Review of Retrofit Assessment in Scotland for Improving Home Energy Efficiency: Policy Report

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Scottish Government
Riaghaltas na h-Alba

Review of Retrofit Assessment in Scotland for Improving Home Energy Efficiency: Policy Report

Report for the Scottish Government by: the Built Environment Asset Management (BEAM) Centre, Glasgow Caledonian University; Robert Gordon University; Carbon Futures; & Bield Housing & Care.

Authors: Dr Keith Baker, Magdalena Blazusiak, Natasha Houchin, Dr Ron Mould, Dr Richard Atkins, Ran Boydell, Dr Bill Sheldrick, Dr Jonathan Scott, & Dr Mark Phillipson

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Executive Summary

In November 2024 the Scottish Government commissioned a team led by Glasgow Caledonian University, Robert Gordon University, Carbon Futures, and Bield Housing and Care to conduct a review to support the design of a Home Energy Efficiency Technical Suitability Assessment (HEETSA).

The research for this project combined a series of four workshops and a survey, supported by a light-touch literature search, and peer-reviewed by a panel of three experts selected for their specialist expertise.

The work was originally intended to be published as a single, short, final report. However, thanks to an unexpectedly high level of engagement with the project, the publication has been expanded in order to more accurately reflect the volume of evidence gathered, and the views of participants. Rather than significantly extend the intended single report, the research team recognised the benefits of producing this accessible summary with clear conclusions and recommendations, alongside a more detailed, technical, and nuanced coverage Technical Report.

For this reason, we are publishing the results of the work as two documents. This Policy Report consists of summary findings under each of four objectives and answers to seventeen research questions set by the Scottish Government. The supplementary Technical Report includes full details of the methodology and a more in-depth coverage of the evidence and the views expressed by our participants.

We encourage readers to use this Policy Report as a jumping off point for reading the sections of the Technical Report that are most relevant and interesting to them.

Our research has highlighted a number of key findings under each objective, as follows.

Objective 1: Overview of existing methodologies

Currently used methodologies often produce generic recommendations, lacking solutions tailored to individual buildings and without sufficiently recognising critical factors like building condition, moisture risks, and long-term effectiveness. Additionally, limited assessor expertise and inconsistencies in assessment outcomes dependant on use of particular methodologies highlight the need for standardized, detailed processes incorporating site visits, consideration of climate and location specific data, and independent assessments. Assessment of clean heating and energy efficiency strategy delivered under HEETSA should thus include:

- Centrally defined operating framework based on real data, recognising building condition and human behaviour.
- Funding aligned to value of quality and long term effectiveness of measures.

- Methods of safeguarding of customer journey supported by competent workforce (designers, assessors and installers).

Clearly defined roles, means of demonstrating competency and compliance supported by stronger collaboration between professionals and clearer funding mechanisms are essential to delivering high-quality retrofits that align with national carbon reduction and energy efficiency goals. Risk management and adequacy of approaches could be supported by development of decision-making matrix/tool to assess suitability of current approaches adequate to the needs of the customer, similar to the Sustainable Traditional Buildings Alliance (STBA) Responsible Retrofit Guidance Wheel[1].
There are a range of existing methodologies which attempt to go beyond the Energy Performance Certificate (EPC), many of which could be a foundation for a HEETSA, but none of them in isolation could fully support the overarching aim of HEETSA.

Objective 2: Gaps in current methodologies

The current assessment market for retrofit projects has significant gaps in evaluating the technical suitability of clean heating and energy efficiency measures. Individual assessment methodologies lack granularity, ability for comparative evaluation of options, further impaired by knowledge gaps and public scepticism. The focus of HEETSA to address limitations identified in this Objective should therefore be:

- Ability to compare options while considering occupant behaviour, lifecycle impact and mandating Post-Occupancy Evaluation (POE)
- Address current data gaps precluding adequate assessment of communal heating and alignment with Local Development Plans and Local Heat & Energy Efficiency Strategies
- Provide means of independent verification of expertise, training and public awareness addressing knowledge gaps limiting successful customer journey
- Develop a decision-making tool allowing for integration and evaluation of existing methodologies best suited to deliver intended long-term retrofit outcomes.

This approach will require sector-wide framework that enhances training, incorporates lifecycle analyses, relevant data collection and prioritises occupiers ensuring long term benefits through post-occupancy evaluations and adequate customer engagement.

Objective 3: Skills and Qualifications

The impacts of the skills shortage and the measures need to address it cut across many of the themes of this project, and across Scottish policy more widely. However, they are particularly acute for retrofit given the greater attraction of professionals and tradespeople to the new build market. They are also directly impacting on capacity to

[1] See: STBA Guidance Wheel - STBA

deliver sufficiently technical standards of independent and impartial advice, leading to projects with sub-standard and negative outcomes, which then impact on public trust in the retrofit and net zero agendas.

Whilst there is no silver bullet solution, there are number of levers that can be employed to start to close this gap:

- Supporting the provision of degrees accredited by the professional associations, and doing more to encourage young people to take them (accepting that the benefits of this will take several years to accrue).
- Enabling adults and professional learners to engage with the growing market for non-traditional learning providers, with their greater focus on andragogy-based learning (adult learning methods, as opposed to pedagogy-based methods designed for children and younger people).
- Understanding the value of enabling professionals to engage with communities of practice, and instilling this in employers.
- Breaking down the emerging role of 'retrofit coordinators' into more discrete roles to enable more people from built environment-adjacent fields to transfer into them, to use their expertise to enable more successful retrofit projects, and in turn to empower householders and help rebuild consumer trust and confidence. This differentiation reflects the different, but complementary, skillsets that need to be applied to retrofit projects, and recognises the higher technical knowledge requirements for assessors.

Doing so will require greater engagement with fields such as social care and learning specialists, particularly adult learning specialists, and so we have deliberately attempted to embed these messages throughout both these reports.

Objective 4: Market Readiness

We appreciate that the findings for this objective paint a fairly bleak, albeit realistic, assessment of the current state of play. Unfortunately, we cannot change the past and the impact that a series of mis-firing policies have had on consumer engagement and public trust in the retrofit and net zero agendas (e.g., the Green Deal and the recent investigation into TrustMark-certified installers of external wall insulation in England). We also recognise that far from all of these problems have been caused by the Scottish Government, and some of the solutions are partially or fully outwith the scope of its devolved powers.

However, there are steps that could be taken to build the retrofit market and rebuild confidence and trust among the public and all those involved in delivering retrofit projects:

- Working across policy silos (including within the built environment, energy, and public health) to do more to align retrofit policy and regulation with areas such as the Building Standards, building warrants, and communal and district heating.

- Tackling the skills shortage (see Objective 3).
- Tackling conflicts of interest, and improving consumer protection, complaints handling, and redress.
- Recognising that there is no standard retrofit journey, and designing retrofit policies to capture all possible entry routes and motivations (or lack of them) for undertaking retrofit projects.
- Recognising that enabling successful retrofit projects, and doing so equitably, will be vital to enabling a just transition, and doing more to align the design and delivery of government policy and regulation with this broader goal in mind.

The process we outline, and recommend, is intended to result in occupants being provided with a technically suitable evidence report that will enable them to confidently understand the most appropriate options for pursuing a full retrofit journey. This should include likely costs and energy savings, as well as benefits such as improved thermal comfort, and the options should be tailored to their individual needs.

As such, the proposals for a HEETSA provide a valuable and rare opportunity to stop history repeating itself by addressing and correcting many of the issues that have hampered previous retrofit and energy efficiency policies, and the impacts they have had on public trust and confidence in retrofit programmes, and the wider net zero and just transition agendas. As such, and to better reflect the evidence gathered and the views of our participants, we have not shied away from stepping outside our original remit where we and our peer reviewers felt that this would enable meeting HEETSA's objectives, and we wish to thank the Scottish Government for agreeing to this flexibility. As a team of multidisciplinary experts, we would have had difficulty doing otherwise.

Finally, we wish to thank all our participants and all those who have supported this work.

Keith Baker, Magdalena Blazusiak, Natasha Houchin, & Ron Mould
March 2025

Recommendations

Core Functions
HEETSA assessments must ensure that all recommended measures are 'no regrets' solutions that result in no detriment to properties, do not result in measures needing to be removed as part of future upgrades, and do not risk negative impacts on thermal comfort and occupant health, or higher energy bills. Rather than assuming a linear retrofit path, the design of HEETSA retrofit journeys should encompass a full range of implementable options through which an optimal critical path can be plotted.
HEETSA needs to become a standardised approach that allows for general, comparative assessments but can also accommodate the complexities of historic and traditional buildings with consideration of location specific environmental differences and climatic predictions.
HEETSA recommendations should be based, at least in part, on the results of on-site inspections by suitably accredited professionals, including invasive inspections where appropriate. In some cases, such as where connection to district or communal heating is being considered, there may be a need for multiple accredited professionals to be involved in the inspection and assessment process.
HEETSA recommendations should also take into account the circumstances and needs of occupants by including interviews with householders as part of designing retrofit projects. We note that many reputable surveyors already do this, so it should become a mandatory element of a HEETSA retrofit journey.
Retrofit Assessors should be independent and regulated to ensure unbiased recommendations tailored to each property's needs rather than commercial interests, and to safeguard consumers by ensuring assessors are sufficiently skilled to produce high quality retrofit plans.
We recommend that the Scottish Government continues to review and improve the range of retrofit advice services being provided to Scottish property owners to ensure that proposed improvements are clearly appropriate and impactful in the medium and longer term. In particular, such reviews should seek to eliminate any potential bias in HEETSA recommendations due to factors such as the availability (or not) of subsidies, especially where such subsidies are administered through advisory services or installers, or where service providers have financial relationships with installers or manufacturers.
Heat networks (HN), strategic acknowledgment and policy-level integration - HEETSA assessments should note the potential for district and communal renewable heating systems, even if they are not directly within HEETSA's current scope at individual property level. It may be easier to identify HN potential where properties are part of a community of properties in close proximity. This allows the Scottish Government and stakeholders to use HEETSA data to identify communities with the greatest need and potential benefit for such systems.
Heat Network (HN), operational coordination and avoidance of suboptimal solutions - Those involved in HEETSA retrofit projects should periodically consult with local authorities to stay informed about ongoing or planned communal heating projects and thereby avoid recommending less effective individual heating measures.

Context (optimal environment)
Fundamentally, HEETSA should be based on a maintenance first principle that ensures HEETSA assessments work to bring all Scottish properties up to good standard of condition, in order to remediate problems before they become more serious and costly, and to maximise occupant comfort and the benefits of energy efficiency and renewable energy measures.
We also recommend further stakeholder consultation to clarify the role of assessors in the HEETSA model.
The introduction of new regulations needs to be sensitive to both the implications of delivering poor-quality retrofit projects and the current, substantial, skills shortages. In the immediate term, regulation should focus on the critical role of the Retrofit Assessor and consumer protection. However, in the longer term, the Scottish Government should commit to ensuring all elements of the HEETSA process are fully regulated, whether this falls under reserved or devolved powers.

The Consumer Journey
There is an urgent need to address the lack of trust amongst householders when it comes to retrofit projects, which has resulted from, amongst other issues, poor (sometimes detrimental) advice from advisory services, poor and costly installations of measures, and cowboy operators. Coupled with the range of qualifications and accreditations applicable to those involved in retrofit projects, this has also resulted in a lack of respect for and understanding of the benefits of seeking advice from and employing suitably qualified professionals. This, in part, should be addressed through awareness raising and ensuring that training programmes, particularly those teaching more basic knowledge and skills, inculcate (develop discipline through consistent practice) learners with the limits of their knowledge, and when a householder should be referred to a more experienced professional before committing to any works.

Learning & Development
The Scottish Government should thus invest in upskilling programs to ensure assessors are well-qualified, including having sufficient knowledge of evaluating heat and hot water systems, and an understanding of communal / district heating systems. Such programs and offerings should be based on andragogical (the practice of teaching adults) approaches to learning as opposed to pedagogical (the practice of teaching young people and children) approaches, in recognition that adults and professionals require different approaches to learning and have different learning needs and understandings of those needs, compared to younger people. This will be invaluable for closing the skills gap by making retrofit-related professions more attractive and easier to access for those with transferrable knowledge and skills. We recommend that the Scottish Government consults with experts in adult learning specifically on this matter.
As regards younger people, we recommend that the Scottish Government continues to support and expand the number and range of further and higher educational learning offerings accredited by the professional associations ensuring local availability of training and upskilling opportunities across Scotland.

Delivery (implementing advice)
The HEETSA process should recognise four distinct but complementary roles in the design and delivery of retrofit projects: a Retrofit Project Manager; a Retrofit Advocate; a Retrofit Consultant; and a Retrofit Assessor. These require different skillsets but, depending on the capacity and needs of a householder and the needs of a retrofit project (and with the exception of the Assessor), one individual, organisation, or company may be able to fulfil more than one role.
Groups such as Local Climate Action Hubs should be seen as having valuable roles to play in HEETSA retrofit journeys, including sharing local knowledge to help identify householders and properties in need of measures, capitalising on the ability of locally-based organisations to build trust amongst householders, advocating for the needs of local people, and supporting the development and delivery of district and communal heating projects. However, we recommend the adoption of names for these groups which de-emphasise climate change and emphasise the direct benefits to householders and communities – e.g., Community Retrofit Hubs, Renovation Hubs, or Maintenance Hubs.
We also recognise the importance of engaging with reputable locally-based installers, particularly in rural and remote areas. However, these companies are invariably time and resource-poor, and a balance needs to be struck between how involved they should be with decision-making and the difficulties and costs (to them and the public purse) of increasing householder protection through technical and consumer regulations.

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Objective 1: Overview of existing methodologies

What are the limitations of existing retrofit assessment methodologies for meeting HEETSA's objectives?

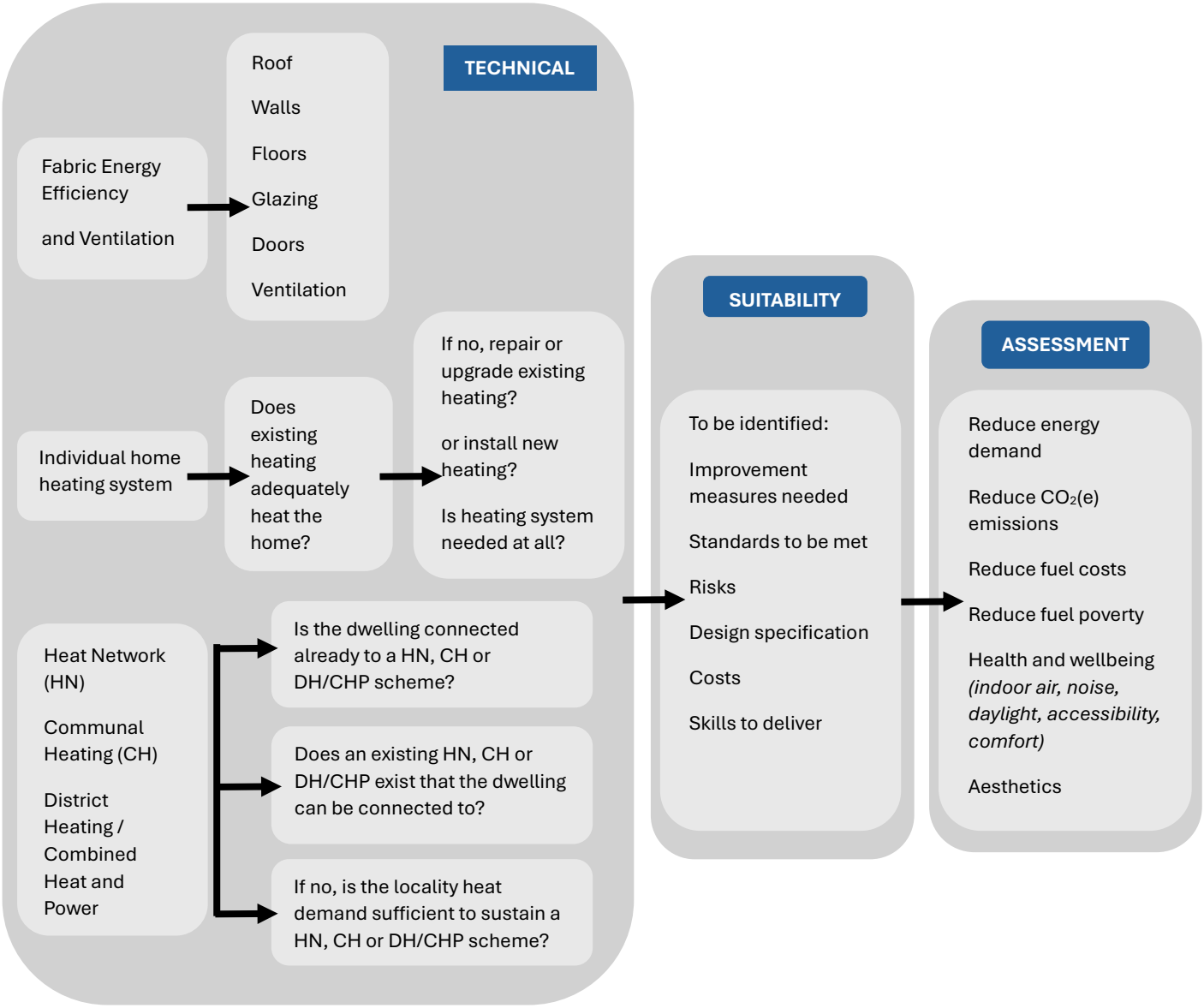


Figure 1: Illustration of requirements of HEETSA

Limitations of currently used methodologies

While combination of existing methodologies can provide a foundation for assessing clean heating and energy efficiency measures, the success is often reliant on the experience and expertise of the professionals involved. The process too often relies on predicted data, lacks context specific assessments, sufficient site investigations,

produces inconsistent and non-comparable results, and is often dictated by financial constraints and funding mechanisms that do not align with best practice and long-term benefits for the occupants. A more thorough, transparent, and standardized approach is needed to ensure high-quality retrofits that improve energy efficiency, protect building integrity, and enhance occupant well-being supporting their long-term needs.

Methodologies, including frameworks, guides, certification and software currently used have been listed in Annex 1, including comparative analysis of purpose, characteristics and suitability to meet HEETSA's goals.

Among all identified methodologies, PAS 2035 and PAS 2038 with complementing standards such as BS 40104 have been considered most holistic in attempting to provide a comprehensive technical assessment. However, these standards are not only voluntary, but also frequently revised, which prevents the industry from fully adopting them. This may make it difficult for the industry to learn from past mistakes and implement improvements over time. Additionally, majority of British Standards require paid access, which can hinder widespread adoption and best practice.

Assumption based assessment

The criticism of current approaches was that assessment methodologies rely on models like RdSAP (Reduced Standard Assessment Procedure) and Passivhaus Planning Package (PHPP)[2], which include assumptions that may not always reflect real-world conditions, underutilising future climate predictions. These assumptions can contribute to misleading results. For instance, Energy Performance Certificate (EPC) ratings do not always capture the true efficiency of a retrofit. Measures like installing photovoltaic (PV) panels or air-source heat pumps (ASHPs) may improve an EPC score but fail to address fundamental building issues such as poor insulation or moisture risks. This can be particularly problematic for vulnerable populations who may end up living in homes that remain inefficient and difficult to heat, aggravating health inequalities.

The Scottish Government accepts that EPCs are limited (and driven by a specific logic) in relation to the ways that improvement measures are specified, and hence why HEETSA is being discussed in the first place.

Building condition, maintenance and building surveys

Additionally, assessments fail to account for key building conditions, such as existing moisture risks or the state of cavity wall insulation. Current methods often assume that these features are in good condition rather than verifying them through detailed inspections, such as thermal imaging or intrusive surveys. More advanced methods, like hygrothermal assessments using WUFI software[3], exist but are rarely used due to

[2] It is worth noting that SAP, RdSAP and PHPP conform to the same BS EN Standard for calculation of energy use for space heating and cooling.
[3] Wärme Und Feuchte Instationär, a hygrothermal simulation software evaluating heat and moisture transfer through building components.

additional complexity, cost, and time required. This lack of detailed investigation can lead to retrofits that are ineffective or even damaging to buildings, and potentially having negative impacts on occupants' health.

Misalignment of funding and retrofit goals

Current funding mechanisms often encourage quick installations where many programs do not provide financial support for addressing pre-existing structural or moisture issues, leading to ineffective retrofits and unintended consequences affecting public health. Some projects have focused on quick, low-cost solutions rather than high-quality, durable improvements. For example, some Energy Company Obligation (ECO) schemes have been managed by energy companies that prioritize profit over quality, leading to poorly executed installations. Social landlords face additional challenges in balancing the cost of retrofits with educating tenants on energy efficiency.

Currently, use of different methodologies can produce varying results, leading to inconsistent recommendations for homeowners and businesses. Decisions can also be driven by funding programs, underestimating the importance of detailed assessments, which without clear comparative analysis and robust operating framework may be considered costly and time-consuming.

Expertise of assessors and value of independent advice

It is therefore imperative that the assessment is carried out by independent and competent assessors to ensure retrofit recommendations are genuinely in the best interest of the building and its occupants.

Adequate assessments help prevent costly mistakes and ensure homeowners can make informed decisions that align with their long-term needs, including reducing fuel poverty, lowering carbon emissions, and improving their health.

What is required to meet HEETSA's objectives

Standardised and Comprehensive Retrofit Process

There is a strong need for a standardised approach that allows for general, comparative assessments but can also accommodate the complexities of historic and traditional buildings. This process should include:

- Detailed occupancy assessments in person-centred approach
- Condition reports that evaluate moisture risks, ventilation, and structural integrity
- Intrusive surveys and thorough investigations to improve accuracy
- Bespoke desk-based assessment supported by knowledge and expertise of the assessor providing critical evaluation of model-generated recommendations

Archetype-based solutions can be useful for area-wide schemes and high-level planning. However, it is required to recognise these recommendations will be generic,

not accounting for unique features of individual homes, and the way they are used by the occupants. Robust framework must therefore allow for:

- Bespoke solutions that consider local geography, wind exposure, rainfall data, and other environmental factors
- Flexibility to account for individual building characteristics
- Consideration of human behaviour factors

Person-Centred Approach and Customer Engagement

A customer-focused approach can empower occupiers to understand and manage their buildings effectively, as well as recognise suitability of approach relative to individual circumstances. Encouraging knowledge-sharing and occupant involvement in decision-making fosters better engagement and informed choices about retrofit measures, and the importance of maintenance as the first step of a retrofit journey.

Retrofit measures must consider both building performance and how occupants interact with their homes. This means including occupancy assessments alongside building performance evaluations to ensure solutions are sustainable. Assessors should also help homeowners understand the long-term carbon and financial costs of different measures, including staged approaches, guiding them toward choices that avoid quick fixes causing costly consequences of building failures. Consumers must also be better informed about the trade-offs between basic, low-cost assessments and more thorough, expert-led evaluations that prevent costly mistakes that can have detrimental outcomes to building performance, property values, and occupant health.

A strong consensus emerged that site visits should be a mandatory part of the assessment process. Expert assessors can identify building defects and poorly installed systems that may not be apparent through remote or desk-based assessments. Direct conversations between occupants and assessors enhance understanding, ensuring that measures are adequate for the building in its context and align with the needs of the occupants recognizing their individual circumstances.

Additionally, quality assurance of installed products and systems can be supported by follow-up engagement with occupants post-installation, and by mandatory Post Occupancy Evaluation (POE).

Improving the Customer Journey

It was recognised that to improve outcomes and ensure customer protection, the role of the retrofit assessor should be supported by dedicated training and qualifications. Currently, Retrofit Assessors[4] often have limited expertise to evaluate critical building physics and condition related variables. Insufficient skills may then lead to inadequate assessments and recommendations. This is a particularly important issue in rural and remote areas, where the lack of adequately trained retrofit assessors is most evident.

[4] Current Retrofit Assessor qualification under PAS2035 route can be as little as 10-hour CPD course beyond a Level 3 qualification in Domestic Energy Assessment.

Their role should be regulated to ensure unbiased recommendations tailored to each property's needs rather than commercial interests, and to safeguard consumers by ensuring assessors are sufficiently skilled to produce high quality retrofit plans.

To enable a successful customer journey, investment is required in building local capacity. Many small, local firms often possess the necessary skills for retrofitting but avoid government schemes due to upfront costs of accreditation and past negative experiences. Support mechanisms, such as council-provided affordable premises and financial support for upskilling and the delivery of retrofit assessments, could help these firms grow and community-based pilot projects, backed by seed funding, could foster local expertise and expand networks through hands-on learning.

While this study did not determine which groups should receive subsidies, financial support is essential for certain demographics and building types. A more streamlined, accessible system is needed to ensure homeowners receive clear and accurate guidance.

Recognised issues affecting customer trust in effective delivery of retrofit are a lack of experienced assessors, a lack of quality control, and insufficient validation processes. Additionally, assessors may not be trained in evaluating different heating and hot water systems tailored to occupant needs. The Scottish Government should thus invest in upskilling programs to ensure assessors are well-qualified, including having sufficient knowledge of evaluating heat and hot water systems, and an understanding of communal / district heating systems. This must include continuous learning requirements to ensure relevant knowledge is maintained and developed. Training within adequate and recognised delivery models must be accessible, reliable and available across Scotland. We also recommend further stakeholder consultation to clarify the role of assessors in the HEETSA model.

Summary

Current methodologies often produce generic recommendations, lacking solutions tailored to individual buildings and without sufficiently recognising critical factors like building condition, moisture risks, and long-term effectiveness. Additionally, limited assessor expertise and inconsistencies in assessment outcomes dependant on use of particular methodologies highlight the need for standardized, detailed processes incorporating site visits, consideration of climate and location specific data, and independent assessments. Assessment of clean heating and energy efficiency strategy delivered under HEETSA should thus include:

- Centrally defined operating framework based on real data, recognising building condition and human behaviour.
- Funding aligned to value of quality and long term effectiveness of measures.
- Methods of safeguarding of customer journey supported by competent workforce (assessors and installers).

Clearly defined roles, means of demonstrating competency and compliance supported by stronger collaboration between professionals and clearer funding mechanisms are essential to delivering high-quality retrofits that align with national carbon reduction and energy efficiency goals. Risk management and adequacy of approaches could be supported by development of decision-making matrix/tool to assess suitability of current approaches adequate to the needs of the customer, similar to the Sustainable Traditional Buildings Alliance (STBA) Responsible Retrofit Guidance Wheel[5].

There are a range of existing methodologies which attempt to go beyond the EPC, many of which could be a foundation for a HEETSA, but none of them go far enough to meet all of its needs. For example, some surveyors will offer an 'EPC+' approach that can take into account factors such as occupancy, but these are not codified approaches and (as far as we're aware) not advertised. Rather, they are negotiated as part of (for example) community projects. Neither are they required by any existing regulations. However, even these are insufficient to meet the needs of designing communal and district heating systems, which ideally require very accurate energy demand data, therefore the Scottish Government must regulate this space - both for methodologies and for assessor skills.

Objective 2: Gaps in current methodologies

What are the shortfalls of current methodologies to deliver HEETSA's objectives and how to overcome them.

Unsuitability of individual methods for comparative assessment

Current retrofit assessment methodologies do not fully capture the costs and benefits of fabric improvements in a whole-building approach and potentials for consideration of communal and district heating schemes. While tools like SAP, RdSAP, and PHPP measure heating demand, they fail to consider factors such as user behaviour, regional cost variations, and long-term operational savings. While they can be adapted to compare different heating solutions or communal heating systems, doing so requires significant effort and expertise, which is rarely feasible in resource-limited projects.

Obstacles to comparative analysis

PAS 2035 and PAS 2038 may prioritise 'fabric first' considerations (insulation and airtightness) before recommending heating upgrades. These frameworks may allow for more holistic assessment of risks, cost benefits, long-term energy and carbon emissions reductions and occupant comfort. However, these standards are voluntary, and adherence relies on the expertise of the assessor and quality of implementation. Other standards, such as the Royal Institution of Chartered Surveyors (RICS) 'Residential Retrofit Standard' and 'BS 40104 Retrofit assessment for domestic

[5] Available at: Responsible Retrofit Guidance Tool

dwellings – Code of practice', provide valuable professional conduct guidance but are not intended for cost-benefit or comparative analysis of options.

Many tools are limited in scope, providing generic recommendations, without context specific retrofitting scenarios required for adequate comparative analysis for energy efficiency and clean heating options. This process can be time consuming, relying on building specific data analysis and expertise of the assessor.

Although some methodologies prioritize a 'fabric first' approach essential for optimizing thermal efficiency and enhancing communal heating system performance, there is little focus on assessment of building condition and maintenance.

Lifecycle impact and post occupancy evaluation

Current assessment tools fail to adequately integrate whole-life carbon analysis, lifecycle costs, and mandate POE in line with BS 40101:2022. These gaps limit informed decision-making on material sustainability, considering toxicity, impact on indoor air quality and safeguard long-term health of the occupant in future operational scenarios. Additionally, appraisal of delivered projects would allow for learning from experience, supporting customer-focused delivery.

It was also noted that methodologies should incorporate whole lifecycle assessments of products and measures. This would help in understanding maintenance and replacement cycles while ensuring proper reuse and disposal planning in line with national circular economy strategies. Such evaluations would be especially beneficial in supporting phased retrofit approaches.

Barriers to deployment and scalability of Communal Heating and District Heating

While assessments such as SAP include communal heating schemes, they all have their limitations, for example overlooking critical elements such as fuel sources, combined heat and power (CHP) systems, and heat pumps in district networks, limiting their usefulness in evaluating system-wide efficiency. Assessment methods often fail to capture complexities such as shared infrastructure, collective energy management, scalability, and cost allocation, overly relying on assumptions, rather than context-specific analysis. Additionally, a major obstacle to district heating expansion is the lack of reliable data on building energy demand.

Current methodologies, policies, and funding structures often favour individual heat pumps over communal heating. A more balanced approach requires:

- detailed performance data,
- whole lifecycle assessments,
- localised planning considerations to enhance communal heating's viability
- transparent methodologies improving public confidence

Regulatory and Planning Barriers

Planning regulations often lack the flexibility needed to adapt communal heating systems to new technologies or changing demands. Local Development Plans (LDPs) may not align with LHEES goals, hindering scalability. The approach needs to be location specific, with tailored solutions required especially in rural areas.

Current Local Heat and Energy Efficiency Strategies (LHEES) depend heavily on estimated energy consumption from Energy Performance Certificates (EPCs), leading to overdesigning systems for peak demand scenarios that rarely occur. This creates financial and operational inefficiencies, increasing costs and investment risks. Additionally, concerns about technical failures in some district heating systems and high energy prices for users, particularly in gas-fuelled networks, contribute to public scepticism.

Opportunities for HEETSA

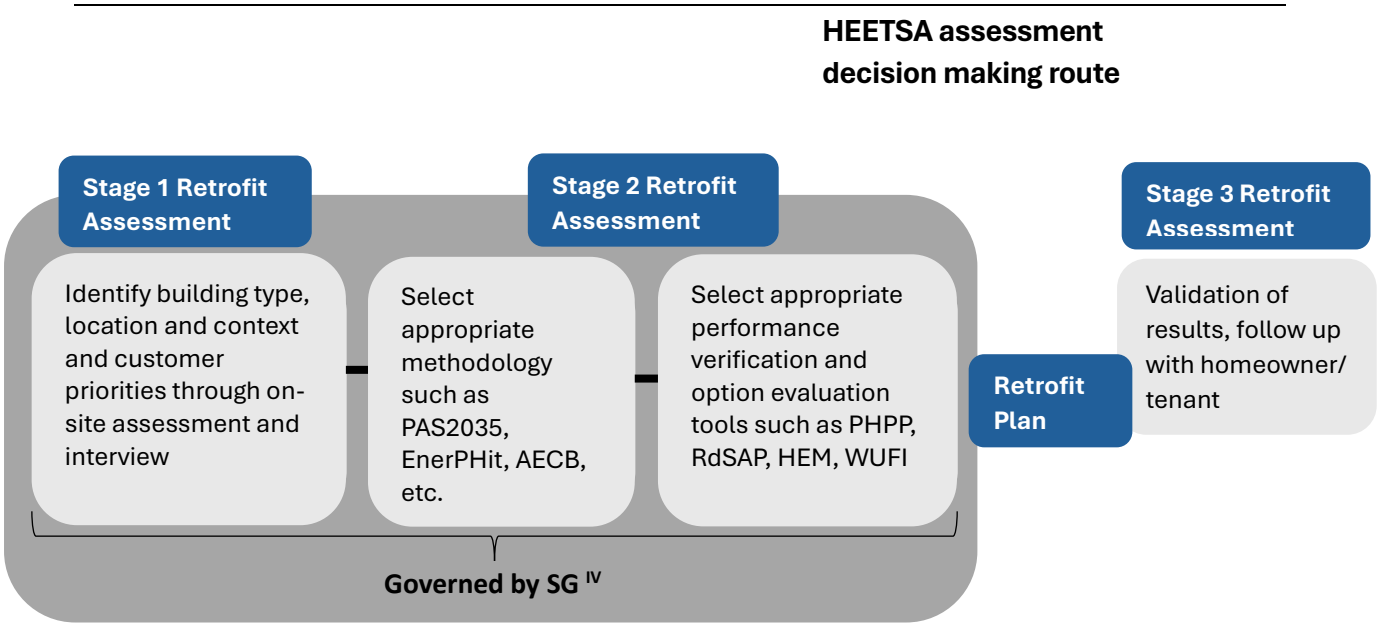
It has been recognised that existing methodologies are often fragmented, leading to inefficient retrofit decisions.

The evidence leads us to conclude that no single methodology is sufficient for meeting all HEETSA's objectives. Therefore, the options are:

1. Create a bespoke methodology
2. Work with the provider of an existing methodology to adapt it to meet HEETSA's objectives
3. Accept that a combination of existing methodologies will be needed, develop a simple framework for their use, and use this to identify where gaps need to be plugged – particularly with regard to the evaluation of the suitability of different individual and communal / district heating options

We are of the view that options 1 and 2 would be prohibited by financial and time costs, and therefore option 3 becomes the default option. Defining adequate method of evaluation of aspects such as suitability of heating options would be necessary to address gaps in the existing methodologies. This could be implemented by developing a simple decision-making tree for use by retrofit consultants[6]. Such a tool would require or rule out the use of an assessment methodology based on questions such as whether a retrofit is intended to meet Passivhaus-equivalent standards, and whether the intention is to replace a heating system with either an individual solution or a connection to a shared heat supply network, etc. Decision-making process recognising staged retrofit assessment requirement and addressing different skills needed to undertake it could look like this:

[6] See 'The Roles and Requirements of a Retrofit Coordinator' under Objective 3. There was a lot of discussion and feedback from stakeholders as to the exact definition and scope of the role(s) of a Retrofit Coordinator. As a result, we have broken this umbrella term down in a way that is intended to provide greater clarity to the Scottish Government, stakeholders, delivery bodies, and consumers.



[I] Including consideration for local planning constrains, listing, building condition, funding, future penalties (current and future regulatory context, such as social landlord's requirements to meet EPC band B).

[II] Selected methodology should be supplemented with relevant guides such as Historic Environment Scotland (HES) guide to retrofit of traditional buildings where appropriate.

[III] The assessment and evaluation tools are valuable aids in informing what options may be available and the assessor to be trained in their use and the interpretation of their results.

[IV] Governed by the Scottish Government (SG) with independent verification and with the aim of protecting public interest. This could be within the powers of the Building (Scotland) Act, the Energy Act 2023 or others, and is yet to be determined.

Figure 2: Simplified diagram of decision-making process illustrating staged retrofit assessment

Emerging technologies such as Building Information Modelling (BIM) and artificial intelligence (AI) offer promising solutions in the future. These innovations could enhance existing methodologies by automating comparisons, incorporating lifecycle costs, and providing actionable, context-specific recommendations, leading to Building Passports/ Logbooks enabling better management and maintenance of the building stock.

Consumer protection and retrofit literacy

Public confidence in retrofitting remains low due to negative press and prior experience of poor installations. Rebuilding trust requires showcasing successful case studies, promoting skilled professionals, and ensuring high-quality outcomes.

The plethora of current assessments, from quality assured assessments and regulated methods to marketing tools and lack of adequate customer and assessor knowledge needed to make informed decisions, together undermine public trust. The customer journey can be enhanced by the following approaches:

- customer centred approaches prioritising long term health outcomes,
- impartial advice,
- quality of assessment and advice delivered by local, skilled assessors,
- tailored retrofit advice

Summary

The current assessment market for retrofit projects has significant gaps in evaluating the technical suitability of clean heating and energy efficiency measures. This is most evident around evaluating heating options and agnostic, sensitive energy efficiency improvements to historic and traditional buildings. Individual assessment methodologies lack granularity, ability for comparative evaluation of options, further impaired by knowledge gaps and public scepticism. The focus of HEETSA to address limitations identified in this Objective should therefore be:

- Ability to compare options while considering human behaviour, lifecycle impact and mandating post-occupancy evaluation
- Address current data gaps precluding adequate assessment of communal heating and alignment with Local Heat and Energy Efficiency Strategies (LHEES) and Local Development Plans
- Provide means of independent verification of expertise, training and public awareness addressing knowledge gaps limiting successful customer journey
- Develop a decision-making tool allowing for integration and evaluation of existing methodologies best suited to deliver intended long-term retrofit outcomes.

This approach will require sector-wide framework that enhances training, incorporates lifecycle analyses, relevant data collection and prioritizes occupiers ensuring long term benefits through post-occupancy evaluations and adequate customer engagement. The process needs to be governed and regulated by the Scottish Government and align with the Building (Scotland) Act, the Energy Act 2023 and any other relevant current and future legislation, (including but not limited to circular economy, bioeconomy and just transition strategies).

Objective 3: Skills and Qualifications

What skills, roles, qualifications, and quality assurance standards will be necessary to meet HEETSA's Objectives?

Qualifications and Training

Meeting HEETSA's objectives will require utilising and expanding the full range of current qualifications and training opportunities. Some specific needs, such as training assessors, come with specific training requirements, and so supply and demand should be relatively easy to map (including geographical mapping of expertise), whilst others are fuzzier (see The Roles and Requirements of a Retrofit Coordinator).

Similarly, some routes to accessing qualifications and training are more formal and clearly signposted than others. For example, higher education institutions offering degrees accredited by the professional institutions offer clear and structured routes to achieving chartered status, and so will be invaluable for meeting demand providing young people can be encouraged to take them. However, relying on traditional routes to meet the skills gap means accepting a time lag, poses barriers to many learners, and means the benefits of non-traditional and informal learning opportunities will not be fully captured.

Barriers to accessing training and traditional learning methods that are based on pedagogic learning (as opposed to andragogic learning) and which require regular attendance (often in-person, on campuses, and during the working day) pose barriers to adult learners. These barriers are particularly pronounced for groups such as women, neurodivergent people, people with caring responsibilities, and those living in rural and remote areas.

However, we are seeing a growth in formal and informal opportunities provided by newer entrants to the training market, which are more suitable for adults and those already employed in HEETSA-adjacent professions. This landscape is currently patchy, evolving, not well captured by policy, and the quality and relevance of offerings is variable. This suggests a need for some further regulation in the future, but this needs to be balanced against the needs of meeting the skills shortage.

The value of professionals engaging in formal and informal communities of practice (CoPs) should not be under-estimated, and should be recognised by employers. As participation in CoPs is usually a transactional relationship, the benefits accrue more as individuals develop their careers and gain more knowledge and experience.

Finally, we note that many of our more qualified and experienced participants expressed the view that their expertise is not sufficiently understood and valued by both government and the public. For example, even if people do understand the difference between a basic home energy check or an Energy Performance Certificate (EPC) and a full, detailed survey, they do not understand the significant added value of paying for a professional with chartered or equivalent expertise.

If householders make decisions and invest their money based on insufficient and/or sub-standard advice this leads to retrofit projects with poor, sometimes negative, outcomes, and serves to undermine public trust in the retrofit and net zero agendas. The proposed changing of wording for the recommendations section of an EPC is a step in the right direction. However, the Scottish Government needs to do more to ensure that delivery bodies, particularly those carrying Scottish Government branding, better communicate the limits of their expertise, and that those undertaking more basic learning understand the limits of their knowledge and the need to consult experts when recommending measures to householders.

Independence and Impartiality of Advice

The complex nature of the retrofit market means the risks of biased advice need to be addressed by policymakers. This may be conscious bias, for example where and advisor or installer has a financial relationship with one or more manufacturers or suppliers, or where recommendations made by advisors are limited to measures subsidised by government funding. Or it may be unconscious bias, for example where an advisor has particular expertise with certain building types or retrofit measures.

The former is probably better addressed through regulation. The latter may, at least partially, be addressed as a result of more skilled professionals entering the retrofit market and developing competitive advantages based on their expertise – if this is clearly communicated to householders and others involved in the retrofit journey.

Quality Assurance and Codes of Conduct

Poor quality installations currently blight some parts of the retrofit market. These can result from rogue businesses, problems with the design and incentives included as part of some retrofit schemes focusing on isolated measures, lacking holistic assessment of building condition and needs of the occupants. For example, the UK Government has recently identified problems with the Energy Company Obligation (ECO) and Great British Insulation Schemes (GBIS). This review has highlighted persistent problems, such as very poor-quality work and materials in order to reduce costs or meet rushed deadlines. Current UK consumer protections on their own do not provide enough pre and post-installation checks and inspections to protect homeowners. Independent advice and versification are essential for successful delivery where current approaches to verification of quality have fallen short of consumer protection, compromising customer trust.

This needs to be addressed through a range of measures, including measures such as requiring all those involved in delivering retrofits to have appropriate and sufficient public indemnity insurance; regulating to improve customer complaints handling and redress processes. We note that business and product regulation is a reserved matter, but that consumer regulation is baked into related legislation (e.g., the Heat Networks (Scotland) Act 2021) and so, where possible, HEETSA's aims would be better served through devolved regulations.

We also found substantial support for a Code of Conduct, which could be introduced to be specific to HEETSA. We have suggested that NHS England's 'six principles' of person-centred care[7] could be easily adapted as an umbrella code for those involved in delivering on HEETSA's objectives. We note that existing codes, such as TrustMark's Consumer Charter, treat people as able and informed decision-makers (i.e., 'customers') whereas codes employed in the care and legal professions treat people as individuals ('clients') with potentially complex needs, and without making assumptions about how able or informed they are. This difference in framing is critical, and should be extended to how we frame properties as well as people.

[7] Available at: HEE - NHS - Person Centred Care

Finally, we also strongly urge the Scottish Government to conduct its own independent investigation of examples of poor-quality retrofit work undertaken in Scotland. This level of regulatory oversight would be further improved by some expansion of the criteria for measures requiring a Building Warrant, based on those measures and property types where there are higher degrees of technical risks.

The Roles and Requirements of a Retrofit Coordinator

This question goes to the heart of what HEETSA is intended to be, how it should be delivered, and what are the skills and qualifications necessary to deliver retrofits. When considering this question, we have had to be cognisant of what HEETSA needs to achieve, and what outcomes it needs to avoid.

What HEETSA needs to achieve is the delivery of effective retrofit projects that improve the performance of properties (beyond simply energy efficiency), save householders money on their energy bills, improve their comfort levels, and leave them with a high level of customer satisfaction. At the end of a HEETSA retrofit journey a householder must be sufficiently happy to recommend the whole process to others.

What HEETSA needs to avoid is the delivery of poor-quality retrofit projects, the installation of measures that will later need to be removed to install measures necessary to meet higher standards. Recommending measures without adequate consideration for and engagement with building users and any other outcomes which would be detrimental to public trust in a government-backed process.

As such, defining what is meant by a ‘retrofit coordinator’ (if, indeed, this term is to be used) will be critical to the success or failure of HEETSA.

Based on the whole body of evidence collated, we have reached the conclusion that although the term ‘retrofit coordinator’ is becoming increasingly common, there is no standard definition of what it means, and we are of the view that it actually covers three roles, as follows.

Note that we are not beholden to these three terms. This is because we are aware of the potential for terminology to become a barrier. For example, an architect or even a householder might not see themselves as a project manager but, in this context, might have all the necessary experience needed to project manage a retrofit project. We recommend that the Scottish Government includes this in the proposed HEETSA consultation.

Finally, we are not concluding that a single individual could not fulfil all three roles, but we are recognising that requiring an individual to be able to do so further limits the potential pool of individuals who could usefully apply their knowledge and skills to one or more aspects of a ‘coordinator’ role.

A Retrofit Project Manager

A project manager is someone who can take a set of information – in this context, a list of measures to be installed (in whatever order), the times needed to install each measure, the costs of installing each measure, a list of suppliers and installers, etc – and produce and manage a project plan. Whilst specific qualifications exist for project managers, many projects across all professional fields are managed by staff without such qualifications, and many householders will have the capability of managing their own retrofit projects. For these householders, the real benefit of employing a project manager is simply to save a considerable amount of time and stress. For less able householders, the benefits are more holistic – coordinating a package of measures, helping them understand what is to be done, the implications of doing so (saving energy, needing to be decanted, etc).

However, none of these aspects necessarily require a project manager to have detailed technical expertise and, importantly, this creates an opportunity to reduce the skills gap and increase provision by attracting people with transferrable skills. For this reason, we would not wish to see specified qualifications as barriers to entry, although some (e.g., the retrofit assessor or coordinator qualification under PAS 2035) may enhance the service that project managers can offer.

The project manager would not be undertaking technical suitability assessments, surveys, making decisions on measures nor give any technical advice. In this context, a project manager might come from a specific business, a local retrofit hub, a Registered Social Landlord (RSL), or they might be the householder themselves (supported as necessary).

Finally, there will also be instances (e.g., where single and/or basic measures are to be installed) where a project manager is not needed.

A Retrofit Consultant

In this context, a Retrofit Consultant is someone who has a substantial amount of more general knowledge and experience of buildings (probably one or more specific types of building) and the likely options for retrofitting them. This is someone who can inspect a property, identify potential problems for further investigation and remediation, and narrow down the range of retrofit measures by excluding ones that are clearly inappropriate and flagging up options that merit consideration (subject to further investigation and assessment by one or more specialists and assessors). The consultant will have sufficient knowledge and contacts to recommend which specialist and assessors should be engaged, and be fully familiar with all the relevant regulations and elements of a retrofit journey.

As such, a retrofit consultant would be expected to have a chartered status or equivalent knowledge and experience however, this is where defining this role becomes trickier. It would be easy to simply say that anyone in this role must have a chartered status with one of a number of professional associations (RICS, CIAT, RIAS, etc.) however, doing so immediately restricts the pool of potential candidates and excludes others without chartered status who could fulfil this role, and chartered status is not an

absolute guarantee of quality. Conversely, not prescribing some minimal level(s) of qualifications and/or experience opens up this role to anyone, and opens the door for cowboy operators and their impacts on public trust.

In addition, given the need for all such persons to be familiar with the HEETSA 'version' of a retrofit journey, this knowledge need highlights the tension between the potential benefits of recommending a HEETSA-specific qualification (either a new qualification or a modification of an existing qualification) versus the likelihood of adding yet another barrier to entry to a market where there is a need to rapidly scale up the supply of staff.

This issue could be remedied by ensuring technical oversight from an accredited professional. Where some levels of accreditation, for example conservation accreditation, would be sufficient to demonstrate expertise, general accreditation may not be sufficient to ensure professional expertise in working with existing buildings. Professional accreditation governed by Accreditation Bodies who keep an independent register of accredited retrofit professionals who are required to provide evidence of their knowledge, skills, and experience. Alternatively, verification of technical expertise could be in the same principle as Approved Certifier of Design, governed by BSD. We would recommend this aspect to be consulted on with the professional associations and the wider industry to ensure suitability of verification of technical expertise.

A Retrofit Advocate

The general term 'advisor' is used throughout this report and across the public policy landscape. In common parlance advisors can be anyone from senior professionals through to volunteers with minimal or no formal training, and in the context of retrofit projects could cover technical, financial, welfare, and other forms of advice. As such, in the specific context of developing a HEETSA, it becomes an unhelpful term.

Therefore, within the HEETSA context, it may be more useful to differentiate between advising on technical issues (where specific technical knowledge and experience is required) and advocating for the best possible experiences and outcomes for householders – understanding householder needs, managing their expectations, dealing with suppliers and tradespeople. This role, therefore, becomes a more specific element of a retrofit journey, emphasising that retrofit projects are also social projects, particularly for community retrofit projects and those involving fuel poor and otherwise vulnerable householders. Not all householders will need an advocate, but advocates should be seen as an essential part of ensuring a just transition.

Whilst we are reticent to recommend specific qualifications likely to create additional barriers to entry, the obvious candidates will be individuals from social, care, and welfare backgrounds, as well as from community groups. This role emphasises the need for empathy, communication skills, and local knowledge. This makes the role distinct from a Project Manager or Retrofit Consultant whilst also clearly falling under the umbrella of what a 'retrofit coordinator' should have within their skillset.

The Roles and Requirements of an Assessor

Assessors are clearly defined roles, in that specific qualifications and certifications are required to become an assessor for any given standard or regulation. If, as we are recommending, the needs of HEETSA cannot currently be met by a single standard or assessment method then the role and requirements for a HEETSA assessor become self-explanatory. I.e., the person(s) managing a HEETSA-based retrofit identify the most appropriate standards and assessments, which directly dictate the necessary qualifications and requirements to meet those needs. If the assessor does not hold the required qualifications, they should be in a position to make a recommendation for a professional qualification required for the project, or outsource that part of the assessment to ensure adequacy of the assessment and the retrofit proposal.

Engaging and Supporting Local Installers

Engaging and supporting local installers, particularly those in rural and remote areas, should be seen as an essential part of the retrofit agenda, and the agendas for empowering rural communities and tackling socio-economic deprivation more widely. However, these individuals are invariably time-poor and working to tight margins. It is important for installers and assessors to be independent and work closely together to offer adequate advice and delivery within a context specific scenario. Incentives and quality assurance schemes must take into consideration challenges of small, local trades people, offering equitable opportunities and endorsing good practice.

As discussed in more detail in our Technical Report, local installers can, and often do, act as advisors, and so can be levers for triggering householders to tackle maintenance issues and begin retrofit projects. Local installers are often seen as being more trustworthy, both than larger firms based further afield and more than those paid to provide advice, and as being able to offer more personalised services. However, their circumstances and previous poor experiences with government schemes (e.g., the Green Deal) pose substantial barriers to engaging with them, upskilling their staff, and convincing them of the benefits of these.

Whilst greater regulation of retrofit service providers is clearly necessary, doing so risks harming the many small businesses who are demonstrating good practice. We recommend that the Scottish Government consults further on this matter in a way that minimises their time costs of responding.

As per the following section, we see significant potential for Climate Action Hubs and similar locally-based trusted intermediaries, working in partnership with local authorities as necessary, to maintain lists of reputable installers and signpost householders to them. In addition, should EPCs become fully ‘live’ digital documents, this would create an opportunity for them to be used to also signpost householders to local installers.

Roles of Community Groups and Hubs

Our evidence base leads us to conclude that engaging community groups and Climate Action Hubs (with a change of terminology) is likely to be fundamental to the HEETSA

process. By rethinking the role(s) of ‘retrofit coordinators’ and the nature of the retrofit journey the roles of these organisations become much clearer (see The Roles and Requirements of a Retrofit Coordinator).

Where we see these groups sitting is as facilitators and capacity builders, working in association with local authorities (as per the Climate Action Hub model), and building networks with all those involved in delivering on HEETSA’s objectives. They may well include members who are in those roles – retrofit coordinators, representatives of local installers, etc. Working with local authorities and other support services, such groups could become invaluable in developing and maintaining lists of local contacts for all those involved in HEETSA retrofit journeys, promoting those following good practice, and flagging cowboy operators. All of which would serve to build much-needed trust in the retrofit agenda at local levels and reaching the hard-to-reach.

Where local capacity is limited, or until it can be built, then it is inevitable that local authorities and other locally-based trusted support services (e.g., Citizens Advice Bureaux) will need to be resourced to ensure a just transition however, this would be to minimise any deviation from a core HEETSA delivery model.

The following diagram illustrates how Climate Action Hubs / Local Retrofit Hubs could be integrated into the HEETSA process.

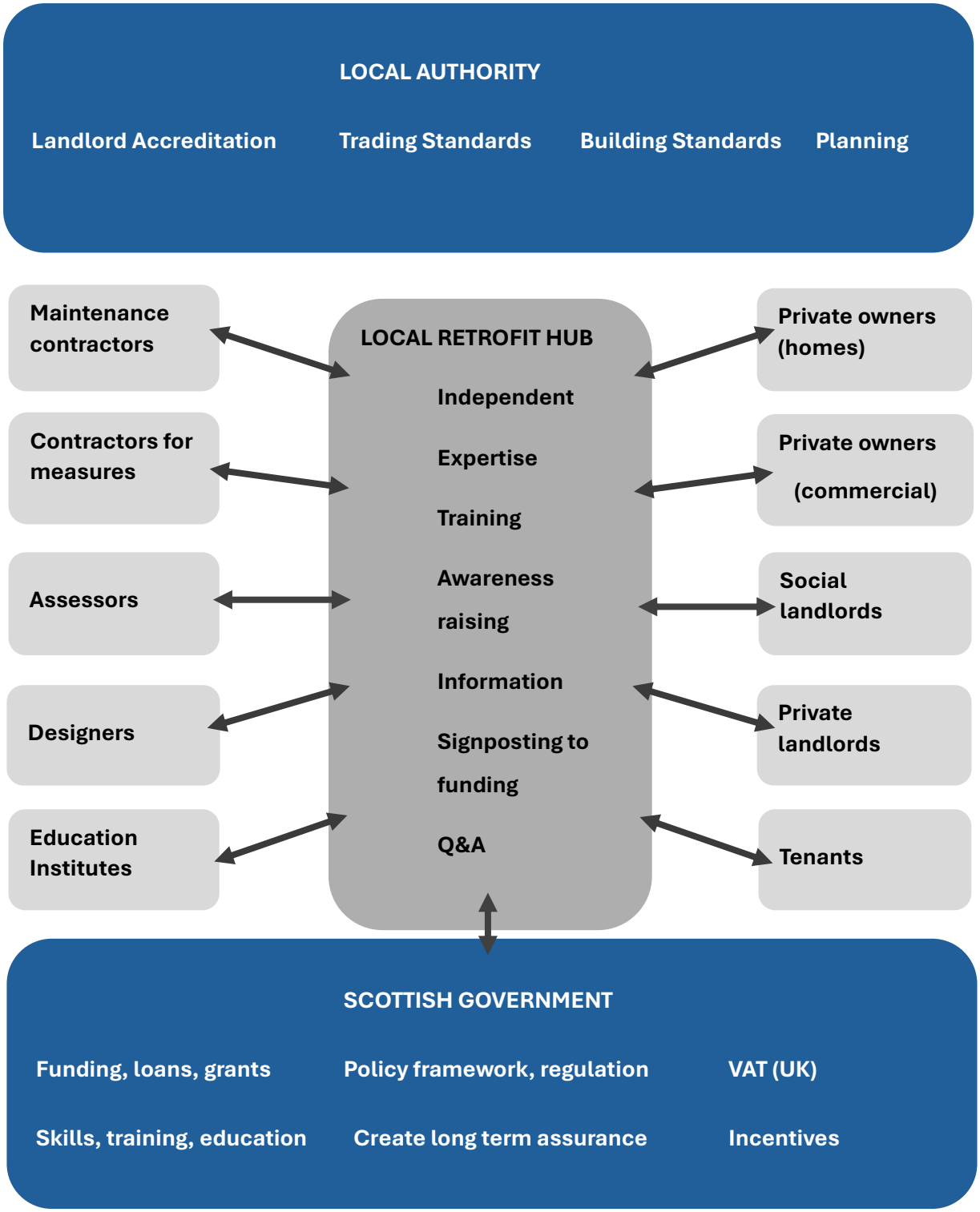


Figure 3: Illustrative diagram of how Local Retrofit Hubs could be integrated into the HEETSA process

Coordinating HEETSA roles

The following diagram illustrates how these roles may be structured. We are not proposing this as a definitive solution, but as an initial process for further discussion.

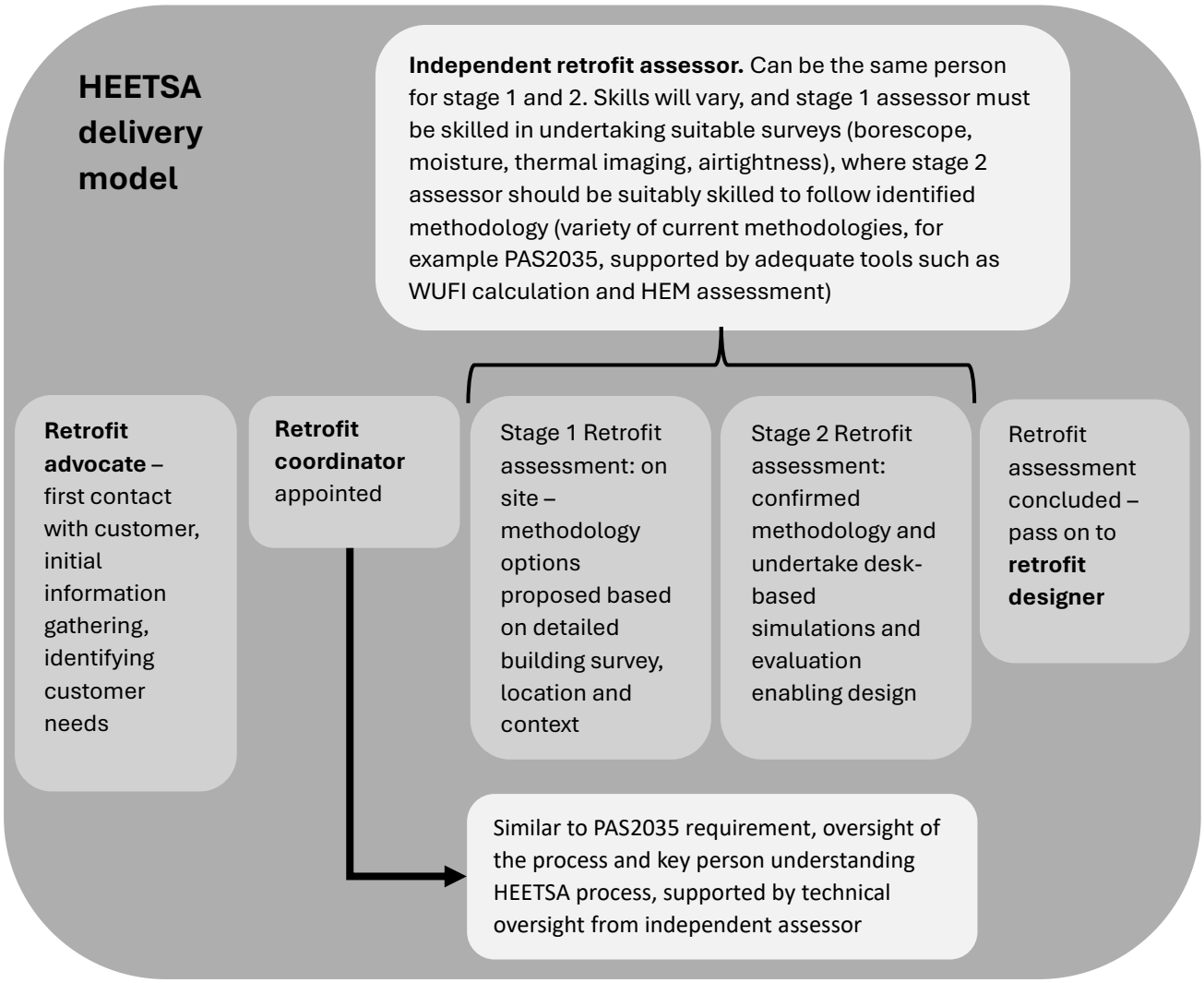


Figure 4: Illustrative diagram of how a HEETSA retrofit may be structured

Retrofit as an enabler for community resilience

Finally, it is important to recognise the value of community-led maintenance, retrofit, and communal / district heating projects as an enabler for community resilience. Figure 5 illustrates how these projects can contribute to building stronger, more resilient communities.

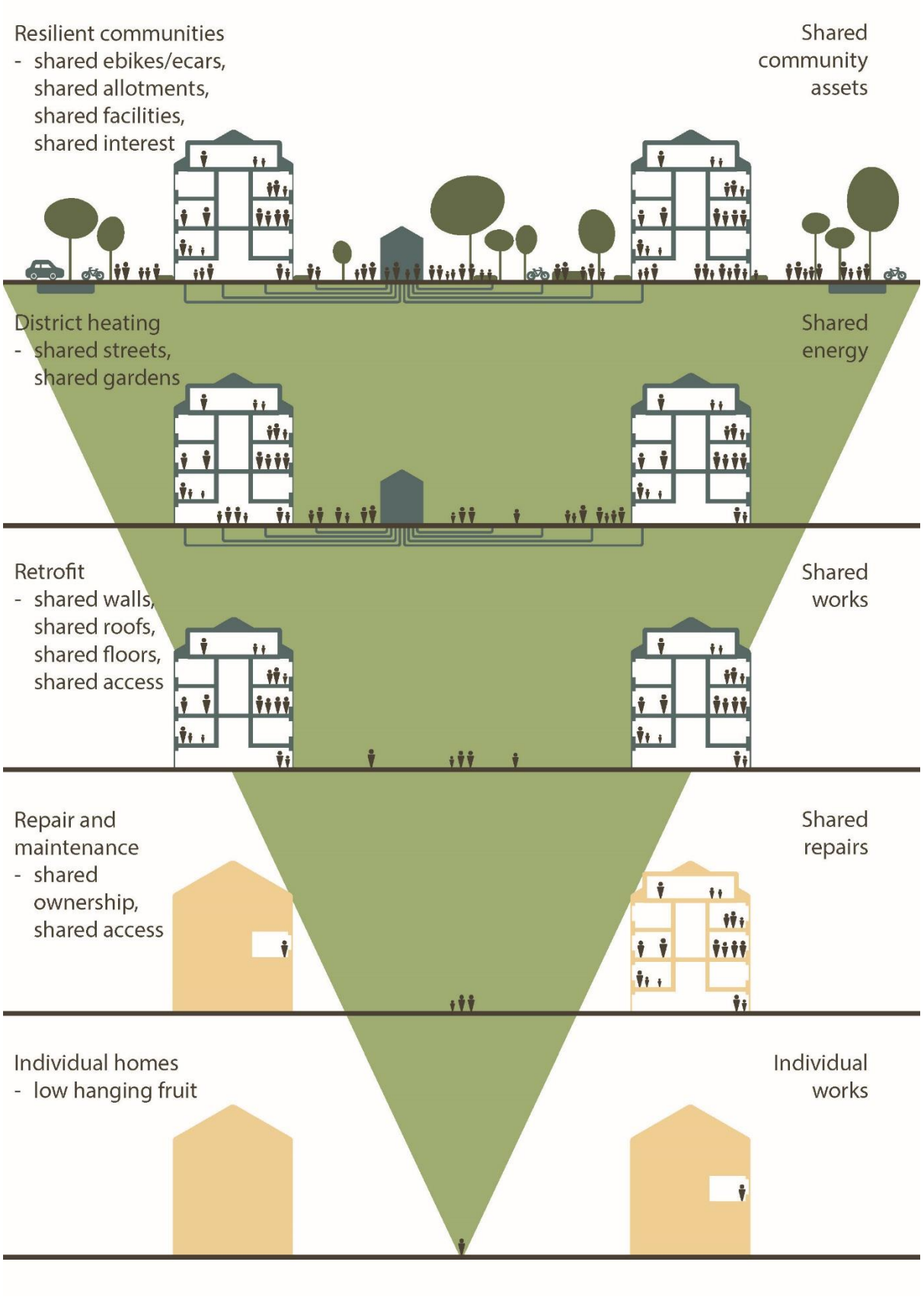


Figure 5. Community maintenance, retrofit, and communal / district heating projects as enablers for building resilient communities

Credit: EALA Impacts. Reproduced with permission.

Source: EdinBRIC. Credit: EALA Impacts. Reproduced with permission.[8]

Summary

The impacts of the skills shortage and the measures need to address it cut across many of the themes of this project, and across Scottish policy more widely. However, they are particularly acute for retrofit given the greater attraction of professionals and tradespeople to the new build market. They are also directly impacting on capacity to deliver sufficiently technical standards of independent and impartial advice, leading to projects with sub-standard and negative outcomes, which then impact on public trust in the retrofit and net zero agendas.

Whilst there is no silver bullet solution, there are number of levers that can be employed to start to close this gap:

- Supporting the provision of degrees accredited by the professional associations, and doing more to encourage young people to take them (accepting that the benefits of this will take several years to accrue).
- Enabling adults and professional learners to engage with the growing market for non-traditional learning providers, with their greater focus on andragogy-based learning. Andragogy-based learning methods are designed for adults and emphasise self-directed and autonomous learning, where the teacher acts as a facilitator. Whereas pedagogy-based learning methods are designed for children and younger people, where the teacher communicates knowledge in a more unidirectional and structured way. Pedagogy-based approaches, amongst other differences, are more content-focused, as opposed to problem-centred, and assume that learners do not know why they need to know something, or have the same self conceptualisation and awareness of their learning needs and how they themselves learn.
- It follows that problem-centred learning, with an emphasis on applying knowledge and experience, benefits from learning being provided in multiple ways, not just in the classroom. This means that, just as gaining practical laboratory experience is essential for teaching the sciences, teaching people about buildings and assessing buildings should include practical (on-site) experience as part of a critical pathway to achieving a qualification. However, given the geographical availability of practical training, it is worth remembering that leaners live in their own 'sites'.
- Understanding the value of enabling professionals to engage with communities of practice, and instilling this in employers.
- Breaking down the emerging role of 'retrofit coordinators' into more discrete roles to enable more people from built environment-adjacent fields to transfer into them, to use their expertise to enable more successful retrofit projects, and

[8] See: Theory — EdinBRIC

in turn to empower householders and help rebuild consumer trust and confidence.

Independent retrofit coordinator's training and qualifications should thus be regulated. This could include APEL[9] route for professionals into HEETSA, valuing existing skills and expertise within a recognition framework to Scottish Government set standards for formal qualifications to become a HEETSA assessor. This would allow more professionals to demonstrate competency and could include HEETSA assessors who are competent to assess and make recommendations on all energy efficiency measures and clean heat assessments as well as HEETSA assessors who have an APEL route, but only for fabric measures or heating system specialist for the clean heat assessment. These two professionals would work collaboratively to propose most adequate solutions for each retrofit project under HEETSA delivery model. Doing so will require greater engagement with fields such as social care and learning specialists, particularly adult learning specialists, and so we have deliberately attempted to embed these messages throughout both these reports.

Objective 4: Market Readiness

What is the current state of the retrofit assessment market in Scotland and its capacity to deliver an effective nationwide technical suitability assessment service?

Current Status and Barriers to Market Development

The housing market is currently heavily dominated by the new build industry, which offers greater economies of scale and higher profits for tradespeople. Retrofits require significantly more management input, driving up costs, while the available trades barely suffice for new builds. Housing owned by registered social landlords (RSLs) is a partial exception due to the economies of scale of servicing large groups of properties.

The retrofit market is also suffering from a legacy of poor practice. Historically, some government funded work has been for incorrect measures, wrong products, and lack of assessment of defects. Among decision makers, there is often a lack of understanding of building physics generally, and a lack of provision of proper advice and installation knowledge (albeit with good intentions).

There is also a pronounced deficit of competent assessors and installers, particularly in rural areas, which is exacerbated by limited training and funding options. Adequate assessment and design requires developing sufficient experience through practical training and professional practice, and this takes time to acquire. Professionals need to be equipped to evaluate buildings comprehensively, considering maintenance conditions, technically appropriate measures, and sequencing their delivery where

[9] Accreditation of Prior Experiential Learning (APEL) – process of demonstrating knowledge and skills through work related experience, towards a formally recognised qualification.

some measures need to be installed before others. Currently these assessors are likely to be professionals such as experienced architects, building technologists, and building surveyors.

There are also practical problems posed by Scotland's diverse and aging building stock, weather conditions, the urban/rural divide, and the need for decision-makers to understand that every building is unique. Whilst the use of archetypes is not without merit, particularly for planning area-based schemes, it needs to be recognised that any two buildings may appear identical but that on-site inspections may reveal different problems requiring bespoke solutions. Relying on basic surveys and remote inspections will result in problems not being identified, storing up more serious and costly problems in the years ahead.

Current provision of advice, education, and awareness raising presents another barrier to market development, and to ensuring a just transition. Whilst some householders will find advice given online or by phone sufficient to enable them to begin retrofit projects, this poses barriers for groups including those with physical and learning disabilities, those for whom English is not their native language, and those who struggle to engage with internet-based services. And once a retrofit journey starts, there is simply no substitute for in-person and on-site advice.

Naturally, funding, and uncertainty of long-term funding, along with a need for greater policy and regulatory alignment, poses its own set of challenges.

These barriers will need to be addressed through tackling both supply and demand.

Policy, regulatory clarity, and alignment

As HEETSA moves forwards we would expect questions to be raised as to how it will interact with building warrants. A building warrant is required for all building work unless the work falls under either regulation 3 or 5 of the Building Standards - work exempt from the building regulations (Regulation 3, Schedule 1) or work that does not require a building warrant but must still meet the building regulations (Regulation 5, Schedule 3). Even if retrofit work falls under Schedule 3 and doesn't need a building warrant the building owner would still need to ensure that the work met the building regulations. In this context, HEETSA could serve to provide greater clarity to building owners by being a starting point that identifies whether a specialist retrofit building warrant will be required, enabling those managing a retrofit project to better plan ahead, and to help manage expectations. It could also be a competency included within the role of the approved certifier of design (ACD) scheme where HEETSA was the design process for works that fall within the scope of the standards. We would recommend consulting the industry on the scope of this role and whether the delivery model should include the approved certifier of construction (ACC). The latter is a delivery role, rather than design, therefore it should be discussed in the wider context of retrofit delivery model, beyond the design stages falling under the remit of HEETSA.

There is a risk that, if not coordinated, the Building Standards and regulations covering retrofits could diverge, which is unhelpful given the prominence of the former to non-

specialists. Whilst it would be impractical to align these regulations so far as requiring all retrofit projects to bring properties up to the current standards for new builds, they should be aligned in a way that enables retrofit projects to identify pathways of measures to reach them over time. Going further, standards should be designed to enable pathways for all buildings to achieve net zero or better by a set date. This would also enable the identification of properties that can never realistically achieve this standard, and so may be better off being replaced. HEETSA provides an opportunity to provide greater long-term clarity as to how this goal can be most effectively achieved.

Emphasis on promoting certain measures and barriers to communal heating

Within policy and funding mechanisms (e.g., ECO), there is an emphasis on promoting certain measures over others. Currently, air source heat pumps (ASHPs) are one prominent example however, more detailed assessments may rule them out or favour other options. Assessments (e.g., EPCs) that focus on individual properties, and do not capture factors beyond the building envelope may also influence technical feasibility assessments. For example, an individual assessment may favour recommending an ASHP, but a community-scale retrofit project may identify grid capacity as a constraint, or highlight greater potential for energy savings from developing a communal or district heating system (assuming that these assessments are based on real, as opposed to modelled, energy demand data, which is often not the case).

Natural building materials, which can offer greater benefits beyond energy savings, are often overlooked, and the need for maintenance and repairs may not be sufficiently flagged. HEETSA provides a valuable opportunity to address these imbalances.

Building Consumer Trust

The Scottish Government needs to recognise that many householders engage in retrofit projects reluctantly – understanding their benefits but needing greater incentivisation. Renovation projects often include retrofit measures but canny householders on fixed budgets will have an eye to which improvements result in the greatest increases to their property value, which may often favour aesthetic improvements (e.g., maximising 'kerb appeal'). Tenants can have issues with understanding the need for and benefits of retrofit projects, and coping with the disruption they can create (e.g. decanting occupants whilst work is being done). And then there are those who are simply unconvinced and actively resistant to the net zero agenda. Therefore, when retrofit projects do not meet householders' expectations and result in sub-standard or negative outcomes these directly impact on public trust, particularly when these are delivered as part of government-backed schemes.

The Scottish Government needs to help ensure that property owners can access expert and impartial advice about the best way to improve their home, recognising the different focus in decision-making and potential for bias. For example, both homeowners and businesses will be keen to deliver improvements at lowest cost but may miss out on longer term benefits as a result. The design of government retrofit schemes needs to

reflect these facts and match investment with the right measures for each individual home. Where advice services are being offered to property owners, these need to be clearly impartial and recommendations should not be weighted in favour of particular improvements or businesses.

We recommend that the Scottish Government continues to review and improve the range of retrofit advice services being provided to Scottish property owners to ensure that proposed improvements are clearly appropriate and impactful in the medium and longer term.

Consumer Protection, Complaints Handling, and Redress

Currently there are a lot of complaints to trading standards in relation to retrofit works (e.g. spray foam insulation, issues with authorisation bodies, how to use heat pumps, missing DNO certificates, no smart export for solar panels). Consumer confidence and energy is very low and there is a high level of detriment. For example, spray foam insulation has been the subject of numerous complaints, with the same companies responsible for improper installations now charging to remove it. Processes are not clear as some traders need to be authorised, and some do not. Some funders require authorised traders and some do not. The consumer journey in relation to EPCs, funding and retrofit is very complex and confusing. Without thorough post-retrofit assessments to ensure installations are correctly set up and works are properly monitored, consumer issues will persist at a significant scale. Handover procedures are also key to this process to reduce complaints. Commissioning needs to be thorough, and occupiers should be being provided with detailed information and assistance in how to operate and maintain all aspects of their buildings.

As such, there is an opportunity for HEETSA to establishing stringent quality assurance processes and independent oversight to address these issues and enhance consumer trust.

Additionally, we recommend that the HEETSA process requires some assessment of occupant behaviour considerations by interviewing occupants, along with adequate site investigations, as a means of re-building customer trust. We note that some assessors already do this, and that community-scale retrofit projects invariably explicitly include these activities.

Funding and Financial Uncertainty

Insufficient levels of funding, short funding cycles, lack of long-term clarity, and instability in policy, all pose barriers to delivering retrofit projects and building consumer confidence. Whilst we recognise that these factors are not entirely within the Scottish Government's control, it has created an antagonistic system, with further friction created where government policy does not sufficiently align with the needs of local authorities and housing associations, leaving them to work 'creatively' within restrictions.

Here, HEETSA provides an opportunity for owners to clearly scope what measures are and aren't needed for an individual property or a group of properties, which can then be

set against what funding is available. It also provides an opportunity to review the recommended measures against schemes for funding community-wide improvements (e.g., LHEES) to better align them for supporting deep retrofits, and so help reduce the costs of developing communal / district heating systems. And where funding is not available or is insufficient, perhaps because a measure is outwith the scope of a funding scheme, it would support the justification for the scope to be adjusted. In the case of reserved and partially devolved policies (e.g., ECO) it would support the Scottish Government's efforts to amend schemes to better meet the needs of Scotland's population and building stock.

Innovation and Collaboration

Many previous government initiatives for funding measures, and assessment methods, have been criticised for restricting innovation by being overly prescriptive, or favouring 'modern' solutions over the use of natural materials. These concerns were also raised with regards to the risk of HEETSA doing similar, particularly if it would be tied to any given assessment method.

Whilst we do not recommend that HEETSA is deliberately designed to promote innovation, if it is as agnostic as possible to all measures, and any assessment method or funding stream, it should be able to avoid this pitfall. In addition, the original proposals for HEETSA, as developed in this report, recognise that retrofit projects are inherently collaborative exercises, and this could be enhanced through a delivery framework that requires collaboration. If this is done successfully, new innovations should become an emergent benefit.

Tackling the Skills Shortage

Tackling the insufficient supply of skilled professionals means increasing support for professionally accredited degrees and encouraging more young people to take them to ensure a long-term supply of skilled professionals. However, this will take time (at least several years) to begin to have an impact, and so it will also be essential to draw on our existing workforce – adults and professionals with transferrable skills – to retrain and upskill them into retrofit roles.

These issues are explored in more detail under Objective 3 of this report and Sections 5.2, 6.8, and 6.12 of the Technical Report.

Rethinking the Retrofit Journey

Building the market for retrofit projects means recognising that there is no standard 'retrofit journey'. To be successful, a HEETSA needs to be cognisant of all possible starting points and how they can be leveraged to result in the maximum energy efficiency gains and co-benefits. This means allowing for the fact that different households will have different starting points, different motivations, different levels of understanding, and different limitations.

Examples of starting points include, but are not limited to:

- Householders actively deciding to undertake a deep retrofit project

- Householders deciding to renovate their properties and then considering energy efficiency improvements as part of that project
- Householders seeking or being given targeted energy efficiency advice that triggers a wider retrofit project
- Householders receiving related support (e.g., for fuel poverty or health reasons) which identifies the need for retrofit measures
- Householders receiving advice or information on energy efficiency measures by installers as part of receiving other services (e.g., boiler servicing)
- RSLs and private sector landlords being subject to energy efficiency and related regulations being required to upgrade properties
- Householders being advised by community groups and/or recruited into community retrofit projects

A HEETSA needs to be designed to work for everyone from engaged and informed self-funders through to fuel poor and otherwise vulnerable householders, and those who may be actively resistant to improving the energy efficiency of their properties.

Enabling a Just Transition

If HEETSA is enable a just transition that ensures all Scottish buildings are energy efficient, comfortable, and healthy, with affordable energy bills, its design needs to learn from past mistakes. It needs to avoid unintended consequences such as favouring urban properties over rural and remote properties, effectively writing off some property types by not being applicable to them, and the risk of the costs of improvements being passed on to tenants by way of increased rents. These issues are explored further in under Objective 4 in Section 6.24 of the Technical Report.

We recognise that many measures needed to address these risks fall outside HEETSA's scope. However, if it can achieve its objectives, become an umbrella process for delivering retrofits, and avoid the pitfalls that exist or have existed in previous retrofit and built environment policies, we would hope that it could serve as an example of best practice that would result in spillover benefits to related policies and policy agendas.

Summary

We appreciate that the opening sections under this objective paint a fairly bleak, albeit realistic, assessment of the current state of play. Unfortunately, we cannot change the past and the impact that some policies and schemes (both devolved and reserved) have had on consumer engagement and public trust in the retrofit and net zero agendas. We also recognise that far from all of these problems have been caused by the Scottish Government, and some of the solutions are partially or fully outwith the scope of its devolved powers. However, it is also important to recognise the positive benefits that previous policies and schemes have had, and to understand how, why, and where these benefits have been delivered.

With this in mind, there are steps that could be taken to build the retrofit market and rebuild confidence and trust among the public and all those involved in delivering retrofit projects:

- Working across policy silos (including within the built environment and energy) to do more to align retrofit policy and regulation with areas such as the Building Standards, building warrants, and communal and district heating.
- Tackling the skills shortage (see Objective 3).
- Tackling conflicts of interest, and improving consumer protection, complaints handling, and redress.
- Recognising that there is no standard retrofit journey, and designing retrofit policies to capture all possible entry routes and motivations (or lack of them) for undertaking retrofit projects.
- Recognising that enabling successful retrofit projects, and doing so equitably, will be vital to enabling a just transition, and doing more to align the design and delivery of government policy and regulation with this broader goal in mind.

Whilst we began this objective with a summary of bad news stories, we are of the view that the development of a HEETSA-based retrofit process presents a significant opportunity to turn the current situation around, and deliver a more sustainable and equitable Scotland.

Answers to Research Questions

1. What are the current options for consumers seeking assessment advice and information on clean heating and measures to improve energy efficiency for their home?

Level of agreement: Strong agreement that there are number of options with embedded limitations.
Strength of evidence: There are a variety of systematic assessment tools based on existing energy models (e.g., SAP and PHPP). There are a number of retrofit tools using these methodologies such as the Home Energy Model, PAS2035, and EnerPHit (see Annex 1 . However, many consumers will start with receiving a home energy check (based on RdSAP) or an EPC (also derived from RdSAP), which are of limited usefulness beyond recommending very basic measures and highlighting options for behaviour change, and so advisors and the Scottish Government should be doing more to be transparent and make consumers aware of these limitations. There was also a strong consensus that there has been enough discussion of these issues and not enough action.

2. To what extent do existing assessment methodologies provide a means of assessing the suitability of energy efficiency and heating measures in buildings?

Level of agreement: Very high agreement that existing assessment methodologies do not provide a robust and holistic means of assessing retrofit options as the assumptions made result in overly simplistic assessments.
Strength of evidence: The veracities of existing models and their capacity to handle multiple variables are questionable as, to greater or lesser extents, all methodologies use simplified variables and embedded assumptions. Influences such as location (e.g., the Borders vs Shetland, east coast vs west coast), exposure, and human behaviour are not dealt with effectively by any existing models, and may lead to unsuitable measures being recommended. In practice, the choice of any given assessment methodology or methodologies not prescribed by regulation becomes one of choosing the least-worst option(s) for the type of project – e.g., changing a heating system, tackling traditional buildings, a deep retrofit, planning a community-scale heating system, etc.

3, What are the limitations of these approaches (e.g. cost, time, specialist skills requirements)?

Level of agreement: Strong agreement on the existence and types of limitations.
Strength of evidence: There are limitations in the number of qualified assessors for any given assessment type, and their individual experience. There is a need for both more training provision across the retrofit landscape, for a higher level of training for assessors, and for training for assessors to avoid siloing them by the assessment method. For example, someone being trained to use the HEM should understand how it relates (or not) to other methods, in order to determine if it would be more appropriate to use an alternative method.

There is also a need to assess the suitability of potential candidates to avoid inexperienced assessors whose knowledge is wholly defined within the assessment tool they qualify in. There is also a common public perception that assessment processes are onerous and overly expensive, and a lack of awareness of the benefits of more holistic assessments, resulting in them favoring more limited assessments which may yield sub-optimal results. This lack of post installation and post occupancy assessments severely limits the verification of recommendations and projected savings which can be used to inform and improve the existing models.

Another significant limitation, which is causing confusion within the sector, is where retrofit recommendations made using those tools can be marketing tools for product suppliers - such as suppliers of heating technologies, insulation, and glazing options - without any limitations on the scope of measures being considered being made clear to service users. Common reasons for limitations on the scope and types of measures recommended by advisers or offered by installers include limiting them to those supported by government subsidies and loans, and advisors and installers having financial or other arrangements with manufacturers or suppliers.

4. Is the assessment of measures provided generic, archetypal, bespoke?

Level of agreement: Strong agreement that assessments are invariably generic, and of the various limitations of each option.
Strength of evidence: Assessment measures are invariably not bespoke and, through necessity of the simplification of variables embedded in the models used, were at best offering archetype-based recommendations and, in some cases, broad generic advice. There are exceptions - e.g., where owners are aware of the benefits of more holistic assessments and can pay for them – but even these can be limited by the choice of assessment(s).

Assessors who lack experience beyond undertaking assessments tend not to question the recommendations that their software packages generate. The ability to offer bespoke recommendations requires flexibility from the assessment methodologies, and so is dependent on the experience of the assessors. Assessors also need to be wholly independent from any of the suppliers of potential technology suppliers. This degree of independence is dependent on the regulation of the assessors.

Archetype-based approaches have some value – e.g. for shaving costs of community-scale retrofits of more homogeneous building types. However, their universality is questionable – e.g., where factors such as geography, exposure, and existing condition and maintenance are not considered.

There are also barriers to delivering the more holistic assessments needed for effective deep retrofits such as their costs, the costs of deep retrofits, an obstruction by tenants - e.g., due to the level of disruption and the (real or perceived) risk that costs will be passed on to tenants as rent increases.

5. Does the assessment process rely on occupants to report building characteristics or is a site visit by an assessor critical?

Level of agreement: Very high.
Strength of evidence: There was a very high, although not quite universal, consensus that, depending on the complexity of the project, at least one site visit by an assessor (and in some cases, a project manager or other professional) is critical. Occupants are not usually experts, and suitably qualified and experienced experts are able to pick up on issues, problems, and opportunities (etc.) that may be missed by occupants, as well as less qualified staff who have yet to develop what can be many years of tacit knowledge gained through experience. Examples of this included cold bridges, insulation quality, and structural issues. However, it should also be acknowledged that conversations between occupants and assessors can provide useful context and confirm details, and that this is more effective when these can happen as part of a site visit. The balance of evidence and views leads us to support the recommendation that site visits should be mandatory.

6. What are the costs associated with providing the assessment? Are there any instances where the service would be provided for free for the building occupant?

Level of agreement: Moderate.
Strength of evidence: There was little discussion of specific costs, or of what minimum or maximum costs should be seen as acceptable for any given occupant type(s). Rather, there was a general acceptance that some occupants should be supported more or less than others depending on their needs, financial circumstances, tenures, building types, etc.

7. Do existing assessment methodologies cover the suitability of multiple buildings or building parts to install a communal heating system?

Level of agreement: High to very high.
Strength of evidence: Very high agreement that, in general, the answer to this question is no. The main exceptions are PAS 2035 and 2038-based approaches, but even these have their limitations. Where the use of the more holistic assessments needed for this was reported, they were invariably extensions of existing methods (including PHPP and SAP, etc.), with varying degrees of success. Therefore, meeting this need is currently heavily dependent on an assessment provider being able to offer a bespoke approach and the (limited) geographical availability of suitable assessors. One suggestion was that BS 40104, if tailored appropriately, could form the basis of such a standard in the future. There is also a strong consensus that meeting this need is a highly complex task that can only be met by highly qualified and experienced professionals.

There was also a high level of agreement that existing methodologies offer very limited opportunities for such evaluations. The evidence strongly suggests that the current methodologies do not allow for systemic evaluation of suitability of multiple buildings or building parts to install a communal heating system. The limitations lie in siloisation of energy efficiency and heating strategies, with methodologies such as RdSAP, SAP, and PHPP not allowing for satisfactory assessments of fabric condition. Such methodologies are over-reliant on generic assumptions in the absence of detailed performance data (including performance in use), failure to address complexities such as shared infrastructure, energy management, scalability, and cost allocation, and neglecting critical system-specific factors like fuel sources and heat pump integration. Robust frameworks integrating detailed data, stakeholder engagement, and tailored strategies are essential to support delivery of communal heating projects across Scotland.

8. Do existing methodologies take a whole building perspective on the costs and benefits of fabric measures?

Level of agreement: Moderate – it was recognised that if interpreted correctly the existing methodologies can offer a whole building perspective on the costs and benefits of fabric measures. However local cost variations may not be sufficiently represented, and the results rely on the expertise of the assessor.

Strength of evidence: High agreement that existing assessment methodologies, such as SAP, RdSAP, and PHPP, lack a holistic framework for evaluating the costs and benefits of fabric measures, failing to account for user behaviour, regional cost variations, and long-term operational impacts. Energy Performance Certificates (EPCs) provide generalized cost estimates but are unsuitable for informed design decisions due to their reliance on assumption-based data.

Key factors such as ventilation, humidity control, and air quality are inadequately addressed to inform whole-building energy efficiency strategies, with limited consideration of air permeability, condensation risks, and material toxicity, which can significantly impact occupant health. Standards such as PAS 2035 and PAS 2038 emphasise a whole-building, fabric-first approach, but their effectiveness depends on assessor expertise and implementation quality. While RICS Retrofit Standard and BS 40104 provide some guidance, they lack detailed, comparable cost-benefit analyses - highlighting the need for more comprehensive, occupant-focused methodologies.

Note that, in hindsight, the wording of this question does not sufficiently clarify what is meant by "whole building". However, most assessments used to guide retrofit projects (e.g., EPCs) are conducted for individual properties, such as flats in mixed-use and multiple-occupancy buildings. For energy efficiency measures, the impacts of the limitations of existing methodologies for assessing multiple-occupancy buildings are simply amplified in terms of assessing costs - i.e., not accounting for economies of scale for retrofitting properties at the same time. For communal and district heating systems, the impacts are the same as those noted under Objective 2 of this Policy Report and in Sections 3.17, 4.11, and 4.12 of the Technical Report.

9. Do existing methodologies allow for options to be compared – e.g. a comparison of the installation, operational emissions and running costs of improved building heat retention first with a low temperature heat pump, vs a high temperature solution without any insulation measures?

Level of agreement: Moderate. Although some respondents recognised that methodologies such as PAS2035, PAS2038, AECB, and Passivhaus / EnerPHit may allow for such evaluation, others observed this is rarely applied. Others felt that current methodologies are not designed or simply do not offer ability to compare cost and emissions to enable holistic decision-making.
Strength of evidence: Moderate. Insofar as existing retrofit assessment methodologies such as SAP, RdSAP, and PHPP are not designed for comparing detailed retrofit options. While these tools can theoretically be adapted for such analyses, the process is time-intensive, resource-dependent, and rarely used in practice due to its complexity and voluntary nature. These methodologies provide high-level insights but lack the detail needed for nuanced decisions, such as evaluating long-term emissions, running costs, or lifecycle impacts. Broad recommendations and limited attention to factors such as material properties, health implications, and net-zero planning further reduce their effectiveness. The need for advanced, accessible tools that integrate lifecycle costs and context-specific recommendations is critical for supporting comprehensive retrofit decision-making aligned with long-term environmental goals.

10. What gaps exist between current assessment methodologies and the methodologies required to deliver the stated scope for a HEETSA?

Level of agreement: High. Current methodologies fall short of the requirements of HEETSA, focusing on individual buildings, relying on predicted data, not accounting for occupant behaviour, dynamic performance modelling, whole lifecycle and projects often focus on regulatory baseline.
Strength of evidence: Conclusive evidence that current methodologies such as SAP, RdSAP, and PAS2035 fail to meet HEETSA's goals. This is due to fragmented approaches, limited focus on whole-building strategies, non-comparable outcomes, and reliance on assessor expertise, all of which weaken their effectiveness.
Poor training and constrained accreditation models of retrofit professionals often lead to inadequate advice, poorly executed installations, customer dissatisfaction, and even non-mortgageable homes. The lack of post-occupancy evaluations hampers learning and improvement, while public confidence remains low due to negative experience and profit-driven advice.

Addressing these issues requires a tailored framework, better training standards, post-occupancy evaluations and customer-centred approaches recognising regional differences across Scotland. Industry collaboration, showcasing success stories and mission driven, resilience focused goals can allow to rebuild trust and demonstrate strong leadership from the Scottish Government.

11. For each source of advice and information on recommended clean heat and energy efficiency measures, what accreditation and qualifications exist to ensure that knowledge provided is accurate, relevant and to what degree it accounts for a building's characteristics or circumstances of its location?

Level of agreement: Very high agreement that advice, often based on limited assessment types (e.g., RdSAP) rarely considers, or sufficiently considers, factors such as building characteristics, location, exposure, fabric condition, or other circumstances (including occupant circumstances). Also, very high agreement that such advice is often not delivered by suitably qualified staff; that the Scottish Government and service providers need to do more to make service users aware of these limitations; that training should include making advisors aware of the limitations of their knowledge; and that not doing so is resulting in non-optimal and (in some cases) negative and costly outcomes.
Strength of evidence: Very high. Many participants were able to cite examples of sub-standard advice leading to unsatisfactory or negative outcomes, commonly due to advisers and/or suppliers lacking sufficient knowledge and experience, and/or being limited or incentivised to promoting certain assessments, measures, or types of measures. This is particularly problematic for delivering clean heat, and even more so for community-scale and communal heating systems. It is not helped by the confusing, and changing, nature of the landscape for formal qualifications and accreditation, which is often driven by political expediency (e.g., for PAS 2035).

12. What code(s) of practice, professional memberships, quality assurance and independent/impartial scrutiny operates to support and regulate the activities of advisors?

Level of agreement: Moderate.
Strength of evidence: One problem here is that the word 'advisor' can cover anyone from a member of a community group, to a non-expert employed by an advice service, or an installer, through to a chartered professional regulated by their own institutional practices. It would, therefore, be unrealistic (and costly) to require all of these to fall under any given regulatory code or scrutiny body. Also, more reputable local installers (who often provide advice) voluntarily sign up to established schemes such as TrustMark, but are also partially regulated through word of mouth and customer reviews.

The question then becomes one of educating consumers about the different levels of authoritativeness of advice, and how to ensure all advisors are required to be scrutinised to a degree appropriate to the limits of their knowledge and experience, and carry appropriate professional indemnity insurance. Furthermore, TrustMark's lack of emphasis on inspecting the quality of workmanship may be giving consumers a false sense of security.

However, as retrofit coordinators become increasingly common, there was a good degree of support for the suggestion of requiring them to adhere to an ethical code of conduct. This could become a simple form of regulation for those advisors whose knowledge and experience does not reach chartered or equivalent levels, help manage customer expectations, and rebuild trust.

13. Can advice on building fabric, clean heating and renewables all be provided by the same service?

Level of agreement: High.
Strength of evidence: The strength of the evidence here was probably stronger than the strength of agreement, due to experts and experienced professionals being more aware of the complexities of buildings and building systems, and being more aware of the limitations of their own knowledge and experience. There is also a supplementary question of whether such a single service would even be desirable, or how easy it would be to manage large numbers of staff with very different areas of expertise, whilst delivering and maintaining high quality outcomes. (Although outwith the scope of this report, there are parallels with other bodies whose performance has suffered due to mission creep).

Going deeper, it is also questionable whether a single service would be optimal for dealing with any of these three aspects. For example, there are many different types of building fabric and even authoritative bodies specialise in different types, so (for example) someone looking to retrofit a traditional building will be better served by advice from Historic Environment Scotland or a conservation architect, whereas someone looking to retrofit a modern building would likely be better served by advice from the Passivhaus Trust or an architect specialising in new builds. Another

differentiation arises between professionals specialising in naturally passive buildings and those specialising in Passivhaus and equivalent builds incorporating MVHR.

Considering this, we note that one of the Scottish Government's changes to EPCs will be to re-word "recommendations" to "potential improvement options"[10]. This wording better reflects the limitations of EPCs, SAP, and RdSAP, and so could be adopted more widely by advisory services.

This also links to how the role(s) of retrofit coordinators could be more closely defined and how training for them could be better aligned. The option being that retrofit coordinators act largely in place of owners managing their own retrofit projects – understanding buildings' and occupants' needs and fast-tracking them to the best sources of more specialist advice before committing to any given measure(s).

14. Are the retrofit advice services provided independent/impartial of any associated supply chains for clean heating and energy efficiency measures installation services?

Level of agreement: Very high.
Strength of evidence: There were numerous examples cited of advice being limited by the availability (or not) of funding for any given type of measure, financial arrangements with manufacturers and installers, and the knowledge or awareness of advisors. These examples covered all services offering advice, including Home Energy Scotland, WarmWorks, local advice services, large and smaller installers, and even community groups. As such, this finding is not a criticism of any of these, but a simple statement of fact. It should also be acknowledged that, even where advice is independent of supply chains, policy, or other influences, there is still the potential for bias from professional experience of measures that have, or haven't, worked in any given set of circumstances. Hence, even where advice is impartial, full surveys remain essential for ensuring optimal outcomes are delivered.

[10] Note: Whilst we are explicitly not commenting on the practices of any quality assurance schemes, it would be remiss not to note that we were made aware of a statement made to the House of Commons by Miatta Fahnbulleh, Parliamentary Under-Secretary of State at the Department for Energy Security and Net Zero, on 23rd January 2025 (just as the final draft of this report was being sent for peer-review). Ms Fahnbulleh reported that ~65,000 households have received substandard solid wall insulation installations from TrustMark registered installers. These installations were funded by the Energy Company Obligation. As a result of an investigation by TrustMark and further investigations by the DESNZ, 39 businesses have been suspended from installing new solid wall insulation in peoples' homes as part of any government-funded schemes. At present this only applies to solid wall insulation installs. Ofgem are following up the findings with affected householders and conducting further investigations. We strong urge the Scottish Government to engage with the DESNZ and Ofgem as these investigations continue. We also strongly recommend that the Scottish Government commissions its own review into the number of substandard insulation installs in Scotland. Sources: IndoorAirAware / House of Commons / BBC.

15. What would be the optimal environmental for delivery considering skills and qualifications, urban/rural access, professional practice (regulation, indemnity, complaints handling and redress), software integration and applications support?

Level of agreement: High, and very high amongst accredited professionals and learning specialists.
Strength of evidence: Strong agreement that there are substantial access barriers for certain types of learners – particularly adults who are earlier in their careers, those in rural and remote areas, and especially women and neurodivergent people. Strong agreement that consumer confidence is low and complaints to trading standards are rising due to issues such as spray foam installs and poor ASHP installations (etc). As regards renewable energy technologies, it is important to understand the differences between a system designer and an installer as these roles require different skillsets (notwithstanding that someone can be qualified to do both).

Also, strong agreement that the needs of adults and professionals are not being sufficiently understood or met due to an emphasis on pedagogy-based (as opposed to andragogy-based) learning opportunities, funding being invariably driven towards younger people (degree courses, apprenticeships, etc), and in-class and traditional learning (especially where such options are not accredited by professional associations). For adults, and particularly professionals, there is insufficient knowledge of professional practice and the types of learning they need and prefer, and the financial and time costs of doing so – e.g., meeting specific knowledge needs for different projects, and engaging in communities of practice. As such, care needs to be taken to ensure that regulation protects the needs of younger and early career individuals, whilst not creating barriers or disincentives for adults and professionals engaging in more targeted, needs-driven, and informal learning.

These problems also impact on indemnity, complaints handling, and redress insofar as how much due diligence a consumer can be expected to do when accessing advice and planning and delivering a retrofit project, should it go wrong and they need to seek redress. Similarly, there needs to be consideration of how much smaller, local installers should be expected to understand about retrofitting beyond the measure(s) they specialise in, especially given that, as they are often very trusted, they provide one valuable route for leveraging consumers towards more holistic retrofit projects. Similar questions and benefits also apply to community groups designing and delivering local retrofit projects.

However, as regards the often-generic advice provided by larger service providers, and particularly those using Scottish Government branding, there was a strong consensus that these should be more tightly overseen and required to have sufficient public indemnity insurance and clear routes to redress (should the Scottish Government decide they offer sufficient value for money, which was questioned). Not doing so was flagged as a risk to public trust in the retrofit agenda, and potentially the climate change and sustainability agendas more widely.

All these issues are exacerbated when it comes to traditional buildings, and to delivering clean heating technologies and communal and community heating projects (e.g., community-scale heat pumps and district heating). These require larger numbers of more qualified professionals and/or professionals with specific expertise (including non-technical expertise).

16. What barriers exist to the development and delivery of a technical suitability assessment service?

Level of agreement: Very high.
Strength of evidence: Strong agreement that the shortage of skilled professionals – assessors, surveyors, tradespeople, etc – is a significant barrier. For example, currently there are very few PAS2035/PAS2030 qualified people in Scotland, with similar shortages for assessing other standards (e.g., Passivhaus). This is partly due to funding being available in England where there has been 50% funding of retrofit assessor and retrofit coordinator courses. Retrofits require significantly more management input, which drives up costs, while the available trades barely suffice for new builds. This was highlighted during the Covid 'home improvement bubble', where householders often faced labour and materials shortages, and increased costs for both. However, whilst supply chains were affected, this was more symptomatic of existing skills and materials shortages rather than a temporary increase in demand.

Also, strong agreement regarding the dominance of new build and derogation of maintenance. Serving the new build market is less complex for tradespeople, and is more financially attractive due to economies of scale. Retrofitting is more complex, and requires additional management and customer engagement, and carries greater reputational risks (e.g., occupants of new builds will invariably blame problems on the developer). Maintenance has largely been overlooked in policy which, even under the 'fabric first' approach, tends to drive installing energy efficiency improvements rather than identifying and tackling fabric condition problems, which limit the effectiveness of energy efficiency measures and may mask underlying problems. This carries the risk of fabric problems becoming more serious and costly to address in the future, and increasing the likelihood that measures will need to be ripped out to address them.

Although with less agreement, there was also a concern that HEETSA could become an additional, potentially onerous, standard, particularly for local authorities and housing associations. This concern merits addressing through clear communication and engagement as plans move forward.

17. What opportunities exist to upskilling existing workforces to effectively deliver a technical suitability assessment?

Level of agreement: High, but stronger in some respects than others. This likely reflects the inherent bias in participants coming from built environment backgrounds.
Strength of evidence: Strong agreement that establishing clear, agreed-upon national occupational standards is critical to defining the required competencies for roles such as independent HEETSA assessors and retrofit coordinators. This will help professionals identify and fill skill gaps systematically. Also, strong agreement that retrofit jobs is a

growing market, but less agreement over how rapidly the market can be expected to grow, and how long the market will last (i.e., how long until most buildings have been retrofitted to sufficient standards?). The main reason for this uncertainty being the gap between policy targets and the effectiveness of policies and support to deliver on them.

Opportunities exist to do more to engage with learning specialists who have moved into training and upskilling for retrofit and related professionals. At present, there are clear routes for young people through apprenticeships and further and higher education courses accredited by professional associations, although there is still a need for more students to take these courses, and the Scottish Government could do more to promote the benefits of taking them. However, beyond this, the market is emerging and much more fragmented, with a 'wild west' of 'CPD certified' training, which creates risks and unnecessary competition for newer and reputable providers. There was strong agreement that there is room, and need, for everyone, but the landscape is confusing, lacking in coordination, and having barriers to entry (i.e., costs and returns on investment). Furthermore, the skilled professionals and experts needed to support this growth are time-poor and will naturally tend to focus on their own career development, but they can and need to be engaged in the development of upskilling and training offerings.

As such, more needs to be done to engage with learning specialists, particularly as regards those specialising in adult and lifelong learning as adults represent significant untapped potential and a poorly served market. This covers adults from community groups with little prior knowledge and experience, through those in employment with transferrable skills seeking to transition into the market, to established professionals.

As regards established professionals, there is a need for the Scottish Government to better understand their learning needs and how they meet them, in order to support a more flexible and effective learning landscape. Chartered professionals benefit from the structured learning offerings provided as part of their memberships of professional associations, but experts and professionals (chartered or otherwise) often regularly engage in the targeted and more informal learning by attending seminars on specific subjects or technologies (etc), and by engaging in communities of practice, and more should be done to understand, support, and recognise the value of this (by employers as well as government).

There is no 'one size fits all' solution, but there are solutions that depend on factors such as the type of learner, their career stages, and their learning needs.

Recommendations for enabling HEETSA to become a Mission-driven Approach to Retrofit

We began the work on this project with a tight scope that was focussed specifically on assessment methods. However, as the work evolved, and based on significant input from stakeholders, we found considerable consensus on many of the key issues. This

means that we are able to present a much more holistic set of recommendations and ways forward.

We are of the view that HEETSA now provides a rare and valuable opportunity to develop a mission-driven approach to delivering retrofit projects that could build resilience into the Scottish building stock and Scottish communities for generations to come. This approach recognises the need to decarbonise our building stock, but also that this cannot be fully realised without bringing consumers and communities on board by tackling fuel poverty, and delivering measures that will benefit occupant health that will reduce demands on health and social care services.

Following the withdrawal of the Heat in Buildings Bill, HEETSA can now be progressed in way that will underpin whatever legislation is to be tabled in the coming years and, by taking a bottom-up approach to improving our building stock, help ensure that this will be successful.

Our key recommendations and proposed ways forward are as follows:

- Taking a maintenance-first approach is fundamental to our findings and proposals. Ensuring all Scottish properties are brought up to good standards of maintenance is an essential first step for improving energy performance and thermal comfort, tackling fuel poverty, and improving occupant health. All retrofit projects should begin with on-site inspections to identify maintenance issues, using thermal imaging and (where appropriate) invasive tests to check for issues such as moisture ingress and insulation settling within cavity walls.

- We recognise that no single assessment method, currently in use or otherwise, will be sufficient to meet HEETSA's needs as an off the peg solution. Furthermore, even using a combination of methods will mean filling gaps where existing methods are insufficient in terms of detail, scope, etc. However, bringing these under a single HEETSA approach should enable these gaps to be plugged more rapidly and cost-effectively, without the prohibitive costs of developing and delivering a single HEETSA-specific assessment. By combining evidence from practical experience with the evidence from this and other reports, this would enable the development of a framework for the comparative evaluation of the most appropriate methodologies, which could be included in training. We further recommend, wherever possible, that such assessments should be based on open-source standards.

- We recognise that the design, delivery, and assessment of communal and district heating systems is a substantially more technically complex task, and does not fall entirely within HEETSA's scope. We further recognise that, in contrast to the previous point, the tools needed for these tasks will likely include at least some that are commercial intellectual property. However, the final HEETSA approach should be one in which all key roles include some awareness

and understanding of these potential solutions, in order to identify where they will likely be preferable to individual solutions.

- We have deliberately broken up the term 'Retrofit Coordinator' into three distinct roles – Retrofit Project Manager, Retrofit Consultant, and Retrofit Advocate. This has been done to provide greater clarity to the Scottish Government, stakeholders, delivery bodies, and consumers. The three roles are complementary but require different skillsets, and so this differentiation is also intended to correspond to those different skills and training needs, and to enable more people to understand how they can contribute to the retrofit agenda.

- The differentiation of 'Retrofit Coordinator' is also intended to enable the better direction of funding to different types and sources of skills and training delivery. We recognise that this is an emerging and growing market serving a diverse audience of learners - different levels of prior knowledge and experience, different learning needs, different barriers to entry, different levels of availability geographically, etc. There is no 'one size fits all' solution to meeting all these needs and a range of learning providers - from large traditional learning providers to emerging and specialist providers - will be needed to meet them.

- Finally, the differentiation makes it clearer how community-based organisations and small, local, installers can enable and provide benefits to the design and delivery of new retrofit projects.

- We recognise that the role of a Retrofit Assessor is a distinct role, requiring a higher degree of technical knowledge and experience, and regulation. We propose that the Building Standards Division (BSD) takes on the role of being the independent verifier for retrofit assessments. Following from this, we are able to identify four key stages in the retrofit journey where some level of verification / oversight would be invaluable:
    - Assessment of building conditions and household circumstances. This falls directly within HEETSA's scope, and would include consideration of measures in individual and community contexts in order to identify cases where community-scale projects and/or communal or district heating may lead to more optimal solutions. For community-scale projects, using archetypes may have some value at this initial level of assessment.
    - Design stage - developing retrofit plans and pathways. This would be further enabled by the introduction of Building Passports.
    - Delivery and verification.
    - Post-occupancy evaluation (POE), in order to identify and rectify any post-retrofit issues, provide any evidence needed for consumer redress, enable the resolution of any complaints, and educate occupants about how best to use any new measures such as replacement heating systems.

- The adoption of BSD as an independent verifier is intended to ensure greater and increasing alignment between standards for retrofit and new builds, and to help justify further resourcing of this important unit of government.

- We recognise that greater regulation of all aspects of the design, delivery, and assessment of retrofit projects is needed. Such regulation needs to be sensitive to the current state of the market and the impacts (time, costs, etc) of meeting new regulations, but it must also be strong enough to tackle the significantly low levels of consumer confidence relating to every stage of the retrofit journey. However, we have not been prescriptive as to where different regulations should sit within the variously devolved / reserved nature of the Scottish Government's powers and responsibilities. As HEETSA moves forward to public consultation we recommend that the team consult with Consumer Scotland on this specific issue.

We are now at a stage where we believe that the evidence base presented here and detailed further in our Technical Report is robust, and that our findings represent a high degree of consensus. As such, we believe that our recommendations and proposals are sufficient to move HEETSA forward to public consultation stage and the introduction of a HEETSA Bill.

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Disclosure of Interests

The Project Team declare that every effort has been made to eliminate bias in the production of this report, and that the three peer reviewers (Dr Richard Atkins, Ran Boydell, and Dr Bill Sheldrick) were not given access to the written drafts of the reports prior to the peer review periods in January and February 2025. However, as would be expected, all members of the Project Team have professional interests in the fields covered by the research, as follows:

Dr Keith Baker FRSA is Research Fellow at the Built Environment Asset Management (BEAM) Centre at Glasgow Caledonian University; a Director of Common Weal and Convenor of its Energy Working Group; a co-founder of the Energy Poverty Research

initiative, a non-constituted organisation recognised as a spin-out from GCU's BEAM Centre; a Director of Pattiesmuir Ltd, a not-for-profit micro-SME established to provide training and education, and to advocate for adult learners; and a Director of Scientists for Global Responsibility.

Magdalena Blazusiak MCIAT is a Chartered Architectural Technologist, Director and a Vice Chair of the Scottish Ecological Design Association, and a lecturer and PhD candidate at Robert Gordon University.

Dr Ron Mould FRSA is a co-founder of the Energy Poverty Research initiative, a member of Common Weal's Energy Working Group, and Zero Carbon Manager at Bield Housing and Care.

Natasha Houchin FRIAS, RIBA is a Director of the Scottish Ecological Design Association and Lead Building Performance Consultant at Carbon Futures, Architect & Passivhaus Designer at CarbonFutures.

Dr Mark Phillipson is Head of the Department of Civil Engineering and Environmental Management at Glasgow Caledonian University.

Dr Jonathan Scott FCIAT, SFHEA is a Chartered Architectural Technologist and a Course Leader in Architectural Technology at Robert Gordon University.

Dr Richard Atkins FRIAS, RIBA is an independent Chartered Architect. A Member of the Royal Institute of British Architects, a Fellow of the Royal Incorporation of Architects in Scotland, a Fellow of the Royal Society of the Arts. A Member of RIAS Council, soon to be Board of Trustees, Chair of the Governance & Policy Committee, member of the Practice Committee and Sustainability Working Group, soon to be Committee. Cofounder of RIAS-regs and Technical Advisor to the Scheme. Director and shareholder of Home Energy and Data Services. Member of the Glasgow Caledonian University's Built Environment and Asset Management (BEAM) Centre Advisory Board. Member of Heriot-Watt University's Architectural Engineering Programme, Industrial Advisory Board. Member of the Norton Park Trust Board. Member and former Chair of the Scottish Ecological Design Association. Former Chair of BHA Enterprise Limited. Member of previous Building Standard Division of the Scottish Government, Working Groups on Sections 3, 4 and 6 of the Technical Standards.

Ran Boydell is an architecture and sustainable design consultant in private practice, has previously taught at Edinburgh and Heriot-Watt Universities, and until May 2025 was a Director of the Scottish Ecological Design Association.

Dr Bill Sheldrick is the founder of Alembic Research and a member of the Energy Poverty Research initiative.

Annex 1

Independent Review of suitability of existing methodologies to deliver HEETSA

Overview of Existing Methodologies (as identified by participants during the review)

	Methodology
A	PAS 2035:2023 - Retrofitting Dwellings for improved Energy Efficiency; and PAS 2038:2021 - Retrofitting non-domestic buildings for improved energy efficiency.
B	Scottish Building Standards – Technical Handbook
C	British Board of Agreement (BBA).
D	Royal Institution of Chartered Surveyors (RICS) Residential Retrofit Standard.
E	Historic Environment Scotland (HES) guide to retrofit of traditional buildings.
F	Passivhaus EnerPHit Standard.
G	Association for Environment Conscious Building (AECB) Retrofit Standard.
H	BS 40104 Retrofit assessment for domestic dwellings – Code of practice (not published).
I	Reduced Standard Assessment Procedure (RdSAP) and Standard Assessment Procedure (SAP).
J	Passivhaus Planning Package (PHPP).
K	Home Energy Model (HEM).
L	Portfolio Energy Assessment Tool (PEAT).
M	Energy Performance Certificate (EPC).
N	Wärme Und Feuchte Instationär (WUFI).

A

Methodology
PAS 2035:2023 - Retrofitting Dwellings for improved Energy Efficiency; and PAS 2038:2021 - Retrofitting non-domestic buildings for improved energy efficiency.
Description
Standard providing specification and guidance for retrofitting of domestic (PAS2035) and non-domestic (PAS2038) properties for improved energy efficiency, with clear identification of roles and responsibilities through retrofit process.
Purpose
Framework defining best practice, risk management to buildings and occupant's health.
Suitability to deliver HEETSA
The most 'all embracing' technical assessment approach currently in use. Reference to BS 7913: 2013 Guide to the conservation of historic buildings. BS 40104 Retrofit Assessment of Dwellings for Retrofit (not yet published), BS 5250: 2021 Management of moisture in buildings. Clear identification of roles and responsibilities.
Limitations to deliver HEETSA
Needs to be accompanied by suitable energy efficiency and heating system evaluation. There is no prescribed requirement for use of intrusive surveys, air tightness testing, thermal imaging. Where these may be recommended, the decision of suitable assessment method is at the discretion of the assessor. There is no comparison of best suited tools for evaluation of retrofit options and comparative suitability of heating systems.

B

Methodology
Scottish Building Standards – Technical Handbook.
Description
Building Warrant process supported by building standards regulations, technical guidance, and certification.
Purpose
Framework defining best practice, risk management to buildings and occupant's health.
Suitability to deliver HEETSA
Should Building Warrant be required for majority of retrofit plans, Building Standards could assist in verification of experience of assessors, in a similar manner to Certification of Design and to be compliant with current Section 6 of the Scottish Building Standards covers energy performance, overheating, and ventilation. This would align the approach to retrofit of existing buildings with regulatory context of new build, including alignment with Scottish equivalent to Passivhaus and Heat in Buildings Bill.
Limitations to deliver HEETSA
Retrofit is currently not regulated by Building Standards. There are relevant sections regarding existing buildings and Building Warrant would be required for, for example external wall insulation, but these are isolated instances.

C

Methodology
British Board of Agreement (BBA).
Description
Products, systems, and installers approval.
Purpose
Independent certification against industry standards and regulations including inspection, to ensure safety, quality, and performance.
Suitability to deliver HEETSA
Certification of approved systems and installers, which could assist in streamlining of the verification process. This would assist in moving through retrofit process from assessment into design and delivery.
Limitations to deliver HEETSA
Certification can be used as accountability and risk mitigation measure, to safeguard interest of the occupants. It should be used alongside not instead of dynamic data modelling. BBA certification can also be sued to ensure competence of installers.

D

Methodology
Royal Institution of Chartered Surveyors (RICS) Residential Retrofit Standard.
Description
Professional framework focused on guidance for professionals including conduct, qualifications, and customer journey.
Purpose
To provide framework aligning with code of conduct for chartered building surveyors.
Suitability to deliver HEETSA
Code of practice can be useful in ensuring adherence to HEETSA requirements, with suitable verification of qualification of retrofit assessors. Reference to BS 7913: 2013 Guide to the conservation of historic buildings, BS 40104 Retrofit Assessment of Dwellings for Retrofit (not yet published) & BS 5250: 2021 Management of moisture in buildings.
Limitations to deliver HEETSA
This standard is aimed at ensuring adequate professional conduct of RICS accredited professionals. It is a referential guide aligning practice to relevant British Standards. It is not however an operating framework that can be used as a standalone methodology to deliver aspirations of HEETSA.

E

Methodology
Historic Environment Scotland (HES) guide to retrofit of traditional buildings.
Description
Energy retrofit guide focusing on energy efficiency measures for traditional buildings, including compatibility with existing fabric (based on HES research), compliance with Building Standards and Planning process.
Purpose
Framework defining best practice, risk management to buildings and resulting occupant's health specific to historic buildings.
Suitability to deliver HEETSA
Holistic guide providing examples of best practice for retrofit measures improving the energy efficiency of traditional buildings, whilst maintaining as much of their historic fabric and creating healthy indoor environments. Emphasis on building condition, maintenance, and compatibility of measures. Can be used as supplementary information informing decisions tested with the use of modelling and simulation tools.
Limitations to deliver HEETSA
This guide can be used as supplementary information for assessment of traditional buildings, alongside standards such as Reference to BS 7913: 2013 Guide to the conservation of historic buildings. It is not an evaluation tool comparing options for energy efficiency and heating improvements.

F

Methodology
Passivhaus EnerPHit Standard.
Description
Retrofit equivalent of Passivhaus Standard, energy reduction focused standard accompanied by certification ensuring quality and as-built performance certified by Approved Certifiers.
Purpose
Performance standard focused on significant improvements to energy efficiency and resulting reductions in heating and cooling demand.
Suitability to deliver HEETSA
Performance and quality standard. Verification of performance is achieved through robust quality checks.
Limitations to deliver HEETSA
Focus on in use building emissions. These are not requirements required for compliance: whole life carbon consideration, user behaviour, building condition & maintenance and post occupancy evaluation. MVHR is a requirement for certification: does not take into account whole building approach recognising suitability of materials and reliant on knowledge & expertise of the assessor/designer.

G

Methodology
Association for Environment Conscious Building (AECB) Retrofit Standard.
Description
Energy reductions focused deep retrofit standard offering step-by-step approaches with Quality Assurance verification by Approved Certifiers.
Purpose
Performance standard offering staged approach to energy efficiency and heating decarbonisation.
Suitability to deliver HEETSA
Performance and quality standard. Verification of performance is achieved through robust quality checks. Variation of Passivhaus standard with lesser operational energy performance. Includes water and indoor air quality/ventilation guidance. Allows for a stepped approach.
Limitations to deliver HEETSA
Focus on operational carbon emissions. These are not requirements resulting in compliance: whole life carbon consideration, user behaviour and building condition.

H

Methodology
BS 40104 Retrofit assessment for domestic dwellings – Code of practice (not published).
Description
Code of practice for retrofit assessment for domestic properties.
Purpose
Standardized, detailed assessment methodology supporting delivery of PAS 2035, ensuring that the building is adequately assessed prior to any retrofit work being designed or carried out.
Suitability to deliver HEETSA
The standard is intended to cover: assessment in building specific context, on-site assessment including building condition, reporting & lodgement, and competencies of assessors.
Limitations to deliver HEETSA
Not suitable as a standalone standard. Suitable methodology and tools enabling comparative analysis of measures is required.

I

Methodology
Reduced Standard Assessment Procedure (RdSAP) and Standard Assessment Procedure (SAP).
Description
Methodology used by Scottish government to estimate energy performance of homes. Conforming to BS EN ISO 13790.
Purpose
Demonstration of compliance of new homes (SAP) and existing homes (RdSAP) with Building Regulations and generation of Energy Performance Certificates (EPCs).
Suitability to deliver HEETSA
RdSAP/SAP can produce energy related analysis (Heat Transfer Co-efficient, Heat Loss Parameter, Specific Heat Loss, Design Heat Loss) that would allow for more in-depth analysis of a dwelling's performance. Could be supplemented by other tools (e.g. WUFI and condensation risk analysis) to enable risk analysis of proposed improvements.
Limitations to deliver HEETSA
RdSAP does not assess risks with associated improvements.

J

Methodology
Passivhaus Planning Package (PHPP).
Description
Spreadsheet based simplified building energy simulation software with monthly results of energy demand for designing and evaluating scenarios in achieving energy efficiency in buildings, including calculation of energy demand, overheating, performance. Conforming to BS EN ISO 13790 Energy performance of buildings - Calculation of energy use for space heating and cooling.
Purpose
Tool for designing and evaluating scenarios in achieving energy efficiency in buildings, including calculation of energy demand, overheating, performance.
Suitability to deliver HEETSA
PHPP can produce analysis of energy demand including variables affecting heat loss, energy use and internal comfort. Can be used as an energy modelling tool for any project.
Limitations to deliver HEETSA
Pass/fail assessment with no recommendations. Time consuming and focused on solutions such as MVHR. Requirement for Passivhaus projects including EnerPHit. Conform to the same BS EN as RdSAP and SAP.

K

Methodology
Home Energy Model (HEM).
Description
Simplified building energy modelling software based on Environmental Systems Performance – Research (ESP-r) results, giving results of building retrofit measures based on dynamic results.
Purpose
Building energy modelling software enabling comparison of retrofit options.
Suitability to deliver HEETSA
Simplified modelling program allowing for assessment of retrofit options. Suitable for evaluation of multiple building options and easy comparison of options for energy efficiency measures.
Limitations to deliver HEETSA
Building parameters are based on building archetypes and some level of predicted data. Although the model could be useful for evaluation of methods, it needs to be supplemented by accurate, site specific data.

L

Methodology
Portfolio Energy Assessment Tool (PEAT).
Description
Modelling tool for comparative analysis. Relies on accuracy of Energy Saving Trust (EST) Home Analytics data. Uses SAP score as a comparative baseline.
Purpose
PEAT models individual properties, portfolios, and specific areas or neighbourhoods, including options of cost, maintenance and replacement cycles, carbon reductions, space heating demand and enable comparison of several retrofit options.
Suitability to deliver HEETSA
Ability to compare options of energy efficiency improvements aligned to funding streams.
Limitations to deliver HEETSA
Home Analytics data has uncertainty because it is modelled, though it is based on a robust and well-tested methodology. The tool does not capture the full range of factors required for holistic retrofit assessments of individual buildings and is mainly used by the social housing sector. PEAT and Home Analytics includes data derived from Energy Performance Certificates; these data are subject to the quality assurance requirements as per the national operational framework for EPC Approved Organisations.

M

Methodology
Energy Performance Certificate (EPC).
Description
Rating system used by the Scottish Government produced using RdSAP (for existing dwellings) and SAP (for new built homes).
Purpose
Report indicating energy efficiency and climate impact of the property, including recommendations report of possible, generic improvement measures.
Suitability to deliver HEETSA
EPC could assist in providing improvement options as opposed to recommendations, recognising requirement for detailed, data-based assessments undertaken by suitably qualified, independent assessors.
Limitations to deliver HEETSA
Produced by energy assessors using assumption-based data. The EPC includes recommendations on how to improve energy efficiency that are generic and not property specific.

N

Methodology
Wärme Und Feuchte Instationär (WUFI).
Description
Software family for hygrothermal simulation and assessment of building envelope with consideration to climate predictions, and location specific weather data.
Purpose
Moisture and heat transfer analysis through multilayer components (such as walls) allowing for risk analysis of moisture build ups in building envelope.
Suitability to deliver HEETSA
Enabling risk analysis of retrofit options in improving energy efficiency of buildings with consideration of dynamic, location and climate specific data and ability to evaluate long term hygrothermal performance simulations and incorporate climate predictions. Particularly relevant for assessment of measures in traditional buildings.
Limitations to deliver HEETSA
This is a supplementary tool enabling evaluation of risks associated with proposed energy efficiency improvements to the building envelope. Cannot be sued as standalone assessment tool for comprehensive retrofit assessment.

Other tools may be required for adequate retrofit design, such as and not limited to thermal bridging coefficient tool and whole life carbon assessment tool. NOTE: This table does not consider models for designing or assessing communal / district heating systems. Some of these models (e.g. SAP) go some way to identifying potential, and bespoke 'EPC+' assessments that involve engaging with householders are useful for underpinning feasibility studies (e.g., by gauging local interest and acceptability). However, designing these systems requires full technical assessments. Such assessments benefit significantly from using real demand and supply data, and may be subject to commercial confidentiality restriction.

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