explained by the following:

- There was a reduction in the number of properties which received measures under Wave 1. SHDF statistics from April 2025 show that a total of 16,056 properties received installations, which is 4,173 (21%) fewer than indicated in project baseline data compiled after bid award. This included four projects dropping out completely[50]
- There was a substantial decrease in the number of clean heat measures installed (1,344 in April 2025 SHDF statistics) compared to those planned according to project baseline data compiled after bid award (1,936)

These changes to project scope arose within a challenging project delivery context as detailed further in the Wave 1 Process Evaluation Report.

CA conclusion: Carbon emissions reductions

Based upon the Contribution Analysis, there is strong evidence that Wave 1 installations resulted in a reduction of carbon emissions for participating households, through reduced gas consumption and in some cases, through installation of a new lower carbon heating system or a renewable energy system (i.e. Solar PV). No other factors were identified contributing to this reduction in carbon emissions.

[49] Source: BEIS (2022) 'UK Energy in Brief 2022'
[50] More detail on this is available in, DESNZ (2024) 'Social Housing Decarbonisation Fund Wave 1 Evaluation'

Preparation of social homes for future clean heat installations

Many homes received new insulation measures as part of Wave 1. This is likely to make them more suitable for the installation of clean heat measures in the future, suggesting Wave 1 may contribute to further carbon emissions reductions in the future if these measures are installed. Interviews with SHLs reinforced this assumption, as some SHLs reported having future plans to install clean heat measures. This included ASHPs, high retention storage heaters, and wood pellet biofuel heating.

> *"We're not going to be in a position to start providing all these properties with clean heat until they are sufficiently insulated, and after Wave 1 there are 280 properties that are ready now."* Successful SHL

Other SHLs, who did not have plans for future clean heat installations, stated that this remained a challenge. One mentioned that this was due to specific challenges installing ASHPs and liaising with District Network Operators (DNOs). They found communicating with the DNO difficult as they did not have a single point of contact, which resulted in mixed messages. Another SHL said this was due to a lack of clear messaging from the government, impacting marketing of heat pumps to residents.

Wave 1 could also generate further carbon emissions savings through motivating residents to engage in further energy efficiency measure installations. The resident survey found that a small proportion (2%) of residents had already had further energy savings measures installed in their homes and almost half (43%) reported that they were likely to consider this in the future. Interviews and focus groups with residents reinforced these findings, as some reported that they wanted to install further energy savings measures, including new windows, Solar PV, and heat pumps.[51] More detail on resident interest in future energy savings measures can be found in Chapter 6.

> *"I don't like storage heaters, they're so complicated to use and if you've got bad eyesight and not technically savvy, it's almost impossible to use, so heat pumps would be great."* Resident

Preparation for clean heat: evidence from scheme monitoring data

Analysis of data submitted by projects on their installations by the end of the scheme indicates that the installation of fabric measures was much more widespread than Clean Heat measures.[52] As shown in Table 4, fabric measures were installed in 14,379 Wave 1 properties (i.e. more than 90% of all properties), while clean heat measures were installed in 792 properties (i.e. just under 5% of all properties). For similar reasons, the high proportion of properties that only received fabric measures (12,086, or 76%) could provide a base to substantially increase the use of Clean Heat measures in the future. It is not possible from the data to assess in detail how ready individual properties are for Clean Heat measures.

[51] No evidence was collected regarding the willingness of residents to self-fund future energy efficiency installations.
[52] Clean Heat, for the purposes of this study, is defined excluding Solar PV or storage heaters.

There is also strong evidence that Wave 1 projects took a 'fabric first approach', as properties that only received clean heat measures were a minority (84 properties, or just over 0.5% of all Wave 1 properties). A total of 708 properties had both fabric measures[53] and clean heat measures installed (89% of properties that received clean heat measures). Most properties receiving Solar PV also had fabric measures installed as part of Wave 1 (70%).

Table 4: Number and percentage of properties with fabric and clean heat measures installed

	Properties that received Clean Heat measures	Properties that received Solar PV but not Clean Heat measures	Properties that did not receive Clean Heat measures or Solar PV	Total
Properties that received fabric measures	708 (89%)	2,143 (70%)	11,528	14,379
Properties that did not received fabric measures	84 (11%)	897 (30%)	558*	1,539
Total	**792**	**3,040**	**12,086**	**15,918**

Source: Project monitoring data submitted by SHLs.

* This would include properties receiving only measures which could not be classified as 'Fabric' or 'Clean Heat' or properties where the nature of measures installed was unclear or missing in the data.

CA conclusion: Facilitation of future carbon emissions reductions

Based upon the Contribution Analysis, there is strong evidence that the installation of Wave 1 measures is likely to contribute to facilitating future carbon emissions reductions in properties that took part in the scheme. This is because the fabric of the social homes treated through Wave 1 has improved making them more suitable for future clean heat installations.

[53] Fabric measures included insulation and windows and doors.

6. Resident outcomes and impacts

This chapter examines evidence from the resident post-installation survey (n=537) and five resident focus groups to explore outcomes and impacts of installations. It focuses on the comfort of residents' homes, their physical and mental health, any changes in behaviour in relation to energy use, confidence in using and maintaining measures and their attitudes to energy efficiency.[54]

Key findings

The **majority of surveyed residents reported being satisfied with the installation process** (67%) **and the quality of the measures installed** (65%). Reasons for satisfaction with the quality of measures included improved comfort of their home and the ability to maintain a warm temperature.

Around **one in five** (19%) **surveyed residents changed the way they heat their homes since the energy saving measures were installed**, and there was a net reduction in the frequency of use across all types of heating.

Evidence also suggests the energy saving measures made heating homes more efficient. Just over two in five (44%) residents agreed they now use less gas or electricity to heat their home, while 48% reported that when they switch their heating off during winter the temperature inside their home now drops slowly. **However, residents still reported that they were not able to use their heating as they would ideally like to**: 37% use their heating less often than they would like, while 20% use it more often than they would like.

Some residents suggested their bills had reduced following the installation of measures. Just over half of residents (54%) reported it was more affordable to maintain a comfortable temperature in their home than it would be without the energy saving measures.

Of the 293 (84%) households that were classified as fuel poor prior to the scheme installations[55] (and had a post-installation EPC rating), **97% of them were taken out of fuel poverty as a result of the scheme installations**. This represents 82% of all Wave 1 households, equating to approximately 13,100 households.

The majority of residents reported no change in their physical or mental health (66% and 64% respectively) following the installation of measures.

[54] Evaluation questions addressed in this chapter: 1.10, 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, 8.10.
[55] In the Wave 1 Process Evaluation Report, 82% of households were estimated to be in fuel poverty before receiving measures. This proportion increases to 84% for residents that responded to the post-installation survey and had a post-installation EPC rating.

Just over two in five residents (45%) **reported they were likely to consider having other energy saving measures installed in the future** or that they had already received these. However, this does not necessarily mean they would be willing to fund measures themselves. The most common reason given for this interest was to save money on their energy bills.

It was relatively uncommon for residents to report having received support or guidance related to the energy saving measures. Only 31% of residents said they had received support or guidance.

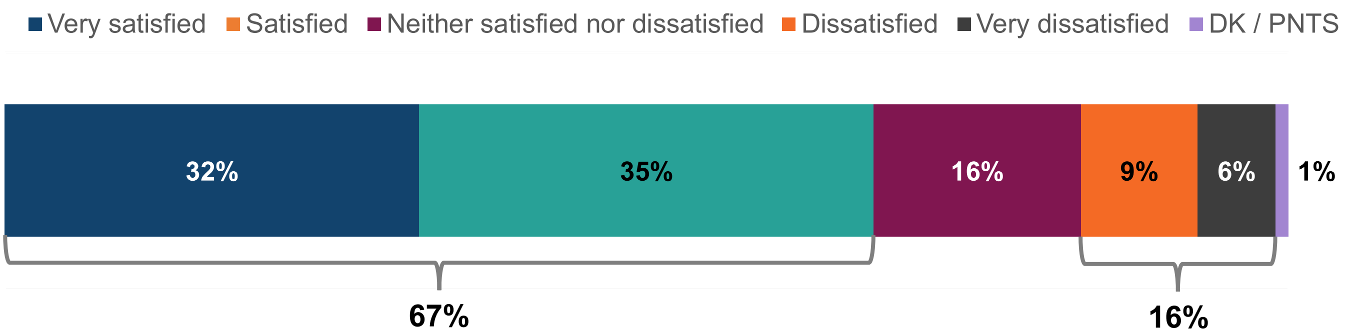
Resident satisfaction

Installation process

Detailed feedback on residents' experiences of the installation process is available in the Wave 1 Process Evaluation Report, which summarises evidence from the during-installation resident survey.[56] In the post-installation survey, residents were asked to reflect again on their satisfaction with the installation process. Findings were in line with the during-installation survey, with two-thirds of residents (67%) reporting they were satisfied with the installation process. As shown in Figure 2, only 16% reported they were dissatisfied with the installation process.

Residents who were over 75 years old (87%) or residents that received new windows and/or doors (73%) were more likely to be satisfied with the installation process than other residents.

Figure 2: Resident satisfaction with the installation process



Source: Resident post-installation survey. G4. How satisfied or dissatisfied were you with the installation process of these energy saving measures? Base: All residents (n=537). DK: Don't know. PNTS: Prefer not to say.

[56] DESNZ (2024) 'Social Housing Decarbonisation Fund Wave 1 Evaluation'

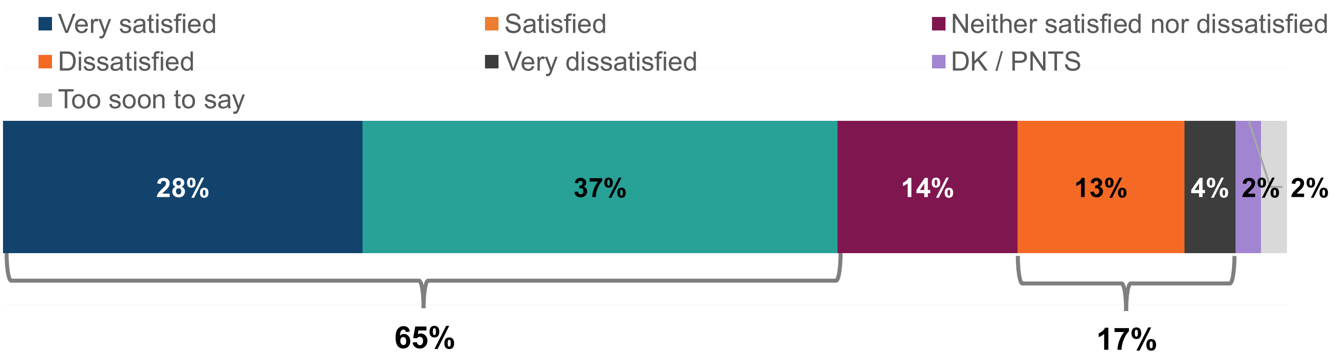
In focus groups, residents commonly attributed their satisfaction to the completion of the installation within a reasonable time frame and clear communication from the installers about when to expect them to carry out works. Nevertheless, some residents shared negative experiences related to communication and timing of works that left them dissatisfied. For example, in some cases installers did not provide enough, or in some cases any, notice of when they would turn up at the residents' homes, carried out work late into the evening or installations took a long time to complete. Another reason for dissatisfaction related to the conduct of installers. For instance, one resident suggested the installers left a hole in their plaster, while another felt they did not respect their home.

Quality of measures

In line with findings from the during-installation resident survey, the majority of residents were satisfied with the quality of the measures installed. As shown in Figure 3, over three in five (65%) residents reported being satisfied with the quality of measures. Under one in five (17%) reported they were dissatisfied with the quality of the measures. Overall, three in five (61%) of residents were satisfied with both installation and quality of the measures.

Residents who received measures related to controls for a heating system (74%), or windows and/or doors (72%), were more likely to be satisfied with the quality of the measures. Nevertheless, in focus groups, some residents who had new windows fitted reported dissatisfaction with the quality of the measures (because of the way such measures were installed). For example, residents mentioned that windows did not fit properly and let a draught in, or poor quality materials had been used in the window frames.

Figure 3: Resident satisfaction with the quality of energy saving measures installed



Source: Resident post-installation survey. G5. How satisfied, or dissatisfied were you with the quality of the energy saving measures installed? Base: All residents (n=537). DK: Don't know. PNTS: Prefer not to say.

During focus groups, residents typically attributed their satisfaction to their improved ability to maintain a warm temperature in their home, with some suggesting that this outcome meant their expectations for the measures had been met.

> *"I am satisfied. It made a difference in keeping the house a certain temperature and getting it up to that temperature."* Resident

Residents were generally satisfied with the quality of Solar PV installed. However, in focus groups some residents were dissatisfied with this measure because they did not receive batteries to store the energy generated. This meant that they did not feel they could take advantage of the financial benefits of the measure.

Energy use and bills

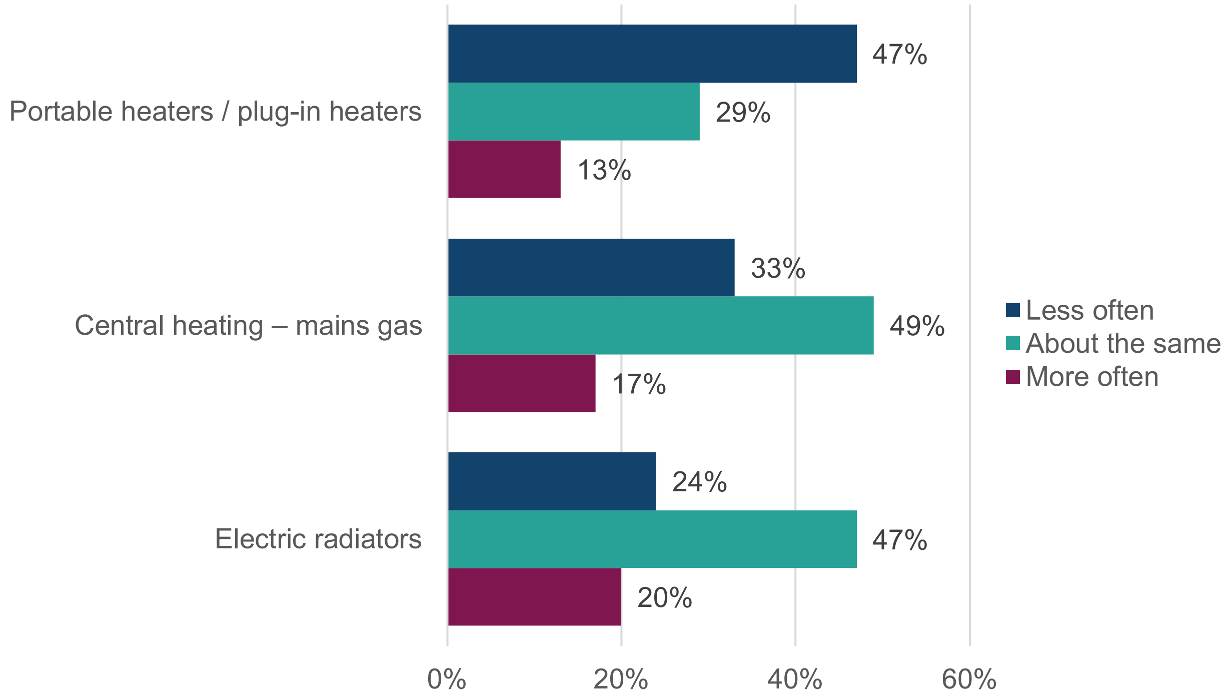
Changes in heating methods

Before energy saving measures were installed, most residents (78%) reported using central heating to heat their homes (66% used mains gas, 8% electric and 5% another type of central heating). Other heating methods used by residents included portable plug-in heaters (26%), electric radiators (14%), storage heaters (5%), an open fire (3%), and an electric fire (3%).

In both the during-installation and post-installation resident surveys, residents were asked whether the way they heated their home had changed since the measures were installed.[57] While the majority reported continuing to use the same forms of heating in both surveys, one in five (19%) residents indicated that they now use different forms of heating in their home.

Among residents who used any of the same heating types before and after the measures were installed, there was a net reduction in frequency of use across all types of heating. After the energy saving measures were installed, more residents reported their usage had decreased than increased. As shown in Figure 4, there was a sharp decrease in use of portable/plug-in heaters, with almost half of residents reporting using these less than before measures were installed (47%). One third of residents reported using mains gas central heating less often (33%), and a quarter used electric radiators less often (24%), since receiving measures.

Figure 4: Change in use of different heating types following the installation of energy saving measures



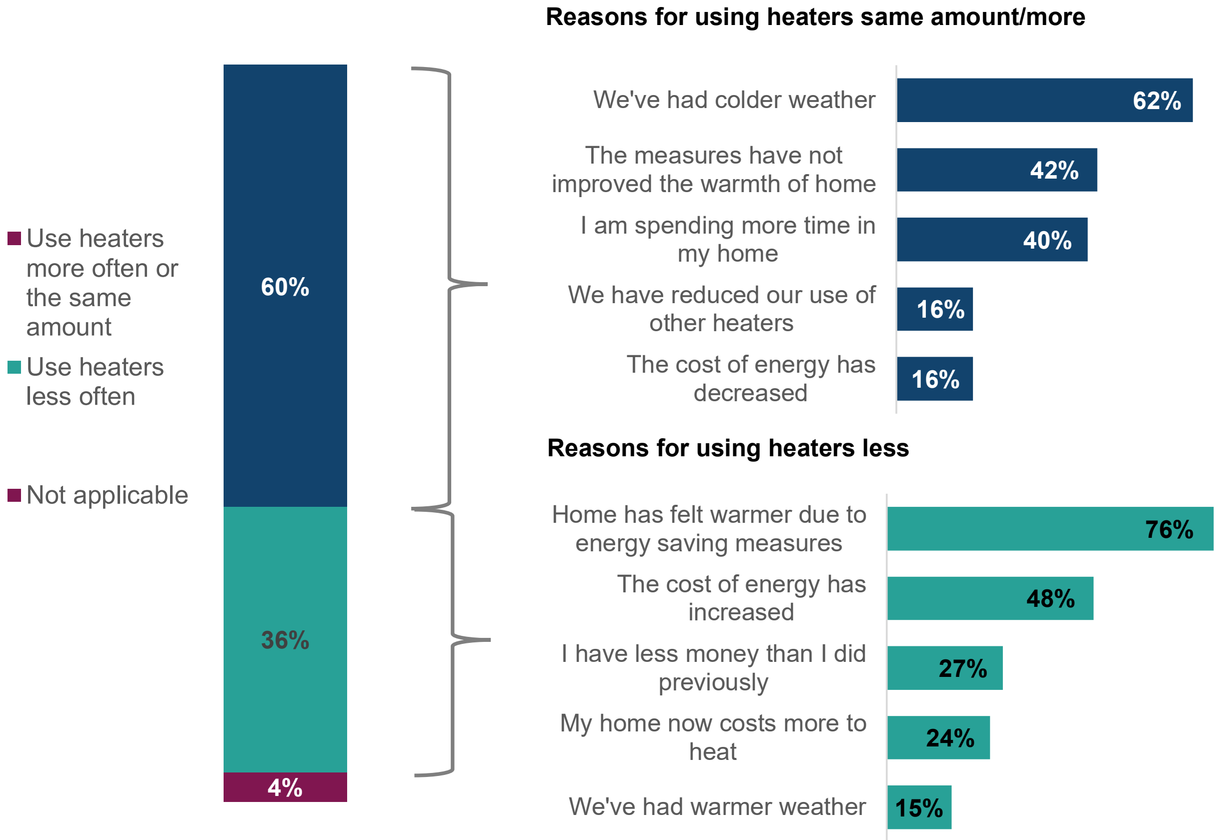
Source: Resident post-installation survey. D6. Thinking about the following types of heaters, do you use them more or less often since the energy saving measures were installed. Base: All residents who reported using any of the same heating type before and after installations. Portable heaters (n=105), Central heating – mains gas (396), Electric radiators (n=60). Note, base sizes lower than 50 not shown, including Central heating – electric, mains 'other', wood burning stove, and heat pump.

[57] In the during-installation resident survey this was only asked to those with works completed or ongoing.

Most residents reported that their heating use had not changed following the installation of measures. Among residents who reported either increasing their use of heating or maintaining the same level of use, most explained that this was unrelated to the measures installed. As shown in Figure 5, the majority (62%) attributed their consistent or increased heating use to colder weather, while 40% said they were spending more time at home. However, two in five of these residents (42%) said they had not reduced their heating use because the energy saving measures had not improved the warmth of their home.[58]

In contrast, among those who reported a decrease in heating use, the majority attributed this directly to the energy saving measures. Three quarters (76%) said this was because their home felt warmer as a result of the measures installed, while 48% reported that this was due to an increase in energy costs.

Figure 5: Change in use of heating systems after the installation of energy saving measures and reasons for the change



Source: Resident post-installation survey. D7. Why have you increased/not reduced your use of these heaters since the energy saving measures were installed? Base: All tenants who use heaters more often or the same amount since installation (329). D8. Why have you decreased your use of these heaters since the energy saving measures were installed? Base: All tenants who use heaters less often since installation (194).

[58] Residents were able to select multiple reasons from the list, which is why the sum of the percentages in Figure 5 exceeds 100%.

Changes in energy use and bills

As well as exploring changes in specific types of heating used, the post-installation survey asked residents more general questions about changes in energy use and their experience of heating their home. Just over two in five (44%) residents agreed with the statement “I use less gas or electricity to heat my home now”, while 30% disagreed. Analysis of changes in energy consumption showed that Wave 1 households saved on average an additional 1,079.9 kWh in annual gas consumption compared to similar homes not involved in Wave 1 (as reported in Chapter 5). When asked whether the temperature inside their home dropped slowly after switching off their heating, 48% of residents said it did, whilst 44% said it dropped quickly. Residents who were satisfied with the process and quality of the installation, and those who had windows or doors installed were more likely to agree they used less gas and electricity and that the temperature drops slowly in their home.[59]

During focus groups, some residents suggested they used less energy than before because their home reached a comfortable temperature more quickly and the temperature remained stable for longer. Although this was not corroborated by related subgroup differences in the resident survey, those in focus groups who had heat pumps installed said their homes had a comfortable temperature at all times with less overall energy use.

> *"Yeah, I had all three installed… the insulation, solar panels and the heat pump, and I've got to say it's been a big impact on me. My house is warmer and my bills are lower… I can only speak positively about it."* Resident

> *“Although I get cold and put the heating on, I don't have to have it on as long as it heats up really quickly. So, I think that's been good. It’s a lot less draughty.”* Resident

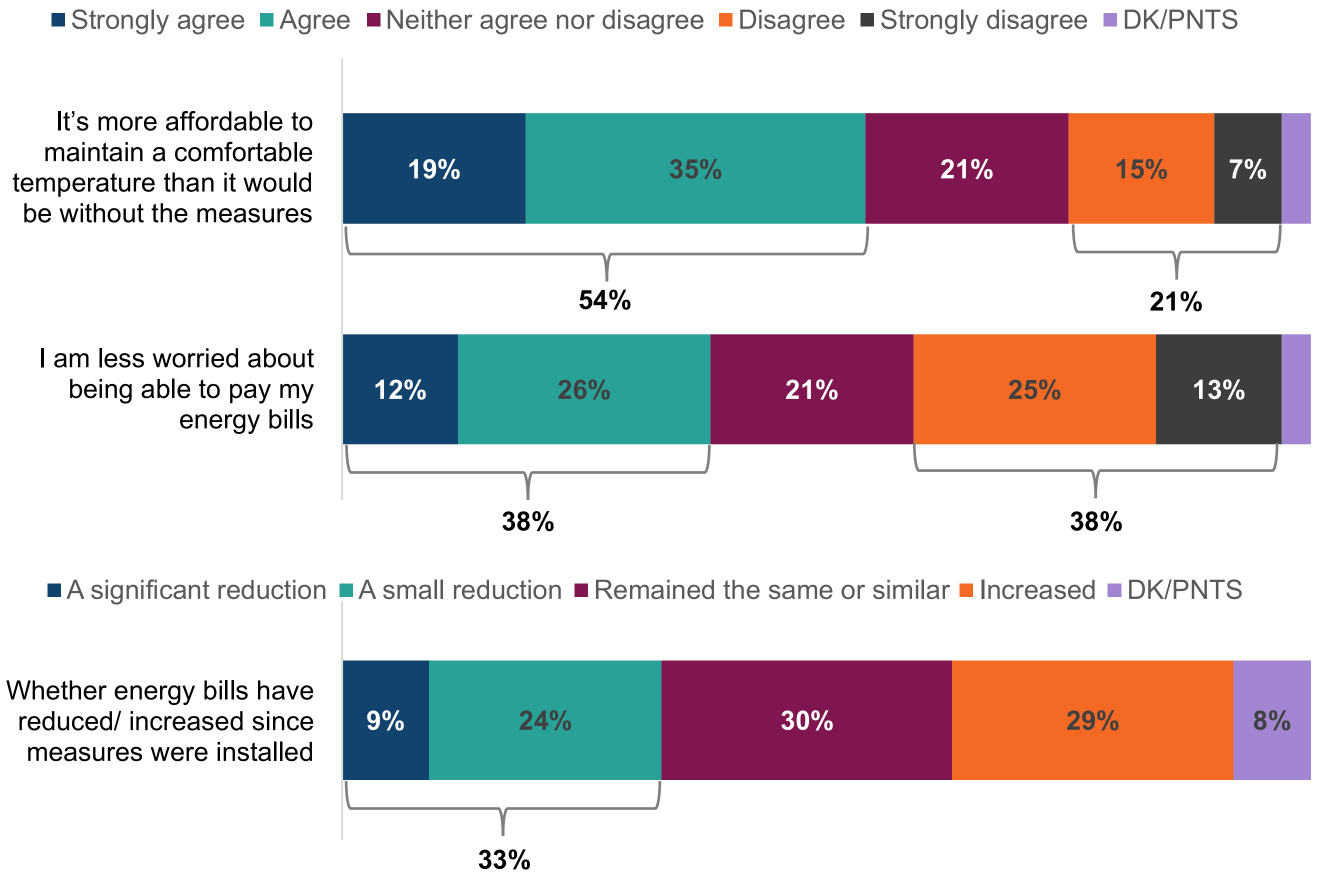
Other residents reported little change to their energy use, while a few suggested this had increased. Two residents suggested the increase was due to poor quality installations (e.g. poor loft insulation).

Some residents also suggested they had seen reductions in their energy bills due to the new energy saving measures. As shown in Figure 6, just over half (54%) of residents agreed with the statement “It's more affordable to maintain a comfortable temperature in my home than it would be without the energy saving measures”, while 21% disagreed. Just over a third (38%) agreed with the statement “I am less worried about being able to pay my energy bills”, while 33% suggested they had seen a reduction in their energy bills since the energy saving measures were installed.

Residents who live in a bungalow (69%) or who reported there had been no change in the way they heat their homes (63%) were more likely to suggest they had not seen a reduction in their bills compared to the average across all residents (59%).

[59] Proportion of residents that agreed with the statement “I use less gas or electricity to heat my home now”: satisfied with the quality of measures installed (62%), satisfied with the process of installation (59%), had windows and/or doors measure installed (52%). Proportion of residents that said temperature drops slowly after heating is turned off in winter: satisfied with the quality of measures installed (66%), satisfied with the process of installation (62%), had windows and/or doors measure installed (57%).

Figure 6: Resident perceptions of changes in energy bills

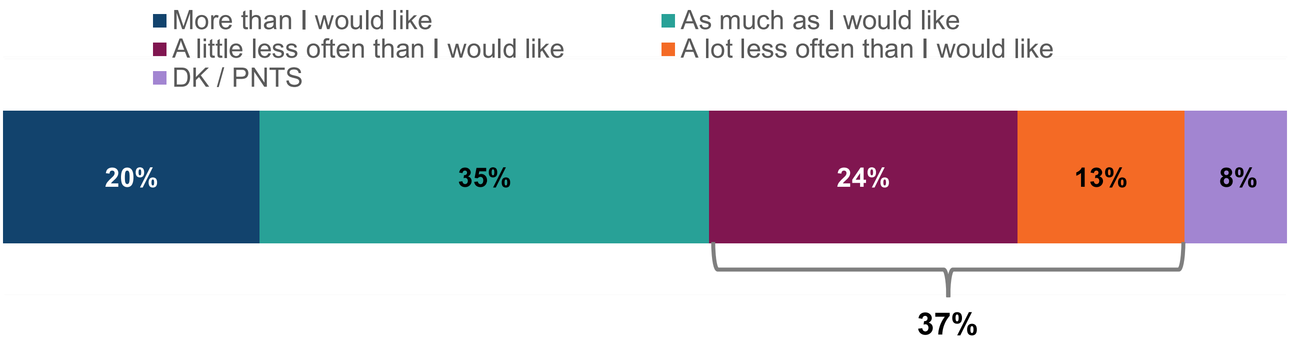


Source: Resident post-installation survey. I1_1/3. To what extent do you agree or disagree with the statement… It's more affordable to maintain a comfortable temperature in my home than it would be without the energy saving measures / I am less worried about being able to pay my energy bills. I4. Have you seen a reduction in your energy bills since the energy saving measures were installed in your home? Base: All residents (n=537). DK: Don't know. PNTS: Prefer not to say.

During focus groups, in the few cases where residents mentioned their bills had increased, they thought this was because of increases in the cost of energy in general. Some residents were not clear on whether the energy saving measures had impacted their bills or not due to changes in lifestyle (for example, having a new child) or general fluctuations in fuel prices.

The majority of residents suggested they were not able to use the heating in the way they would ideally like to. As shown in Figure 7, only a third (35%) of residents reported they use their heating as much as they would like during the winter months. The proportion of residents being able to use heating as much as they liked was higher among those with a heat pump installed (51%) and those satisfied with the quality of measures they received (44%). Meanwhile, 37% suggested they used the heating less often than they would like to and 20% reported that they used the heating more than they would like (rising to 42% among those dissatisfied with the quality of measures installed).

Figure 7: Whether residents can use their heating as much as they like



Source: Resident post-installation survey. I5. Since the energy saving measures were installed, do you use your heating as much as you would like, or less often than you would like, during winter? Base: All residents (n=537). DK: Don't know. PNTS: Prefer not to say.

Comfort and pride in the home

Addressing problems in residents' homes

For most residents, the installation of measures had been completed between one and two years prior to the post-installation survey. Data from both the during- and post-installation resident surveys showed that the majority of residents were experiencing issues in their homes prior to measures being installed.[60] Nearly nine in ten residents (87%) reported having at least one problem in their home prior to installation, with 72% reporting two or more issues. The three most common issues reported by residents were:

- Their home was too expensive to heat to a comfortable temperature (55%)
- They experienced draughts (54%)
- They had condensation or steamed up windows (51%)

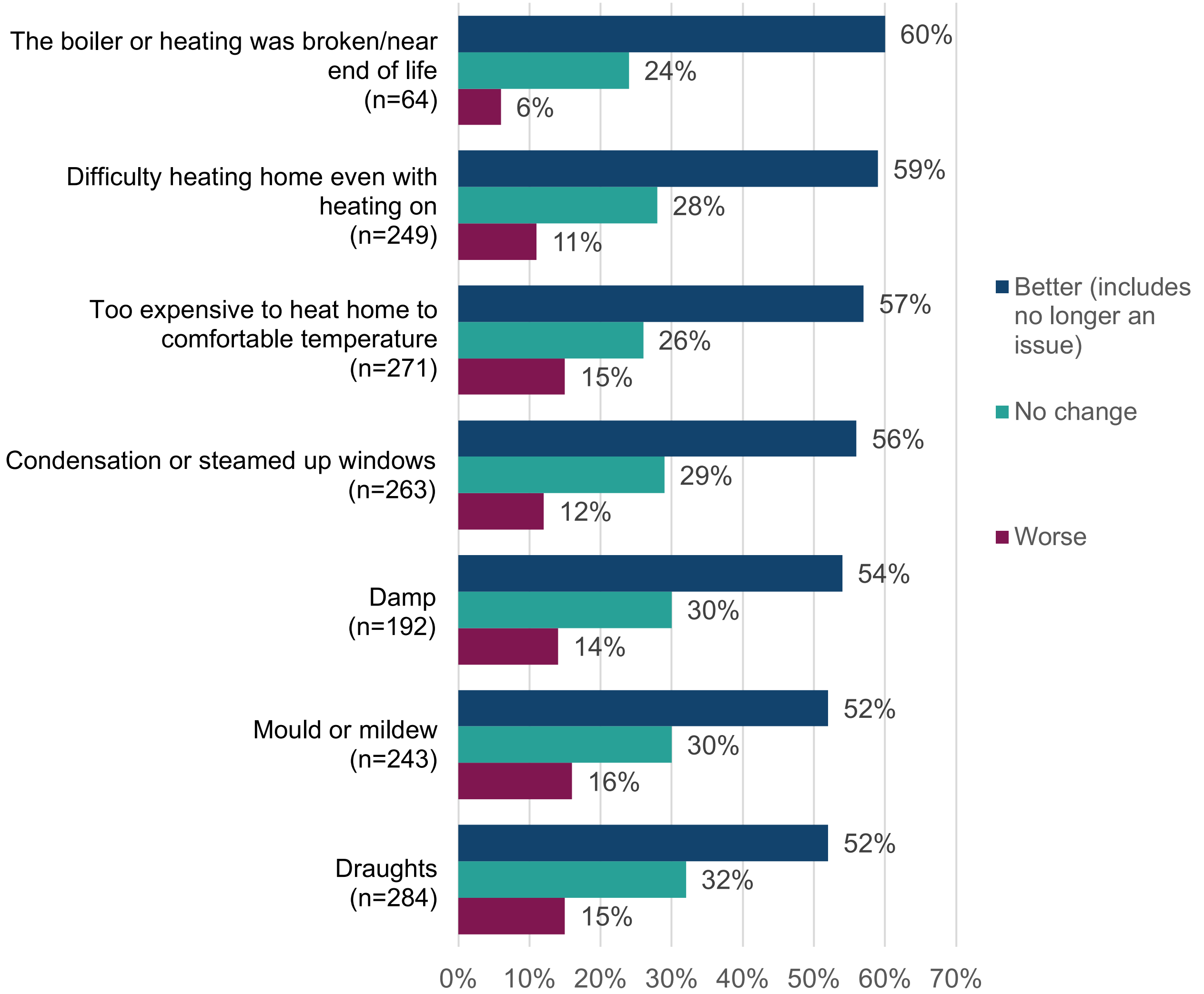
In the post-installation survey, residents were asked whether these issues had improved since they received energy saving measures. As shown in Figure 8, over half of residents said that the problems they were experiencing in their home had improved since energy saving measures were installed. Some residents mentioned that problems had improved to such an extent that they were no longer an issue: this ranged from 22% of residents saying it was no longer too expensive to heat their home to a comfortable temperature, to over half (53%) saying they no longer had an issue with their boiler or heating being broken or near the end of its life.

[60] Data from the during- and post- installation surveys was combined for this question. Most residents reported the issues they had prior to the installation of measures in the during-installation survey as this was closer to the time their measures were installed. The minority whose works had not begun in the during-installation survey were asked about this in the post-installation survey.

There was also evidence of residents experiencing additional, unintended benefits to the comfort of their homes. In their closure report,[61] one project lead referenced that the installation of windows in homes within the vicinity of Heathrow Airport had led to reduced noise pollution for residents.

Between 24% and 35% of residents said that there had been no change in the issues they faced since energy saving measures were installed, while relatively few residents (between 6% and 16%) reported that issues in their home had worsened since measures had been installed. Of those that did, the most common issues to have worsened were problems with mould or mildew (16%), draughts (15%), and the cost of heating their home to a comfortable temperature (15%).

Figure 8: Change in problems experienced by residents since installation of energy saving measures



Source: Resident post-installation survey. E3. Since the energy saving measures have been installed, have the following problems got better, worse, or has there been no change? Base: All residents who had each problem with home before works. Note, base size lower than 50 not shown (Rot in window frames or floors (n=45)).

[61] These are self-completed reports returned by Wave 1 projects upon project completion. 17 of 69 SHLs had not submitted project closure reports at the time of this analysis. The data has not been quality assured by DESNZ or monitoring officers. However, they provide an indication of any unintended consequences during, or as a result of retrofit works.

Certain groups of residents were more likely to report improvements in issues within their homes following the installation of measures. Residents who had new windows and/or doors were more likely than other residents to report improvements across nearly all of the pre-existing issues listed in Figure 8. In addition, residents who had ventilation measures installed were more likely to report improvements in issues with condensation or steamed-up windows (61%) and draughts (56%), consistent with the intended effects of improved ventilation.

Those living in bungalows were more likely than other residents to report that specific issues had improved, including the difficulty to heat their home to a comfortable temperature even with the heating on (69%), the presence of mould or mildew (63%), and problems with draughts (67%). In contrast, those living in a house were more likely to report that it had become more difficult to heat their home to a comfortable temperature (15%).

In addition, residents who reported a change in how they heat their home (i.e. they have been using different forms of heating since receiving measures) were more likely to report that issues had improved, including the difficulty to heat their home to a comfortable temperature (70%), damp (75%), mould or mildew (69%), and draughts (71%).

Among residents who reported improvements to the problems they had previously experienced, the majority (78%) had not had any additional works done to their home to address these issues, suggesting that the improvements were largely attributable to the measures received as part of Wave 1.

During focus groups, a key improvement residents emphasised from having the measures installed was the warmth of their home. These residents commonly reported that their homes now retain heat better and warm up more quickly, leading to improved comfort. Some residents also highlighted a greater sense of control over the temperature of their homes. For example, one resident who had previously struggled to adjust the temperature using a storage heater noted that, following the installation of (multiple) measures, they now have significantly more flexibility and control over their home's temperature.

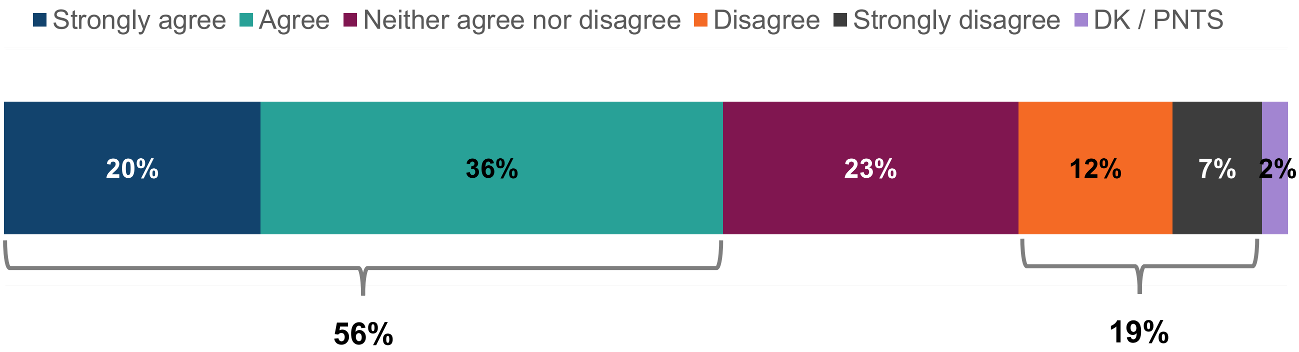
> *"Generally, once the place is up to temperature, it will stay reasonably warm for quite a while, which is good. So, we're not having to have the heating on 24 hours or anything like that."* Resident

Not all residents in the focus groups felt that the measures had led to improvements in the warmth or comfort of their homes. Some residents reported that the measures installed had made little to no difference to their ability to maintain a comfortable temperature. Residents said this was because of poor assessments of the property’s specific needs or issues with the quality of the installation work. For example, a couple of residents who had loft insulation or new windows installed, felt their homes were left susceptible to draughts due to the installations not being done to a high standard. Another resident explained that while insulation installed in their home had improved issues with moisture in most of the house, mould had returned to the room that had not been insulated properly.

Pride in home

As shown in Figure 9, over half of residents in the post installation survey (56%) agreed that they were prouder of their home since the installation of energy saving measures. One in five (23%) neither agreed nor disagreed, while 19% disagreed.

Figure 9: Residents' pride in their home following the installation of energy saving measures



Source: Resident post-installation survey. I1_4. To what extent do you agree or disagree with the following statement? The work has made me feel more proud of my home. Base: All residents (537). DK: Don't know. PNTS: Prefer not to say.

Those that were satisfied with the quality of measures, and satisfied with the installation process overall, were more likely to agree that they felt prouder of their home (75% and 73% respectively). Similarly, those who had windows and/or doors installed were more likely to agree that pride in their home had increased (66%).

Residents in focus groups and project leads in project closure reports specifically highlighted aesthetic updates to the homes as promoting resident pride in their homes, for example new renders applied to the outside of homes.

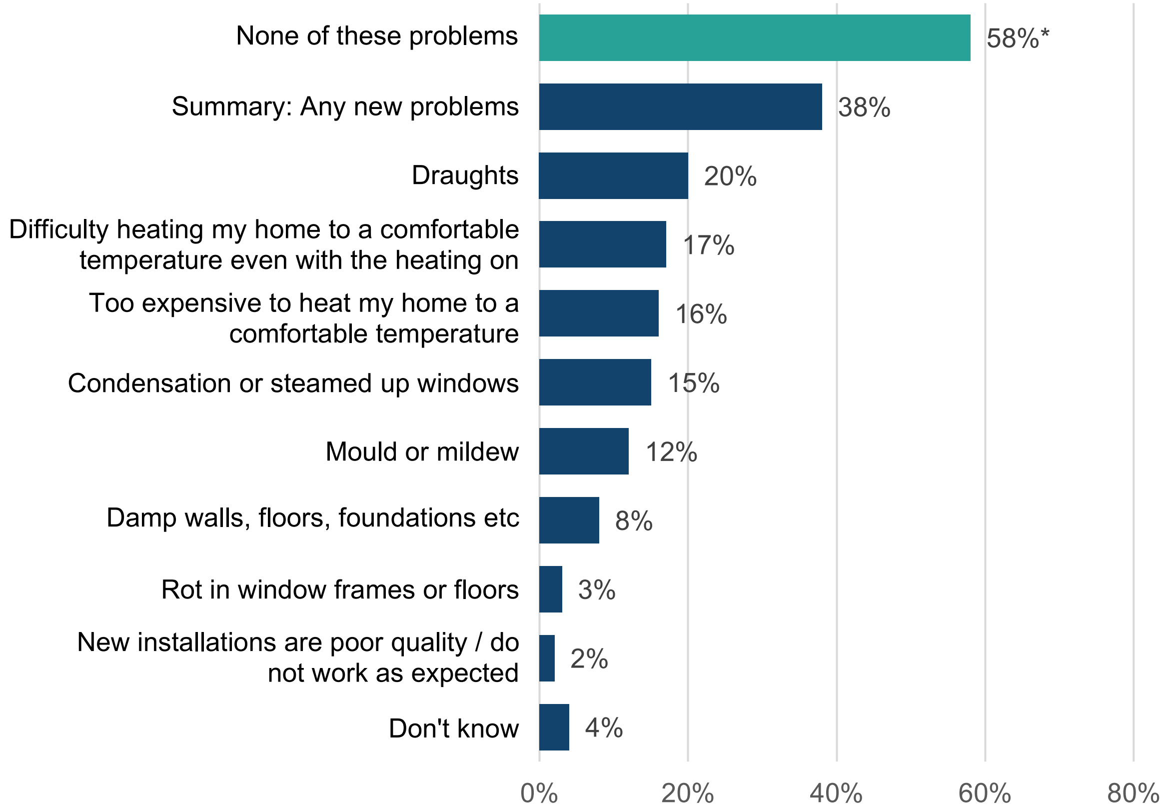
Among residents that felt the measures had not enhanced pride in their home, in focus groups some evidenced dissatisfaction with the quality of workmanship, with reports of untidy finishes or poorly fitted installations that left parts of their homes looking incomplete.

> *"They fitted the windows, but when they took out the old ones, they put some foam around the side and then put plastic around. But it's all cracked and coming off and you can feel a breeze coming through."* Resident

New problems with residents' homes

Residents were also asked whether they had experienced any new problems with their homes related to the measures installed. Half reported no new issues resulting from measures, and a further 7% mentioned problems that appeared unrelated to the installations (either identifying them as pre-existing in follow-up questions or attributing them to other factors, such as the age of the property). However, as shown in Figure 10, some residents reported new issues post-installation which they said to be related to measures installed. For example, around one in five noted new draughts in their homes (20%) or found it difficult to heat their home to a comfortable temperature even with the heating on (17%).

Figure 10: New problems experienced by residents in their homes following the installation of energy saving measures



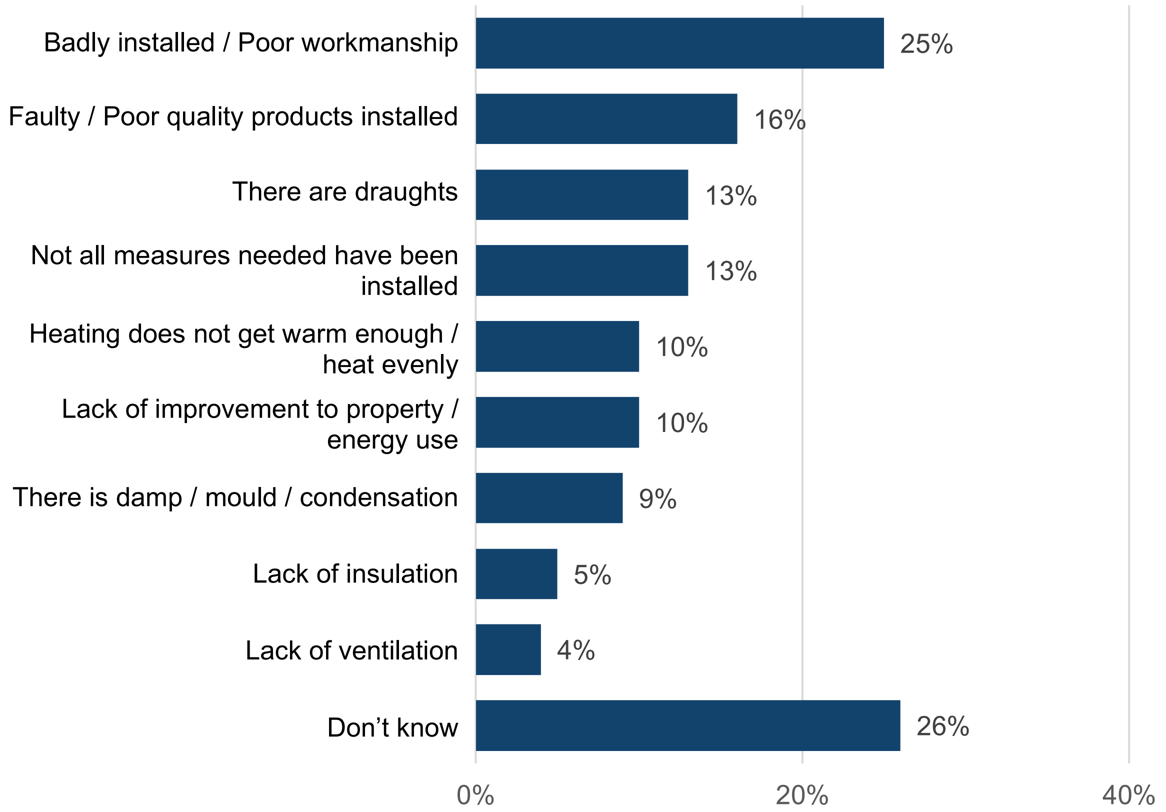
Source: Wave 1 Post Installation Survey. E5. Since the energy saving measures have been installed, have you experienced any problems in your home related to these measures? Base: All residents. Note, codes below 1% not shown.

*Includes responses from residents who listed new problems that were unrelated to the measures installed (7%).

Although residents were specifically asked to only report new problems related to the energy saving measures installed, their responses to this and follow-up questions suggested this was not always the case. As shown in Figure 11, a quarter of residents said they didn't know why measures caused these new issues (26%). Some residents also said that not all the measures they needed in their homes had been installed (13%) or cited a lack of overall improvement to the property (10%). While both are valid concerns, they don't directly explain how the measures installed led to new problems in their home.

However, other residents explained that the new issues happened as a result of poor workmanship during the installation process (25%), faulty or poor quality measures (16%), and draughts caused by measures (13%). Those that had new windows and/or doors installed were more likely than others to report that poor workmanship (34%) led to new issues.

Figure 11: Reasons why energy saving measures have led to new problem(s) in residents' homes



Source: Wave 1 Post Installation Survey. E6. Why do you think that the energy saving measures installed in your home have led to this/these problem(s)? Base: All tenants who have experienced new problems related to the measures installed (196).

While most residents in the focus groups did not mention new issues in their home as a direct result of measures installed, a few reported new issues with damp, which they sometimes said were caused by poor workmanship. For example, one respondent explained that the poor installation of cavity wall insulation in their home had led to one patch of wall being more susceptible to mould than the rest of the wall, where it had been installed correctly. In their closure reports, a few projects also referenced unexpected issues with mould, damp and condensation in homes following installation.

Change in proportion of households classified as fuel poor

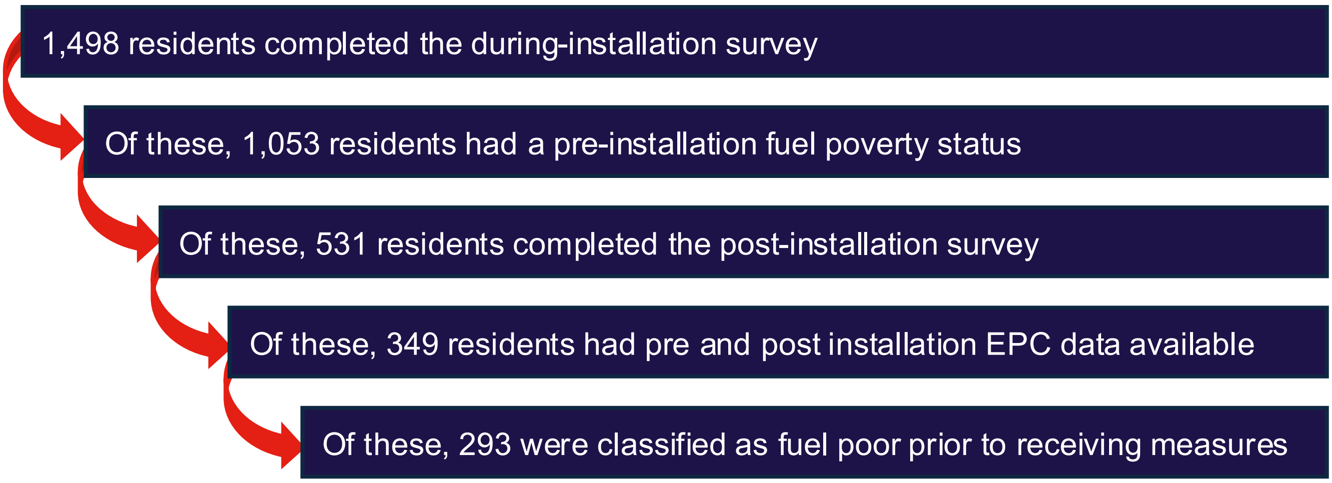
Summary of methodology

Analysis of the proportion of fuel poor households taken out of fuel poverty[62] as a direct result of participating in Wave 1 was carried out as part of the evaluation.[63] The analysis used the AHC income collected through the resident survey and home EPC ratings before installations (from scheme data) to estimate the fuel poverty status of participating households. In order to quantify the direct impact of Wave 1 on the fuel poverty status of participating households, the analysis assessed the change in the energy efficiency of homes (i.e. EPC ratings) following Wave 1 installations, while the AHC income and demographic makeup of the households were kept constant (i.e. assumed not to have changed post-installation).

The methodology was based on the 'Low Income, Low Energy Efficiency' (LILEE) definition of fuel poverty. Households were classed as 'low income' based on their reported AHC income and as 'low energy efficiency' if they had EPC band rating of D or below. Homes that went from EPC band D or below to EPC band C or above following installations were classed as having moved from low to high energy efficiency (under the LILEE fuel poverty definition) and therefore out of fuel poverty. A more detailed summary of the methodology is provided in the Methodology chapter, with full detail provided in the Technical Annex accompanying this report.

The following analysis focused on the households who were identified as being fuel poor prior to scheme installations (293, as shown in Figure 12).

Figure 12: Summary of samples used within Fuel Poverty analysis



[62] Fuel poverty or being fuel poor is where a household is living in a property with a fuel poverty energy efficiency rating of band D or below in a home that cannot be kept warm at reasonable cost without bringing their residual income below the poverty threshold. Fuel poverty in England is measured using the Low Income Low Energy Efficiency method (LILEE).
[63] One of the policy objectives of SHDF is to tackle fuel poverty, however the Wave 1 scheme did not set any eligibility requirements for or targets regarding fuel poverty.

Fuel Poverty Analysis

Of the 293 (84%) of households that were classified as fuel poor prior to receiving measures (and had a post-installation EPC rating), 97% were taken out of fuel poverty as a result of Wave 1.[64] These were low income households who lived in homes that improved from EPC band D or below to EPC band C or above as a result of scheme installations, and therefore moved out of fuel poverty under the LILEE fuel poverty definition.

Applying these proportions to the whole Wave 1 population as a whole (i.e. all the households who participated in Wave 1 (including those who were not fuel poor), of the 16,056 households who took part in Wave 1, it is estimated that just under 13,500 (84%) were fuel poor prior to receiving installations. Of these, just over 13,100 (97%) are expected to have been taken out of fuel poverty as a result of the scheme installations, which represents 82% of all Wave 1 households.

For the 3% of fuel poor households who were not taken out of fuel poverty, the measures installed in these homes were not sufficient to bring their properties up to EPC band C.

CA conclusion: Change in fuel poverty

Based upon the Contribution Analysis, there is strong evidence that the installation of Wave 1 measures made an essential contribution to reductions in the number of residents in fuel poverty that participated in the scheme because the majority of properties treated were improved to an EPC C or above.

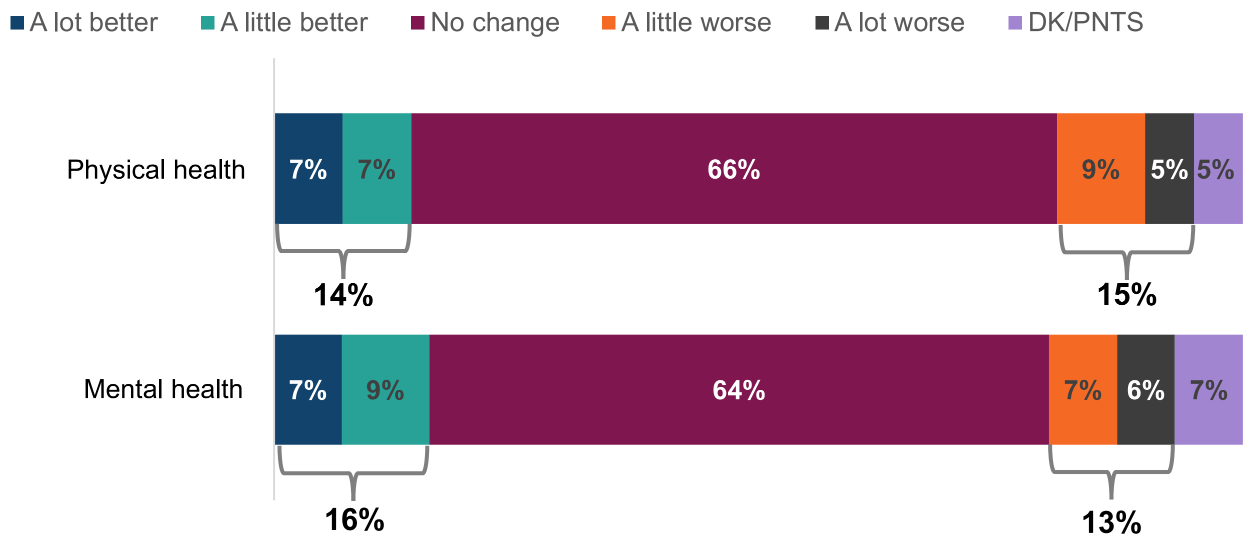
Health impacts

Two-thirds (65%) of residents that responded the post-installation survey reported having a long-term physical or mental health condition or illness. They were asked whether they had noticed any changes in their physical or mental health in the period since the energy saving measures were installed. It is worth noting that the question simply asked about changes since installation, without clearly stating that these changes needed to be a result of the measures they received. This means some reported health impacts may reflect other influences over time rather than the measures themselves.

As shown in Figure 13, most residents in the post-installation survey said that there had been no change in their physical or mental health since energy saving measures were installed in their homes (66% and 64% respectively). Around one in seven residents reported that their physical (14%) or mental health (16%) had improved since the measures were installed in their homes, while a similar proportion felt that their health had worsened (15% physical health and 13% mental health).

[64] In the Wave 1 Process Evaluation Report, 82% of households were estimated to be in fuel poverty before receiving measures. This proportion increases to 84% for residents that responded to the post-installation survey and had a post-installation EPC rating.

Figure 13: Change in residents' physical and mental health since installations



Source: Resident post-installation survey. I1b_1/I1b_2. Since the energy saving measures were installed in your home, has your physical health/mental health got better, worse or has there been no change? Base: All residents (537). DK: Don't know. PNTS: Prefer not to say.

The following groups of residents were more likely to report their mental or physical health had improved since measures were installed in their home.

- Those who now use a different method to heat their home since the installation of measures (32% reported an improvement in physical health, 31% reported improved mental health)
- Those living in a flat, apartment or bedsit (29% reported improved physical health, 27% reported improved mental health)
- Those satisfied with the quality of installations (21% reported improved physical health, 22% reported improved mental health)
- Those in full time paid work (24% reported improved mental health)

During focus groups, a few residents provided examples of when their health had been impacted by the energy saving measures installed. These residents reported a noticeable improvement in their physical health, particularly those with pre-existing long-term health conditions. Feeling warmer and more comfortable at home was mentioned as helping with breathing and improving respiratory health. For example, two residents with Chronic Obstructive Pulmonary Disease (COPD) noted a reduction in symptoms and greater ease in managing their condition. One resident reported that the condition of their home had led to improvements in their symptoms to the extent that they had been able to rely less on medication they had previously used to manage their health condition.

> *"I have COPD and obviously the damp and stuff is really bad, and… can really exacerbate that... I've also got fibromyalgia. … I struggle with body temperature control and stuff. I have to say, since it's all been done, I've not been on steroids and antibiotics, which is interesting."* Resident

There were a few residents that highlighted improvements in mental wellbeing. These improvements were linked to a reduction in anxieties related to heating costs and the general condition of their home. In particular, residents reported a sense of relief due to lower bills, reduced mould and condensation, and overall improvements in home comfort.

There were others that had not experienced any significant changes in their health since the installation of the measures. In some cases, this was attributed to the fact that their homes were relatively modern and did not present major issues likely to impact health in the first place.

CA conclusion: Resident comfort, health and wellbeing

Based upon the Contribution Analysis, there is strong evidence that the installation of Wave 1 measures contributed to increased comfort, health and wellbeing for some residents. However, there was some moderate strength evidence that these benefits have been limited for some residents by rising energy prices and cost of living.

Confidence in using the equipment

Information, handover and guidance

During focus groups, residents typically came across as knowledgeable regarding the measures installed in their homes. Some residents said they had researched the measures that were going to be installed in their homes when they first found out about them.

While residents in focus groups appeared fairly knowledgeable about the measures in their homes, the majority of residents in the survey reported not receiving guidance or support related to the measures installed. Three in ten (31%) residents reported receiving support or guidance about the energy saving measures in their home. One in five (21%) received guidance from the installer, while 15% received this from their landlord. Those who had heat pumps installed were more likely to have received support (51%).

Focus group findings echoed the idea that it was rare for guidance to be shared with residents. Among those who received guidance, individual examples included a safety leaflet, a welcome pack (that was delayed by over a year), a manual, and guidance on who to contact if something went wrong. Other residents suggested they received a verbal explanation of basic information from installers after the installation was complete, for example how to tell if Solar PV were actively producing electricity. A couple of residents received demonstrations from installers on how to use their measures.

> *"The supervisor or the manager of the company that installed everything actually knocked on everybody's door [once finished] (18 bungalows in the court) and asked if everything was working OK and … are you happy? Have any questions?"* Resident

The vast majority of surveyed residents reported that they found the guidance to be relevant (88%) and easy to understand (84%).

Of residents who did not receive support or guidance, 40% said it would have been useful to receive it, while 40% said it would not have been useful. There was no significant variation across measure types.

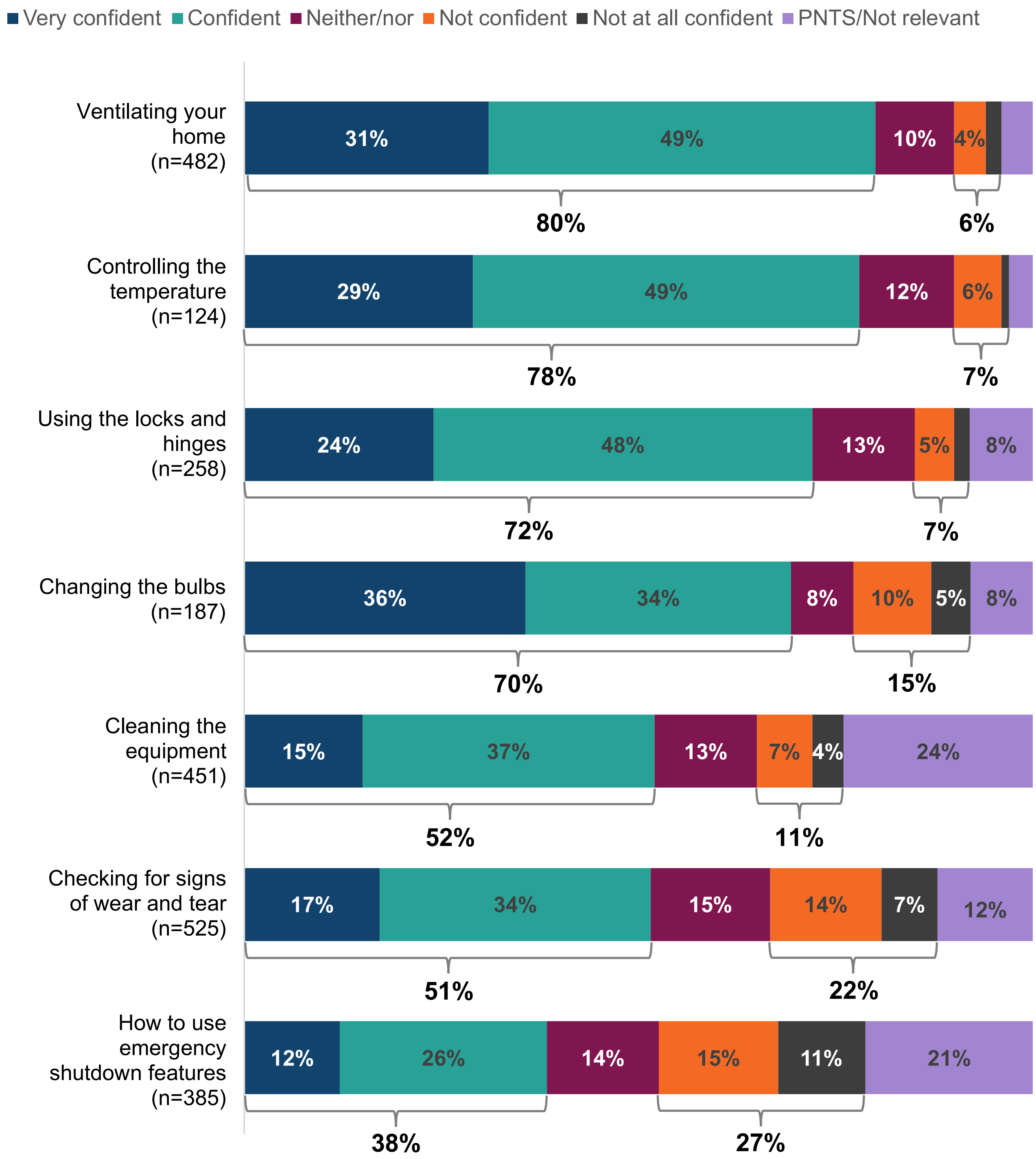
Examples of information residents would have liked, as reported in focus groups, included how the measures work, how to look after them and whose responsibility it is to maintain them. Residents who participated in focus groups and received Solar PV were particularly interested in receiving more information, for example about when to replace batteries, who should do this and how to tell if they are working correctly. However, others were content not to have received any information, since they felt their measures did not require any input from them to continue working effectively (particularly those who had ventilation or insulation installed).

Some residents suggested that they were able to find the information they needed themselves and therefore did not need to be given this. For example, a few residents who said they did not receive guidance or support mentioned using YouTube to answer any queries or fix problems that came up. Other residents suggested they used their smart meters to learn when their Solar PV were producing electricity or not.

Confidence in maintaining measures

Residents were asked how confident they felt with maintenance tasks relevant to the specific measures they had received in their home. As shown in Figure 14, residents felt most confident about ventilating their home (80%) and controlling the temperature of their homes (78%).

Figure 14: Level of confidence residents had with specific maintenance activities



Source: Resident post-installation survey. H3. How confident do you feel doing each of the following in relation to the energy saving measures installed in your home? Base: All residents who received relevant measures (varies per option, see chart). PNTS: Prefer not to say.

Residents who received measures related to windows and/or doors (57%) were more likely to feel confident cleaning the equipment than other residents. Similarly, residents who had windows and/or doors (56%) and energy efficient lighting (60%) installed were more likely to feel confident checking for signs of wear and tear, while those who had Solar PV installed (41%) were less likely to feel confident with this.

During focus groups, residents were generally not clear on how their equipment would be maintained. Just one resident said they had been given detailed information about maintenance. They received a letter from the council saying that their Solar PV would be maintained when their guttering was done and that their heat pump had been serviced recently.

Residents who suggested they were not confident in carrying out maintenance activities were asked what could improve this. As shown in Table 4, receiving a leaflet and having installer(s) or their landlord show them how to maintain the measures, were the main types of guidance that would have increased residents' confidence.

Table 4: Factors that would help residents feel more confident with maintenance activities

	Cleaning the equipment (n=51)	Checking for signs of wear and tear (n=110)	How to use emergency shutdown features (n=106)
Online instructions	26%	24%	29%
A leaflet	35%	33%	47%
The installer(s) or someone from my landlord showing me	28%	38%	33%
Making the equipment easier to access	10%	13%	7%
Being able to contact someone for help	22%	20%	25%
Don't know/Prefer not to say	13%	14%	12%

Source: Resident post-installation survey. H4.What would help you feel more confident? Base: All residents who are not confident with each aspect of maintenance (varies per option, see chart). Note maintenance activities with a base size of fewer than 50 are not shown.

Follow-up activities from either the installer or the landlord to confirm residents did not have any issues after installations were rare. Over two thirds (69%) of residents reported they had not had someone contact them to check if they were experiencing any issues (compared to 26% who said they had). Among those who did have someone follow-up with them, 46% informed their landlord/installer about issues they had experienced with the measures. Three quarters (75%) of those who raised an issue said this had been addressed.

Views on further energy saving measures

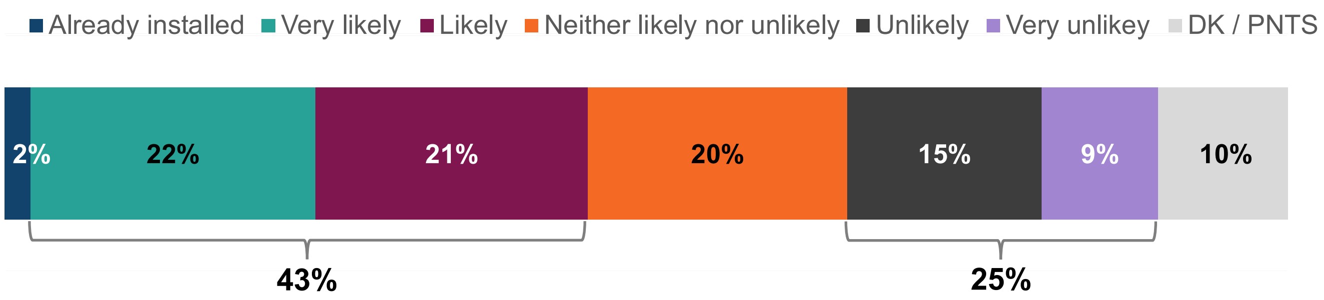
Interest in further energy saving measures

Residents were asked how likely they would be to consider other energy saving measures in the future. As shown in Figure 15, over two in five two (43%) residents reported they would be likely to consider other energy saving measures, while 25% were unlikely to do so. A minority of residents (2%) had already had further energy saving measures installed in their homes.

Those that were more likely than other residents to report their interest in other energy saving measures included:

- Those satisfied with installation process (53%, compared to 21% of those dissatisfied)
- Those satisfied with the quality of the measures installed (52%, compared to 25% of those dissatisfied)
- Those aged 35-54 (52%)
- Non-white residents (72% compared to 39% of white residents)
- Those in full time paid work (56%)

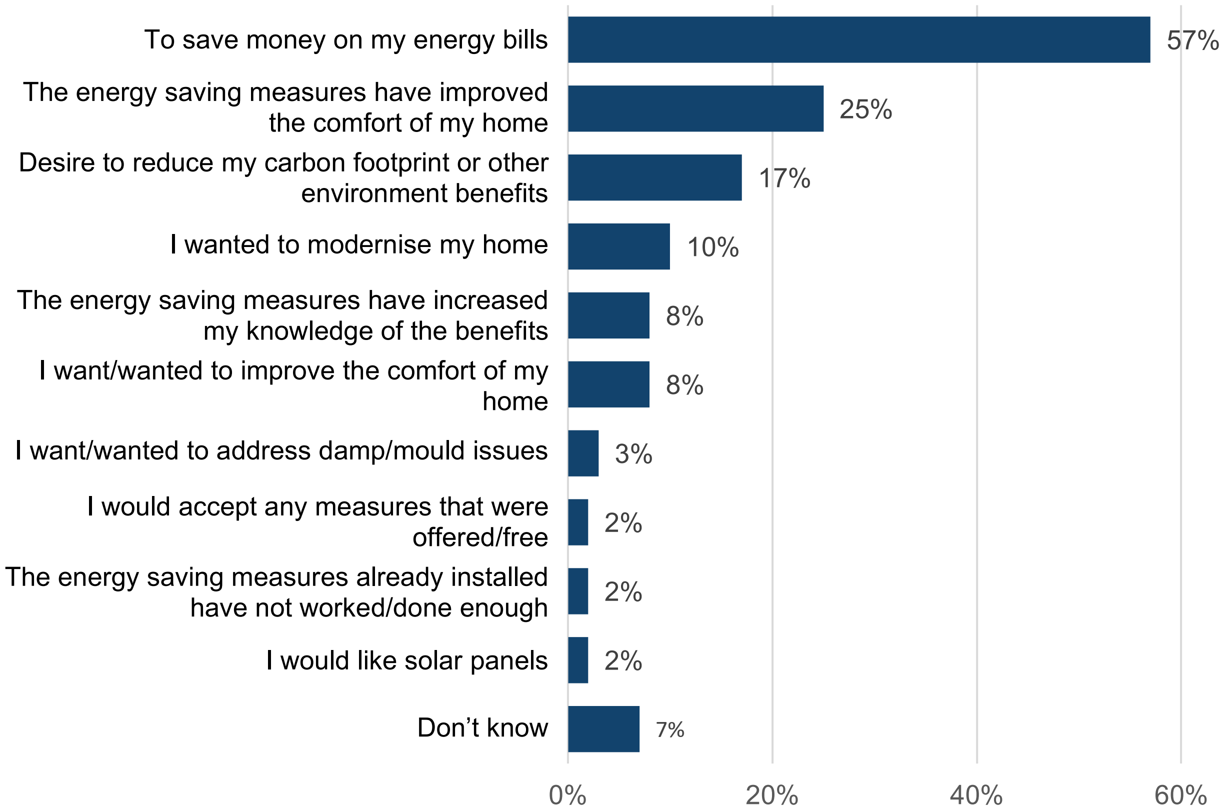
Figure 15: The extent to which residents are likely or unlikely to consider other energy saving measures



Source: Resident post-installation survey. J1. As a result of having energy saving measures installed in your home, how likely or unlikely are you to consider other energy saving installations in the future? Base: All residents (n=537). DK: Don't know. PNTS: Prefer not to say.

As shown in Figure 16, saving money on bills was the top reason why residents were likely to consider other energy saving measures in the future.

Figure 16: Reasons why residents were likely to consider other energy saving measures in the future

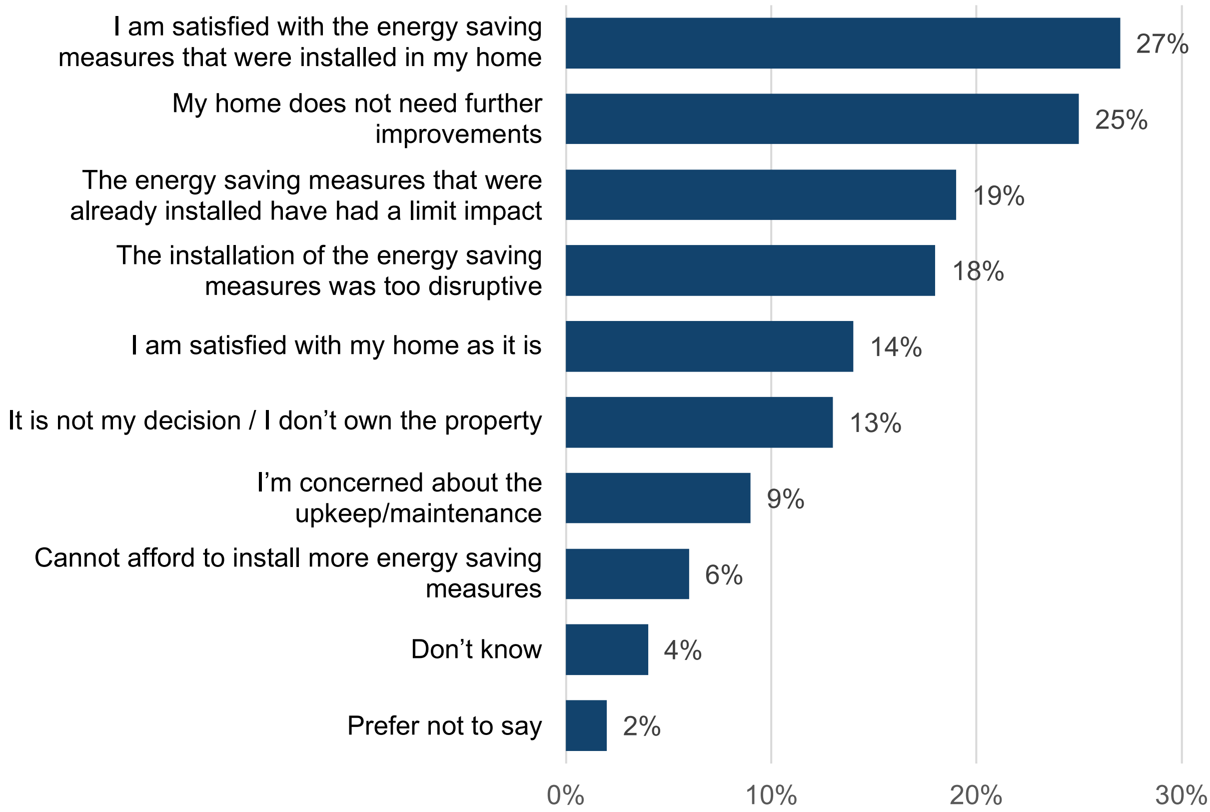


Source: Resident post-installation survey. J2. Why do you say that it is likely that you will consider other energy saving installations in the future? / Why did you install other energy saving measures in your home? Base: All residents who are likely to consider/have already installed other energy saving installations (n=242).

During focus groups, residents provided reasons for considering other energy saving measures in the future. Some felt that initial works were 'incomplete' due to persistent issues. For example, some residents that experienced issues with damp, mould or draughts in their home expressed an interest in new windows to address these. Residents said they did not understand why windows had not been included in their original package of measures.

As shown in Figure 17, the most common reasons for residents being unlikely to consider other energy saving measures in the future were dissatisfaction with the energy saving measures installed in their home (27%), or believing their home does not need further improvements (25%).

Figure 17: Reasons why residents were unlikely to consider other energy saving measures in the future



Source: Resident post-installation survey. J3. Why do you say that it is unlikely that you will consider other energy saving installations in the future? Base: All residents who are not likely to consider other energy saving installations (n=144).

7. Value for money

This chapter explores the value for money of the Wave 1 scheme, in terms of installation costs, inflation, economies of scale and fuel bill and carbon savings. It primarily examines evidence from scheme monitoring data, supported by qualitative data from interviews with SHLs and the supply chain.

Key findings

Wave 1 offered value for money in retrofit by enabling SHLs and supply chain stakeholders to **take advantage of economies of scale** through delivering larger scale retrofit projects than they might otherwise have done without government funding. Wave 1 also **improved the energy efficiency of some of the poorest performing social housing stock** with starting EPCs E to G. Fuel bill and carbon savings were identified.

However, **the costs of retrofit under the scheme rose significantly over time** and to a greater extent than broader economic and construction inflation levels. **Rising costs and other delivery challenges led to descoping**, meaning that fewer properties had measures installed than originally intended, and there were also fewer measures installed per home. At the same time, average spending per home increased substantially compared to original projections.

Total scheme costs

At baseline, all Wave 1 projects combined intended to spend a total of £179 million of grant funding, and £190 million of co-funding from their own resources or other grants, totalling £369 million. Over time, projects experienced several difficulties, including rising costs, as detailed in the Wave 1 Process Evaluation Report. This resulted in the submission of Project Change Requests (PCRs), averaging six per project, and ranging from one to 12. PCRs were submitted for a number of reasons, including cost changes or challenges with installations in properties.

By the end of the scheme, a lower value of grant funding had been spent by projects (£159 million across all projects), and a higher value of co-funding (£222 million), with a higher overall total of £381 million. This resulted in an increase in the ratio of co-funding from 51% at baseline to 58% by the end of the scheme. Four projects dropped out of the scheme, accounting for 3% of all the properties which were intended to receive installations at baseline.

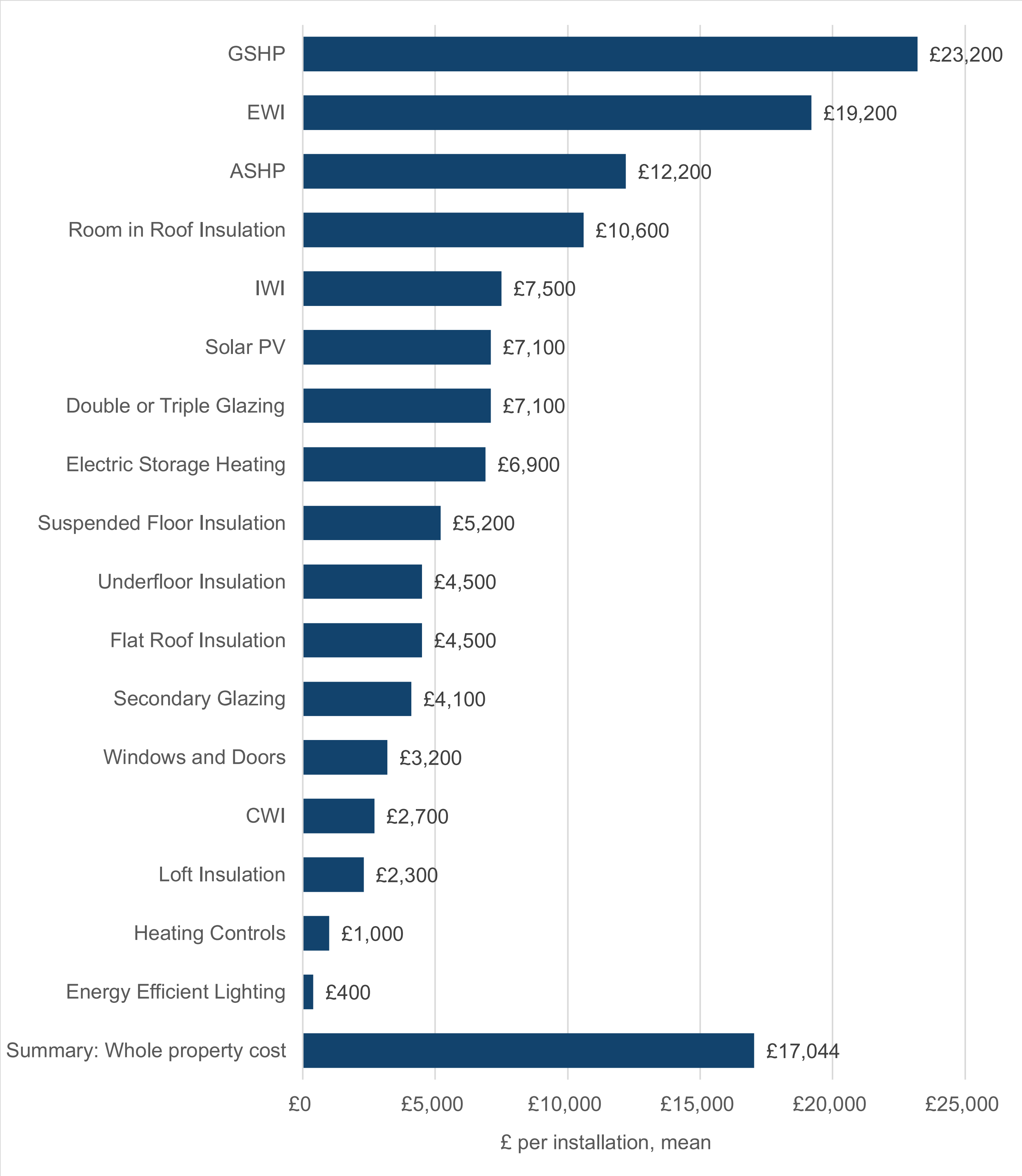
Excluding the projects that dropped out, the total cost of all projects combined from baseline[65] to the end of the scheme increased by 9% (based on Change Control data). However, the sum of grant funding for all projects combined fell during the same period (−8%), which reflects significant descoping. There was a 17% decrease in the total number of homes that received measures across all projects over the same time period, and a reduction of 12% in the number of measures installed per home (from an average of 2.3 to 2.0). Average spending per home increased substantially over the same time period (+32%[66]). Much of the increased cost of delivery per home was borne by grant recipients and consortium partners, as explained in more detail in the next sections. Total co-funding across all projects increased by a quarter (+25%), and increased quite substantially per home retrofitted (+51%), while grant per home increased by a lesser amount (+17%).[67]

Property and measure costs

On average, it cost £17,044 to install measures in a property[68] as part of Wave 1, excluding non-measure costs such as procurement and administration. The most expensive measures to install were Ground Source Heat Pumps (GSHPs) (£23,200), alongside EWI (£19,200) and ASHPs (£12,200). Cheaper measures included CWI (£2,700) and Loft Insulation (£2,300), as shown in Figure 18.

[65] The point at which the grant funding agreement was signed for each project in 2021.
[66] Based on Change Control register. Estimated spend per property (calculated by dividing the sum of spending across all projects by the number of properties included in the Wave 1 scheme, excluding any cancelled projects) was £17,763 at baseline, as of the signing of the Grant Funding Agreement (GFA) for each project. Projected spending per property in the final Change Control register (as of March 2025) was £23,416, 32% higher.
[67] Although the number of homes included in the project fell by 17%, and the grant per home rose by 17%, mathematically these do not cancel each other out; this is not incompatible with overall grant funding falling by 8%.
[68] This figure includes only costs which were attributed to a specific measure by the SHL. This would exclude administrative costs and other non-measure costs such as EPC inspections.

Figure 18: Average cost of installation by measure type



Source: Measure costs: SHDF Statistics, April 2025, updated to end February 2025. Measures with <25 installations excluded. For method of calculation and notes, see Social Housing Decarbonisation Fund statistics. Whole property costs: DESNZ monthly delivery data, based on combined cost of all measures; submitted at property level by SHLs. Excludes any non-measure costs such as administration. On average, SHLs installed 2.45 measures per property.

Cost increases during Wave 1

Overall cost increases

As detailed earlier in this chapter, substantial increases in costs per project and per property occurred compared to original plans. Inflation in the wider UK economy was generally high at the time of Wave 1, peaking at an annualised 9.6% in October 2022 (ONS, CPIH Annual Rate 00)[69]. Inflation of the price of construction materials rose steeply from the beginning of 2021 and then decreased from mid-2022.[70] However, the increase in project spend per property (32% across projects), including administrative costs, comfortably exceeded both the general economic and construction material inflation rates. The increase in project costs also occurred at a later point in time in the scheme (beginning quarter 3 of 2023) whereas both general and construction material inflation rates peaked in 2022. Thus, whilst wider economic and construction material inflation is expected to have contributed to Wave 1 project cost increases, it is unlikely to explain this entirely.

The Wave 1 Process Evaluation Report details a range of other delivery challenges which contributed to project cost increases. These included:

- Labour shortages in the retrofit supply chain led to increases in costs as demand for skilled retrofit labour rose and/or projects had to be redesigned.
- Lack of familiarity with PAS 2035 compliance which meant that planned works had to be revisited again or additional unanticipated works were needed.
- Difficulty engaging residents leading to delays or the need to select alternative properties for the project.
- Poor weather creating delays.
- Issues in pre-work assessments of properties such as failure to identify structural issues, or poor quality of prior works, requiring additional unexpected works in the properties.

As shown in Table 5, inflation of overall project costs was highest in London (+26%), followed by the South West (+21%) and West Midlands (+21%). Overall project costs decreased in the South East (−17%) and East Midlands (−2%) but in each case this was due to substantial descoping in terms of number of properties.

[69] ONS, 'CPIH Annual Rate 00'
[70] DBT (2024) 'Construction building materials: commentary June 2024'

Table 5: Project cost at baseline compared to the end of Wave 1[71]

Region	Sum of forecast project costs at baseline*	Sum of project costs (actual)	Change in project costs
East Midlands	£52,443,000	£51,212,000	−2%
East of England	£48,906,000	£52,503,000	+11%
London	£33,780,000	£42,494,000	+26%
North East	£25,568,000	£28,562,000	+12%
North West	£54,359,000	£55,525,000	+2%
South East	£23,165,000	£19,114,000	−17%
South West	£17,572,000	£21,238,000	+21%
West Midlands	£50,473,000	£61,136,000	+21%
Yorkshire and the Humber	£43,321,000	£47,266,000	+9%

Source: Change Control register. Figures rounded to the nearest £1,000.

*Baseline costs are as of the signing of the Grant Funding Agreement (GFA), after the application stage.

Administrative and ancillary (A&A) cost increases

Project data also included a breakdown of administrative and ancillary (A&A) and capital costs within grant funding. Since grant funding could not be increased, this data could not be used to show cost overruns for A&A or capital. Data on co-funding spend was not broken down into A&A and capital components. However, the time it took for grant allocated to A&A to be spent could be considered as a proxy for overspend, assuming that projects would aim to spend their grant for A&A evenly across the project, and that A&A spending must have continued until the end of the project (i.e. until installations were complete).

On average across Wave 1, the full allocation of grant funding for A&A was spent 7.6 months before a project ended (i.e. it reached the maximum allowed in the grant agreement and did not increase further after this time), suggesting that in most cases projects spent several months supporting their ongoing A&A activity wholly through their own resources. Consortia led by Combined Authorities performed considerably better than LA-led projects on this metric, using up their A&A grant only 5.5 months before project end. One LA-led project reported that they thought A&A costs could have become higher, as their project was extended and they were required to do more monthly reporting than was planned.

[71] Costs have been rounded to the nearest £1,000

Cost increases over time

Average cost per property increased substantially over the course of the scheme (Table 6). On average, projects with four or fewer Change Requests completed installations in 2023, while those with five or more completed installations in 2024.[72] This suggests projects with fewer Change Requests were able to complete their projects more quickly. This may partly explain higher costs towards the end of the scheme, if these projects experienced difficulties, delays or changes in the scope of their project later in delivery.

Table 6: Average cost per property and variation by date of completion of installations (by quarter)

Date of completion of installations (quarter)	Number of properties retrofitted	Average cost of installing measures per property
Q1 2022	223	£6,676
Q2 2022	298	£4,993
Q3 2022	713	£10,620
Q4 2022	1,202	£10,380
Q1 2023	2,638	£12,661
Q2 2023	3,530	£17,266
Q3 2023	3,136	£18,051
Q4 2023	2,462	£22,746
Q1 2024	1,458	£25,641
Q2 2024	37	*
Q3 2024	9	*
Q4 2024	24	*

Source: DESNZ monthly delivery data, submitted by SHLs. Costs exclude non-measure costs. Measures without costs data excluded from cost calculations. Two projects were excluded from cost calculations due to targeting mostly hard-to-treat properties.[73] Years are calendar years. * Data suppressed since base size <25.

[72] Source: DESNZ monthly delivery data (as of end of the scheme) and Change Control Register (as of end of the scheme).

[73] A check was undertaken for all outliers in the cost analysis. Two projects had very high average per property costs which distorted the figures for projects in any category where these two projects were included. The high costs are understood to be because these projects were installing measures in large developments that were hard to treat. These two projects were therefore excluded from the analysis to enable more meaningful comparison of costs data across categories.

SHLs typically agreed that the cost of labour and materials increased over the course of their Wave 1 project as a result of inflation. More than a quarter of projects (17 of 69) at some stage during delivery reported high risks regarding cost inflation, including increases in the cost of materials. However, as noted earlier, wider economic and construction material inflation was lower than Wave 1 project cost inflation, and peaked at an earlier time compared to when projects started to experience cost increases. Thus, this does not constitute an entire explanation for project cost increases over time.

A couple of projects also stated delays had resulted from cost inflation due to the need to replan and rescope projects, offering an additional explanation for why properties retrofitted late in the scheme might have cost more to complete:

> *“Expense [has been] incurred and delivery delayed… in future programmes where there are doubts regarding the building construction… invasive surveys may be required to confirm the detail. [We] may elect to keep a void property vacant in order to facilitate this activity.”* SHL entry on risk register

> *“ASHP [costs] have gone up 21% since the bid took place and insulation [costs] has gone up by 30%... we may have to reduce the amount of stock being improved…”* SHL entry on risk register

> *“EWI costs have increased by a further 45%... [we are having] meetings directly with suppliers and contractors to understand where these costs are coming from.”* SHL entry on risk register

Variation in measure costs

Costs per measure varied extensively, as shown in Table 7.[74] This reflects that the cost of some measures (e.g., CWI, EWI, Storage Heaters, Loft Insulation and Flat Roof Insulation) can vary greatly depending on the type and size of property, whereas others (e.g., any type of heat pump, Solar PV) are products with a fixed capital cost, with variation largely relating to installation costs. Furthermore, some types of measures are broad descriptions and may cover a wide range of products. For example, ‘ventilation’ could cover a range of activities from installation of a few vents in existing windows to a full house Decentralised Mechanical Extract Ventilation (DMEV) system, therefore showing high variation in cost.

[74] Note that in some cases the extent of cost variation may have been dampened (to an unknown extent) by individual large projects reporting the same cost for all measures of the same type, since they have not measured or reported costs separately for each installation. In some cases, this may be justified (e.g., if installing EWI for a full tower block it would be unreasonably difficult to cost per flat, and to do so would hide costs of insulating communal areas) but in other cases it reflects difficulty gathering data (e.g., contractors may report costs or quote for work across an entire estate rather than by property).

Table 7: Cost distribution by measure

Measure	Lower Quartile	Median	Upper Quartile	Spread (difference from lower to upper quartile, relative to the median)[75]
Ventilation	£352	£831	£1,845	±90%
Flat Roof Insulation	£2,832	£4,277	£7,713	±72%
Loft Insulation	£614	£850	£1,710	±64%
Storage Heaters	£5,395	£6,019	£8,000	±59%
Draughtproofing	£480	£3,384	£4,333	±57%
CWI	£1,193	£2,215	£3,534	±53%
Internal Wall Insulation (IWI)	£3,398	£6,182	£9,172	±47%
Double or Triple Glazing	£4,473	£6,668	£9,024	±34%
EWI	£13,250	£16,641	£22,793	±29%
Other	£851	£1,500	£1,501	±22%
Solar PV	£5,649	£6,302	£7,860	±18%
Insulated Doors	£2,048	£2,304	£2,835	±17%
Underfloor Insulation	£3,830	£4,790	£5,306	±15%
ASHP	£11,107	£11,107	£13,559	±11%
Controls for a Heating System	£1,000	£1,079	£1,079	±4%
GSHP	£23,648	£23,648	£23,648	no variation shown
Extractor Fan(s)	£648	£648	£648	no variation shown
Environmental Sensors	£547	£547	£547	no variation shown
Energy Efficient Lighting	£380	£380	£380	no variation shown

Source: DESNZ monthly delivery data, submitted by SHLs. Measures without costs data submitted are excluded from the analysis. Costs exclude non-measure costs. Base sizes: ASHP (398), Controls for a Heating System (493), CWI (2,781), Double or Triple Glazing (5,207), Draughtproofing (263), Energy Efficient Lighting (804), Environmental Sensors (1,060), EWI (6,656), Extractor Fans (71), Flat Roof Insulation (147), GSHP (332), Insulated Doors (1,808), IWI (717), Loft Insulation (7,429), Other (168), Solar PV (3,108), Storage Heaters (616), Underfloor Insulation (129), Ventilation (2,921).

[75] Calculated by subtracting the lower quartile from the upper quartile, dividing this by two (to generate an average difference above and below the median), and dividing this by the median. This measures variation in cost relative to the median cost. This is more analytically useful than an absolute value in £, which would always show less variation for cheaper measures.

Variation in costs by property and project characteristics

This section explores variation in costs across projects by property type, EPC rating, urban/rural location, region, the number and nature of organisations involved and the geographical concentration of properties.

Table 8 shows the number of properties and the average cost per property across Wave 1 projects. However, because the measures installed vary by property type and project type, a single average of cost per property does not give a clear indication of value for money. More expensive measures are not necessarily poorer value. To address this, an adjusted percentage is provided in the final column of each table, based on the costs of measures installed compared to the average costs for the same measures across Wave 1.[76]

On average, flats had higher measure installation costs (+4%, after adjusting for measure type), reflecting the need for more expensive measures to improve their EPC rating (e.g. high-rise EWI). Flats may include a range of designs, including low-rise and high-rise properties, so costs are likely to vary substantially, although the data gathered does not support a more detailed breakdown. Costs for bungalows were considerably lower compared to flats or houses (−4%, after adjusting for measure type).[77]

Table 8: Property and measure cost variation by property type

Property type	Properties retrofitted	Average cost per property	Measure costs relative to average (percentage difference)
Bungalow	2,637	£16,223	−4%
Flat	3,574	£20,971	+4%
House	9,527	£15,668	0%

Source: DESNZ monthly delivery data submitted by SHLs. Data processed by IFF Research; not official statistics. Measures without costs data excluded from cost calculations. Costs exclude non-measure costs. Two projects were excluded from cost calculations due to targeting mostly hard-to-treat properties, which resulted in particularly high costs and distorted findings.

We looked at variation in the average cost of measures, in relation to starting EPC rating. Upgrades for properties with lower starting EPC ratings usually cost substantially more, as shown in Table 9. This is expected, as more measures would be required to improve the EPC rating to the target of EPC C.

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[76] To calculate this, we calculated for each project the average (mean) cost of each named measure. These were compared against the average (mean) cost of each measure across Wave 1 to produce a percentage difference from the average. For each project, the weighted average of these percentages was taken (by volume of measures installed by the project), excluding low value measures with an average installation cost of less than £1,000. This produced a single figure for each project, giving the difference in measure costs that project experienced across all measures installed.

[77] This standardisation by measure type (described in the footnote above) uses difference from the average cost for the same type of measure, and therefore to a large extent prevents the figures shown simply reflecting that these property types will tend to have different measure types installed.

Table 9: Average (mean) property cost by starting EPC rating (final EPC rating could vary)

Starting EPC rating	Properties retrofitted	Average cost per property	Measure costs relative to average (percentage difference)
Starting EPC D	12,022	£15,255	−5%
Starting EPC E	2,458	£22,461	+3%
Starting EPC F	477	£26,154	+21%
Starting EPC G	41	£44,489	+23%

Source: DESNZ monthly delivery data submitted by SHLs. Data processed by IFF Research; not official statistics. Measures without costs data excluded from cost calculations. Costs exclude non-measure costs. Two projects were excluded from cost calculations due to targeting mostly hard-to-treat properties.

Analysis by rural/urban classification (using the ONS and DEFRA rural-urban classification[78]) shows that the overall costs of measures were generally higher for rural properties. However, after adjusting for measure mix, costs were usually higher for properties in urban areas than in rural areas. This may relate to the types of properties in urban areas; for example, 27% of properties that received installations in urban areas were flats, compared to 4% in rural areas.

Table 10: Property and measure cost variation by urban / rural classification

Classification	Properties retrofitted	Average cost per property	Measure costs relative to average (percentage difference)
Rural	2,563	£14,068	−5%
Urban	13,176	£17,548	+1%

Source: DESNZ monthly delivery data submitted by SHLs. Data processed by IFF Research; not official statistics. Measures without costs data or without valid postcodes excluded from cost calculations. Costs exclude non-measure costs. Two projects were excluded from cost calculations due to targeting mostly hard-to-treat properties.

Measure costs were generally highest in London, the South East of England and West Midlands, and tended to be lower further from London, especially after adjusting for the measure mix. Interviews with supply chain representatives suggest that costs were higher in London to account for contractors paying the London Living Wage, as well as higher costs for parking and road user charges.

[78] Rural-Urban Classification (2025) 'Rural-Urban Classification Methodology (2021)'. Rural covers the classifications of: rural hamlet and isolated dwellings, rural village in a spare setting, rural village, rural town and fringe in a sparse setting, rural town and fringe. Urban covers the classifications of: urban city and town, urban minor conurbation and urban major conurbation.

Table 11: Property and measure cost variation by region

Region	Properties retrofitted	Average cost per property	Measure costs relative to average (percentage difference)
North East	2,116	£7,924	−22%
South West	771	£20,497	−16%
East Midlands	2,075	£17,478	−12%
East of England	1,890	£19,275	−7%
North West	2,526	£17,518	−3%
Yorkshire and the Humber	2,091	£18,266	−1%
London	1,828	£16,990	+13%
South East	757	£8,492	+30%
West Midlands	1,693	£23,323	+50%[79]

Source: DESNZ monthly delivery data submitted by SHLs. Data processed by IFF Research; not official statistics. Measures without costs data or without valid postcodes excluded from cost calculations. Costs exclude non-measure costs. Two projects were excluded from cost calculations due to targeting mostly hard-to-treat properties.

Economies of scale: variation between projects

Wave 1 was intended to offer value for money via economies of scale through SHLs undertaking larger scale retrofit projects than they would otherwise have done. Evidence for this has been explored and reported in more detail in the Wave 1 Process Evaluation Report. In summary, some SHLs reported taking advantage of economies of scale in their Wave 1 procurement exercises. Supply chain stakeholders typically agreed that Wave 1 offered a cost-effective way to decarbonise social housing stock and identified a number of means through which this was achieved. An example of this was securing cost savings through being able to buy materials in bulk.

Analysis of variation in costs has also been undertaken in relation to the size and geographic concentration of projects. This was used to provide some insight into whether these factors might illustrate economies of scale occurring to a greater extent in some projects compared to others.

[79] In large part this is due to a single large project with unusually high per measure costs; however, even when this is excluded, the West Midlands adjusted measure costs remain at +20%.

On average, costs per property were higher for smaller projects, as shown in Table 12. However, the most cost-efficient projects, after adjusting for measure mix (as found in the Wave 1 Process Evaluation Report), were mid-sized projects with 100 to 249 properties.

Table 12: Property and measure cost variation by project size

Project size at baseline	Properties retrofitted	Average cost per property	Measure costs relative to average (percentage difference)
Less than 100 homes	1,089	£27,574	+14%
100 to 249 homes	2,495	£21,036	−8%
250 or more homes	12,163	£15,194	0%

Source: DESNZ monthly delivery data submitted by SHLs. Data processed by IFF Research; not official statistics. Measures without costs data were excluded from cost calculations. Costs exclude non-measure costs. Two projects were excluded from cost calculations due to targeting mostly hard-to-treat properties.

The trend shown in Table 12 above can be partially explained by that shown in Table 13. Projects led by a single LA had the highest adjusted measure costs (+6%). Costs per measure were lowest for local consortia (i.e. multiple landlords in one LA area), or projects involving a local ALMO. This suggests these were the most cost-efficient organisational structures, although other factors relating to the nature of projects within different organisational structures could also be influencing this finding.

Table 13: Property and measure cost variation by project organisational structure

Project size	Properties: Number completed	Average (mean) unadjusted cost per property of all installations	Measure costs relative to average (percentage difference)
Single LA: one landlord	3,531	£21,371	+6%
Single LA + ALMO: one landlord	1,055	£21,340	−13%
LA-led consortium: one landlord	2,236	£19,707	+3%
LA-led consortium: multiple landlords in one LA area	3,561	£12,723	−12%
LA-led consortium: multiple landlords across multiple LA areas	1,392	£15,432	−5%
CA-led consortium: multiple landlords across multiple LAs	3,972	£14,995	+10%[80]

Source: DESNZ monthly delivery data submitted by SHLs. Data processed by IFF Research; not official statistics. Measures without costs data excluded from cost calculations. Costs exclude non-measure costs. Two projects (both single LA landlords) were excluded from cost calculations due to targeting mostly hard-to-treat properties. Projects were classified as consortia if more than one organisation was involved in the bid.

Cost analysis was undertaken considering the geographical spread of projects' properties (i.e. the density of homes in an area), as shown in Table 14. This was based on the number of postcodes[81] relative to the number of properties receiving measures.

After adjusting for measure mix, costs per measure were highest for geographically spread out projects (with fewer than four properties per postcode) compared to other projects. However, costs per measure in the most geographically concentrated projects (with eight or more properties per postcode, which would include projects focusing on large blocks of flats) were slightly higher than projects with four to eight properties per postcode.

In interviews, supply chain stakeholders reported that installing measures on multiple homes in close proximity to each other was a cost-effective approach to decarbonising properties. They explained that this was because this allowed for cheaper labour costs, as contractors were able to do more work in a day where properties were close to one another.

[80] This high figure is due to a single large CA-led project which had higher than average costs. When this is excluded, adjusted relative costs for measures installed at this type of project come in at −6%.
[81] Referring here to full postcode, rather than postcode area or postcode district.

Table 14: Property and measure cost variation by geographical spread

Project geographical spread (based on number of postcodes relative to properties)	Properties retrofitted	Average cost per property	Measure costs relative to average (percentage difference)
Concentrated (8+ properties per postcode)	3,552	£25,291	−1%
Average (4 to 8 properties per postcode)	4,754	£18,045	−7%
Spread out (<4 properties per postcode)	7,441	£12,537	+5%

Source: DESNZ monthly delivery data submitted by SHLs. Data processed by IFF Research; not official statistics. Measures without costs data excluded from cost calculations. Costs exclude non-measure costs. Two projects were excluded from cost calculations due to targeting mostly hard-to-treat properties. 'Postcode' refers to a full postcode.

Hardest to treat stock

The Wave 1 competition guidance[82] explains that the scheme takes a 'worst first' approach, defining this as:

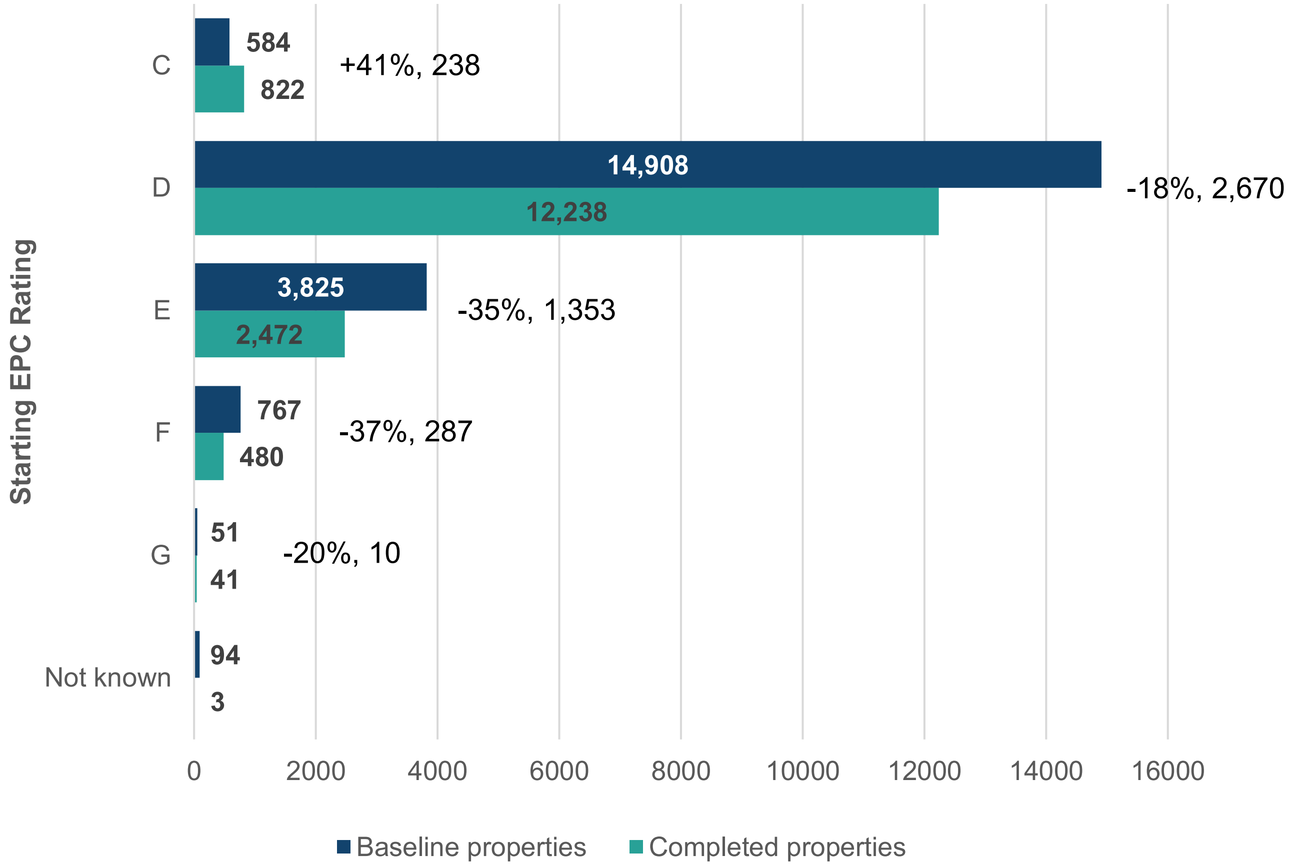
> *"Worst First: Facilitating the treatment of the worst performing homes through a scaled cost cap that allows for greater spend on those homes with a lower starting EPC Band. Whilst applications to the SHDF including the worst performing properties are encouraged, there is no requirement for properties of certain EPC Bands to make up a certain percentage of the overall number of properties included in an application to the SHDF."*

This 'worst first' approach would be expected to enhance value for money by enabling the improvement of the poorest performing social housing stock. Wave 1 had cost caps per property which varied by the property's EPC rating, so SHLs were able to access more funding to retrofit properties with lower EPC ratings.

Figure 19 shows that 2,993 properties with starting EPC E to G (i.e. below the minimum scheme required level of EPC D) had measures installed under Wave 1, which represents 18.6% of all properties retrofitted. However, scheme monitoring data also shows that properties with lower EPC ratings (E to F) were more likely to be descoped across projects (Figure 19). It is not possible to tell from the data whether projects swapped properties originally selected for retrofit with others that had higher EPC ratings, or whether they reassessed starting EPC ratings for the same properties and found them to be better than previously reported. In interviews, SHLs mentioned that data on EPC ratings at bid stage (including at contract award) were often uncertain.

[82] BEIS (2021) 'Social Housing Decarbonisation Fund: Wave 1 - competition guidance notes'

Figure 19: Properties retrofitted by starting EPC rating, post-bid baseline vs. final installation data



Baseline property data processed by IFF Research; not official statistics. Source: Baseline post-bid data. Baseline relates to the profile of provision planned immediately after the signing of GFAs. Completed data: SHDF Statistics, April 2025 release.* indicates <0.5%, but not zero.

Further information on the installation of measures in 'hard-to-treat' properties[83] as part of Wave 1 is available in a thematic case study[84] published alongside the Wave 1 Process Evaluation Report. This includes evidence on:

- Decision-making of social housing landlords (SHLs) in terms of selecting hard-to-treat properties for retrofit, and relevant measures.
- Enabling factors and challenges in delivering retrofit in hard-to-treat properties.

[83] For this case study, a 'hard-to-treat property' was defined as a property that is difficult or costly to renovate or improve in terms of energy efficiency, because of specific features or conditions such as complex architectural designs or structural issues that make standard renovation methods less effective or impractical. The following types of properties were considered as potentially hard-to-treat:

- Properties with low EPC ratings (F or G).
- Archetypes such as bungalows, flats including high-rise, non-traditional houses, and Wimpey No-Fines properties.
- Older properties, built before 1945.
- Properties in rural locations.
- Properties that are off the gas grid.

[84] Technopolis Group (2024) '[Social Housing Decarbonisation Fund Wave 1: thematic case study (installing measures in hard-to-treat properties)]'

As detailed further in the case study, SHLs reported some specific challenges in installing measures in hard-to-treat properties due to their structure, the quality of previous work undertaken, and planning requirements. These challenges often increased costs and timelines of projects. SHLs also generally reported the high costs of installations in hard-to-treat properties, some of which were unanticipated. This may partly explain why fewer hard-to-treat properties were retrofitted compared to what was originally planned.

Further to this, properties with the lowest EPC ratings would be expected to need the highest number of measures installed to reach EPC C. As noted previously, supply chain stakeholders mentioned that where properties required the installation of multiple measures, the higher quantities of materials needed meant they were more subject to inflationary increases. Supply chain stakeholders reported that in some cases the larger than anticipated outgoing costs on materials (owing to cost inflation and supply chain disruption) were not possible to meet as the organisations did not have the capital to pay for them. This could have resulted in certain properties, potentially those with the highest increase in costs, being removed from project plans.

In conclusion, the evidence shows that fewer hard-to-treat properties were included in Wave 1 projects than originally planned, largely as a result of specific challenges involved with installing measures in these homes including cost factors. This may slightly impact the overall value for money of the scheme. This is because more properties with a lower starting EPC being retrofitted to EPC C would have offered more value for money, as they would have seen the greatest benefit in terms of energy efficiency gained.

The role of innovation in contributing to value for money

There was limited evidence of innovative techniques being used on Wave 1, or contributing to value for money. However, Wave 1 was not an innovation scheme so this is not unexpected. Most supply chain stakeholders described their installations as standard, although the majority said they delivered retrofit on a larger scale and in shorter timescales than they were used to. However, there was one example of an assessor using evidence photos to conduct assessments remotely, which they considered to have reduced costs and resident disruption. Another insulation company spoke of how the use of thermoscopic lances[85] reduced the need for scaffolding when insulating walls which also led to cost savings.

Some SHLs mentioned using innovative solutions to remedy particular retrofit issues, but did not specifically link these to improved value for money. For example, one SHL mentioned a situation where the planning department did not allow tiles to be removed for EWI due to aesthetic reasons. The SHL circumvented this issue by installing a hybrid EWI system which allowed them to hang the tile back on afterwards. Another SHL used a thinner phenolic insulation[86] with the cladding system because alleyways were narrow between properties. Some SHLs also reported instances of innovation in processes used. For example, one SHL improved their delivery model by undertaking building safety testing and notification of the Health and Safety Executive earlier in the process. This avoided scaffolding being left dormant whilst they waited for this process to be undertaken.

[85] A cutting tool that uses extreme heat to cut through tough materials like steel and concrete.
[86] Phenolic insulation is a rigid type of insulation with a closed-cell structure.

CA conclusion: Contribution to better value for money in retrofit

Based upon the Contribution Analysis, there is moderate evidence that Wave 1 projects experienced economies of scale through undertaking retrofit projects with larger number of properties than they would have otherwise done. This has contributed to value for money in retrofit. However, there is also strong evidence that inflationary pressures on the costs of labour and materials may have limited value for money to an extent.

This publication is available from: www.gov.uk/government/publications/social-housing-decarbonisation-fund-wave-1-impact-evaluation