


Energy Efficiency Standard for Social Housing 2032 (EESSH2)

Research and modelling for the Scottish Federation
of Housing Associations (SFHA)

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Executive Summary

The Energy Efficiency Standard for Social Housing (EESH) was created to help remove poor energy efficiency as a driver for fuel poverty and contribute to achieving the Scottish Government's ambitious climate change emissions reductions targets. EESH had a minimum rating milestone and target date of 31 December 2020 and its successor (EESH2) has the equivalent 2032 date.

This report combines the results of a survey and interviews among members of the Scottish Federation of Housing Associations (SFHA) on EESH and EESH2, and a quantitative EESH2 analysis of Scotland's housing association stock based on data from the Scottish House Condition Survey. Both the SFHA member research (Section 1, starting at page 8) and the housing stock analysis (Section 2, page 36) inform each other, although they can be read as standalone reports as well.

A previous study on the first phase of EESH was carried out by Changeworks in conjunction with SFHA in 2017¹.

EESH2 survey

Changeworks was commissioned by the SFHA to gather feedback from member organisations about the Energy Efficiency Standard for Social Housing (EESH and EESH2). A survey was designed and circulated to members, remaining open for responses for around six weeks.

In total, 55 SFHA members responded to the survey (of 141 members, 39%). Of those that provided data, the largest group were urban-based (77%). Only three respondents were 'national' organisations, and while many cover more than one local authority area, 68% only have properties in one local authority. All but one local authority was covered by the organisations who responded to the survey. Organisations ranged in size from 185 properties to 7,293 properties.

Only a small proportion (16%) said their properties would comply with EESH by the December 2020 deadline; a large number (89%) had temporary exemptions in place.

Just less than half of organisations had begun work to make their properties meet EESH2 (49%); yet only 37% have a plan in place to meet EESH2. Most organisations (65%) said their plans would take more than ten years to implement; two said their upgrades would not be complete by the 2032 deadline. The majority of respondents (65%) said that between 1% and 25% of their stock currently meet EESH2.

¹ [EESH Compliance Survey: Research into Housing Associations' compliance with EESH \(Changeworks 2017\)](#)

Almost three-quarters of respondents said they would need external support to meet EESSH2. The most common external support request was for funding application support (87%). The most challenging aspects of EESSH2 were also related to funding. Almost 80% respondents found sourcing funding for measures and also capital investment for measures either 'very challenging' or 'extremely challenging'; 47% of organisations found these aspects 'extremely challenging'. Funding upgrades were identified as the greatest challenge to meeting EESSH2 by three-quarters of respondents.

The second greatest challenge (as noted by 26% of organisations) was upgrading specific property types. Noted property types include Victorian or sandstone tenements, pre-1919 or older properties, off-gas properties, mixed-tenure properties and those with restrictions on upgrades (listed, conservation areas, World Heritage sites).

The air quality and environmental impact of EESSH2 upgrade measures will be included as part of a review of the standard in 2023. Around a third of organisations had already considered the air quality implications of measures, including additional ventilation and engagement with tenants. A greater proportion of organisations (44%) were considering the environmental impact of their upgrades, including reducing carbon emissions of heating, using renewable technologies, and reviewing material specifications.

More than half of respondents (58%) said they had concerns about maintenance of measures installed under EESSH or EESSH2. Key concerns included a lack of skilled and locally available contractors and the cost of maintenance. However, most (83%) did not have safety concerns about the upgrade measures being installed.

COVID-19 has impacted on EESSH and EESSH2 plans and progress for many organisations. The most common impact was a delay to timescales, with many adding that the delays were impacting on future plans. Delays were due to many factors including being unable to access properties to install measures, to survey, or to produce EPCs. Only 14% of organisations said that COVID-19 had not caused too much disruption and only 5% said the pandemic had no impact at all on EESSH / EESSH2.

Follow-up interviews

Follow-up interviews were conducted with 11 survey respondents to explore survey findings in more detail. The interview participants represent a range of large and small housing associations with properties across rural, urban and island areas in Scotland.

Interview participants described the preparatory work their organisations are doing for EESSH2 in order to get a full understanding of their housing stock and the measures required to bring them up to standard. The majority of interviewees

explained that their organisations had not yet installed any measures to work towards meeting EESSH2.

In some cases, participants said they are waiting for more certainty from the Scottish Government before starting to install measures. Participants stated they require clarification on issues such as grid constraints, the hydrogen roll out and whether EESSH2 targets are aspirational or mandatory. Participants expressed a concern that the use of EPC ratings for EESSH2 does not align with the goal of decarbonisation.

Interviewees described the factors driving their approach towards EESSH2 and how they intend to prioritise properties. These included EPC ratings, high energy prices and targeting hard-to-treat properties. All participants are using stock data to drive their approach. However, the interviews revealed that the data which organisations hold on their housing stock varies considerably in quality.

Interviewees shared frustrations around the competing priorities of higher SAP scores and providing affordable warmth for tenants. Some questioned the financial investment required to achieve higher SAP scores if these measures do not provide benefits for tenants.

Interview participants gave more detail on the types of financial support that they require. A key theme was ensuring that the funding available from Scottish Government is aligned with the end goal of decarbonisation and doesn't encourage the installation of measures which will later need to be replaced. Additionally, participants noted that the funding landscape is complex and that funding bids require a lot of detailed information.

Air quality was raised by several interviewees as something which they are giving serious consideration to. However, participants stated that they require more guidance from Scottish Government around how air quality will be measured and defining the goals for compliance.

All interview participants were aware of the Scottish Government's 2045 net zero target. None of the 11 organisations have a target or strategy to become carbon neutral.

EESSH2 modelling analysis

Changeworks carried out EESSH2 modelling across the entire Scottish housing association stock based on Scottish Housing Condition Survey data on a representative sample of housing association properties.

The average EE rating across all 282,000 housing associations properties in this analysis is 71, which is equivalent to a 'low' EE band C. This is higher than the average score of 65 across all properties in Scotland. Most of the housing association stock has an EE band C (61%). Almost one-third (31%) are in the lower

bands of D to F, whilst an extremely low number (49 properties) have an EE band G (the lowest band).

20,926 properties (7%) currently reach the EE rating of 81, which is the aspirational target for EESSH2. Of the 261,074 properties that currently do not meet the standard, 45% are estimated to meet EESSH2 using the packages of fabric, heating and solar measures that have been modelled in this analysis. Installing all the applicable modelled improvements would increase the overall rate of meeting EE band B from 7% to 41%.

To increase the energy efficiency of the stock and to work towards meeting EESSH2, the following measures would be required for the properties that currently do not meet the standard. Each measure is accompanied by a figure for the number of applicable properties and represented as a percentage of overall properties currently do not meet the standard:

- Low energy lighting (146k properties/ 56% of properties that do not currently meet EESSH2)
- Loft and roof insulation (61k properties/ 23%)
- Wall insulation measures (56k properties/ 21%)
- High efficiency glazing (128k properties/ 49%)
- Floor insulation measures (92k properties/ 35%)
- Hot water tank insulation (2k properties/ 1%)
- Central heating control upgrades (60k properties/ 23%)
- Boiler upgrades (45k properties/ 17%)
- Air source heat pumps (16k properties/ 6%)
- High heat retention heaters (27k properties/ 10%)
- Solar thermal (15k properties/ 6%)
- Solar PV (53k properties/ 20%)

At least one measure would be required for 254,610 properties, whereas for 6,464 properties no applicable measures could be assigned (2% of properties currently not meeting EESSH2). Over two-fifths of the properties that still do not meet EE band B (67,625 properties) are within 3 SAP points from meeting this aspirational target, and may in some circumstances be 'treated as meeting EESSH2'.

Estimated costs

If all the identified measures were installed, it is estimated to cost **£2bn**. Lighting and fabric measures account for over two-thirds of these costs. The average cost per property requiring measures to reach or work towards EESSH2 is **£7,661**.

Estimated carbon savings

The average estimated CO₂ emissions per property is 4.4 tonnes per year. This is less than the average across all properties in Scotland of 6.8 tonnes per household. The overall annual CO₂ emissions across all housing association stock is estimated

to be 1,248,764 tonnes per year. If all the measures identified in this analysis were installed, an estimated 303,522 tonnes of CO₂ would be saved annually (1.2 tonnes per household requiring at least one measure), accounting for around one-quarter of the overall estimated emissions.

Estimated running costs savings

The average estimated annual running costs across all properties is **£1,231** per year. This is less than the average across all properties in Scotland of £1,710 per household. If all the measures identified in this analysis were installed, an estimated **£279** would be saved annually per household requiring at least one measure, a 22% reduction in running costs for properties requiring at least one measure.

Fuel poverty

It is estimated that just over 108k households are currently in fuel poverty (38% of the housing association stock). If all measures were installed, this would decrease to 82k (29% of the households living in housing association housing stock).

Introduction

EESH (Energy Efficiency Standard for Social Housing) is the Scottish Government's approach to encourage landlords to improve the energy efficiency of social housing in Scotland. EESH supports the Scottish Government's ambition for warm, affordable, high quality homes in a low carbon housing sector and wider economy. It was introduced in March 2014, with an initial target set for December 2020; EESH2 is the second energy efficiency target, set for 2032, as confirmed in June 2019².

The EESH2 target is for all social housing to meet Energy Efficiency (EE) band B (energy efficiency rating of 81), or to be as energy efficient as practically possible by the end of December 2032, within limits of cost, technology and necessary consent. A formal review is proposed for 2023 which is to include air quality and the environmental impact of interventions, with a view to strengthening and realigning the standard with net zero requirements so that social housing leads the transition to zero emission buildings.

The recent Scottish Government Heat in Buildings strategy highlights a commitment to extending the Social Housing Net Zero Heat Fund until 2026 to further accelerate the decarbonisation of the social housing stock and considers how this financial support will work in tandem with our domestic energy efficiency programmes to deliver a comprehensive approach to decarbonising our social housing stock.

While housing associations have to report to the Scottish Housing Regulator on a number of factors, including the percentage of their properties that meet EESH (2) and the anticipated number of exemptions, this does not give a clear picture of the levels of engagement with EESH2, the barriers that landlords face and the support that they require.

The research conducted for this report combines an SFHA member survey, interviews with a selection of SFHA members and an analysis of housing association stock from the Scottish House Condition Survey.

Research aims

The aim from the survey and interviews was to establish a clear picture of how SFHA members understand their levels of meeting EESH2, the progress made to date, and to identify changes in engagement with the standard, barriers faced by housing associations and consequently the support required from SFHA.

The aim from the analysis was to provide a baseline picture of the current EESH2 compliance status of the Scottish housing association stock, as well as what proportion of that stock that will not meet EESH 2 with all current possible energy

² [Latest EESH2 by the Scottish Government \(March 2021\)](#)

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efficiency and heating upgrades, and the potential impact of EESSH2 measures on tenants.

Section 1: Qualitative research

1. Survey and interview participants

An online survey to gather feedback on EESSH and EESSH2 compliance challenges was designed by Changeworks and issued by SFHA to their members. The survey was issued on 2 December 2020 and closed on 15 January 2021. A reminder was sent to members in early January.

Survey participants were asked if they would participate in follow-up interviews. Interviews were conducted with 11 participants.

Survey respondents

In total, 55 SFHA members responded to the survey³, 44 of which (80%) provided the organisation name (55 of 141 members, 39% response rate). For those 44 named organisations, data was extracted from the Scottish Housing Regulator⁴ to establish the size of the organisation and location of properties.

Most organisations (34 of 44, 77%) had only urban properties, three (3 of 44, 7%) only rural properties and seven (7 of 44, 16%) had properties in a mix of locations.⁵

Only three organisations were classed as 'national' (7%)⁶, while 28 organisations (64%) have properties in only one local authority area. All but one of the Scottish local authorities (Comhairle nan Eilean Siar) are served by these housing associations. Of the 44 housing associations, 13 (30%) have properties in Glasgow City and ten (23%) have properties in the City of Edinburgh⁷. Two local authorities have only one of these 44 housing associations within their boundaries.

The housing associations for which we could identify data ranged considerably in size; the smallest had only 185 properties and the largest had 7,298⁸. Five organisations (11%) were 'small' (less than 500 properties), 18 (41%) were 'medium' (between 501 and 1500 properties), and 20 (45%) were 'large' (more than 1501 properties).⁹

³ Note, two housing associations submitted two responses each. Their responses were combined where appropriate and only one from each organisation was included in the analysis. Not all organisations completed all questions in the survey; the base number is given for all graphs.

⁴ [Home | Scottish Housing Regulator](#)

⁵ This is comparable to data for all SFHA members: 83% urban, 3% rural, 14% mixed.

⁶ Again, this is comparable to data for all SFHA members; only 7% are classed as national.

⁷ Of the SFHA membership, 39% of organisations have properties in Glasgow City and 18% have properties in the City of Edinburgh. All local authority areas have SFHA member properties within them.

⁸ Based on 2019/20 data.

⁹ A greater proportion of larger organisations completed the survey compared to the SFHA membership as a whole: 23% small, 42% medium, 35% large.

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Follow-up interviews

Follow-up interviews were conducted with 11 survey respondents. The aims of the interviews were to further interrogate interesting survey findings and to understand in more detail the reasons for responses and comments made in the survey. Interviews were conducted via teleconferencing with participants from the following organisations:

- Barrhead Housing Association
- Cairn Housing Association
- Ferguslie Park Housing Association
- Hjaltland Housing Association
- Lister Housing Co-operative Ltd
- Lochalsh & Skye Housing Association
- Ochil View Housing Association
- Orkney Housing Association Ltd
- Prospect Community Housing
- Scottish Borders Housing Association
- Shettleston Housing Association

The interview participants represent a range of large and small housing associations with properties across rural, urban and island areas in Scotland.

2. Meeting EESSH2

Overall compliance

The survey asked whether organisations had begun work to make their properties meet EESSH2. The response was very divided; 49% (27 of 55) said they had begun, while 51% (28 of 55) said they had not.

The majority of survey respondents (34 of 52, 65%) said that between 1% and 25% of their housing stock currently meet EESSH2; eleven organisations said a larger proportion of their stock currently meet EESSH2 (see Figure 1). Two organisations (4%) said that none of their properties currently meet EESSH2, while five did not know (10%). Four of these five who were unsure said they had not yet begun EESSH2 preparations (the fifth did not respond to the initial question). Note that the data analysis in section 9.3 shows that 27% currently meet EESSH2, which falls in the most chosen option of this question.

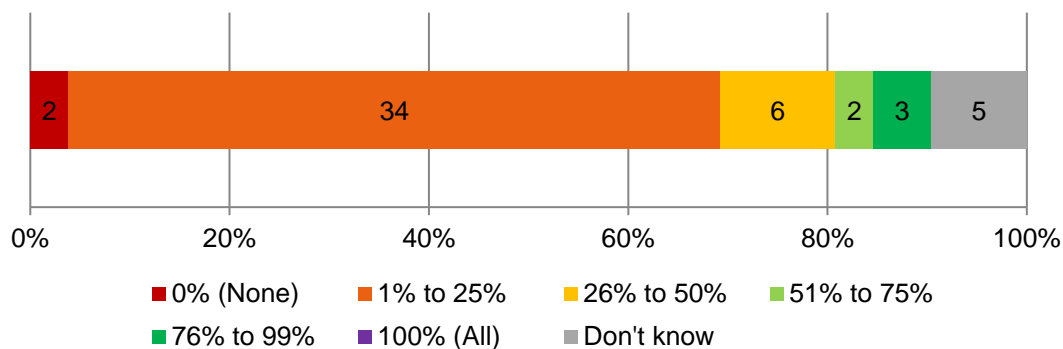


Figure 1: Percentage of housing associations' properties which are meeting EESSH2 (Base = 52)

In the follow-up interviews participants were asked to elaborate on the steps they have taken so far to make their housing stock meet EESSH2. Most participants described that they are doing preparatory work for EESSH2 in order to get a full understanding of their housing stock and the measures required to bring them up to standard. The majority of interviewees explained that their organisations had not yet installed any measures in order to work towards meeting EESSH2:

“The difficulty is trying to make a plan. Because there’s that much legislation floating about at the moment. Trying to make a proper plan is very difficult because we don’t know the funding landscape, we have an idea of measures that can be implemented for certain houses. But until the SAP revisions, we are in a period of limbo”.

One interview participant described their organisation as being “in a holding pattern on EESSH2” as the organisation has a very good overview of their housing stock but are not installing any measures yet.

Stock disposal

Two-thirds of survey respondents (36 of 54, 67%) said that they do not envisage having to sell or otherwise dispose of housing stock which will not meet EPC D by 2025 (see Figure 2).

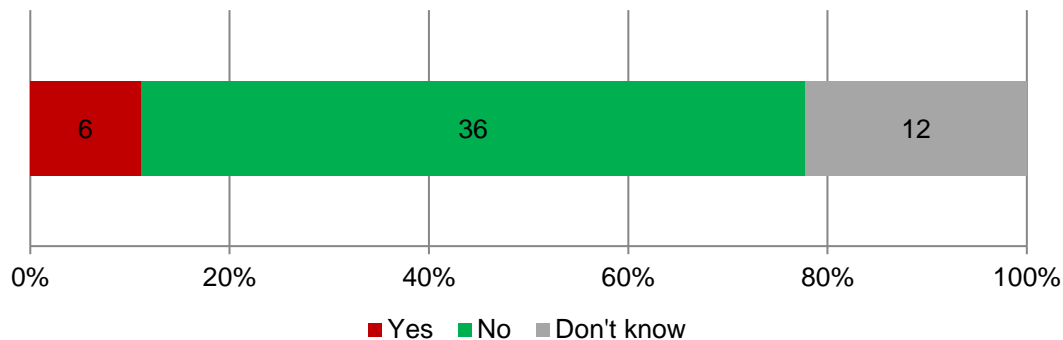


Figure 2: Organisations envisaging having to sell or dispose of properties which will not meet EPC D by 2025 (Base = 54)

Six organisations (11%) said they will have stock to dispose of; these organisations added comments to explain either the type of properties which are affected, or their plans for disposal:

- “Interwar properties”
- “We have a very old housing stock and some of which will never get over a band G so we will need to decide if we need to dispose on a case-by-case basis”
- “A number of Pre1919 tenement flats will not meet EPC D & SHQS following internal wall insulation install”.
- “Some properties where there is no factor and our ability to upgrade the properties will be limited”.
- “We are developing a disposal strategy”.
- “Carrying out options appraisals to possibly carry out demolition.”

A further organisation which did not have plans for disposal added: “We currently have 8 houses that are band E, so we are hopeful we can improve these by 2025.”

2.1 Planning for EESSH2

As shown in Figure 3, those organisations with a plan in place to meet EESSH2 by 2032 are in the minority; 20 of 54 organisations (37%) have a plan in place or under development. Five of the 20 organisations with a plan in place are among those organisations who are yet to begin work on meeting EESSH2 (see section 0 ‘overall compliance’).

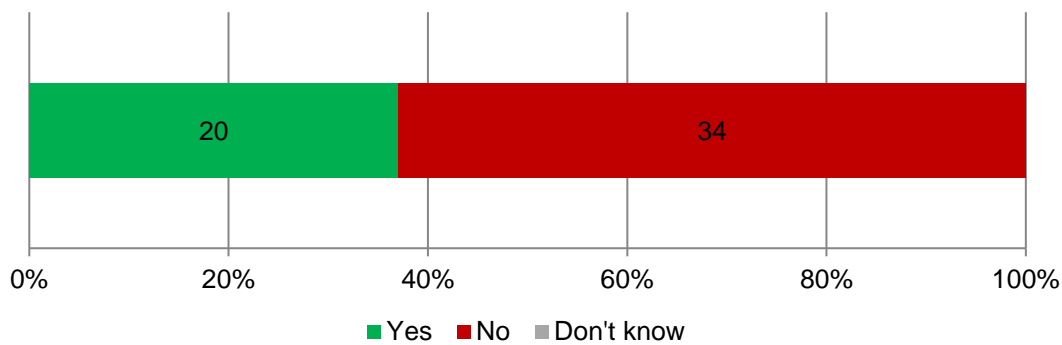


Figure 3: Organisations with plans in place to meet EESSH2 (Base = 54)

Of those that have a plan in place, two organisations (11%) do not anticipate meeting the 2032 deadline (see Figure 4). More than half (11 of 20, 55%) felt that their plans would take more than ten years to implement but that they would meet the deadline. Five other organisations said they would take less than ten years to fulfil their EESSH2 plans. No organisation intends to have fully implemented their EESSH2 plans in less than three years.

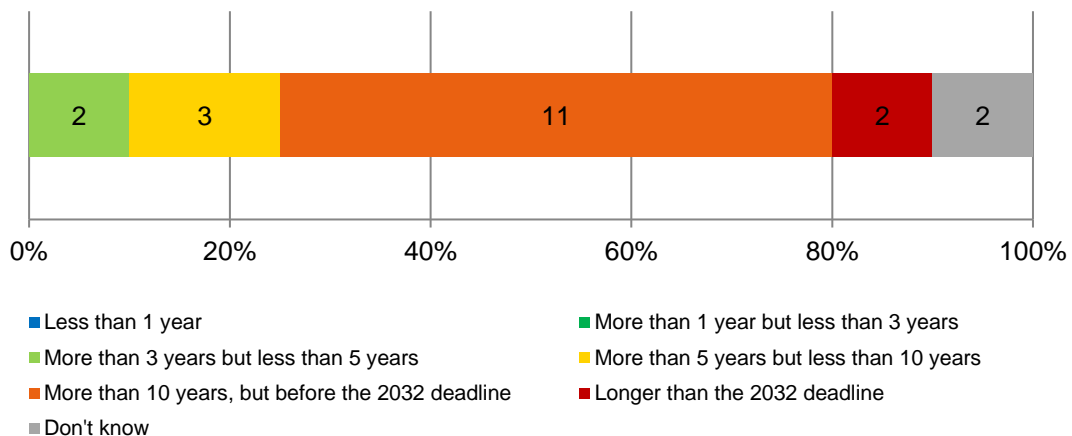


Figure 4: Time to fully implement EESSH2 plans (Base = 20)

Interview participants were asked how their organisations had developed their plans for meeting EESSH2. Nearly all participants referred to their wider asset management strategies, component replacement programmes and 5-year and 30-year plans.

One participant described that EESSH2 is an opportunity to take a fresh look at their entire building stock. The organisation is preparing a delivery plan and costed business case for each type of building stock.

Other participants with less diverse stock discussed particular strategies or technology pathways they have chosen to follow:

“We have opted for storage heaters and not heat pumps. We’re also looking at solar PV and battery storage.”

“Our plan is to install heat pumps in properties and improve ventilation.”

Participants discussed the factors guiding their approach to EESSH2. One participant explained they have developed a set of principles to inform the organisation's strategy which include improving affordable warmth without increasing rents and identifying a date to stop installing gas boilers. Another participant described that the organisation's approach to EESSH2 is being led by an affordable warmth agenda. High electricity prices are a major concern for this off-gas housing association, and they are prioritising tenant affordability over SAP scores.

Participants also discussed how they are prioritising properties. One organisation is focussing on hard-to-treat properties which will require long-term projects to meet EESSH2. They have not yet made plans for their properties that are currently a band C. Another participant described that their prioritisation of properties is not based on EPCs:

“We are prioritising properties with high energy prices and those with partial heating outcomes, not on EPC scores.”

“Do we do it to get the quickest compliance rate early? Do we target fuel poverty first? How do we plan it? What are our priorities? Is it cheapest way? Most efficient way? Alleviate fuel poverty first? Or achieve compliance first?”

Generally, interviewees shared frustration around having to make decisions through competing priorities. The financial investment required to achieve higher SAP scores does not necessarily reflect the benefits for tenants.

“The low hanging fruit has been done already, so achieving those additional SAP points is very, very expensive and I'm not sure that that's a reasonable use of tenants money in terms of benefit to tenant, us and the environment.”

Stock data

In discussing their plans for EESSH2 all interviewees referred to the data they hold on their housing stock. The amount and detail of organisations' databases varied considerably. One participant described the very detailed monitoring data their organisation holds on every property in their stock. This includes monitoring of heating system performance and indoor temperatures, as well as regular tenant feedback. Other participants have much more limited data on their stock. For example, one participant explained that they have new EPCs for 40% of their stock and are using cloned data for the remaining 60%.

Use of innovative technology

Most organisations (29 of 53, 55%) did not know whether innovative technology would play a part in helping their properties meet EESSH2; 15 organisations (15 of 53, 28%) did envisage having properties which would be classed as EE Band A or B due to the use of innovative technologies (see Figure 3).

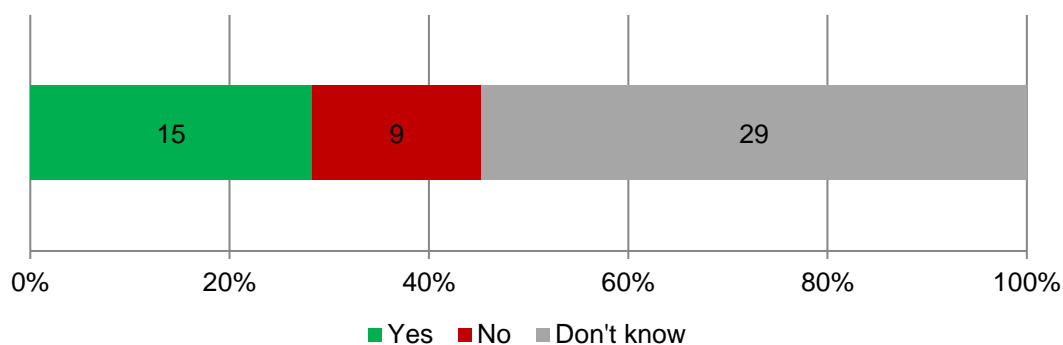


Figure 5: Organisations envisaging having properties which will be treated as meeting EE Band A or B due to use of innovative technology (Base = 53)

Innovative technologies proposed (or currently being used by organisations) include¹⁰:

- Solar PV / thermal panels (8)
- Heat pumps (6)
- Battery storage (3)
- Heat networks (1)
- Sunamp heat batteries (1)
- Smart heating controls / monitoring (1)
- Grid services (1)
- Community energy (1)
- Infrared heating (1)

Organisations also mentioned Passivhaus (1), Energiesprong (1) and a 'Green Pilot' project (1) as innovative approaches to meeting EESSH2. One organisation said that:

"We regard ... confirmation that the property delivers good comfort levels at normal costs as adequate proof of a positive outcome even if the SAP score is potentially below Band B - our evidence is that a SAP score on its own right is not an adequate performance criteria and that properties need to be judged

¹⁰ Note, organisations may be using or proposing to use more than one technology. Number in brackets indicates the number of times the technology was mentioned in survey responses.

more holistically. ... The additional innovation we will provide will include a lot of monitoring, support, education and advice rather than just technology."

Two organisations who did not currently know whether innovative technologies would be used added comments:

"Budget to meet these bands seems unlikely,"

"Trial currently underway."

During the follow-up interviews participants discussed that they will particularly look to use innovative technology in order to decarbonise and move away from mains gas. However, at this stage none of the interviewees with on-gas properties had a firm plan for replacing gas boilers.

"The main thing looking forward to EESSH2 is the whole thing about decarbonisation of the heating systems. Obviously, it seems clear for new developments that gas boilers will not be fitted after a certain date. However, the vast majority of gas boilers are existing gas boilers, and they have a lifespan, so we are in that dilemma of what happens next."

One housing association with off-gas properties are currently trialling solar PV and batteries in a small number of properties. This project is still in the early stages.

One interview participant mentioned that their organisation had been early adopters of exhaust air source heat pumps and a heat network and consequently *"had our fingers burnt"*. For EESSH2 they are now purposefully holding back and intend to only use tried and tested measures for properties.

3. Challenges in preparing to meet EESSH2

Survey respondents were asked to rate aspects of their preparation for EESSH2 in terms of how challenging they were. The results are shown in Figure 6 below.

The most challenging aspects were related to funding measures: 21 of 45 (47%) found 'sourcing funding for measures' and the same proportion also said finding 'capital investment for measures' extremely challenging. Almost 80% of respondents found these two aspects either 'extremely challenging' or 'very challenging', highlighting a barrier for a huge number of organisations.

Producing EPCs for properties was the aspect that organisations found least challenging; 42% (19 of 45) said they found this aspect 'not at all challenging'.

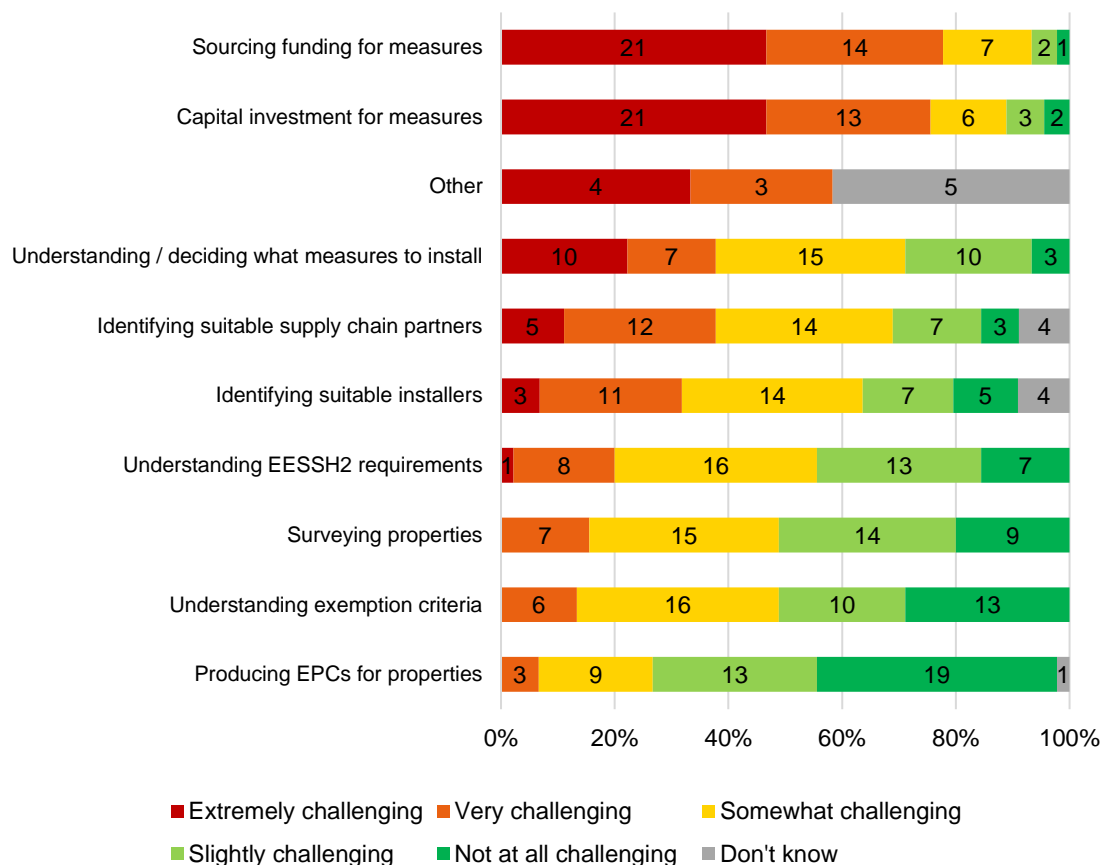


Figure 6: Level of challenge of aspects of EESSH2 preparations (Base = 45, except 'Identifying suitable installers' = 44, and 'other' = 12)

Four organisations added other aspects that they found to be extremely challenging:

- “Upgrading properties within mixed tenured properties to meet EESSH2.”
- “Ensuring measures deliver tangible benefit for tenants and don't just tick the EPC rating box.”

- *“Fully understanding air quality and environmental impact requirements. Also, the age and mix of our stock and ability to bring this up to aspirational targets. consideration for conservation areas and restrictions.”*
- *“Owner Occupiers and Residents refusal, disruptions to residents due to heating and other major upgrades.”*

While three added other aspects they considered to be very challenging:

- *“Making properties EESSH2 compliant but also ensuring net zero carbon is considered and building performance actually attaining at least the EE Bands indicated level, to ensure fuel poverty is actually addressed. Air quality is also a challenging area.”*
- *“Having suitably trained local contractors to maintain and service components.”*
- *“Our concern relates also to the policy framework for EESSH. We would like greater clarity on timescales, better information on exemption criteria, greater acceptance of alternate performance measures rather than just SAP, an understanding of how new technology and time of use tariffs will impact, an understanding that the Highlands & Islands is already green in renewable electricity and this should be embedded in SAP models, inclusion of more devices in the EPC PCDF etc. there are many hurdles to overcome and currently SAP on its own right is an inadequate performance criteria.”*

The organisations were then asked to rate how challenging they had found (or felt they would find in the future) a second set of aspects related to making their properties meet EESSH2 (see Figure 7). Here, upgrading hard-to-treat properties was seen as the most challenging aspect, 42% (18 of 43) felt it was ‘extremely challenging’. Note that the SHCS data analysis in section 9.3 shows that this worry regarding upgrading reaching EESSH2 in hard-to-treat properties is not unfounded.

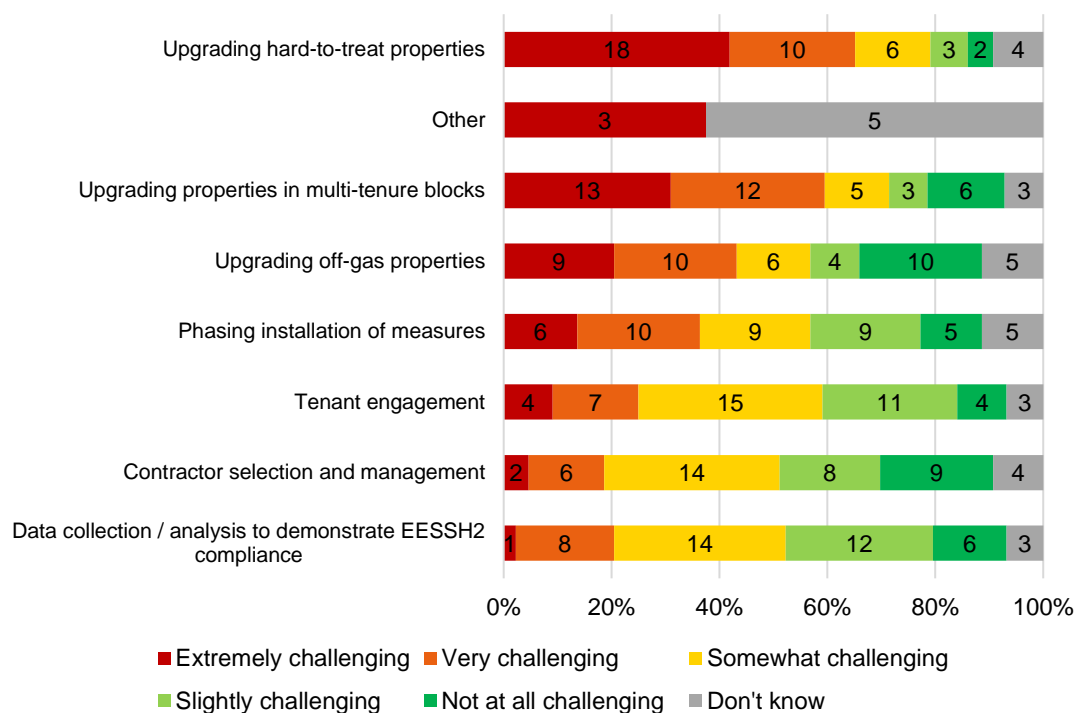


Figure 7: Level of challenge organisations have found (or will find) aspects of making properties meet EESSH2 (Base, from top to bottom = 43, 8, 42, 44, 44, 44, 43, 44)

Three organisations added additional aspects that they also found extremely challenging:

- “In many cases there are no current recommendations that take a property to Band B (this is principally due to the inability to locate solar water heating and solar PV on flats). Most of the recommended measures are challenging to install in terms of tenant disruption and cost and real world value - e.g. upgrading solid floor insulation is significantly disruptive in comparison to its value – solar water heating has little value if a good heat pump is present, the anticipated saving (according to the consultation document) to social housing tenants of £160 on their average annual dual fuel bill is of course just a modelled saving and actually a lot of tenants could achieve that now with supported energy tariff switching so the capital cost of installing and maintaining PV etc. needs to be judged in terms of the best use of tenants’ money...”
- “Consideration given to sampling data and extrapolation of information across stock”.
- “Engagement with and buy in from owners in mixed tenure blocks.”

Funding challenges

Survey participants were asked what their greatest challenge was in relation to EESSH2. Note, the response from many organisations included more than one challenge. Funding upgrades was the greatest challenge identified by the largest

number of organisations (29 of 43, 67%). Specific cost-related challenges (aside from lack of finance) include high costs of measures for certain properties types and supporting owners in mixed-tenure blocks to fund upgrades:

- *“As an urban landlord with 95% gas heated properties we will struggle to secure any funding in terms of ECO or utility measures, in addition we have high number of mixed tenure flatted properties, where owner occupiers are not interested in funding energy improvements from their own reserves.”*
- *“Funding to bring over 90% of stock to level B by 2032 due to construction styles will be challenging. I think the banding should be construction style related as getting some property styles to a B will be extremely challenging.”*
- *“Defined budgets [within the organisation].”*
- *“Both meeting the cost of upgrading our own stock and assisting owners in securing funding for their homes in mixed tenure blocks.”*
- *“It will only rise towards the deadline. Balancing the business as usual with the additional cost of meeting EESSH2 where the general feeling from Board is that this doesn't feel like a priority within our budgets.”*
- *“It will just not be economically viable to upgrade some properties.”*
- *“Low-income area meaning owners are unlikely to agree to improvement works.”*

Affordability of the measures was highlighted by two organisations who specifically noted that they did not want to burden their tenants, *“not transferring fuel poverty to rent poverty”*.

The follow-up interviews provided an opportunity to explore the challenges relating to funding in more detail. Many interview participants had successfully accessed grant funding for previous projects, mostly from Scottish Government. However, participants described this as a challenging process. One participant explained that the misalignment between EESSH2 standards and decarbonisation goals means that accessing decarbonisation grants will not help with work to bring their stock to meet EESSH2 standards.

Participants described the challenges in preparing funding applications for Scottish Government grants:

“They expect bids to be for site ready projects. They require so much information like which contractors have you got lined up? But for us the project going ahead is contingent on winning the funding, so we can't have all that detail ready at the time of writing the funding application.”

“It's quite confusing the amount of different pots of funding out there and timescales. Sometimes we have to compete against other housing associations for that money. Should we be competing? Scottish Government could work with the sector and divvy funding out based on who has the most need or who has more fuel poverty in the area. Rather than us fighting and competing.”

In addition, two participants mentioned Clean Heat Grants and were unsure whether these will apply to social housing.

The different lifecycles of technologies were also cited as a challenge in terms of funding. Moving from 25-year replacement cycles for storage heaters to 10-year replacement cycles for heat pumps requires a completely different business model.

One participant explained that although they have access to private borrowing, they are unable to borrow for the level of spending which they are anticipating to meet EESSH2.

Interviewees were asked to give an indication of the level of spend per property that they are anticipating for different property types. The figures given by participants were:

- £30-40,000 for sandstone tenement flats. This estimate is based on projects by John Gilbert Architects. The interviewee added that the value of these flats is usually in the region of £50-60,000.
- £10,000 for installing solar PV and batteries in off-gas new build properties.
- £10,000 per property to replace storage heaters with heat pumps, with an anticipated £5,000 back through RHI.
- £3,000 for flatted properties in an off-gas area. This is because there are very limited options for the measures which can be installed in these properties.
- £8-14,000 to upgrade non-traditional steel frame properties. However, this participant noted that they could only make a business case for costs up to £8,000.
- An average cost per property across the organisation's whole stock of £6,250.

Note that the latter estimate is a bit lower than the modelled costs per property to work towards meeting EESSH2 (£7,661) from the data analysis in section 10, though in the same order of magnitude.

Hard-to-treat properties

The second most common challenge raised by survey respondents was upgrading specific property types (11 of 43 organisations raised this issue, 26%). Noted property types include Victorian or sandstone tenements, pre-1919 or older properties, off-gas properties, mixed-tenure properties and those with restrictions on upgrades (listed, conservation areas, World Heritage sites). These concerns are not unfounded, as the data analysis in section 9.3 indicates that a large number of properties will not be able to meet the EESSH2 standards with all 'off the shelf' energy efficiency and low carbon heating solutions added to them.

In the follow up interviews, participants were asked to give details of the challenges around hard-to-treat properties. Sandstone tenement properties were the most commonly mentioned property type, and even organisations with no tenement stock

commented on the challenges that these buildings present for other housing associations.

“It would be good that for properties like ours if the Government had a plan. We will come up with our plan, but it might look like we are dodging out of doing things because of the nature of our buildings. It would be better if the Government, SFHA and us sat down and said “look we know these buildings have these characteristics and we expect and hope you will do x,y,z”. That would be very useful to do this sort of thing together. Rather than us perpetually having to say we have failed on this or failed on that”.

Insulation measures were seen as a huge challenge for tenement properties, and other types of hard-to-treat properties:

“Insulation is the biggest issue. We want to do fabric first, but it’s hard. Internal wall insulation is so disruptive to tenants. And there are legal issues as to what we can and can’t do.”

“Pre19-19 tenements are a real challenge, or interwar tenements are actually in some ways worse because the construction is not as robust. Our steel estate homes have already been overclad to meet EESSH1 and so there’s a limit to what we can do to those.”

“There isn’t a fabric first recommendation for early timber frame housing. Properties from the 70s and 80s are very draughty. There’s no easy fix.”

Mixed-tenure properties were also highlighted as a key challenge. For tenement buildings this compounds the challenges of high-cost measures, but the issue was raised by several participants across a variety of flatted property types.

“It’s not just the technical challenge, the majority of tenement buildings have owners in them. In an ideal world we want to take the owners with us, but most owners probably don’t have the finances to bring a property up to EESSH2. Some things can’t be done without owners’ consent so that will limit what we can do.”

Another interviewee commented that mixed tenure buildings limit the remodelling and disposal options for properties.

Technology challenges

Identifying or choosing (cost-effective) technologies to install was the third most common ‘greatest challenge’ for organisations who responded to the survey. This was due to properties being in an off-gas location, or older. Nine organisations (9 of 43, 21%) said this was a great challenge, including two organisations who specifically noted that identifying suitable non-gas alternatives to heating was their greatest challenge.

Interview participants with on-gas properties expressed a lot of uncertainty around whether to replace gas boilers with electric heating or to retain gas heating infrastructure and wait for the roll-out of hydrogen through the gas network.

“There are people thinking we will wait for 15 years and hopefully hydrogen comes along. It’s an area that could lag change, it could make people stop doing stuff. The government should make it clearer; they are pushing for heat pumps but keep mentioning hydrogen. It should be clearer for EESSH2 that hydrogen is not going to play a big part in social housing. Scottish Government should tell housing associations to ignore hydrogen and get on with doing something positive rather than waiting around hoping. Some landlords are thinking I’m not going to do anything.”

One participant expressed concerns about electricity grid constraints and stated that they need assurances that grid constraints will be addressed before they consider installing electric heating on a large scale.

Other challenges

Tenant upheaval or disruption was the greatest challenge raised by three organisations in the survey (3 of 43, 7%), and lack of support from residents for new technologies (including in mixed-tenure properties) was highlighted in another three responses.

Interviewees discussed that buy-in from tenants will be difficult due to the disruption to their homes. One participant explained that whilst the measures they installed for EESSH were quite light touch, for EESSH2 measures will be more intrusive and may require tenants to be decanted. In addition, they anticipated that tenant buy-in may be low as the immediate benefits from upgrades to decarbonise are less tangible than those installed to help reduce tenant bills:

“We need to work with tenants to explain the decarbonisation agenda and get them on board, because EESSH2 isn’t really about affordable warmth.”

A lack of skilled or trusted contractors was the greatest challenge indicated by two organisations in the survey (2 of 43, 5%), including one who added:

“We have some negative experiences of heat pumps not being installed correctly which has been frustrating for tenants and the Association.”

Two organisations (2 of 43, 5%) said their greatest challenge was understanding what is required from EESSH2. This concern was raised by interviewees who expressed the point that EESSH2 had always been framed as an aspirational rather than mandatory target, but that they anticipate this might change based on the recently published draft Heat in Buildings Strategy. One participant stated:

“It’s hard to understand the priority as EESSH2 and decarbonisation are not aligned. It needs to be tidied up and Scottish Government need to confirm whether its mandatory or aspirational.”

Eleven other 'greatest challenges' were identified in the survey (by one organisation each):

- Limitations of SAP scoring: *"our current preference is to validate real world performance and costs to better inform decision making and not rely solely on the EPC model of efficiencies and costing."*
- Technical knowledge (including knowledge of new technologies).
- Timescales.
- Need for additional staff.
- Diversity of housing stock.
- Location of housing stock.
- How to order / phase works to minimise disruption and cost.
- Meeting the targets for 2032 with properties which have already had their energy performance maximised (to meet EESSH).
- How to measure air quality.
- Volume of stock requiring major work.
- Lack of enforcement: *"Simply put, as EESSH2 is not a mandatory requirement then I believe that we will view the requirement with one eye on the exemptions when funding is required against the need for other business development or pressures. I do not think we will be alone in this."*

Impact of COVID-19

Clearly in 2020, COVID-19 has had a huge impact on all areas of life and work. The survey asked organisations how the pandemic had impacted on their EESSH and EESSH2 preparations and progress. Most responses related to EESSH programmes, with several organisations stating that EESSH2 preparations are not developed enough to have been impacted by the pandemic yet.

The most common impact reported by organisations was a delay to timescales; 17 of 43 respondents (40%) indicated this, with many adding that the delays were impacting on future plans. Delays were due to many factors including being unable to access properties (5 organisations noted this as a general problem), with specific issues around access including:

- Inability to access properties to install measures (7)
- Inability to access properties to survey for measures (pre- or post-install) (7)
- Inability to access properties to produce EPCs (to identify suitable measures or to show compliance) (2).

The impact of these delays has meant that for two organisations, some properties which should have been compliant now require temporary exemptions for EESSH.

Other impacts were internal issues:

- Financial pressures of COVID – review of expenditure within organisation (2)
- Dealing with staff / tenant wellbeing has been a higher priority (2)

- Staff diverted to managing other projects / customer contact (1)
- Staff working from home has reduced capacity / efficiency (1)
- Impact on all areas of the business (1).

While others were external factors:

- Supply chain issues (heat pumps / other materials) (1)
- Auto assessor tool delay – inability to identify properties for potential upgrades (1)
- Contractor furlough (1)
- Reduced household income is impacting ability to do works (1).

Six organisations (of 43, 14%) said that the impact of COVID-19 had not been too bad or too disruptive so far, and two organisations (5%) said that it had not impacted on EESSH / EESSH2 at all.

3.1 Support required for EESSH2

Almost three-quarters of survey respondents (32 of 44, 73%) felt they would need external support to achieve EESSH2 compliance (see Figure 6). Only two organisations (2 of 44, 5%) said they would not, while ten (10 of 44, 23%) were unsure.

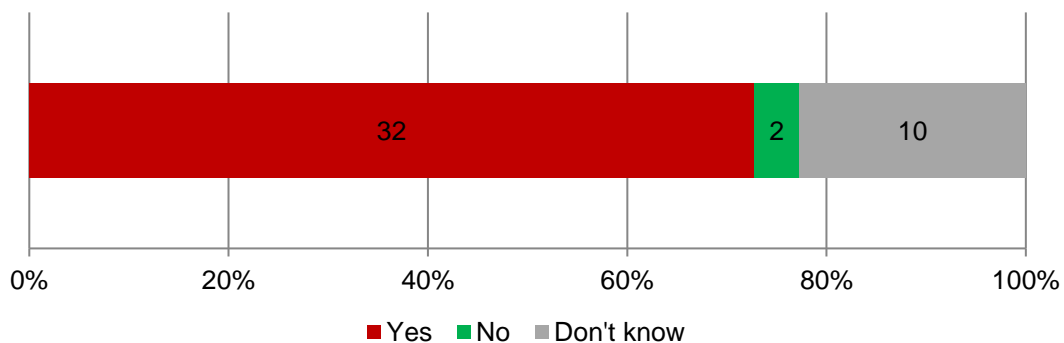


Figure 8: Need for external support to meet EESSH2 (Base = 44)

When asked what type of support would help organisations meet EESSH2, by far the most common response was 'funding application support' which was selected by 87% of organisations (27 of 31). As shown in Figure 7, 12 organisations each said that surveying / data gathering, and RdSAP modelling would help them to meet EESSH2.

Contractor selection / management support and project management of capital programmes were the support types least selected by organisations (6 of 31 each, 19%).

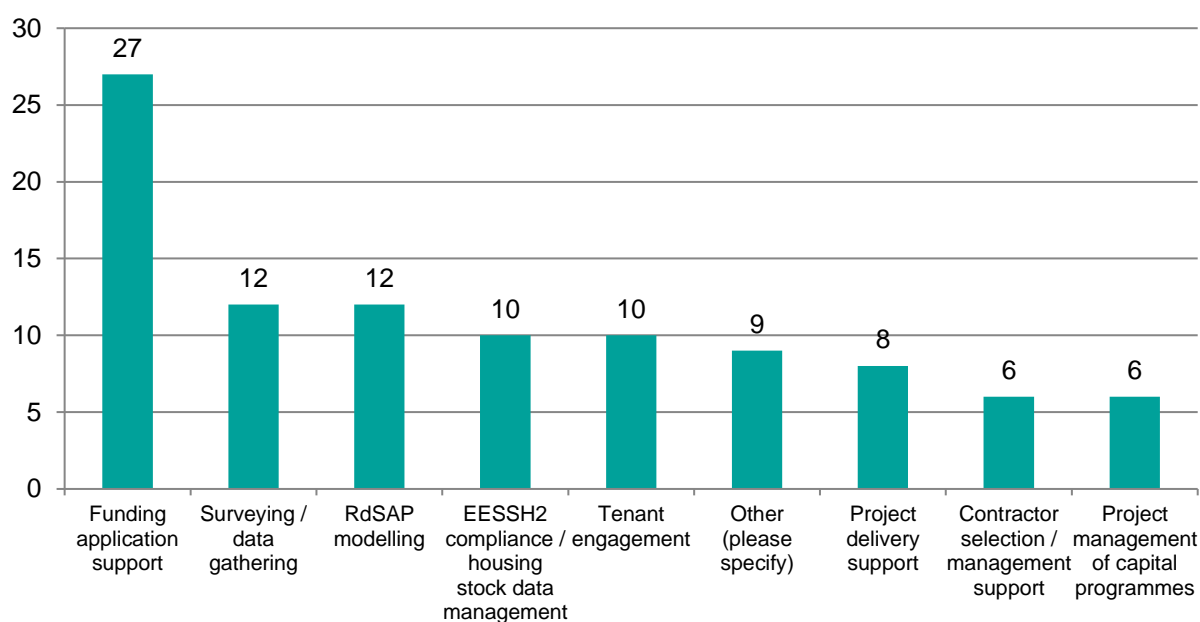


Figure 9: Types of external support required (Base = 31)

Nine organisations added other types of support they would utilise; four said ‘funding’ (4 of 31, 13%). Two support requests (2 of 31, 6%) were related to RdSAP (but not specifically modelling support):

- Relaxation of rigid SAP/EPC score compliance; move to a more holistic property and tenant sensitive framework.
- Use of a RdSAP SFHA engine that all members could utilise; and a push for RdSAP to account for new technologies.

Other requested support types were:

- Support deciding on the correct strategy for upgrades.
- Support with post completion monitoring and evaluation to ensure the systems are working to maximum efficiency and are cost effective for tenants.
- Engagement and support for owners.

One organisation added a comment to say that the areas they need support with (funding applications, project delivery and project management of capital programmes) are due to having limited staff members within the organisation.

During the interviews participants also mentioned that support with monitoring and evaluation (both technical monitoring and tenant experience) would allow them to determine which measures work well and provide good outcomes. In addition, knowledge sharing between housing associations was suggested to share issues, problems, learnings and good practice.

“The SFHA is doing very well for encouraging dialogue and publicising new initiatives and encouraging us to network with other housing associations. There’s always more

that could be done, the people doing the exciting work and new developments are usually so busy they don't have the time to tell others."

Several participants stated they require support to provide education for housing association staff, residents and tenants. This included support and learning resources on how to operate new heating systems.

Although not mentioned in the survey, several interview participants noted that they require guidance and support around heat networks. Participants recognised that heat networks will provide heating solutions for property types such as tenements. One interviewee expressed a concern that becoming a heat supplier was the organisation's biggest fear because the risks are so huge.

Financial support

Interview participants gave more detail on the types of financial support that they require. Responses were particularly focussed on grant funding from Scottish Government. A key theme which emerged was ensuring that the funding available from Scottish Government is aligned with the end goal of decarbonisation and doesn't encourage the installation of measures which will later need to be replaced.

"Be clear about the end goal. We got lots of government funding for gas connections and free gas meter installations because we are in an area of high deprivation. But now we need to look at going back to electricity."

"We received millions from the government to fund the biomass boiler district heating scheme as renewable heating. But now clearly it isn't renewable [...] it will have to be replaced."

Additionally, participants noted that the funding landscape is complex and that it is difficult to know which Scottish Government funds are appropriate for them to apply for:

"It's difficult just keeping up to date with all the funds that are coming out and the different criteria."

"There's been a lot of name changes which has made it very complex."

One participant suggested that funding for 10-20% of project costs would help with the business cases when projects are presented to the organisation's board. They also suggested that for hard-to-treat properties requiring multiple measures it would be useful to tap into funding for one type of measure to relieve some of the burden from the housing association.

Another participant suggested that housing associations could be allocated funds according to need:

"It would be a whole lot easier if everyone was just allotted an amount rather than all going up against each other."

For tenement properties, grant funding for full building refurbishments was suggested as an ideal solution. This would enable measures to be installed on a block-by-block basis in mixed-tenure buildings. The tenement repair grants in the 1970s and 80s were cited as an example. Although the interviewee added that the cement repair works carried out under these programmes have led to hugely challenging and expensive stonework repair needs.

4. EESSH compliance

Organisations were asked whether their properties were fully compliant with EESSH or would be by the deadline of 31 December 2020. As can be seen in Figure 10, only a small proportion of organisations were fully compliant (5 of 32, 16%). The majority (26 of 32, 81%) were not fully compliant, nor did they expect to be so by the deadline. One organisation was unsure.

Of those organisations who were not fully compliant, 23 (of 26, 89%) had properties which were subject to temporary exemption. Three organisations who were fully compliant also had properties subject to temporary exemption.

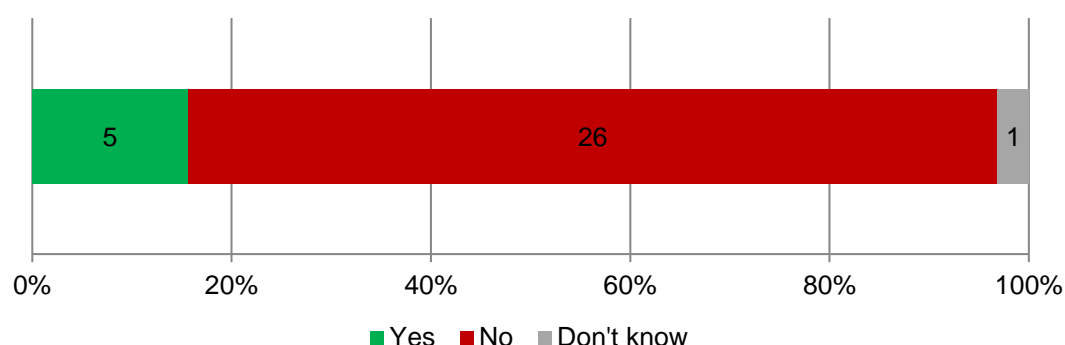


Figure 10: Levels of compliance with EESSH (as of 31 December 2020) (Base = 32)

The survey asked whether there were specific property types that were challenging to make EESSH compliant; 19 organisations (68%) agreed there were, nine (32%) said there were not. Specific property types which were mentioned were¹¹:

- Pre-1919 / sandstone tenements (especially ground floor) (7)
- Electric heated (or solid fuel) / off-gas properties (5)
- System-built, or non-traditional properties (especially older properties) (5)
- Ground or top floor (tenement) flats, especially with gable walls, or situated at a corner (4)
- Properties in mixed-tenure blocks (3)
- Stone-built properties (2)
- Detached / semi-detached / end-terraced properties (especially if non-traditional construction) (2)
- Flats in listed buildings (2)
- Properties with 1.5 stories
- Gable end flats
- Flats with close walls
- Listed buildings

¹¹ Note, organisations may have noted more than one property type.

- Older flat roofed properties.

In the interviews one participant explained their approach for non-traditional properties which were not EESSH compliant by the deadline:

“For hard-to-treat properties we are looking at internal wall insulation and ASHP, or solar PV and some form of insulation. These properties won’t meet EESSH 1 for the December deadline, but they are long term projects we are working on and this will bring them up to EESSH2.”

5. Wider impacts of EESSH / EESSH2 upgrades

5.1 Indoor air quality

The air quality impact of EESSH2 upgrade measures will be included as part of a review of the standard in 2023. Organisations were asked whether they had yet considered the air quality implications of measures to meet EESSH or EESSH2. As shown in Figure 11, over half (24 of 43, 56%) had not considered the implications. Around a third (14 of 43, 33%) had considered air quality.

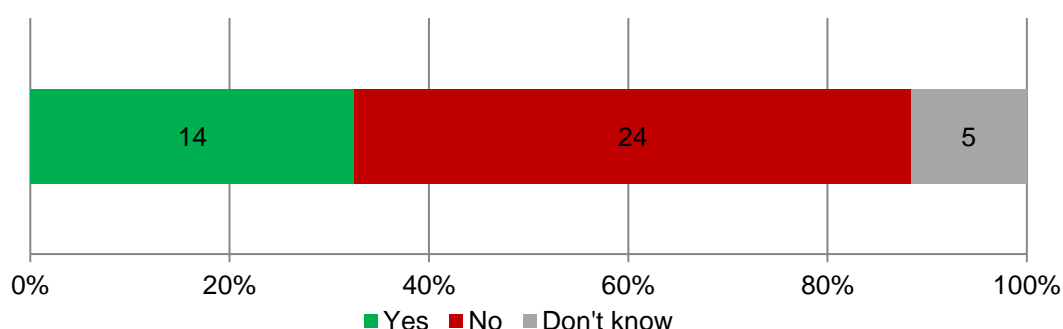


Figure 11: Consideration of indoor air quality impacts of upgrades (Base = 43)

Some organisations had taken specific steps, such as:

- “Engagement with customers to explain how to keep the home well vented”.
- “We do regular temperature and humidity monitoring of homes to identify outcomes and help us identify and tackle any failures. We advise our tenants on humidity management and the importance of ventilation”.
- “We are looking to improve and upgrade existing ventilation extract system as part of works”.
- “We have taken air quality tests pre and post works”.
- “The [organisation] is of the opinion that in order to truly make its properties energy efficient you cannot rely on drafts or leaky buildings to provide the air changes required but instead you must control them and recover any heat/energy whilst doing so. [The organisation] is concerned that the current method for assessment (RdSAP) unfairly penalises the installation of ventilation systems which are essential for maintaining good air quality... There is an existing ‘retrofit standard’ PAS 2035 which details best practice guidance and provides a specification for the energy retrofit of domestic buildings which could be used to ensure proper consideration of air quality in the design process.”

Three organisations (one which had considered air quality and two which had not yet) said that further clarification of the air quality requirements was needed.

Air quality was also mentioned by several interviewees as a particular concern when considering measures for properties:

“We regard ventilation as just as important as heating levels [...] Our data shows us that humidity is huge a problem, modern housing holds too much moisture.”

Participants also reiterated the importance of clear guidance from Scottish Government around how air quality will be measured and defining the goals for compliance. The importance of ventilation was highlighted by interviewees who frequently see mould and condensation problems in properties that have received insulation measures:

“We need an improved national understanding of ventilation. For years people have been led to believe that in Scotland you need to have your home very well insulated, have everything sealed and keep the cold out. But we’ve maybe gone a bit too far and are forgetting about the importance of fresh air and ventilation. We need an education campaign.”

5.2 Environmental impact

The wider environmental impact of measures will also be part of the 2023 EESSH2 review. A greater proportion of organisations (19 of 43, 44%) were considering the environmental impact than had considered indoor air quality implications (14 of 43, 33%) (see section 5.1). However, just over a third of organisations (15 of 43, 35%) were unsure about whether they had considered the wider environmental impacts of EESSH2 measures, as shown in Figure 12. Considerations that were made by organisations include:

- Reducing the carbon emissions associated with use of heating systems (e.g., phasing out electric to gas installs)
- Use of renewable technologies
- Material specification (embodied carbon, whole life cycle, sustainability)
- Provision of energy advice
- Offsetting (tree planting)
- Use of contractors with suitable environmental policies.

Two organisations felt that the lower carbon intensity of Highland and Island grid electricity should be taken into consideration by RdSAP modelling and EESSH2 as part of the environmental impact review.

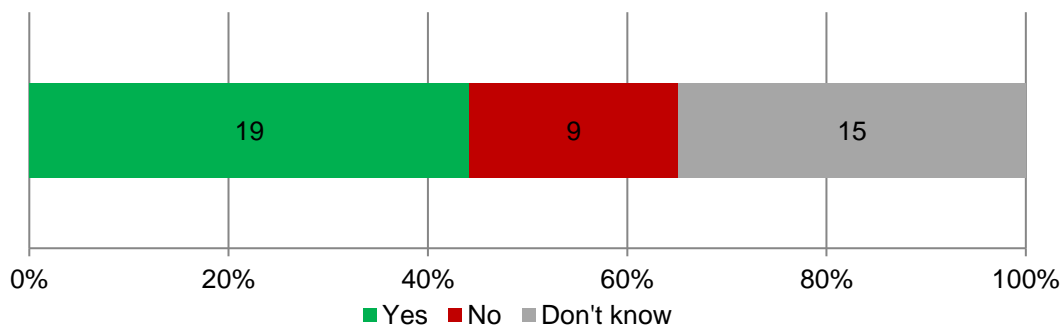


Figure 12: Consideration of the wider environmental impacts of EESSH2 interventions (Base = 43)

During the follow-up interviews participants discussed the Scottish Government's 2045 net zero target and were asked whether their organisations have similar targets. No organisations had a date, plan or target for becoming carbon neutral. However, interviewees described the activity that their organisation is doing to reduce overall carbon emissions:

"It's on our agenda but we don't have a fixed policy. As part of our day-to-day activity, we consider the carbon footprint. For example, for the current window replacement contract we are doing a piece of analysis on the overall carbon footprint of timber vs PVC window frames."

Others mentioned that existing strategies will be updated in order to align with net zero ambitions:

"We had a carbon management plan created 9-10 years ago. I need to update this to be in line with net zero."

"There's no strategy or target for becoming carbon neutral. We currently have an Affordable Warmth strategy, and this will morph into a decarbonisation or net zero strategy over time."

Several participants mentioned that they will need to consider carbon offsetting due to the use of gas heating in their stock:

"If we were to be truly carbon neutral, then we would need to replace all gas boilers. But that's not practical at the moment. 2500 of our homes have gas boilers. It's not achievable, so we would need to look at offsetting instead of removing."

5.3 Maintenance concerns

More than half of respondents (25 of 43, 58%) said they had concerns about maintenance of measures installed under EESSH or EESSH2 (see Figure 13). A third (14 of 43, 33%) did not have maintenance concerns, while four organisations (4 of 43, 9%) were unsure. The key concerns raised were:

- A lack of appropriately qualified, skilled and local contractors or staff to carry out maintenance (e.g., ASHPs) (11)
- Cost of maintenance (especially electric heating / heat pumps) and the impact this may have on rent (9)
- Shorter lifespan of newer technology (components) (3)
- Increased maintenance requirements of newer technologies (e.g., ASHPs) compared to gas – this may make them less favourable to tenants (3)
- Availability of parts for maintenance (2).

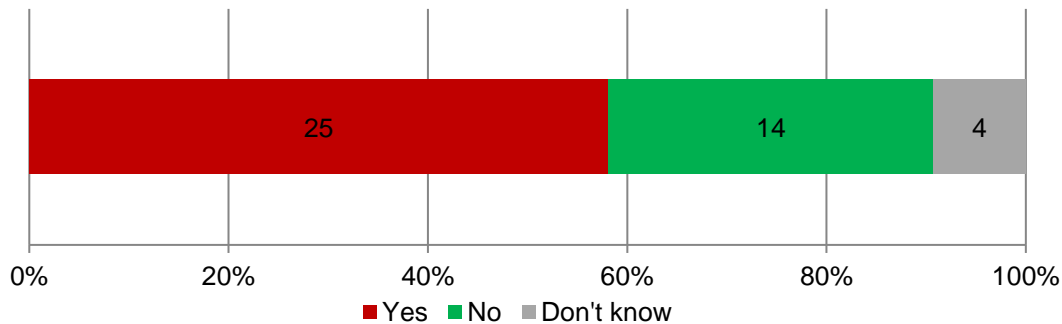


Figure 13: Concern about carrying out maintenance of measures installed under EESSH or EESSH2 (Base = 43)

Many of the organisations who raised concerns, identified more than one issue. This quote from one organisation included many common concerns:

“The cost of maintaining new technology is significantly higher than more common systems. For example, Heat Pumps, particularly ASHP require significantly more maintenance than high heat retention storage heaters. Not only do they require annual servicing which storage heaters do not, the various components do not last as long. The overall life expectancy of the units is also less than half that of a storage heating system while costing nearly double to install.”

5.4 Safety concerns

The vast majority of organisations (35 of 42, 83%) did not have any safety concerns about the measures being installed under EESSH or EESSH2 (see Figure 14). Three organisations were unsure (3 of 42, 7%), while four (4 of 42, 10%) did have some safety concerns. Three of these organisations stated that their concerns were related to increasing airtightness and the impact this may have on tenant health; only two of these three said they had considered the air quality impact of their interventions (see section 5.1).

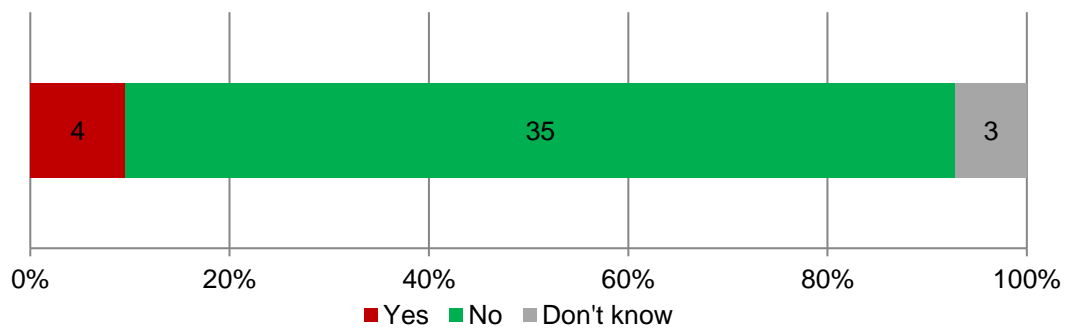


Figure 14: Safety concern about measures installed under EESSH or EESSH2 (Base = 42)

6. Summary of qualitative research

Both the survey and interviews showed that housing associations have low levels of properties meeting EESSH2. The majority of interviewees explained that their organisations had not yet installed any measures to work towards meeting EESSH2 and are still at the preparation stage. The majority of housing association surveyed and interviewed do not have plans in place for meeting EESSH2. Housing associations with newer housing stock tended to be more prepared.

Most housing associations do not envision having to dispose of properties that do not meet EPC D by 2025.

The most pressing concerns that housing associations are facing are funding and upgrading hard-to-treat properties. The funding landscape was described as confusing and participants described grant application processes as having very short timescales whilst requiring a high level of detail.

Interview participants expressed a concern that the use of EPC ratings for EESSH2 does not align with the goal of decarbonisation. Some also shared frustrations around the competing priorities of higher SAP scores and providing affordable warmth for tenants.

Nearly 40% of survey respondents reported that 'understanding what measures to install' is challenging. Understanding what is required from EESSH2 was also highlighted as a challenge. Interview participants said that they are waiting for more certainty from the Scottish Government before starting to install measures. Most participants did not know whether innovative technology would play a role in helping their properties meet the standards. Additionally, none of the interviewees with on-gas properties had a firm plan for replacing gas boilers, and were very unsure of the role that hydrogen might play.

Almost three-quarters of survey respondents said they would need external support to meet EESSH2. The main forms of support mentioned were funding application support, surveying, monitoring and evaluation and knowledge sharing between housing associations.

The air quality and environmental impact of EESSH2 upgrade measures will be included as part of a review of the standard in 2023. Most housing associations agreed that air quality should be given consideration, however, most have not yet factored air quality impacts into their plans. No housing associations have a plan or target for becoming carbon neutral.

Section 2: EESSH2 modelling

7. RdSAP and EESSH

Background

RdSAP is the calculation methodology behind Energy Performance Certificates (EPCs). EPCs were introduced in Scotland in 2008 as a method to assess the energy performance of existing domestic dwellings. When first introduced, EPCs were a legal requirement for properties to have conducted at point of sale or rental. EPCs are valid for ten years.

RdSAP is a simplified calculation methodology of the Standard Assessment Procedure (SAP) which in turn was first developed in 1992.

The SAP and RdSAP calculations are based on the energy use per unit floor area, using a daily standard heating regime of 21°C in the main living area and 18°C in the rest of the dwelling for 9 hours during the week and for 16 hours at days in the weekend ¹². The standard heating regime means EPCs and RdSAP scores do not account for actual fuel use and behaviour in the dwelling. Occupants could be underheating or overheating a property. Likewise, the property could be under or over-occupied as the calculation makes assumptions on occupancy based on the floor area of each dwelling. Overall, although differences in heating regimes and heat use will influence (modelled) energy use they do not affect the (modelled) energy efficiency.

Two ratings are provided for the dwelling, the Energy Efficiency rating (EE) and the Environmental Impact rating (EI). The EE rating is based on the energy costs per m² whereas the EI rating is based on the CO₂ emissions per m². Consequently, estimations of fuel costs and CO₂ emissions are calculated and provided on the EPC. These calculations are mostly based on the energy use for space heating and domestic hot water. The calculations do not account for appliance use other than fixed lighting and ventilation.

Like energy appliances, the certification has an Energy Efficiency banding A to G, where A is very energy efficient. Each of the bands are linked to the EE rating, these are detailed below.

¹² A longer “enhanced” heating regime for households that would require higher temperatures for longer hours, as used in the fuel poverty calculations of vulnerable households, is not used in the SAP model and has not been used in the calculations this report because no data was available regarding the vulnerability of the households. However, the fuel poverty gap data from the SHCS does take enhanced heating regimes into account, so savings applied in the fuel poverty analysis of Section 13 are a conservative estimate because the calculated savings are based on the standard regime in the absence of vulnerability data.

Table 1: EE bandings and EE ratings

EE band	EE rating
A	92+
B	81 - 91
C	69 - 80
D	55 - 68
E	39 - 54
F	21 - 38
G	1 - 20

Since their introduction in 2008, EPCs have evolved to be used in a number of key energy and energy related policies including the Green Deal, Energy Company Obligation, Feed-in-Tariff and Renewable Heat Initiative. RdSAP remains the methodology for EPCs for existing dwellings, whilst SAP is used for new build domestic dwellings as a design and certification tool.

Social housing

In 2014, the Scottish Government introduced the Energy Efficiency Standard for Social Housing (ESSH) and set a first milestone for social landlords to meet for social rented homes by 31 December 2020. This required properties to reach a specific EE rating depending on the type of property¹³ and main heating fuel, varying from 47 for an oil heated property to 69 for mains gas heated flats and houses.

A second milestone was confirmed in June 2019: by December 2032, social rented housing should aim to meet an Energy Efficiency (EE) band of B, with a minimum EE rating of 81. Whilst newly built housing can reach EE band B through the building design with a full SAP calculation, it can be a challenge for existing housing to reach EE band B because of the limitations of RdSAP.

Environmental impact

There is no current legislation on standards for the Environment Impact (EI) ratings issued on an EPC. As such, the EI rating has not been included in this analysis.

Whilst the Scottish Government has set ambitious targets to reduce Scotland's emissions of all greenhouse gases to net-zero by 2045, it should be stated that an EE band B relates to energy efficiency and fuel costs and not to carbon reduction targets. Although there are CO₂ savings in achieving higher energy ratings, the main

¹³ For mains gas and electrically heated properties there are four property types: detached houses, houses (other than detached), four-in-a-block flats (with no common stair) and flats (with common stair). For all other fuel types, there is a generic compliance rate irrespective of property type.

point of reference for higher EE ratings is on reducing energy costs and increasing energy efficiency.

8. Methodology EESSH2 analysis

8.1 Data collation

Changeworks received data from the Scottish Government's Scottish Household Condition Survey (SHCS)¹⁴ from 2017, 2018 and 2019, which included RdSAP data for a representative sample of the Scottish housing association stock. The data covered 853 properties, which when weighted and adjusted would represent the entire Scottish housing association stock (an estimated 282,000 properties¹⁵). This dataset is the basis of estimating the portion of the Scottish housing association stock currently meeting the EESSH2 goal of EE band B, and identifying measures required to work towards meeting EESSH2.

8.2 Archetypes

The housing stock was categorised into eleven main archetype groups, based on built form (bungalow, house, flat or four-in-a-block) and location in the block (for houses – detached, semi-detached/ end-terrace and for flats – ground, mid and top floor). Sub-archetypes were created based on wall construction, age and fuel type. Each archetype consisted of typical dimensional data and fabric properties.

This categorisation prompts different upgrade options per archetype, as well as different EE rating increments for improvements (e.g., wall insulation will have a higher impact on energy efficiency for detached properties that have more exposed external walls than terraced houses). Furthermore, creating sub-archetypes based on wall types and property age impacts on the EE rating increments (e.g., external wall insulation will have a greater impact on a pre-1965 system built property than a system built property built after this period because of the assumed wall u-values inherent in the RdSAP software). The main heating fuel can also impact on the EE rating increments (e.g., for some measures electrically heated properties have a higher increment increase than mains gas properties).

Modelling was carried out on each of these archetypes using SAP software¹⁶ modified to make RdSAP calculations. Increments for each applicable measure were modelled per sub-archetype. It should be noted that whilst these increments are for typical properties within each archetype, there may be instances where increments are over-estimated (e.g., a property with a lower exposed wall to floor area ratio may have a lower increase in EE rating for wall measures or Solar PV may have a lesser effect on a property with a larger floor area than typical). Likewise, there may be instances where the increments are under-estimated (e.g., a property with a larger exposed wall to floor area ratio may have a higher increase in EE rating for wall

¹⁴ [*Scottish Household Condition Survey \(Scottish Government\)*](#)

¹⁵ [*Housing statistics: Stock by tenure \(Scottish Government\)*](#)

¹⁶ [*Elmhurst Design SAP*](#)

measures or Solar PV may have more effect on a property with a smaller floor area than typical).

Estimated annual savings (both CO₂ and running costs) were derived from the modelling.

8.3 Measures modelled for meeting EESSH2

Using the SHCS dataset, the addition of measures was modelled using a hierarchy of fabric improvements and lighting first, followed by heating upgrades, and finally a solar measure (thermal or PV). Each measure was modelled if applicable until EE band B was reached or until measures were exhausted. The hierarchy of measures modelled is detailed below:

Fabric upgrades (including lighting) were:

- Low energy lighting
 - Properties with under two-thirds low energy lighting.¹⁷
- Loft insulation
 - Virgin loft insulation for properties with less than 100mm loft insulation and top-up for properties with 100mm to 150mm loft insulation.
- Flat roof insulation
 - Properties with less than the equivalent of 200mm quilted flat roof insulation.
- Cavity wall insulation with no external wall insulation
 - Cavity wall properties recorded as uninsulated and built prior to 1984.¹⁸
- Cavity wall insulation with additional external wall insulation
 - Modelled for properties that do not meet EE band B with the cavity wall insulation measure.
- External wall insulation
 - System built (non-traditional) properties recorded as uninsulated and built prior to 1984.
- Internal wall insulation
 - Solid stone or brick properties recorded as uninsulated and built prior to 1984 (this only includes two properties).
- Internal heat loss wall insulation
 - An additional insulation measure for flats that do not meet EE band B with insulation measures.
- High efficiency glazing

¹⁷ There is little effect on the EE rating if lighting is upgraded for properties that already have more than two-thirds low energy lighting.

¹⁸ It is assumed that properties built 1984 onwards have insulation included in the wall construction.

- Single glazed properties and double glazing recorded as being installed prior to 2003.
- Floor insulation
 - Houses, bungalows and ground floor flats built prior to 1991 (either suspended, timber or exposed floor (above unheated space)).¹⁹

Heating upgrades:

- Hot water tank insulation
- Heating controls upgrade
- Mains gas boiler upgrade to condensing boiler
- Air source heat pump
 - Off-gas houses, bungalows and four-in-a-blocks requiring a heating upgrade.^{20 21}
- Electric heating upgrade to high heat retention heaters (e.g. “Quantum”)
 - Flats heated by traditional electric storage heaters, electric boiler systems and electric room heaters.
- LPG boiler upgrade to condensing boiler
 - Flats heated by non-condensing LPG boilers.

Solar:

- Solar thermal
 - Houses or bungalows recorded as being suitable for solar measures and having an existing hot water cylinder.
- Solar PV
 - Houses or bungalows recorded as being suitable for solar measures.

¹⁹ RdSAP software assumes that properties built from 1991 onwards have floor insulation.

²⁰ Flats have not been included and as such a like-for-like heating upgrade has been modelled for off-gas flats (e.g. electrically heated properties upgraded to high heat retention heaters and non-condensing LPG boilers upgraded to condensing).

²¹ Ground source heat pumps and district heating networks have not been modelled as there was insufficient data on whether each archetype would be suitable for the technology.

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9. Meeting EESSH2 across the housing stock

The average baseline EE rating for the Scottish housing association properties is 71, which is equivalent to a 'low' C band. This is higher than the average of 65 across all Scottish housing stock²². As for the spread of the EE rating throughout the housing association stock (Figure 15), the majority of properties are an EE band C (61%). Just under one-third (32%) are a D or lower. Very few properties are a band G (the lowest band). No properties from the sample are currently in band A (the highest band)²³.

The current EE banding across the housing stock is shown below.

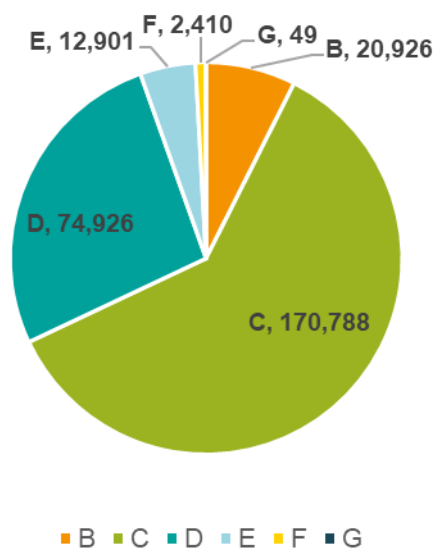


Figure 15: Baseline EE banding across housing association stock

9.1 Measures required for meeting EESSH2 across entire stock

Measures were modelled using a hierarchy of fabric improvements first, followed by heating upgrades, and finally solar measures. Each measure was modelled if applicable until EE band B was met, or until measures were exhausted.

Breaking down all the measures required to work towards or meet EESSH2, we estimate that for properties not reaching EE band B, the following would be required

²² Scottish Government (2020) **Scottish House Condition Survey: 2018 key findings**. Although the 2019 key findings have been published, we make comparison to the 2018 key findings as they are a mid-point to the data being used (2017-19) and the number of housing association properties are from 2018 statistics.

²³ The SCHS estimates are based on a sample of 10,000 properties in Scotland per year, and it is possible that some band A properties may have been missed in the sample. As such, there is likely a limited amount of band A properties in the real housing association housing stock, but not many.

across the entire housing stock: Each measure is accompanied by a figure for the number of applicable properties and represented as a percentage of overall properties currently not reaching EE band B:

- Low energy lighting (146k properties/ 56% of properties currently not meeting EESSH2)
- Loft and roof insulation (61k properties/ 23%)
- Wall insulation measures (56k properties/ 21%)
- High efficiency glazing (128k properties/ 49%)
- Floor insulation measures (92k properties/ 35%)
- Hot water tank insulation (2k properties/ 1%)
- Central heating control upgrades (60k properties/ 23%)
- Boiler upgrades (45k properties/ 17%)²⁴
- Air source heat pumps (16k properties/ 6%)
- High heat retention heaters (27k properties/ 10%)
- Solar thermal (15k properties/ 6%)
- Solar PV (53k properties/ 20%)

Please note that these figures are best case scenarios and that some of the measures in the modelling may be subject to other factors (e.g. consent for wall insulation in mixed tenure blocks, planning considerations).

These measures are detailed in Table 2. Assuming there are currently 282,000 Scottish housing association properties²⁵, for 254,610 properties at least one measure was identified. For 6,464 properties no applicable measures could be assigned with the data provided, representing 2% of those that currently are not meeting the EESSH2 requirement of an EE band B. The table indicates whether each of the measures would be required as the sole measure to get to an EE band B or not. Interestingly, 5,462 properties seem on the cusp of meeting EE band B as they only require installing low energy lighting, and 19,795 properties would meet EE band B by installing only one measure.

²⁴ The current EESSH2 guidance describes that upgrading boilers should not be included as a measure in for reaching the EESSH2 requirements. However, there are no instruction on how to adjust for existing gas boilers in energy efficiency scores from existing EPCs and baseline scores. Given this unclarity of the EESSH2 instructions and the expectations of revisions in 2023, upgrades in gas boilers were kept as part of the current EESSH2 analysis.

²⁵ Scottish Government (2020) [Scottish House Condition Survey: 2018 key findings](#). Although the 2019 key findings have been published, we make comparison to the 2018 key findings as they are a mid-point to the data being used (2017-19) and the number of housing association properties are from 2018 statistics.

Table 2: Number of properties requiring each measure across Scotland's housing association stock

Measure package	Measure group	Measure	Number of properties requiring measure	Number of properties meeting EESSH2 with sole measure	% of properties that do not reach EE band B
Lighting	Low energy lighting		146,007	5,462	56%
Fabric upgrades	Loft and roof insulation	Loft insulation (virgin)	20,904	0	8%
		Loft insulation top-up	35,458	192	14%
		Flat roof insulation	4,252	0	2%
	Wall insulation	Cavity wall insulation with no additional external wall insulation	220	0	<1%
		Cavity wall insulation with additional external wall insulation	25,551	202	10%
		External wall insulation	7,988	0	3%
		Internal wall insulation	22,365	0	9%
		Internal heat loss wall insulation *	31,884	N/A	12%
		Glazing	Single to high efficiency glazing	5,089	0
	Double glazing upgrade		122,756	1,656	47%
	Floor insulation	Suspended floor insulation	74,254	141	28%
		Solid floor insulation	17,590	0	7%
		Exposed floor insulation	437	0	<1%
Heating upgrades	Hot water tank insulation		1,863	0	1%
	Central heating controls upgrades		60,413	2,221	23%
	Boiler upgrade	Mains gas boiler upgrade	44,155	1,066	17%
		LPG boiler upgrade	513	0	<1%
	Air source heat pumps (ASHP)	Electric storage heaters to ASHP	12,323	0	5%
		Electric boiler to ASHP	2,584	467	1%
		Electric room heaters to ASHP	1,271	0	<1%
		LPG boiler to ASHP	49	0	<1%
		Solid fuel to ASHP	272	0	<1%
		High heat retention heaters (HHR)	Electric storage heaters to HHR	20,950	675
	Electric boiler to HHR		5,413	803	2%
	Electric room heaters to HHR		449	0	<1%
Solar	Solar thermal		14,682	0	6%
	Solar PV		53,283	6,910	20%
Totals			254,610 properties requiring at least one measure	19,795 properties requiring one measure to meet EESSH2	98%
			206,817 properties requiring multiple measures		

* Internal heat loss wall insulation is a measure in addition to other wall insulation measures for flatted properties and not a stand-alone measure.

9.2 EE bands across the entire stock

Meeting EESSH2 works towards reaching an EE band B or higher. Figure 16 compares the EE bands from the overall housing association stock before and after all modelled applicable measures would be installed. It shows that no properties would be an F band or lower after adding all possible improvements, and the 2,410 baseline F band properties would shift towards a higher band after installing the identified measures. After exhausting all measures, 10,371 properties would still be an E or D band, and 154,985 properties would be a C band, although 95,718 properties that were a C band or lower would move to a B band or higher.

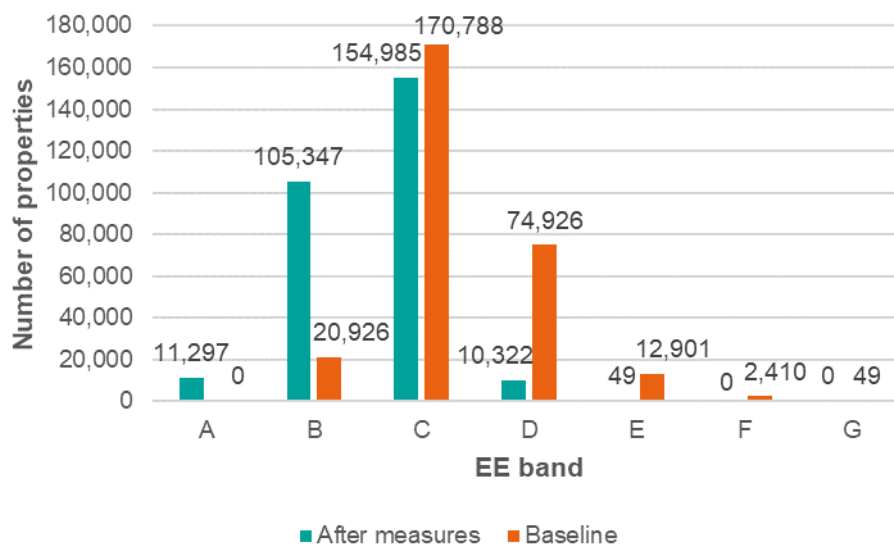


Figure 16: EE bands across housing association stock before and after modelled improvements

9.3 EESSH2 across entire stock

Figure 17 shows the shift in properties meeting EESSH2 through each package of measures. Of the 261,074 properties that currently do not meet EESSH2, we estimate that 45% would meet the standard using the packages of fabric, heating and solar measures that have been modelled. Across the entire housing association stock, the rate of properties meeting EESSH2 is estimated to increase to 41% with the installation of all modelled improvements.

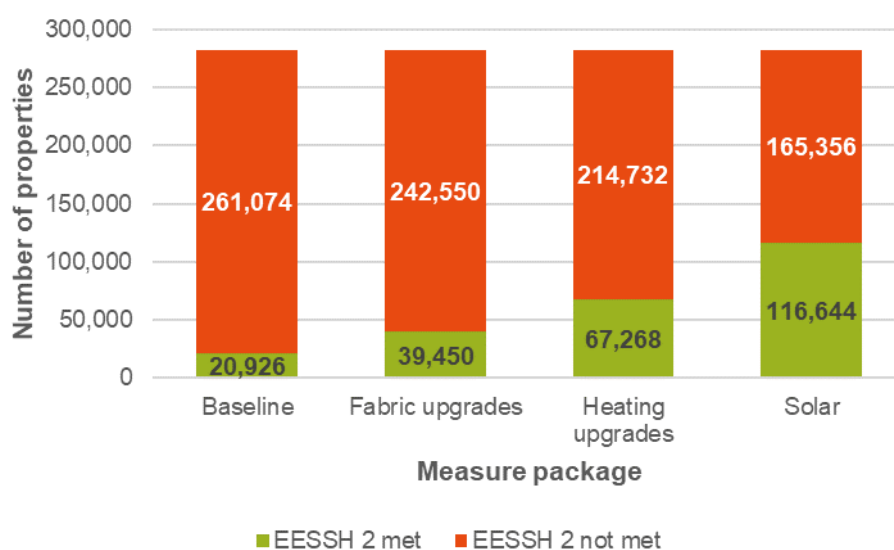


Figure 17: EESSH2 standard of housing association stock at each stage of modelling

The shift in meeting EESSH2 is further detailed in Table 3. If all applicable measures were installed the amount of properties not meeting EESSH2 would decrease from 261,074 to 165,356. It is worth noting that of the properties still do not meet EE band B, 41% of them do not meet the standard within 3 SAP points (67,625 properties).

Table 3: Breakdown of EESSH2 standard of housing association stock per package

Measure package	EESSH2 met	EESSH2 not met	Increase in meeting EESSH2 from package	Increase in meeting EESSH2 (cumulative)	Rate meeting EESSH2 (from overall stock)	Rate meeting EESSH2 (from stock not meeting EESSH2)
Baseline	20,926	261,074			7%	
Fabric upgrades	39,450	242,550	18,525	18,525	14%	15%
Heating upgrades	67,268	214,732	27,818	46,342	24%	26%
Solar	116,644	165,356	49,376	95,718	41%	45%

9.4 Modelled increments in EE ratings

The modelled increase in the EE rating for each measure varies between property types and heating fuel. The increases are detailed in Table 4, showing that they can range from a minimum 1 point for some measures (e.g., low energy lighting, loft insulation, glazing upgrades) to a maximum 31 points for virgin loft insulation.

Table 4: Increase in EE rating for each measure

Measure package		Measure	Range of increase in EE rating	Average increase in EE rating across stock
Lighting	Low energy lighting		1 - 2	1
Fabric measures	Loft/ roof insulation	Loft insulation (virgin)	1 - 31	10
		Loft insulation top-up	1 - 4	1
		Flat roof insulation	3 - 31	12
	Wall insulation	Cavity wall insulation with no additional external wall insulation	2	2
		Cavity wall insulation with additional external wall insulation	2 - 17	5
		External wall insulation	2 - 14	8
		Internal wall insulation	4 - 14	5
		Internal heat loss wall insulation	1 - 3	1
	Glazing	Single to high efficiency glazing	3 - 9	3
		Double glazing upgrade	1 - 3	1
	Floor insulation	Suspended floor insulation	1 - 7	3
		Solid floor insulation	1 - 6	2
		Exposed floor insulation	6 - 13	10
Heating upgrades	Hot water tank insulation		9	9
	Central heating controls upgrades		1 - 2	2
	Boiler upgrade	Mains gas boiler upgrade	2 - 6	3
		LPG boiler upgrade	5	5
	Air source heat pumps (ASHP)	Electric storage heaters to ASHP	2 - 9	5
		Electric boiler to ASHP	22 - 30	26
		Electric room heaters to ASHP	16 - 22	20
		LPG boiler to ASHP	26	26
		Solid fuel to ASHP	8	8
	High heat retention heaters (HHR)	Electric storage heaters to HHR	2 - 4	3
		Electric boiler to HHR	8 - 20	15
		Electric room heaters to HHR	11 - 15	12
Solar	Solar thermal		1 - 3	2
	Solar PV		9 - 16	13

9.5 EESSH2 margins across entire stock

Over two-fifths (67,625 properties (41%)) that do not reach EE band B are within 3 SAP points from this EESSH2 requirement. In addition, over one-fifth do not meet the standard by between 4 to 5 SAP points (36,561 properties) and a further quarter are between 6 to 10 SAP points (43,733 properties) removed from the standard.

However, 17,437 properties do not meet the standard by over 10 SAP points (11%) with 706 of these properties being over 20 SAP points removed from an EE band B (1%).

The EESSH2 margin results are detailed in Table 5, showing the results separately for properties that have had at least one measure modelled to arrive at these results, as well as properties that do not have any applicable measures for improvements.

Table 5: EESSH2 margins

EESSH2 margin	Number of properties with at least one measure modelled	Number of properties with no applicable measures	Total	% of properties that do not reach EE band B
-1	21,069	2,016	23,086	14%
-2	20,969	1,842	22,811	14%
-3	21,185	544	21,729	13%
-4	19,707	669	20,376	12%
-5	15,766	419	16,185	10%
-6	14,120	0	14,120	9%
-7	9,742	199	9,941	6%
-8	9,140	272	9,412	6%
-9	4,964	104	5,068	3%
-10	5,193	0	5,193	3%
-11	3,226	318	3,544	2%
-12	3,486	37	3,522	2%
-13	2,514	0	2,514	2%
-14	599	0	599	<1%
-15	2,413	0	2,413	1%
-16	1,201	46	1,246	1%
-17	1,634	0	1,634	1%
-18	1,204	0	1,204	1%
-20	55	0	55	<1%
-21	351	0	351	<1%
-22	217	0	217	<1%
-23	40	0	40	<1%
-25	49	0	49	<1%
-28	49	0	49	<1%
Total	158,892	6,464	165,356	

10. Modelled install costs

If all the identified measures would be installed, it is estimated to cost **£2bn**. Most of these costs have been calculated with standard costs provided by the Energy Saving Trust²⁶. The average cost per property requiring measures would be **£7,661**²⁷. This varies from **£20** for a property only requiring low energy lighting to **£32k** for a property requiring a package of fabric, heating and solar measures. Installing battery storage alongside solar PV installations would cost an additional **£213m**.

For 30,946 properties (12% of the properties requiring at least one measure) costs would exceed £15k. 14,984 of these properties would not meet the EE band B requirements after exhausting measures, with 2,294 being within 3 SAP points.

It should be noted that the estimated costs do not consider potential purchase cost savings that can be made through a bulk purchase scheme or area-based scheme, i.e., options where buying measures collectively or in a large quantity lowers the unit price. According to BEIS, savings up to 10% can be made through the economies of scale²⁸. This is similar to the experience of the Project Management team at Changeworks, who have been responsible for area-based schemes across multiple local authority areas and report savings of 10-20% on capital costs for wall insulation through area-based schemes.

The costs are based on installation costs and do not account for additional costs such as strategy development/planning, other enabling works, ventilation and achieving air tightness/IAQ standards, monitoring and evaluation, PAS 2030/35 requirements, tenant engagement and support, ongoing maintenance²⁹ and potential redress. The costs are summarised in Table 6 and detailed per measure in Table 7. They show that lighting and fabric measures account for over two-thirds of the overall costs (68%).

²⁶ [Energy Saving Trust](#) With the exceptions of solid floor insulation (EPC generated costs), high heat retention heaters and flat roof insulation (social landlords) and Solar PV (Changeworks decarbonisation projects). Please note the suspended floor insulation costs assume [Q-Bot underfloor insulation](#).

²⁷ By comparison the Scottish Government's [Consultation on the Energy Efficiency Standard for Social Housing post-2020](#) estimates a cost of £2bn for 87% of housing association stock to meet EESSH2 (£9.3k per property not meeting EESSH2) based on case studies grossed up to sector level or £2bn for 51% of housing association stock to meet EESSH2 (£5.6k per property not meeting EESSH2/ £6.1k per upgraded property) based on a National Household Model.

²⁸ Department for Business, Energy and Industrial Strategy (2017) [What does it cost to retrofit homes?](#)

²⁹ Scottish Government (2020) [Low carbon heating in domestic buildings - technical feasibility: cost appendix](#)

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Table 6: Modelled cost for each package

Measure package	Total cost
Fabric upgrades (inc. lighting)	£1,324,846,179
Heating upgrade	£399,698,021
Solar	£225,915,872
Total	£1,950,460,072

Table 7: Modelled costs for each measure across housing association stock

Measure package	Measure	Number of properties	Total cost	Average cost	% of overall costs
Lighting	Low energy lighting	146,007	£2,920,138	£20	<1%
Fabric measures	Loft insulation (virgin)	20,904	£5,490,414	£263	<1%
	Loft insulation top-up	35,458	£7,814,184	£220	<1%
	Flat roof insulation	4,252	£36,242,981	£8,523	2%
	Cavity wall insulation with no additional external wall insulation	220	£75,883	£345	<1%
	Cavity wall insulation with additional external wall insulation	25,551	£237,691,632	£9,303	12%
	External wall insulation	7,988	£71,860,685	£8,996	4%
	Internal wall insulation	22,365	£135,479,770	£6,058	7%
	Alternative wall insulation	31,884	£63,297,231	£1,985	3%
	High efficiency glazing	127,846	£490,378,699	£3,836	25%
	Suspended/ exposed floor insulation	74,691	£168,055,345	£2,250	9%
	Solid floor insulation	17,590	£105,539,215	£6,000	5%
Heating upgrades	Hot water tank insulation	1,863	£372,693	£200	<1%
	Central heating controls upgrades	60,413	£18,581,170	£308	1%
	Boiler upgrades	44,668	£102,736,689	£2,300	5%
	Air source heat pumps	16,499	£164,992,850	£10,000	8%
	High heat retention heaters	26,812	£113,014,619	£4,215	6%
Solar	Solar thermal	14,682	£66,067,402	£4,500	3%
	Solar PV	53,283	£159,848,470	£3,000	8%
Totals/ average		254,610 <i>properties requiring at least one measure</i>	£1,950,460,072	£7,661 for properties requiring at least one measure	

11. Modelled carbon savings

The annual CO₂ emissions across the entire housing association stock is 1,248,764 tonnes per year. This is based on estimations from the SHCS data. The average CO₂ emissions across the entire stock is estimated to be 4.4 tonnes per property per year. This is considerably lower than the average of 6.8 tonnes per year for all housing stock in Scotland³⁰.

If all the measures were installed, 303,522 tonnes of CO₂ would be saved annually (1.2 tonnes per property receiving measures), based on the modelled impacts. This would account for a 24% reduction across the entire stock. Fabric measures would account for half of these savings.

Table 8 shows the overall estimated emissions if each package of measures were installed and Table 9 shows the estimated savings for each measure. The average CO₂ emissions across the entire stock per household after all measures are installed is estimated to be 3.4 tonnes per year.

It should be noted that the carbon savings per measure will decrease in the future if heat itself becomes less carbon intense due to the use of renewables in electricity generation.

Table 8: Total modelled CO₂ savings for each package of measures

Measure package	Total CO ₂ emissions (tonnes/ year)	Average CO ₂ across all housing stock (tonnes p/a)	CO ₂ savings from each package (tonnes p/a)	% CO ₂ savings from each package across all housing stock
Baseline	1,248,764	4.4		
Fabric upgrades	1,096,409	3.9	152,355	12%
Heating upgrade	1,009,302	3.6	87,107	7%
Solar	945,242	3.4	64,061	5%
Total savings			303,522	24%

³⁰ Scottish Government (2020) [Scottish House Condition Survey: 2018 key findings](#). Although the 2019 key findings have been published, we make comparison to the 2018 key findings as they are a mid-point to the data being used (2017-19) and the number of housing association properties are from 2018 statistics.

Table 9: Overall and average modelled CO₂ savings for each measure

Measure package	Measure	Number of properties	Total CO ₂ savings (tonnes/ year)	Average CO ₂ savings per measure (tonnes/ year)	Average % CO ₂ savings from measure per receiving property
Lighting	Low energy lighting	146,007	15,973	0.1	2%
Fabric upgrades	Loft insulation (virgin)	20,904	25,360	1.2	22%
	Loft insulation top-up	35,458	6,436	0.2	4%
	Flat roof insulation	4,252	6,447	1.5	23%
	Cavity wall insulation with no additional external wall insulation	220	57	0.3	9%
	Cavity wall insulation with additional external wall insulation	25,551	17,344	0.7	14%
	External wall insulation	7,988	7,908	1.0	17%
	Internal wall insulation	22,365	12,028	0.5	12%
	Internal heat loss wall insulation	31,884	4,857	0.2	3%
	Single to high efficiency glazing	5,089	1,998	0.4	9%
	Double glazing upgrade	122,756	22,834	0.2	4%
	Suspended floor insulation	74,254	25,749	0.3	7%
	Solid floor insulation	17,590	4,817	0.3	5%
	Exposed floor insulation	437	545	1.2	26%
Heating upgrades	Hot water tank insulation	1,863	2,273	1.2	19%
	Central heating controls upgrades	60,413	14,916	0.2	6%
	Mains gas boiler upgrade	44,155	18,411	0.4	9%
	LPG boiler upgrade	513	159	0.3	13%
	Electric storage heaters to ASHP	12,323	35,032	2.8	34%
	Electric boiler to ASHP	2,584	6,288	2.4	32%
	Electric room heaters to ASHP	1,271	2,095	1.6	23%
	LPG boiler to ASHP	49	97	2.0	21%
	Solid fuel to ASHP	272	1,286	4.7	41%
	Electric storage heaters to HHR	20,950	6,108	0.3	5%
	Electric boiler to HHR	5,413	439	0.1	2%
	Electric room heaters to HHR	449	2	0.0	<1%
Solar	Solar thermal	14,682	5,053	0.3	5%
	Solar PV	53,283	59,007	1.1	19%
Totals/ average		254,610 <i>properties requiring at least one measure</i>	303,522 <i>(tonnes) across all properties</i>	1.2 <i>(tonnes) per property requiring at least one measure</i>	26% <i>reduction in CO₂ across all properties requiring at least one measure</i>

12. Modelled running costs savings

The average running costs across the entire housing association stock is £1,231 per year. This is based on estimations from the SHCS data. This is considerably lower than the average of £1,710 per year for all housing stock in Scotland³¹.

If all the measures were installed, £279 would be saved annually per property receiving measures, based on the modelled impacts. This would account for a 20% reduction in fuel costs across the housing stock or a 22% reduction in fuel costs for properties requiring measures. Fabric measures would account for almost half of these savings.

Table 10 shows the overall estimated annual running costs if each package of measures were installed and Table 11 shows the estimated savings for each measure. The average estimated running costs across the entire stock per household after all measures is £979 per year.

Table 10: Total modelled running costs savings for each package of measures

Measure package	Total annual running costs across all housing stock	Average annual running costs across all housing stock	Annual running costs savings from each package	% running costs savings from each package across all housing stock
Baseline	£347,222,719	£1,231		
Fabric upgrades	£315,294,723	£1,118	£31,927,995	9%
Heating upgrade	£298,684,483	£1,059	£16,610,241	5%
Solar	£276,104,024	£979	£22,580,459	7%
Total savings			£71,118,694	20%

³¹ Scottish Government (2020) [Scottish House Condition Survey: 2018 key findings](#). Although the 2019 key findings have been published, we make comparison to the 2018 key findings as they are a mid-point to the data being used (2017-19) and the number of housing association properties are from 2018 statistics.

Table 11: Overall and average running costs savings for each measure

Measure package	Measure	Number of properties	Total annual running costs savings from measure	Average annual running costs savings per measure	Average % running costs savings from measure per receiving property
Lighting	Low energy lighting	146,007	£6,456,087	£44	4%
Fabric upgrades	Loft insulation (virgin)	20,904	£4,754,397	£227	16%
	Loft insulation top-up	35,458	£1,208,101	£34	3%
	Flat roof insulation	4,252	£1,255,546	£295	17%
	Cavity wall insulation with no additional external wall insulation	220	£10,118	£46	5%
	Cavity wall insulation with additional external wall insulation	25,551	£3,214,782	£126	9%
	External wall insulation	7,988	£1,480,586	£185	13%
	Internal wall insulation	22,365	£2,127,082	£95	8%
	Internal heat loss wall insulation	31,884	£873,866	£27	2%
	Single to high efficiency glazing	5,089	£359,325	£71	7%
	Double glazing upgrade	122,756	£4,365,064	£36	3%
	Suspended floor insulation	74,254	£4,803,601	£65	5%
	Solid floor insulation	17,590	£910,152	£52	4%
	Exposed floor insulation	437	£109,288	£250	18%
Heating upgrades	Hot water tank insulation	1,863	£460,275	£247	17%
	Central heating controls upgrades	60,413	£2,815,186	£47	4%
	Mains gas boiler upgrade	44,155	£3,241,775	£73	6%
	LPG boiler upgrade	513	£43,623	£85	9%
	Electric storage heaters to ASHP	12,323	£2,986,313	£242	10%
	Electric boiler to ASHP	2,584	£2,347,236	£908	35%
	Electric room heaters to ASHP	1,271	£760,794	£599	27%
	LPG boiler to ASHP	49	£22,875	£468	13%
	Solid fuel to ASHP	272	£5,981	£22	1%
	Electric storage heaters to HHR	20,950	£1,676,292	£80	5%
	Electric boiler to HHR	5,413	£2,103,062	£389	29%
	Electric room heaters to HHR	449	£146,829	£327	27%
Solar	Solar thermal	14,682	£956,726	£65	3%
	Solar PV	53,283	£21,623,732	£406	26%
Totals/ average		254,610 <i>properties requiring at least one measure</i>	£71,118,694 <i>across all properties</i>	£279 <i>per property requiring at least one measure</i>	22% <i>reduction in running costs across all properties requiring at least one measure</i>

13. Fuel Poverty

It is estimated that 108,139 housing association households (38%) are currently in fuel poverty^{32 33}. If all measures were installed, and using the calculated savings and the SHCS fuel poverty gap data, this would decrease to 81,650 (29% of the housing stock).

Figure 18 shows the reduction in fuel poverty through each stage of measures. It shows:

- Fabric measures would remove 13,011 households from fuel poverty, reducing the fuel poverty level to 95,128 properties (34% of the entire housing stock).
- The installation of heating upgrades would remove a further 5,157 households from fuel poverty, reducing the fuel poverty level to 89,972 properties (32% of the entire housing stock).
- The installation of solar measures would remove a further 8,321 households from fuel poverty, reducing the fuel poverty level to 81,650 properties (29% of the entire housing stock).

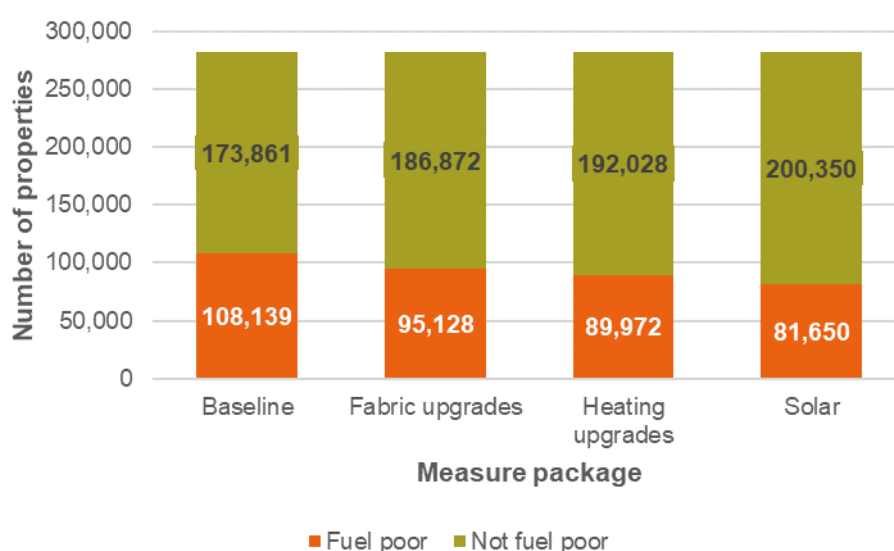


Figure 18: Fuel poverty across housing association stock at each stage of modelling

³² Fuel poverty gap data was provided with the SHCS dataset.

³³ [Fuel Poverty \(Targets, Definition and Strategy\) \(Scotland\) Act 2019 \(Scottish Government\)](#).

Under the 2019 definition, a household is in fuel poverty if, in order to maintain a satisfactory heating regime, total fuel costs necessary for the home are more than 10% of the household's adjusted net income (after housing costs), and if after deducting fuel costs, benefits received for a care need or disability and childcare costs, the household's remaining adjusted net income is insufficient to maintain an acceptable standard of living. The remaining adjusted net income must be at least 90% of the UK Minimum Income Standard to be considered an acceptable standard of living, with an additional amount added for households in remote rural, remote small town and island areas.

14. Summary of EESSH2 modelling analysis

Changeworks carried out EESSH2 modelling across the entire Scottish housing association stock based on Scottish Housing Condition Survey data on a representative sample of housing association properties.

The average EE rating across all 282,000 housing associations properties in this analysis is 71, which is equivalent to a 'low' EE band C. This is higher than the average score of 65 across all properties in Scotland. Most of the housing association stock has an EE band C (61%). Almost one-third (31%) are in the lower bands of D to F, whilst an extremely low number (42 properties) have an EE band G (the lowest band).

20,926 properties (7%) currently reach the EE rating of 81, which is required for meeting EESSH2. Of the 261,074 properties that currently do not meet EESSH2, 45% are estimated to meet the standard using the packages of fabric, heating and solar measures that have been modelled in this analysis. Installing all the applicable modelled improvements would increase the overall rate of meeting EESSH2 from 7% to 41%.

To increase the energy efficiency of the stock and to work towards meeting EESSH2, the following measures would be required for the properties that currently do not meet EESSH2. Each measure is accompanied by a figure for the number of applicable properties and represented as a percentage of overall properties currently not meeting EESSH2:

- Low energy lighting (146k properties/ 56% of properties currently not meeting EESSH2)
- Loft and roof insulation (61k properties/ 23%)
- Wall insulation measures (56k properties/ 21%)
- High efficiency glazing (128k properties/ 49%)
- Floor insulation measures (92k properties/ 35%)
- Hot water tank insulation (2k properties/ 1%)
- Central heating control upgrades (60k properties/ 23%)
- Boiler upgrades (45k properties/ 17%)
- Air source heat pumps (16k properties/ 6%)
- High heat retention heaters (27k properties/ 10%)
- Solar thermal (15k properties/ 6%)
- Solar PV (53k properties/ 20%)

At least one measure would be required for 254,610 properties, whereas for 6,464 properties no applicable measures could be assigned (2% of properties currently not meeting EESSH2). Over two-fifths of the properties that still would not meet EESSH2 (67,625 properties) are within 3 SAP points from meeting EESSH2.

Estimated costs

If all the identified measures were installed, it is estimated to cost **£2bn**. Lighting and fabric measures account for over two-thirds of these costs. The average cost per property requiring measures to reach or work towards EESSH2 is **£7,661**.

Estimated carbon savings

The average estimated CO₂ emissions per property is 4.4 tonnes per year. This is less than the average across all properties in Scotland of 6.8 tonnes per household. The overall annual CO₂ emissions across all housing association stock is estimated to be 1,248,764 tonnes per year. If all the measures identified in this analysis were installed, an estimated 303,522 tonnes of CO₂ would be saved annually (1.2 tonnes per household requiring at least one measure), accounting for around one-quarter of the overall estimated emissions.

Estimated running costs saving

The average estimated annual running costs across all properties is **£1,231** per year. This is less than the average across all properties in Scotland of £1,710 per household. If all the measures identified in this analysis were installed, an estimated **£279** would be saved annually per household requiring at least one measure, a 22% reduction in running costs for properties requiring at least one measure.

Fuel poverty

It is estimated that just over 108k households are currently in fuel poverty (38% of the housing association stock). If all measures were installed, this would decrease to 82k (29% of the households living in housing association housing stock).

15. Conclusion and discussion

Scotland's socially rented housing stock comprises the most energy efficient tenure in Scotland as highlighted in this report which focuses on SFHA members. Housing associations are motivated to provide their tenants with high quality housing, affordable to heat and with low environmental impact. EESSH and EESSH2 has provided a driver and an aspiration which has accelerated this process.

However, it is clear from this research that EESSH and now EESSH2 have aspirations and targets that continue to present considerable challenges for the housing association sector and in its present form potentially insurmountable ones. These challenges go beyond those that might be expected from the considerable undertaking to install (multiple) measure across the majority of the stock. The triangulation of findings from the SFHA member survey, interviews and desk based EESSH2 modelling have only served to reinforce this.

While challenges are numerous, five particular issues are highlighted below:

Funding and Investment: Sourcing funding and capital investment for measures were the two most challenging aspects of EESSH2 cited. Sectoral investment of £2 billion is required to install 'all measures' to improve housing energy efficiency, transition to low carbon heat³⁴ and realise the domestic renewables potential, but would still leave 165,356 properties falling below EPC band B. While bulk purchase, anticipated reductions in technology costs and the potential to integrate works into maintenance cycles might ameliorate some of those costs, this still presents a considerable barrier.

Housing associations will face additional costs of strategy development/planning, other enabling works, ventilation and achieving air tightness/IAQ standards, monitoring and evaluation, PAS 2030/35 requirements, tenant engagement and support, ongoing maintenance³⁵ and potential redress. There are also concerns about higher costs for housing associations in rural or remote areas.

Bidding for Scottish Government funding was also cited as being confusing and challenging at times. Some housing associations also expressed a concern that this cost was not placed on their tenants and exchanging fuel poverty for rent poverty.

EPC ratings for EESSH2: The adoption of EPC ratings as the standard assessment tool and output presents considerable challenges for the sector. The limitations of the

³⁴ The improvement measures in this analysis includes air source heat pumps as a low carbon heating measure for suitable off-gas properties, however, ground source heat pumps and district heating have not been included as there was insufficient data to identify suitable archetypes for these measures. While it is recognised that there will be opportunities for housing associations to install ground source heat pumps and district heating measures, the costs for these measures have not been included.

³⁵ Scottish Government (2020) [Low carbon heating in domestic buildings - technical feasibility: cost appendix](#)

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modelling software (RdSAP) are well understood and while updates are in development, there is a justified concern that as it stands the use of EPC ratings for EESSH2 does not align with the goal of decarbonisation, focusing instead on energy efficiency and fuel costs. A high EPC rating is not necessarily an indication that properties are meeting the desired goals within Scotland's Heat in Buildings Strategy (2021). While Scottish Government is actively looking to address some of these issues, the sector requires clarity.

2023 EESSH2 review: The sector is increasingly aware of issues surrounding air quality in properties. Where levels of insulation and airtightness are increased and ventilation without intervention decreases, the decision making around integrating of ventilation needs to be better understood and its value recognised in assessments. Housing associations want to make the right decisions for the good of their tenants, the environment and the fabric of their properties. While the bringing forward of the review to 2023 is welcome, uncertainty regarding the findings and the inclusion of Environment Impact (EI) does not encourage early decision making.

Measures combinations: The modelling highlighted the challenges for a significant percentage of the stock in achieving an EPC band B even after all measures were installed. It is hard for the sector to know quite how to address this issue as it is unlikely that in the timescales required, there will be new technological solutions that will overcome that challenge. Multiple measures tend toward a more whole house approach which can allow for more innovative approaches to be adopted (which can include off site fabrication). However, for long term planning, the sector needs to have confidence in its ability to invest in a combination of measures for their stock that is going to meet the needs of tenant, fabric and environment, are affordable and will meet the required standard.

The role of hydrogen: The response of the sector to the potential impact of hydrogen in decarbonising heat is discussed in the report. Interview participants with on-gas properties expressed a lot of uncertainty around whether to replace gas boilers with electric heating or to retain gas heating infrastructure and wait for the roll-out of hydrogen through the gas network. Some actively called on the Scottish Government to be explicit about hydrogen not playing a meaningful role in the decarbonisation of heat. Failure to do so might encourage some organisations to make their gas boilers hydrogen ready or delay decision making on installing heat pumps.

16. Recommendations

Funding and Investment:

Scottish Government

- Allocate specific funding and dedicated support for fabric improvement measures to reduce heat demand. Well insulated properties need smaller heat pumps thus reducing install costs. This should include specific funding for hard-to-treat properties including Victorian or sandstone tenements, pre-1919 or older properties, off-gas properties, mixed-tenure properties and those with restrictions on upgrades (listed, conservation areas, World Heritage sites).
- Adopt realistic timescales for RSLs to bid for LCITP Net Zero Heat Fund (or equivalent) and deliver improvements. By allowing financial spend over a longer time horizon (and certainly over 12 months), proper planning and alignment with RSLs confirmed capital programmes can take place.
- Opportunity to provide more support for applicants or amend the application process. Participants mentioned that the applications are burdensome and require information and detail which applicants do not have at the time.

EPC ratings for EESSH2:

Scottish Government

- Provide clarity on minimal requirements or standards for monitoring and evaluation as a base for evidencing improved outcomes for tenants sufficient to complement EPC and realise EESSH2.

SFHA

- Continue to express concern and frustration with Scottish Government on the use of RdSAP and EPCs as a measurement tool. EPCs cannot be the deciding factor for providing warm comfortable low carbon homes and are not fit for the purpose of EESSH2.
- Promote an exchange of best practice between members on M&E to evidence improved impact on tenants where EPCs are falling short as an assessment route.
- Repeat the cost modelling exercise to incorporate any changes to EPCs or EESSH2 targets and guidance.
- Welcome the creation of Zero Emission Social Housing Task Force (ZEST) and hold to account its goal to consider the blueprint for the ideal system that promotes the economic and environmental aspirations for Scotland in the short, medium and long term of the actions required by all parts of the social housing sector in achieving zero emissions homes while maximising the wider social and economic opportunities relating to green jobs and warm, quality, sustainable homes.

2023 EESSH2 review:

SFHA

- Advocate for the inclusion of air quality and Environmental Impact in the 2023 EESSH2 review. Most RSLs do not have definitive plans for EESSH2 and while the earlier review date of 2023 (from 2025) is welcomed, the lack of clarity is helping maintain the current inertia. There should be no drift with the date and outcomes from the review.

Measures combinations:

SFHA

- A whole house approach is needed to deliver impactful retrofit programmes, deliver economies of scale and minimise the disruption to tenants.
- Improved information exchange between SFHA members. Develop case studies and deliver awareness raising events showcasing good examples and best practice.

Scottish Government

- A whole house approach is needed to deliver impactful retrofit programmes, deliver economies of scale and minimise the disruption to tenants.

The role of hydrogen:

SFHA

- Advocate for an incentive for RSLs not to install replacement gas boilers into properties as part of maintenance cycles thus locking them in to a carbon intensive fuel beyond the 2032 EESSH2 target. A heat pump installation incentive or gas boiler scrappage scheme could encourage RSLs to take action sooner.
- Push Scottish Government for clear and realistic guidance to RSLs who are waiting for more information related to Hydrogen before they start planning and delivering heat decarbonisation programmes. This is particularly the case with RSLs with properties connected to the gas grid. In the lifetime of EESSH2, it is inconceivable that green hydrogen will be sufficiently on stream to play a meaningful role in the decarbonisation of heat in a domestic setting across Scotland. However, RSLs from across the country are holding off in anticipation that this might be the case. In order to meet the national carbon reduction targets there is a need to start decarbonising heat immediately.



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