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Tenement Retrofit: A Toolkit for Flat Owners

ORGANISING OWNERS FOR THE ENERGY TRANSITION
UNIVERSITY OF STRATHCLYDE WITH UNDER ONE ROOF

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This toolkit has been developed within the [Hunter Centre for Entrepreneurship, Strategy and Innovation](#) of Strathclyde Business School, University of Strathclyde, and supported by the [Strathclyde Institute for Sustainable Communities](#). It has been developed in partnership with [Under One Roof](#) and funded by the Economic and Social Research Council through the Creating Opportunities through Local Innovation Fellowships (COLIF).

Under One Roof is Scotland's only charity providing free, impartial information to owner-occupiers, landlords, factors and other housing professionals on tenement maintenance, common repair management and retrofit support.

The idea for the toolkit has its origins with the UK Energy Research Centre (UKERC)¹ funded project: **'Whole Person - Whole Place' energy solutions for net-zero neighbourhoods**, which brought together energy social science scholars from the University of Leeds, the University of Sussex and the University of Strathclyde. The project explored the social context of retrofit decision making. The publication in the journal *Energy Policy* of the paper ['Under one Roof: The Social Relations and Relational Work of Energy Retrofit in Multi-owned Properties'](#) [1] provided the empirical and theoretical basis from which this toolkit was developed.

This toolkit builds on the findings from this research and more recent outreach activities. This includes a workshop which was held on the 18th of March 2024 that brought flat owners' representatives together with property

factors, technical specialists, local authority officers, solicitors and other housing professionals to explore the challenges and opportunities of tenement retrofit.

We would like to extend our thanks to the stakeholders without whose valuable insights this toolkit would not have been possible.

Thanks also to our reviewers for their comments and suggestions on early drafts. These are:

Matthew Hannon, Strathclyde Institute for Sustainable Communities
Annie Flint, Under One Roof
Chris Carus, Loco Home Retrofit
Kevin Sturgeon, Solicitor
Mick Patrick, member of the Home Energy and Retrofit circle of BANZAI (Bruntsfield Area Net Zero Action Initiative).
Neil Watt, Hacking and Paterson Management Services
Rowan McCall Smith, Redpath Bruce Property Management Ltd

Any errors or omissions in this toolkit are solely the responsibility of the authors. The involvement of the reviewers does not imply endorsement of the content.

Suggested citation:

Miller, E. & Cairns, I. (2025), Tenement Retrofit: A Flat Owner's Toolkit, University of Strathclyde, DOI |

Commented [IC1]: Source the DOI

¹ UKERC is a cross-UK Research Council funded energy research centre.

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Executive Summary

With the growing cost of energy, much anticipated regulatory changes relating to energy efficiency in domestic properties and growing concern amongst the public about climate change and its impacts, it has never been more important for tenement flat owners to have the tools needed to improve the energy efficiency of their homes.

This toolkit is designed to support tenement flat owners work with co-owners on their journey toward creating warmer, more energy-efficient homes that are cheaper to run. It provides an accessible introduction to current best practices in energy efficiency upgrades (retrofit) for tenement buildings and signposts users to key resources for further guidance.

Recognising the unique challenges of tenement living, particularly the need for collective decision-making and the sharing of costs for common building parts, the toolkit offers practical guidance to help owners navigate these complexities.

While primarily aimed at flat owners, much of the content will also be useful to other building professionals involved in retrofit projects. Many of the materials are also shared with a companion toolkit created specifically for property factors, which can be accessed [here](#) [2].

The toolkit is introduced, in Section 1, with an outline of why such a toolkit is necessary and how it can be used. Section 1 also provides definitions of the key terms which are used in the document: tenement, retrofit, net zero, relational work, owners' association, maintenance and improvements.

Section 2, entitled 'Understanding Retrofit in Tenements', provides an overview of current thinking on retrofit as it relates to tenements. It identifies key resources to enable readers to learn more about retrofit and to source funds for energy efficiency upgrades. It provides a brief overview of the key varieties of approaches to retrofit. This section concludes by noting the importance of connecting with local retrofit actors for support in driving retrofit in tenements.

Section 3.0 discusses responsibility for retrofit in tenements. This section highlights the key sources available for determining responsibility for the common areas of the building: titles and the Tenement Management Scheme. It concludes with a note on the role of property factors in tenement buildings and what part factors can play in tenement retrofit.

Section 4 highlights collaboration between tenement co-owners as key to drive retrofit in tenements. It provides an overview of possible organisational forms in tenements and across tenements and provides some practical guidance on how owners might start getting organised to retrofit their building.

Section 5 introduces the Tenement Retrofit Dashboard tool, designed to help owners visualise their role through a tenement retrofit journey. In the dashboard a sequence of 12 different 'aspects of retrofit' (types of retrofit intervention, like installing energy efficient windows or insulation) is proposed, to help flat owners work together to plan that journey.

Section 6 provides a generalist's overview of what is involved in implementing each of 'aspects of retrofit' identified in Section 5. The aspects discussed in Section 6 are:

1. Baseline assessment
2. Soft Measures
3. Lighting
4. Windows and doors
5. Draughtproofing
6. Ground floor insulation
7. Roof insulation

8. Wall insulation
9. Ventilation
10. Energy for heating
11. Microgeneration (e.g. solar panels)
12. Post-retrofit evaluation (e.g. handover and in-use performance evaluation).

Key elements of the discussion of each aspect include:

- An explanation of what each of the aspects means for moving a tenement towards greater energy efficiency.
- Some examples of potential retrofit trigger points (explained in Section 5.3).
- A note on responsibility and decision-making, highlighting any challenges associated with establishing responsibility for the part of the building affected by the aspect of retrofit.
- An outline of the key issues related to the aspect of retrofit, e.g. the technical options available, their effectiveness and / or importance for retrofit.
- Where there may be financial support available the most likely sources are indicated.

The toolkit concludes, in Section 7, with a reiteration of the purpose of the toolkit and indication of the next steps for the toolkit authors in providing further materials to support tenement retrofit.

1 Introduction

1.1 Why a retrofit toolkit for tenement flat owners?

This toolkit has been developed specifically for tenement flat owners. In light of anticipated increases in energy efficiency standards for domestic properties, rising energy costs and growing awareness among tenement owners of climate change and its impacts, it is more important than ever for flat owners to acquire the knowledge necessary to support the retrofit of their buildings.

When tenement flat owners seek to make their homes more comfortable and affordable to heat, they face a unique set of challenges not typically encountered by owners of other building types. These include determining responsibility for different parts of the building and coordinating improvement works with other owners.

To support flat owners with these challenges the toolkit provides a comprehensive range of resources designed to help owners engage confidently and knowledgeably on topics such as retrofit, energy efficiency and the Scottish housing sector's transition to net zero. All materials are tailored specifically to the context of tenement buildings.

While the toolkit is primarily intended for flat owners, it may also be of value to other stakeholders involved in tenement management or improvement works.

1.2 How to use this toolkit

Tenement flat owners can read the toolkit from start to finish, browse through it to get an overview of current thinking on retrofit or use it to quickly look up specific topics. It provides research-backed information and the references are provided for further reading for those who wish to understand a topic in more detail.

- Arrow bullets points, like this, are used to indicate suggested action points.

Following this introduction, Section 2, 'Understanding Retrofit in Tenements', provides an overview of current thinking and key resources about retrofit.

Section 3 discusses establishing responsibility for different aspects of retrofit by understanding the property's 'titles' and the Tenement Management Scheme.

Section 4 provides an overview of three different approaches to organising within tenements: 1) informal arrangements, 2) establishing an owners' association through an agreed constitution and 3) organising via a Development Management Scheme. This section also explores some of the advantages and challenges for retrofit in coordinating across multiple tenement buildings. It also offers practical guidance for initiating collaboration with co-owners.

Section 5 introduces the Tenement Retrofit Dashboard tool, designed to help tenement flat owners visualise the steps that they might take to achieve greater energy efficiency in their tenement.

Section 6 discusses 12 different 'aspects of retrofit' (types of retrofit intervention), from 'baseline assessment' to 'post-retrofit evaluation', providing a generalists account of different types of retrofit initiatives.

1.3 Key terms

Tenement: In this toolkit, the term '**tenement**' follows the definition set out in the [Tenements \(Scotland\) Act 2004](#) [3] referring to a building or part of a building that consists of two or more interconnected flats, separately owned and divided from each other horizontally.

Retrofit: The term '**retrofit**' has evolved over recent years beyond the initial aim of reducing the energy consumption of existing buildings to become more broadly defined as the upgrading of buildings in response to the imperative of climate change. Current UK [best practice for domestic retrofit](#) [4] takes a holistic approach, aiming for existing homes to be energy and water efficient, decarbonised, comfortable, healthy, resilient, with

retrofit works done in a way that is responsible towards heritage and conscious of embodied carbon.

Net zero: in the context of a tenement building, net zero means that the total amount of energy the building consumes over a year is balanced by the amount of renewable energy it produces on-site or sources from renewable providers. In practice, this involves designing or retrofitting the tenement to minimise energy use through efficient insulation, lighting, heating and ventilation systems, while integrating renewable technologies such as solar panels or heat pumps. The goal is to reduce the building's carbon footprint to zero, ensuring that its operations neither add to greenhouse gas emissions nor rely on fossil fuels for energy.

Relational work: A term derived from relational sociology that encompasses network building, communication management, business negotiation, information sharing and decision-making support [5]; because of the challenges of collective decision making in tenements, more relational work is required in these buildings than in other types of building.

Owners' Association: Under One Roof defines an owners' association as follows: *"An owners' association is a formal arrangement between the owners of your building. It arranges regular meetings to discuss how your building will be managed and maintained. By 'formal' we mean having a constitution, an agreed set of rules and procedures"* [6].

Maintenance: In the Tenements (Scotland) Act 2004 maintenance "includes repairs and replacement, cleaning, painting and other routine works, gardening, the day to day running of a tenement and the reinstatement of a part (but not most) of the tenement building, but does not include demolition, alteration or improvement unless reasonably incidental to the maintenance".

Improvements: while the Act is less clear on a definition of improvements, an improvement is generally defined as introducing a new feature or element to a building that did not previously exist. Under one Roof write: *"Whereas, maintenance primarily involves repairing the existing parts of a building that need fixing. However, when something new is added or*

upgraded that is essential to a repair, this is still considered maintenance" [7].

2 Understanding retrofit in tenements

2.1 Key resources

The National Retrofit Hub is a UK-wide not-for-profit organisation that brings together everyone involved in the retrofit sector to share expertise and work together in response to the Construction Leadership Council's 2021 publication, the [National Retrofit Strategy \(NRS\)](#) [8]. The NRS is a 20-year blueprint for how the construction industry can work with government to retrofit the UK's 28 million existing homes.

- Explore the online material of the [National Retrofit Hub](#) (NRH) [9] and follow content updates on the [useful resources](#) page [10].

Built Environment ~ Smarter Transformation (BE~ST) is NRH's partnering organisation in Scotland. It positions itself as the launchpad to a zero carbon-built environment by 2045, working with industry and academia to drive action on retrofit by curating scalable solutions and best-practice standards that will *'empower a just transition, thinking in terms of materials, measures, strategies and people'* [11].

1. Visit and share with neighbours the website of [Built Environment ~ Smarter Transformation \(BE~ST\)](#) [11].

The Energy Saving Trust is an independent social enterprise founded in 1992 as a public-private partnership dedicated to promoting energy efficiency. Funded by the UK government, devolved administrations and the private sector, it provides advice, policy proposals, administers grants and tests technologies. Its website has a host of valuable materials on energy efficiency and retrofit.

- Visit and share with neighbours the website of [Energy Saving Trust](#) [12].

Home Energy Scotland is a Scottish Government-funded advice service that helps residents improve energy efficiency, reduce energy bills and transition to renewable energy. It offers free, impartial advice on home upgrades, available grants and loans for retrofits like insulation, heating systems and solar panels.

- Visit and share with neighbours the website of [Home Energy Scotland](#) [13].

Historic Environment Scotland (HES) is a Scottish Government agency which plays a key role in retrofit for historic buildings by providing research and support to ensure energy efficiency improvements are sensitive to the character and heritage of these properties. HES publishes a wealth of information on retrofit in historic buildings on its website.

- Visit and share with neighbours the [website pages](#) of Historic Environment Scotland dedicated to energy efficiency [14].

Under One Roof is Scotland's only charity offering free, impartial information to homeowners, landlords, property factors and housing professionals on tenements. It has a range of materials available on energy efficiency and retrofit on its website.

- Visit and share with neighbours the [website pages](#) of Under One Roof dedicated to energy efficiency [15].

2.2 Key sources of financial support for retrofit in tenements

There is no financial support dedicated to supporting retrofit specifically in tenements. However, support can be sourced from a variety of general schemes, depending on various criteria, such as the type of measure (e.g. heating or insulation), the income of the household, and the energy efficiency of the property.

There are various potential sources of funding. In what follows the main schemes put in place by the Scottish Government and the UK Government are highlighted.

Scottish Government

The main gateway to financial support for energy efficiency improvements in domestic properties in Scotland is **Home Energy Scotland**. Their Grant and Loan Scheme provides homeowners in Scotland grants, interest-free

loans or a combination of both to install a broad range of measures, such as clean heating systems and insulation. Home Energy Scotland also has a 'funding finder' function on its website and an advice helpline.

- Visit and share with neighbours the [Grant and Loan webpages](#) of Home Energy Scotland [12].

The national programme to help those living in or at risk of fuel poverty is **Warmer Homes Scotland**. Means-tested grants and loans are provided for insulation, draughtproofing, central heating and renewables. Eligibility is based on several factors, including 1) a poor energy rating of the home, 2) tax band A-F and 3) a resident being the recipient of certain benefits. It is administered by Home Energy Scotland.

- Find out more about Warmer Homes Scotland [here](#) [17] and apply [here](#) [18].

[Area-Based Schemes \(ABS\)](#) [19] are designed and delivered by councils. They are usually larger projects which target the fuel poor in difficult to treat properties. They aim to install energy efficiency measures for whole buildings or neighbourhoods at the same time.

- To find out more about the schemes they can contact [Home Energy Scotland](#) [20].

The **Community and Renewable Energy Scheme (CARES)** supports projects including installing renewable technologies in community buildings, community benefits and shared ownership. The fund is administered by Local Energy Scotland. Local Energy Scotland also operates a **Community Heat Development Programme** which provides technical support to successful applicants to appraise the feasibility of communal or community-led clean heating projects.

- Find out more about CARES visit the Local Energy Scotland [website](#) [21].

Scotland's Heat Network Fund (SHNF) provides capital grants to public, private and third-sector businesses and organisations to develop heat

network projects, promoting the expansion of zero-emission district and communal heating systems.

- Find out more about the fund and begin the application process [here](#) [22].

Historic Environment Scotland offers Grants Framework funding. Funds are typically only available for tenements that are listed buildings or are in conservation areas, and only when works are part of a comprehensive repairs scheme.

- For owners of heritage buildings visit the '[Grants refresh](#)' page of Historic Environment Scotland's website [23].

Local **City Heritage Trusts** may have their own grant streams. For example, the Traditional Buildings Health Check (TBHC) scheme in Stirling provides its own [Retrofit Grant](#) [24]. TBHC is a pilot project supported by Historic Environment Scotland, set up as a not-for profit membership-based service for traditional property owners. Following its success, an options appraisal has been commissioned to consider delivery of the Traditional Buildings Health Check service in three additional areas: Fife, Perth and Kinross, and Falkirk.

- Contact your local City Heritage Trust to find out what types of help the trust might offer.

UK Government

The **Energy Company Obligation 4 (ECO4)** is a UK government initiative aimed at improving the energy efficiency of low-income and vulnerable households [25]. Running from April 2022 to March 2026, ECO4 obligates larger energy suppliers to fund and facilitate energy-saving measures, such as insulation and efficient heating systems, to reduce carbon emissions and alleviate fuel poverty.

ECO4 focuses on a whole-house retrofit approach, targeting homes with energy efficiency ratings of band D or below. The scheme encourages the installation of multiple measures per household to maximize energy efficiency improvements. Eligibility criteria means the scheme primarily

targets households receiving income-based benefits, tax credits or pension credits.

Potentially eligible households wishing to take advantage of the scheme can apply through [Home Energy Scotland](#) [20], their local council or an approved contractor. The council helps with assessment of eligibility criteria.

- Explore the Ofgem [website](#) [26] for further information and [guidance documents](#) [27].
- Visit local authority websites to:
 - Search for 'ECO4 Flex Statement of Intent' for more information on local provision.
 - Identify the ECO4 administrator for enquiries about the local process for application.
 - Identify list of approved ECO4 Flex installers.
- Where owners are advised to contact installers directly, they are advised to approach several installers.

Households that do not meet the criteria for fuel poverty or vulnerability to cold may still qualify for certain ECO4 measures if they are located within the same building or block as households that do meet those criteria. These measures are referred to as 'in-fill' [28]. For every flat that qualifies under ECO4, one additional in-fill flat within the same block can also be treated. This means a whole tenement building could be upgraded if at least 50% of the flats are occupied by ECO4-eligible households. In-fill measures are limited to solid wall insulation, cavity wall insulation and district heating connection. Note that eligibility can be in relation to private rental tenants, subject to their landlord's consent.

- Explore a whole building upgrade, leveraging the eligibility criteria of the full tenement community.

The **Great British Insulation Scheme** (GBIS) is designed to complement ECO4 [29]. Unlike ECO4's 'whole house' approach, this scheme will mostly

deliver single insulation measures. Eligibility depends on a low energy performance of the home and on a council tax band A-E.

- Visit [this page](#) to check on your eligibility for GBIS or initiate an application [30].

Note*: There have been well-publicised examples of insulation being applied incorrectly, leading to damage in homes [31]. It is therefore recommended that surveyors or architects are consulted before any work is carried out.

2.3 Different approaches to retrofit

There are different schools of thought on how to approach retrofit. Each has a different emphasis, although some may be complementary.

2.3.1 An archetype approach: which suite of measures are best suited to which type of tenement?

One overarching approach seeks to provide guidance on the measures used to retrofit a tenement based on which type of tenement is being retrofitted.

Tenements can include the following [categories of flatted buildings](#) [32]:

- Traditional stone tenements and villas
- Older masonry and render flats
- Low-rise flats
- High rise flats
- 4-in-a-block
- Modern apartment buildings

The categories can be further subdivided into wall types. There is technical information on traditional buildings on the [Historic Environment Scotland](#) website [33]. For more modern buildings find information [here](#) [34].

At the University of Edinburgh academics have been leading the development of an [archetype-centric approach](#) [35] for retrofitting the

Scottish housing stock. The aim is, by creating a system of coded archetypes, to produce publicly available guides, or 'pattern books', to provide accessible guidance to the most appropriate measures for Scotland's major building types. This will have benefits for the strategic implementation of retrofit of different tenement types.

2.3.2 Repair First...

The [Tenement Short Life Working Group](#) [36] recommends that a tenement building has to be in good repair before retrofit work can take place and that the order of addressing issues should be: 1) repair, 2) maintenance, 3) energy efficiency and 4) zero direct emissions from heating.

Separately, the [Retrofit Roundtable Group](#) [37] proposes the following hierarchy:

- Property is watertight.
- Property is appropriately windproof.
- Property is regularly maintained to keep it watertight and windproof.
- Property has appropriate insulation fitted and adequate ventilation.
- Property has a clean heating system (zero direct emissions heating system).
- Micro-renewables (small scale electricity technologies, e.g. solar panels) are introduced to the property.

2.3.3 Fabric First...

Fabric first describes an approach to improving the thermal performance of residential buildings, in which work to reduce heat loss through the building fabric precedes addressing the efficiency and energy source of the heating system. It typically promotes ultra-high levels of insulation, air tightness and controlled ventilation. However, its interpretation varies greatly between installing very basic measures to 'whole house deep retrofits'.

- Find more info on this approach in this [briefing note](#) [38].

2.3.4 Fabric Fifth...

An emerging approach turns the fabric first perspective on its head. The argument here is that the full fabric first approach is idealistic; it is often complex, disruptive and costly. An alternative prioritisation of interventions is suggested which places fabric improvements in fifth place: 1) switch to heat pumps, 2) adopt smart technology use, 3) enhance comfort with simple upgrades, 4) install solar and storage and 5) improve the building fabric.

From the fabric fifth perspective, if technological advancements are sufficient to achieve the desired objectives with only the essential and necessary fabric improvements, followed by the integration of a well-designed and properly installed heat pump, the fabric fifth approach could prove to be faster, more cost-effective and less disruptive

- Read more about Fabric Fifth approach by energy expert Nigel Banks in his [article](#) [39] on LinkedIn.
- Find more info on this approach on an episode of the Zero Ambitions [podcast](#) [40].

2.3.5 People and Maintenance First...

Another emerging perspective is proposed by [Bill Bordass](#), an expert in the interactions between people, buildings, systems and controls. He makes the case for starting with the people living in the home and working outwards. To support this approach, he recommends working with homeowners to identify key items on a checklist, such as:

- Statutory designations (listing / conservation areas).
- Building condition.
- Previous work that may have been inappropriate.
- Condition of environmental controls.
- Annual consumption of fuels.
- Opportunities for collaboration with neighbours.
- Examples of retrofit work in the neighbourhood.
- Grants and loans available.

- Scope for adopting 'soft' or fine-tuning measures for rapid results.

Bordass proposes that the checklist should be developed with and supported by '*locally based generalist advisors, broadly aware of the issues and able to identify any needs for specialist support where required. They could also signpost local capabilities (e.g. advisers, contractors and suppliers), local examples of successful outcomes, and guidance for DIY*' [41].

2.4 Connecting with local retrofit actors

Given the varied perspectives in the field of retrofit and the complexity of retrofit processes and interventions, no one can be expected to deliver retrofit on their own. To be better placed to drive retrofit in your tenement it is important to be aware of the growing support networks that are available.

Scotland's city authorities are members of [the Global Covenant of Mayors for Climate and Energy](#) [42] which shares a vision of supporting voluntary action to combat climate change.

The volunteer led [Scottish Communities Climate Action Network](#) [43] oversees a growing number of regional hubs supporting groups such as the [Edinburgh Building Retrofit and Improvement Collective](#) [44].

EdinBRIC helps residents form into groups so they can tackle building retrofit & improvement together, so this could be a source for future clientele.

In Glasgow, [Loco Home Retrofit](#) [45] is advancing a community-based approach and provides a service tailored to tenements.

- Research and connect with local climate action groups.

3 Responsibility for tenement retrofit

3.1 Overview of responsibility in tenements

Co-owners are usually jointly responsible for any retrofit work in the shared parts (often describes as 'common parts') of the tenement and so need to organise this work with the other owners.

Key shared responsibilities of co-owners of a tenement are laid out in titles of the property (Section 3.1.1) and, where the detail is incomplete, silent or unworkable in the titles, in the Tenement Management Scheme (Section 3.1.2).

- For more detail on establishing responsibility in tenements see the Governing Scottish Tenements toolkit, available here [XXX].

3.1.1 Titles

In Scotland, the title² of a property is the legal proof of ownership, recorded in the Land Register of Scotland, showing who owns the property and any rights or restrictions affecting it. The conditions in property titles, listed as 'real burdens', are obligations that go along with the ownership of the flat. They are put in the titles to control the use of the flats in the tenement, for example, ensuring that the owners maintain or contribute to the maintenance of the common parts.

- Consult the titles of your property and share what you've found with your co-owners.

3.1.2 Tenement Management Scheme

The Tenement Management Scheme is found at Schedule 1 of the Tenement (Scotland) Act 2004.

According to the Tenement Management Scheme, decisions are made about maintenance works on common parts of the tenement on the votes of a simple majority of owners (i.e. 50% of owners plus 1) while work that is

considered an improvement requires a unanimous vote (i.e. all of the owners).

Most aspects of retrofit would be considered improvement and so require unanimity amongst owners. However, one aspect of retrofit that is considered maintenance is insulation. Section 69 of the Climate Change (Scotland) Act 2009 [46] altered the Tenement Management Scheme, by specifying that insulation installation is within the scope of maintenance (for a detailed look at the law in Scotland see [Weatherall et al.](#) [47]).

- Become familiar with the Tenement Management Scheme, found [here](#), and share your knowledge with co-owners

3.2 The role of factors

Property factors are professionals appointed by flat owners to manage and maintain the shared parts of a building. But they do not own the building and so are not ultimately responsible for any aspect of the building and are not responsible for any services other than whatever they have been contracted to provide to the co-owners.

- To find out where a factor might assist with a retrofit project review their Written Statement of Services. You can ask your factor to provide this.

Owners may lack time and expertise to manage the upkeep of the building on their own. A good factor brings organisation, technical, legal, communications and administrative expertise. For this reason in general, tenements that are factored tend to be in a better condition [48].

Good property management depends on active owner involvement. Regular communication with the factor, clear expectations and a willingness to collaborate all help ensure the building is well-maintained and future-proofed.

Commented [IC2]: Cross ref when both toolkits are complete.

² Since the 1980s, property documentation in Scotland has evolved from traditional Sasine Title Deeds to Land Certificates, which are now referred to as Title Sheets. In this document, the terms 'titles' or 'property titles' apply to all these forms collectively.

Where a factor is present it is important that there is clarity on how the roles of the factor differ from the roles of the owners (either organised as an association or individually). Figure 1 provides an overview the ideal split in roles between the factor and an owners' association.

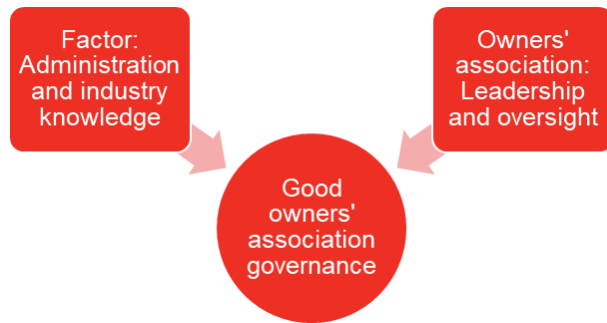


Figure 1 - How factors and OAs contribute to good tenement governance

4 Getting started: working with co- owners

To retrofit the common parts of tenements, owners will need to be organised to make decisions on what steps to take. Deciding how to organise involves choosing the best model of tenement governance to suit the particular tenement.

In Section 4.1, three key models of tenement governance are discussed: 1) informal organising; 2) constituted owners associations and; 3) Development Management Scheme Owners Association (OAs).

In Section 4.2 the advantages and disadvantages for retrofit of organising at a scale larger than an individual tenement are discussed.

In Section 4.3 some practical tips are suggested for starting organising with co-owners.

- For more detail on organisational models and practical steps for organising see the Governing Scottish Tenements toolkit, available here [XXX].

4.1 Different models of owners' association

In a tenement the extent of owner organisation can range between informal interaction to forming an incorporated organisation, as is illustrated in Figure 1.

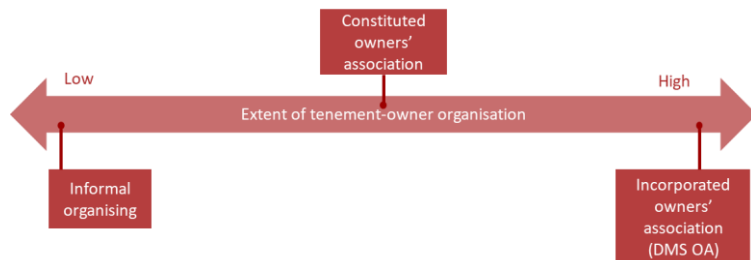


Figure 2 - Differing degrees of owner organisation

In general, **the more organised an owner group is the easier they will find it to undertake retrofit in their building.**

4.1.1 Informal organising

For small tenements (with two or three flats) having an owners' association constitution may not be considered necessary [49]. There may be several reasons for this:

- **Easier Communication:** with fewer owners, direct communication is simpler and more efficient.
- **Fewer Decisions:** small tenements have fewer shared responsibilities, reducing the need for formal decision-making structures.
- **Lower Maintenance Needs:** smaller buildings may require less coordination for repairs and upkeep.
- **Less Administrative Burden:** forming and managing an association involves paperwork and costs, which may not be justified for a small group.
- **Informal Agreements Work:** owners can often manage shared responsibilities through informal agreements rather than a formal association.

However, even when tenements are small there are advantages of having a more formal form of organisation (see summary in Table 1).

4.1.2 Constituted owners' associations

Owners' associations are considered to be more formal than simply a collection of co-owners who discuss and agree upon issues related to the co-owned property. A defining feature of an owners' association is that it has a constitution [6], [49].

An owners' association constitution outlines the structure and operation of an association within a building. It usually will have a number of key features [6], [49]:

1. **Name of the Association:** the name of the association, typically linked to the property address, should be clearly stated.

Commented [IC3]: Cross ref when both toolkits are complete.

2. **Objectives and Purpose:** it should outline the association's purpose, such as managing common repairs, improving communication among owners and maintaining shared areas.
3. **Membership:** it should define eligibility (e.g., all owners of flats within the tenement) and state that membership ceases upon selling the property.
4. **Committee Structure:** it should detail any roles, such as Chairperson, Secretary and Treasurer. It should explain how committee members are elected and their responsibilities.
5. **Decision-Making and Meetings:** it should specify how decisions are made (e.g. when resolutions require a majority vote, when unanimity, etc.). Outline procedures for holding Annual General Meetings (AGMs) and emergency meetings.
6. **Financial Management:** it should describe how funds will be raised (e.g., membership fees or contributions for repairs). State how a maintenance account will be managed, including signatories and spending rules.
7. **Amendments to the Constitution:** Detail how changes can be proposed and approved.

An owners' association that is constituted is recommended because it has certain advantages [6]:

- Banks may require a constituted owners' association to open a Maintenance Account.
- Studies show that owners' associations increase satisfaction with property management [50].
- They enable faster and more effective decision-making.
- They provide leadership in repairs and encourage active participation.
- They serve as a central point of contact, improving communication.

³ There are potentially other organisation forms that incorporated OAs could take. However, the Scottish Law Commission advises that the most suitable model should be tailored specifically for owners' associations and highlights the

However, it is important to recognise that simply having an owners' association that is formed only by adopting a constitution may not be sufficient to meet the needs of a tenement owners' association. There are two main shortcomings of setting up a 'constitution-only OA':

- The authority of the constitution is limited by the legal standing of the property titles and, where applicable, the Tenement Management Scheme (TMS). If the decision-making procedures outlined in the association's constitution conflict with what is set out in the property titles or the default rules of the TMS, decisions made may not be enforceable in a court of law and any decisions made under its rules may be challenged or overturned.
- Having a constitution in place does not create an association which is considered a 'body corporate'. When an organisation is considered a 'body corporate' that means it exists as a separate legal entity distinct from the individual owners (or members). Having only a constitution and not creating a 'body corporate' means that the OA lacks the legal protections and powers that incorporation provides, such as limited liability, the ability to enter contracts in the association's name or the capacity to hold funds and assets independently of the owners.

4.1.3 Development Management Scheme OA

The Development Management Scheme (DMS) addresses the shortcomings of the constitution-only owners' association³. When adopting a DMS OA the title deeds are altered to include the set of default decision-making rules associated with the DMS (although these may be amended) and a 'body corporate' is created.

The scheme is registered with the Land Register, giving it strong legal standing and making its provisions binding on all current and future owners.

Development Management Scheme (DMS) as a bespoke framework already available in Scotland.

However, there are also significant drawbacks to creating a DMS OA. Implementing a DMS is legally complex, requiring agreement of all owners, the services of a solicitor to amend the existing title deeds and to implement the scheme and is therefore the costliest option.

It must be noted that, at the time of writing, the Scottish Government has committed to introducing mandatory owners' associations across Scotland. According to the draft bill produced by the Scottish Law Commission 2025 [51], the mandatory framework will take the form of a body corporate. The draft will still have to go through various stages before it becomes law, so the proposed structure that owners' associations will take remains unclear at the time of writing. In light of this, it is advisable to await further details of the reforms rather than investing the time, effort and expense involved in establishing a DMS OA at this stage, as the reforms are likely to result in owners automatically obtaining an association that fulfils the same function within a few years.

4.1.4 Comparing the different forms of owners' association

Table 1 summarises the key features of the three models of OA discussed here, together with the strengths and weaknesses of each model.

Table 1 - Key differences between key OA models⁴

	Informal organising	Constitution-only owners' Association	Owners' Association under DMS
Legal Basis	Not defined by legislation. Established by informal relationships between owners.	Not defined by legislation. Established by owners signing a constitution.	Established under Section 71 of the Title Conditions (Scotland) Act 2003
Legal Status	Unincorporated association with no separate legal status	Unincorporated association with no separate legal status	Body corporate (separate legal entity)
How Constituted?	No constitution, based on mutual trust and informal relationships.	Owners agree a constitution	Owners automatically become members when DMS application granted
Owners' Liability Limited?	No	No	Yes

⁴ Adapted from [60]

Able to enter into contracts, sue and be sued in own name?	No	No	Yes
Key advantages	Little administrative burden	- Better decision-making. - Provides leadership in repairs. - Encourages participation. - Central point of contact, improving communication.	- Shares all the advantages with an unincorporated OA. - Legal protection for individual owners through the body corporate. - Streamlined decision-making.
Key disadvantages	- Dependent on good neighbourly relations - Banks may require a constitution to open a Maintenance Account	No body corporate (separate legal entity)	- Legally complex. - Costly to establish

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4.2 Larger-scale organisation

For retrofit, organisation above the scale of individual tenements may provide benefits. This is because a larger scale is necessary to make some energy efficiency renovations work well, e.g. heating systems that serve several tenements may be more energy efficient and cheaper per household to instal and maintain than those supplying an individual flat or tenement [52], [53], [54]⁵ and being represented by a larger organisation can help owners negotiate a better price with suppliers [55].

Apart from the potential benefits for retrofit of working across multiple tenements, there are other possible benefits too:

- Mutual responsibilities:** there may be responsibilities shared between neighbouring tenements (such as gable walls and mutual chimneys)[56], in which case it would be wise to join together since decisions will need to be taken across tenements.

⁵ The optimal implementation of district heating depends on factors such as heating densities, current heating structures and local conditions [139].

- **Economies of scale:** It can be cheaper to undertake large jobs all at the same time (called “economies of scale”), e.g. fixing walls and roofs that connect several tenements is usually cheaper than each tenement hiring different contractors to do similar repairs on their own.
- **Improved governance:** Larger scale organisation can improve the quality of governance of tenements, e.g. a larger membership means there are more people from which to source the management team making it more likely that there are better leadership and being better able to negotiate good deals with building specialists or other contractors [57].⁶

On the other hand, it is important to note that there are considerable logistical and cost challenges of organising across multiple tenements.

- Coordinating improvement works across multiple tenements is more complex, e.g. managing more complicated programmes of works and reaching agreements with a greater number of owners.
- For ongoing organisation of multiple tenements, realistically owners will need to create a formal and incorporated organisation [58] to deal with the greater scale and complexity [59]. This means, e.g. changes in the titles for all owners of all of the flats in the buildings concerned and associated legal fees, requiring significant cooperation between multiple owners.
- To the authors' knowledge, forming multiple tenements into a single or connected governance structure has no precedent in Scotland⁷; owners who wish to attempt this will be confronted by a process that will involve much trial and error, e.g. groups may need to experiment with different approaches to collaboration, decision-making and management structures to find what works best for their particular context.

⁶ Notably, the benefits of improved quality of management which come from operating at a larger scale do not necessarily continue at the beyond a certain point. Karpestam & Palm [57] suggest an optimal size for building governance ranges from 40-150 apartments. Notably, even the lower range (40 flats) is far in excess of many Scottish tenements, such as traditional sandstone tenements, where the number of flats rarely exceeds 8.

While there is limited general advice available on creating an organisation to work across multiple tenements, one exception is produced by law firm Harper Macleod, specifically to provide an overview of the legal structures available for heating systems which serve multiple tenements.

- Consult the '[Guidance for owners on the installation of solar panels, heat pumps or insulation in common parts of tenements in Scotland](#)' [60], produced by law firm Harper Macleod.

While there are clearly challenges in organising formally across multiple tenements, it is evidently possible for neighbours to work together on joint projects which affect multiple tenements. For example, Glasgow City Council has produced a toolkit to help residents and owners understand more about the ownership and maintenance responsibilities of any adjoining lanes to their property.

- Explore Glasgow City Council's online [toolkit](#) [61] for tips, testimonials and guidance on how collective action across tenements.

Such examples show that working across tenements is feasible. Such schemes may even lay the foundations to build momentum for a more formal approach to organising.

4.3 Practical steps to organising

Owner organisation is likely to start small with informal discussion between groups of neighbours. These discussions need not begin with daunting building-related projects. They may start with something simple yet impactful, like tackling issues with overflowing bins or breathing new life into a neglected garden.

⁷ Where larger developments are organised under a single structure under the Development Management Scheme it appears that these are all set up by the developer before individual unit owners told on ownership.

4.3.1 Securing factoring services

To organise for retrofit work in common areas it is important that factoring services are in place. This does not necessarily mean that a professional factor must be appointed; much might be achieved through organisation amongst owners. However, as noted in Section 3.2, many owners will struggle to perform the roles undertaken by a factor.

- Owners should discuss whether they will appoint a professional factor.

Some factors include in their Terms of Service support for setting up an owners' association (Section 4.1).

- Where there is a factor appointed but no owners' association in the building, ask your factor what help they can provide to help owners set up an owners' association.

If an existing factor will not provide help in setting up an owners' association or if there is no factor it is helpful to shop around for factors that can be more helpful.

- Owners should ask for a copy of the Written Terms of Service of their factor and any other factors they are considering employing and make a comparison between the services on offer.

4.3.2 Getting started

Argyll and Bute Council have [published guidance](#) [49] on making contact with neighbours to start the process of getting organised as a group of owners:

- Speak to neighbours to identify common concerns. This will help assess if there is enough interest to establish a owners' association.
- Initially, it may not be clear who are owners and who are tenants. This can be clarified later.
- Teaming up with another person to handle initial outreach can make the process easier, though many associations begin with just one determined individual.

- Door-to-door conversations are often most effective. Consider distributing notes in advance to explain the purpose of the visit.
- Expect varied responses. While some may show enthusiasm, others may be indifferent or reluctant to get involved. Continuing to offer opportunities for participation can encourage wider engagement over time.
- The Housing Services department at the local council may assist with initial steps in setting up a group.

4.3.3 Help identifying the co-owners of the tenement

Sometimes getting organised can prove challenging because it is difficult to identify some of the other owners of the flats in the tenement, e.g. where flats are unoccupied or rented.

- For unoccupied flats or cases where owner contact details are unknown, ownership information can be obtained from [Registers of Scotland](#) [62]. Note there is a fee for this service.
- Under Part 8 of the Antisocial Behaviour Act 2004, private landlords must register with their local authority. This register can be searched [here](#) [63] to identify and contact landlords

4.3.4 Improving communication

While working on common goals, setting up a private messaging group can ease and speed up owners' communication.

- Encourage neighbours to set up a WhatsApp (or other private messaging application group (e.g. Signal, Threema).

[Novoville Shared Repairs](#) [64] is an innovative digital platform designed to facilitate and streamline the process of property maintenance and shared repairs. The platform serves as a central hub where property owners, tenants, property managers and local authorities can collaborate and efficiently address repair needs.

- Explore the potential of the [Novoville Shared Repairs platform](#) [64] to encourage a more participatory approach among property owners to repairs and maintenance.
- Again, owners may consider appointing a property factor (see Section 3.2). Factors often act as a central point of contact, streamlining communication amongst owners and with contractors (see Section 4.3.1).

5 Visualising the tenement retrofit process

5.1 Tenement Retrofit Dashboard

The tenement retrofit dashboard helps owners visualise tenement retrofit as a process that is likely to take place in several phases (e.g. progressing through different stages involving different 'aspects of retrofit', from 'baseline assessment', shown bottom left, to a 'post retrofit evaluation', bottom right).

Sections 5.2 to 5.5, below, detail the different elements of the dashboard, how they interrelate and, in so doing, provide an overview of a tenement retrofit process leading to a net-zero building.

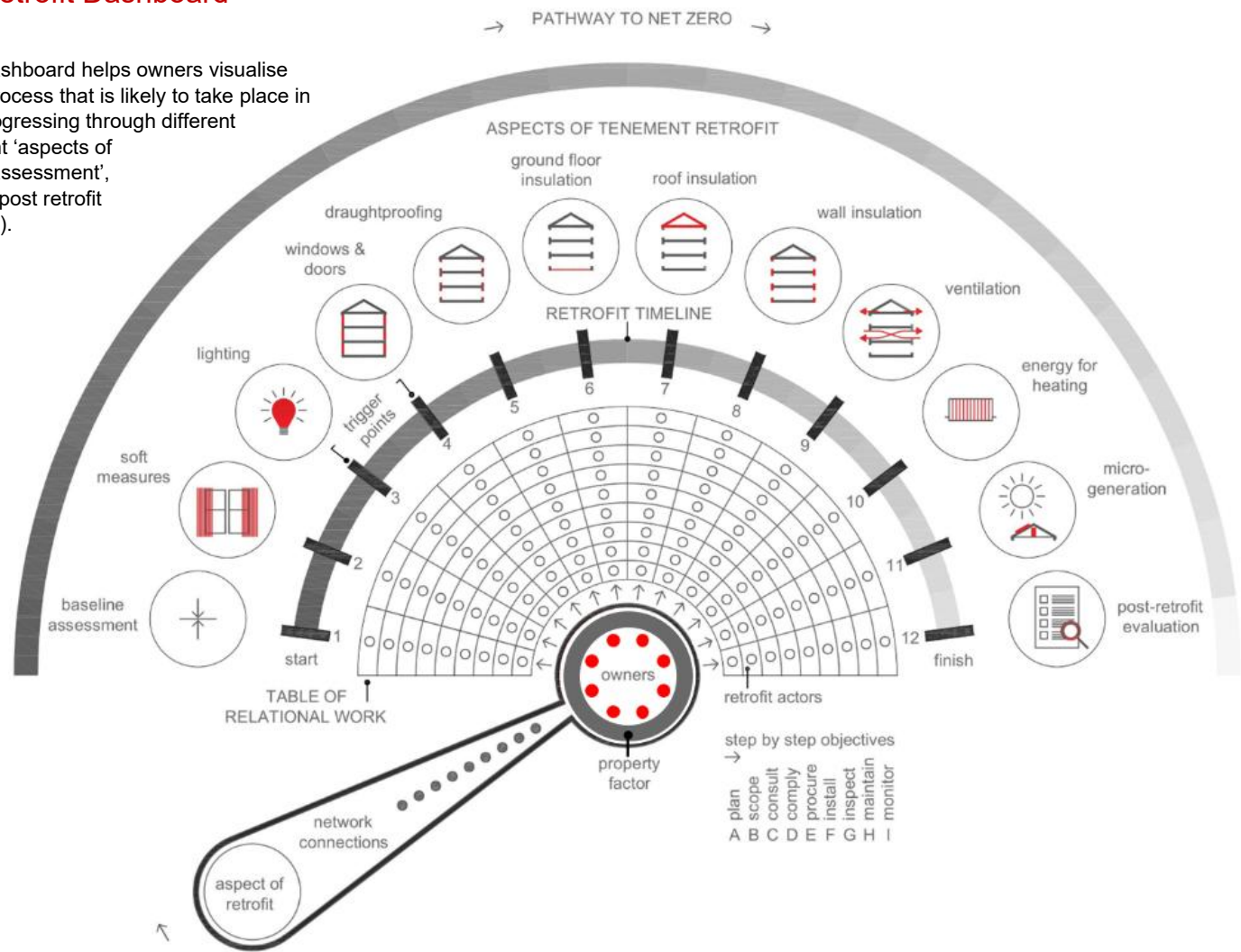


Figure 3 - Tenement Retrofit Dashboard

5.2 The order of aspects of tenement retrofit

The dashboard includes two timelines. First is the 'Pathway to Net Zero' which is laid out in a semi-circle around the top of the dashboard. The 'Pathway to Net Zero' runs left to right (and darker to lighter) and illustrates the broader context of sustainability transitions in which the retrofit of tenements takes place.

The second timeline, in the centre of the diagram, is the 'Retrofit Timeline'. This also runs left to right (and darker to lighter) intersected by 'Trigger Points' (discussed below) illustrating the time required to renovate a particular tenement building for net zero.

Between the two timelines are graphic icons depicting the key aspects of tenement retrofit (highlighted in Figure 4). These are arranged left to right, starting with 'baseline assessment' (bottom left) and ending with post-retrofit evaluation (bottom right). Each of the 12 aspects of retrofit are explained in detail in Section 6.

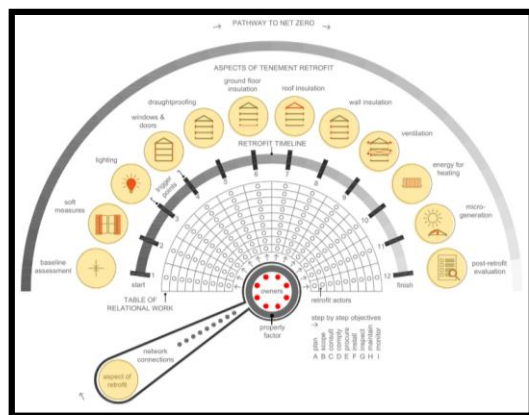


Figure 4 - Sequence of retrofit interventions

The order in which aspects appear in the diagram has been determined by:

1. How challenging the interventions are to undertake (easier coming first, e.g. curtains or lighting; more difficult coming later, e.g. communal heating);
2. Sequencing (how different types of intervention are considered better achieved if done in a specific order, e.g. insulation before clean heating) and;
3. Where delaying action might make taking action easier, for example where government intervention is anticipated in the future to a) provide greater investment for clean energy infrastructure (e.g. construction of more district heating systems), b) tighten energy efficiency standards (resulting in increased demand and supply for retrofit interventions) or c) implement new funding mechanisms.

Balancing these elements is by necessity a matter of judgement. Hence, this toolkit does not claim to present the definitive ordering of tenement retrofit interventions. In Section 2.4, different approaches to retrofit are acknowledged that may favour very different sequences of interventions.

Nonetheless, there is value in providing an indication of possible sequencing as it provides a guide to that might better aid flat owners through their retrofit journeys.

5.3 Trigger points

On the Retrofit Timeline and aligned with each of the aspects of retrofit are trigger points (highlighted in Figure 5).

Retrofit trigger points are key moments in a building's life cycle when energy efficiency upgrades can be most cost-effective and convenient to make. Trigger points often occur during major events like renovations, repairs, changes in occupancy or system replacements. Other trigger points might occur during changes in life course (e.g. when owners retire) or in response to government legislation.

Research [65] has shown that by aligning retrofit work with trigger points, the costs and disruption associated with retrofit is minimised.

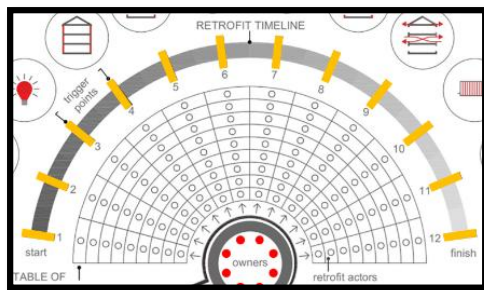


Figure 5 - Trigger points

In Section 6 of this toolkit trigger points are highlighted for each of the 12 aspects of retrofit (e.g. building maintenance or improvement issues).

The inclusion of these types of trigger points is designed to illustrate key moments when owners might seize the opportunity to open up dialogue with co-owners about retrofit.

5.4 Table of Relational Work

The dashboard also contains a semi-circular table, the Table of Relational Work (highlighted in Figure 6). This table illustrates the personal and professional connections required in each tenement to deliver each aspect of retrofit; while the term 'relational work' indicates the effort required to build and maintain the relevant relationships (see Section 1.3)

The Table of Relational Work is sub-divided by columns, radiating out from the middle of the dashboard (corresponding to the 12 aspects of tenement retrofit). These are cut across by 9 arch-shaped bands (corresponding to

key objectives that need to be realised to deliver retrofit, e.g. planning, scoping, consulting)⁸. Each objective is defined in Table 1.

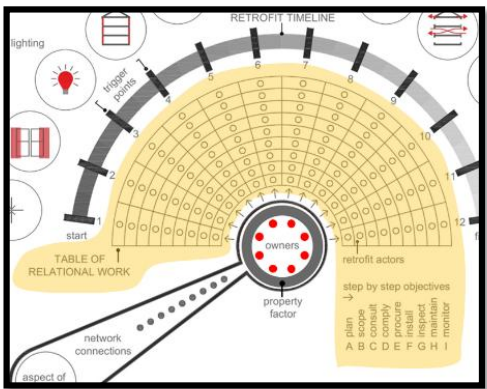


Figure 6 - Table of relational work

Each objective will require support and services as appropriate. In some cases the owners might be able to do some of the work themselves, e.g. 'plan', 'scope' or 'install' 'soft measures' (see Section 6.2).

However, owners will still need reliable sources of information to help them take the most effective action. And in most cases specialists will be required to both provide advice and carry out interventions. In each of the cells of the Table of Relational Work there are small circles, representing specialists appropriate for each aspect and objective of retrofit. In Table 2 examples of the types of actors necessary to undertake each aspect of retrofit are also provided.

⁸ The sequence of the objectives is broadly aligned with the [RIBA Plan of Work \[120\]](#) stages

Table 2 - Explaining the notation on the Table of Relational Work

Objective	Definition	Examples of types actors needed to realise objective
A (Plan):	Define the project strategy and establish the initial brief.	Local Authority / City Heritage Trust / Home Energy Scotland / Local Energy Scotland
B (Scope):	Confirm preferred option and establish the professional services required to develop the design.	Local Independent Retrofit Intermediary
C (Consult):	Engage stakeholders and specialists to refine the design, provide cost advice and ensure feasibility.	Design Team (Architect / Engineers / Quantity Surveyor)
D (Comply):	Ensure the design adheres to regulations, standards and approvals.	Design Team / Local Authority Planning and Building Control Departments
E (Procure):	Select contractors and suppliers, formalise procurement strategies and prepare contracts.	Design Team / Trusted Traders
F (Install):	Execute construction or installation activities based on the design and specifications	Heating engineer / insulation installer / secondary glazing installer / ventilation system installer
G (Inspect):	Review and test completed works for compliance with the design and performance requirements.	Design Team / Clerk of Works
H (Maintain):	Manage and oversee maintenance plans to ensure operational efficiency.	Maintenance contractor
I (Monitor):	Continuously evaluate performance and functionality to ensure long-term success.	Design Team / Independent Consultant

5.5 Visualizing the role of co-owners

Owners are situated at the centre of the dashboard, illustrating their central responsibility as decision makers in tenement retrofit (Figure 7). The owners are represented by 8 red dots arranged in a cluster, representing the formation of an owners group (e.g. owners association).

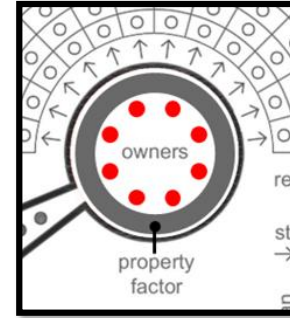


Figure 7 - The role of co-owners

Around the owners is a grey band representing property factoring (labelled 'property factor'), illustrating the essential functions of factoring services as key parts of the retrofit process (e.g. administration and communications). While it is not essential to employ a professional property factor to deliver tenement retrofit, the functions of the factor will need to be carried out by owners if there is not a professional factor appointed, which many owners will find challenging (see Section 3.2).

Around the owners and property factor are twelve arrows, illustrating the relational work that owners (potentially with the support of factor) must undertake to engage the relevant specialists for each aspect of retrofit.

In the dashboard, owners and factors are also shown connected to a 'rotating needle' (Figure 8).

The tapered part of the needle is marked with 9 black dots, labelled 'network connections' which represent specialist advisors and trusted traders. Each of these dots corresponds to one of the circles in the table of relational work, which (as explained in Section 5.3), represent specialists appropriate for each 1) aspect and 2) objective of retrofit. The eye of the needle (marked 'aspect of retrofit') corresponds to the 12 aspects of retrofit in the dashboard.

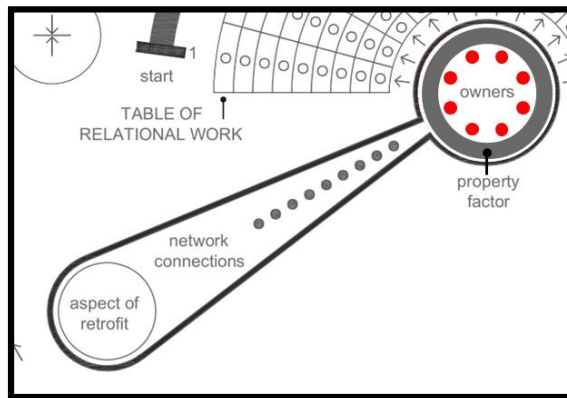


Figure 8 - Rotating needle

The rotating needle, including its network connections and 'eye', illustrates how, to deliver tenement retrofit, owners (and potentially also factors where they are present) act as a 'rotating gear', sweeping the needle around the dial (Figure 9). It also illustrates that, as they do so, they must link up their network connections with the appropriate specialists for each aspect of retrofit, to get the job done for each aspect of retrofit.

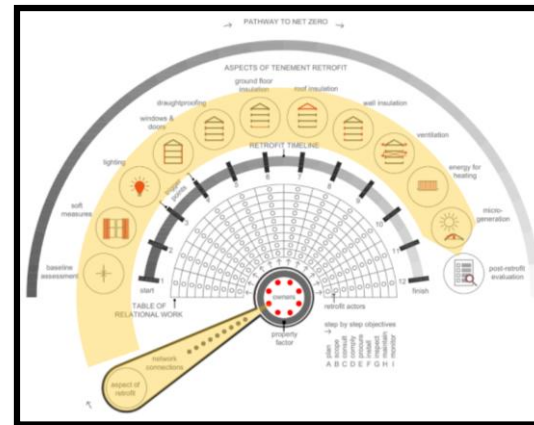


Figure 9 - Sweeping the needle around the dashboard

Note, some additional resources for mapping out the network connections necessary for factors to better support the tenement retrofit process are available in the property factor tenement toolkit [2].

- Signpost property factors to the 'Factoring in Tenement Retrofit' toolkit [here](#) [2].

6 Aspects of tenement retrofit

6.1 Baseline assessment

6.1.1 Explanation: What does baseline assessment mean in retrofit?

Baseline assessment refers to an initial evaluation of a building's current energy performance, identifying areas for improvement and setting a reference point for measuring retrofit outcomes.

6.1.2 Possible trigger point

Owners might have worries about the high cost of energy or environmental concerns and are considering their options.

6.1.3 Responsibility

Flat owners are responsible for assessment in their own flats and co-owners for assessment in the common parts of the building. Owners will need to source specialists for energy assessments where these relate to the common parts of a tenement.

6.1.4 The value of baseline assessment

- Owners should document the performance of energy systems within their flats and the condition of their property, to provide a 'before' scenario against which the 'after' can be measured.

6.1.5 Three aspects of baseline assessment

Measuring existing energy use and performance will allow a more robust selection of the most appropriate and cost-optimal combination of energy efficiency measures, along with more accurate sizing of heat pumps or other appropriate technologies. It will also provide a 'before' scenario against which the 'after' can be measured.

There are three key aspects of Baseline Assessment:

1) Citizen science

Retrofit is more likely to happen if people are engaged and knowledgeable about it [66]. In this context, citizen science (public participation in research, data collection and analysis) can be supportive of retrofit in tenements.

- Engage with the tools (e.g. smart meters and apps) that are widely available to help them track their energy use against their energy bills and the instruments that can sense the indoor temperature, humidity and air quality to get a closer understanding of what these readings actually feel like for them.

2) Building Surveying

The [Scottish Parliamentary Working Group on Tenement Maintenance](#) [67] recommends that all tenement areas in common ownership should be subject to five-yearly property inspections, carried out by an accredited building surveyor.

The group recommends that the survey report should be made publicly available to existing and prospective owners, tenants, neighbours and policy makers. The survey would detail the actual condition of each tenement building as well as provide an indicative cost for the work required to address any defects (e.g. dampness and mould), together with recommendations for on-going maintenance. It also recommends that the inspection survey report should take the form of a [logbook](#) [68].

- Visit the Royal Institution of Chartered Surveyors ([RICS](#)) [69] website to find local building surveyors.

3) Assessing the 'social context' of the building

- Consider / discuss with co-owners:
 - How much money are the owners willing to spend on retrofit.
 - How long they plan to stay in the building.
 - Whether they have plans for home improvements.

- Whether they have problems with faltering equipment.
- Their aspirations in relation to energy and carbon saving.
- The amount of disruption they can tolerate.
- The degree to which alterations might be better left to future owners.

Asking the following questions can also help owners understand the constraints and opportunities of their specific context:

- Is the tenement listed or situated in a conservation area?
- Does the tenement have a garden?
- Would owners be interested in electric vehicle charging points?
- Is there any previous work that has been inappropriate?
- Are there any tenement retrofit works being undertaken nearby?
- Do owners have any concerns about fire safety?
- Has your water system been checked for the presence of old lead pipes?
- Would you consider collaborating with neighbours to explore:
 - Group purchasing of goods and services?
 - The feasibility of a communal heating system?
 - The setting up of a renewable energy source co-operative?

Answering these questions will make it easier to make a plan for the retrofit of the building that is in keeping with the needs and wishes of co-owners.

6.1.6 Making a plan

Making a whole building plan (or whole flat plan for individual flat) is highly recommended. It is also recommended to do this with the assistance of an expert who is independent of installation contractors (e.g. [Loco Home Retrofit](#) [45] in Glasgow in [EdinBRIC](#) [44] in Edinburgh). That plan can take a phased approach.

- Develop a whole building plan with support from independent specialists.

6.2 Soft measures

6.2.1 Explanation: What are soft measures in retrofit?

Soft retrofit measures refer to interventions aimed at improving the energy efficiency and sustainability of existing buildings without involving major alterations to the building's structure. Soft measures can improve energy performance cheaply and rapidly.

6.2.2 Possible trigger point

Owners might be experiencing discomfort from cold and draughts, have worries about the high cost of energy or concerns about how their energy use is impacting upon the natural environment.

6.2.3 Responsibility

Soft measures are typically an individual responsibility as they predominantly impact upon the immediate surroundings of homeowners, i.e. within their flat.

6.2.4 Clothing

A simple way to reduce energy consumption for heating (by 35%) is to lower the thermostat from 22° to 18° and put on more clothes, most effectively by wearing long thermal underwear made from hi-tech eco-friendly materials.

- Read and share with neighbours this article for more detail about the energy savings potential of clothing.

6.2.5 Soft furnishings

[Laboratory tests](#) [70] have demonstrated that simple soft furnishings can reduce heat loss from window areas, as shown in Table 1Table 3.

Table 3 - The energy benefit of key soft measures

Measure	Benefit
Heavy curtains:	14% heat loss reduction
Modern roller blind:	22% heat loss reduction
Victorian blind:	28% heat loss reduction
Thermal honeycomb blind	36% heat loss reduction
Modern roller blind with low-E film backing	46% heat loss reduction

Minimising heat loss from [open chimney flues](#) [71] can be achieved using a [wool chimney draught excluder](#) [72]. Rugs and carpets (as opposed to exposed floorboards) may also help to make you feel warmer [73].

6.2.6 Ventilation as a soft measure

Measures to reduce energy such as reducing the temperatures on thermostats or basic draughtproofing (detailed in Section 6.5) can have knock-on effects on condensation or air quality. Hence, other measures to help to control levels of relative humidity ([dehumidifiers](#) [74]) and indoor air quality ([air purifiers](#) [75]) may be required.

However, dehumidifiers and air purifiers neither remove CO₂ nor supply O₂, making them an incomplete strategy to fully improve air quality. Additionally, they incur operational costs.

A straightforward approach to ventilation is to periodically open windows on opposite sides of the building for a short duration to enable cross-ventilation. This method facilitates air exchange without significant heat loss, as long as it is not undertaken long enough that walls and objects cool appreciably (e.g. five minutes). A low-cost humidity meter (hygrometer) can be used to monitor indoor conditions and prompt ventilation when relative humidity exceeds 65%. More substantial ventilation interventions are outlined in Section 6.9.

6.3 Lighting

6.3.1 Explanation: What does retrofitting lighting mean?

Upgrading to energy-efficient lighting systems, such as LEDs, to reduce energy consumption and improve both cost and energy efficiency.

6.3.2 Possible trigger point:

Lighting may be broken or dysfunctional in the stairwell or backcourt.

6.3.3 Responsibility

Lighting in flats is an individual responsibility.

The responsibility for lighting in stairwells and in the backcourts varies greatly across Scotland as it depends on the commitments put in place by local authorities.

There are three main ways in which responsibility for close and stair lighting is structured.

- 1) Both the provision (organising and arranging for payment of electricity for lighting) and maintenance of lighting in tenement closes and back courts is done by a local authority (Glasgow's [stair and backcourt lighting service](#) [76]).
 - 2) Local authorities may provide a lighting *only* service in tenement closes and back courts, with maintenance being the responsibility of the owners.
 - 3) The provision and maintenance of lighting in tenement closes and back courts may be the responsibility of owners.
- Check the details of local authority close and back court lighting services.
 - If owners are responsible for maintenance related to lighting, owners have a legal duty of care to ensure that all common stair lighting is always in good working order. To comply with this legal responsibility,

arrangements must be put in place to deal with common issues such as:

- Speedy replacement of faulty or broken lights.
- Electrical Installation Condition Reports (EICR) every 5 years to comply with legislation.
- Replacement of old light fittings when required.
- Minor wiring repairs.
- Maintenance of stair lighting timers.
- Replacement and maintenance of emergency lighting.

- For owners wishing to make communal lighting arrangements themselves, explore directories for reputable electrical contractors, who will also be needed to obtain the security driver and keys: [Trusted Trader Scheme](#) [77] or [SELECT](#) [78] and [NICEIC Find a Contractor](#) [79].

Flat owners may wish to opt out of a full local authority stair lighting service if it is likely to be more energy efficient and cost effective to do so.

In such cases, owners would need to make alternative arrangements with a utility company.

- Check with co-owners if the group wishes to pursue the option of taking over responsibility for electricity provision and offer to progress this on their behalf.
- Check if the owner group wishes to self-generate electricity for stair lighting. Refer to Section 6.11 for more information on self-generation.

6.3.4 Material interventions

Changing lighting can be a 'quick win' to improve energy performance and enjoy cheaper running costs.

- Read and share this [guide](#) [80] on switching to LED lighting.
- Read and share this [price guide](#) [81] for LED lighting.

6.4 Windows and doors

6.4.1 Explanation: What does retrofitting windows and doors mean?

Replacing old windows and doors with energy-efficient ones or adding secondary glazing to improve insulation, reduce heat loss and enhance airtightness.

6.4.2 Possible trigger point

Windows are in need of repair, e.g. the window frame is old and /or damaged.

6.4.3 Responsibility

Windows in flats are normally the responsibility of individual owners. However, windows and doors in the close are likely to be a shared responsibility (depending on the property's titles).

6.4.4 *Maintenance and Repair*

Heat loss through windows can be minimised if they are properly maintained. Windows should be repaired and painted every five years.

- Establish when stair windows were last repaired and painted.
- Arrange for a window health check five years from last inspection.

For traditional sash and case windows a helpful guide is [Historic Environment Scotland: A Short Guide on Sash and Case Windows for Homeowners](#) [82].

6.4.5 Secondary Glazing

A good guide for secondary glazing is [Historic Environment Scotland: A Guide to Energy Retrofit of Traditional Buildings: 9.3 Improving Traditional Windows](#) [83]. According to this guide, secondary glazing is one of the most effective methods for improving thermal performance, reducing heat loss by 63%, without changing the external appearance of the original windows.

Hence, it may be a good option for listed buildings and tenements in conservation areas.

- Connect with prospective installers through [Trusted Trader](#) [84].
- Arrange no-obligation free surveys.

One organisation that could be helpful for flat-owners in conservation areas is [Gecko Glazing](#) [85], specialising in timber framed windows for heritage homes.

6.4.6 Shutters

[Laboratory tests](#) [70] have demonstrated that combinations of shutters / blinds / curtains can reduce heat loss from window areas as follows:

Traditional shutters:	51% heat loss reduction
Traditional shutters and Victorian blind:	58% heat loss reduction
Insulated traditional shutters:	60% heat loss reduction
Traditional shutters, Victorian blind & curtains:	62% heat loss reduction
Plantation shutters:	64% heat loss reduction

Custom made plantation shutters (with tilting louvres) can also provide passive night cooling with open windows, optimise daylight and reduce solar glare.

6.4.7 Doors

Heat loss from doors can be reduced by either draughtproofing around the door or insulating the door itself. Draughtproofing can involve sealing the edges, letterbox and keyholes. Improvements can also be made to panelled doors by insulating the thinner wood panels with vapour-permeable materials, maintaining the door's external appearance.

- Read and share Section 3.4 of this [short guide to fabric improvements for energy efficiency](#) [86] for information on improving the thermal performance of external doors.

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6.4.8 Possible financial support

Home Energy Scotland: [Loan Scheme](#) [16] Loans are available to homeowners for double glazing or secondary glazing. Loans are only available for improving single glazing, not for the replacement or improvement of existing double glazing.

Historic Environment Scotland: [Grants Framework](#) for windows and doors for tenements in listed buildings or conservation areas and only when works are part of a comprehensive repairs scheme [87].

City Heritage Trusts: a [Retrofit Grant](#) [24] may be available for secondary glazing, draughtproofing, window shutter and storm door insulation and/or repair as part of the Traditional Buildings Health Check (TBHC).

ECO4: Single to double glazing, improved double glazing and high performance external doors are eligible, subject to other scheme rules detailed in the [ECO4 Guidance Document](#).

See Section 2.2 for more details on these funds.

6.5 Draughtproofing

6.5.1 Explanation: What does draughtproofing mean?

Sealing gaps around windows, doors and other openings to prevent cold air infiltration and reduce heat loss.

6.5.2 Possible trigger point

Draughts / cold might be coming into flats from the stairwell.

Complementary interventions: Draughtproofing can be more conveniently managed as part of larger window and / or doors repairs or improvements work.

6.5.3 Responsibility

Draughtproofing in flats is an individual responsibility. On the other hand, draught-proofing the communal stairwell area would typically be a shared responsibility amongst owners (depending on property titles).

6.5.4 The importance of draughtproofing

Buildings are prone to heat loss through cracks and gaps which develop as various building elements move and distort over a long period. This is particularly the case around windows and doors, making draughts around them a potentially a major source of heat loss. Less than a quarter of the heat lost through a typical traditional window escapes by conduction through the glass - the rest is by draughts (air infiltration) [88].

Since draughts make people feel colder, they often turn up the heating and run it for longer, leading to increased energy consumption, increased emissions and increased cost to the bill payer. There are two main pathways for draughts associated with windows: 1) gaps between the window frame and the wall and 2) gaps between the sliding sashes and their frames.

Draughtproofing in internal stairwells can be important especially where there is a desire to reduce heat loss through the (potentially thin) walls of the flats adjoining the stairwell.

- Learn and raise awareness amongst co-owners of the key sources of draughts.

6.5.5 Identifying draughts

Thermography, the use of an infrared camera that creates a visual map of temperature patterns across an object or material, is a quick way to identify heat loss pathways and target areas for draughtproofing. It can also detect inadequate or missing insulation, areas of thermal bridging, water ingress and early condensation.

- More details about thermal imaging can be found [here](#) [89].

Another option is the use of a smoke pen or pencil. This is a more rudimentary and cost-effective tool that emits a vapour plume resembling smoke, allowing for the identification of subtle draughts and air leaks.

6.5.6 Guidance on undertaking draughtproofing

Guides to historic buildings are particularly helpful regarding draughtproofing, with guidance being helpful for other building types too.

- Read and share this [short guide to sash and case windows](#) [82] with co-owners.

The guide will help owners understand the way in which traditional windows are constructed and operate and establish how much preparatory work they can do themselves before engaging a specialist.

The guide explains that it is relatively simple to seal between the frame and the wall with silicone and foam backed strips, but the more intricate work of fitting brush strips between the stiles and the frames is best left to a joiner as it involves routing channels for the brush carriers.

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The glazing putty around windowpanes needs to be well-maintained and not cracked or missing, providing a good seal between the glass and the window timbers. Linseed oil putty protects window timbers and prevents panes from being draughty and rattling.

The sash and case guide includes an inspection checklist that can be filled out by the owner to be passed on to a joiner (which can help pricing for the work).

- Read and share with co-owners this [case study](#) [82] on window upgrades.
- Read and share with co-owners this [Quick Start Guide](#) [90] with owners in heritage buildings on Sash and Case Windows.

If co-owners are keen to initiate a programme of window repairs, they will often have the option to add-on a draughtproofing service to the programme of works.

6.5.7 Possible financial support

Home Energy Scotland [Grant and Loan Scheme](#) [16]: Draughtproofing is included in the list of secondary measures as part of the grant and loans scheme, but only when combined with an application for a primary measure (e.g. secondary glazing).

Warmer Homes Scotland also provides support for draughtproofing for those on a low income. Details can be found on the dedicated [Home Energy Scotland webpage](#) [18].

ECO4: Draughtproofing is eligible, subject to other scheme rules detailed in the [ECO4 Guidance Document](#).

See Section 2.2 for more details on these funds.

6.6 Ground floor insulation

6.6.1 Explanation: What does ground floor insulation mean?

Adding insulation to or underneath the ground floor to prevent heat loss through the floor and improve thermal comfort.

6.6.2 Possible trigger point

Bottom floor flat-owner occupiers may feel the discomfort from a cold floor or cold air coming up through their floorboards.

Floors may be damaged and need to be replaced.

An insulation intervention might form part of a larger body of work to address issues with damp and mould.

6.6.3 Responsibility

Some insulation may be placed upon a floor in a tenement. In such cases the flat owner is the responsible party.

Below the floorboards responsibility may vary. Every part of the tenement's foundation, extending to the basement floor or ground floor level, is a collective responsibility unless otherwise stated in the property's titles [91]. Maintenance and repairs costs are, therefore, typically shared amongst owners. Moreover, as insulation is considered a maintenance measure in the Tenement Management Scheme (see Section 3.1.2), according to the scheme a simple majority of owners is required to make a decision to install ground floor insulation.

However, it may be a challenge to get owners who do not live on the ground floor to vote and pay for an underfloor insulation project which has little direct benefit to them.

- Check titles to establish responsibility for ground beneath a building (sometimes referred to as solum).

6.6.4 Scaling up a ground floor insulation project

Owners within a tenement or in adjacent tenements might keep costs to a minimum by coordinating work in multiple ground floor properties at the same time.

- Ask all ground floor flat owners in the tenement if they are interested in exploring a ground floor insulation project.
- Consider working together with owners of adjacent tenements to create a larger scale project.

6.6.5 Material selection

The materials used for insulation will depend on the type of floor in question. In many modern homes there will be a solid concrete floor. For these types of floors, [Energy Savings Trust](#) [73] suggests two types of suitable insulation:

- 1) Rigid insulation foam which can be installed either above or below the concrete. Insulation is placed below the concrete floor when it is being replaced. When placed below, it allows the concrete to store heat during the day, helping keep the room warm at night. When placed above, the room heats up more quickly.
- 2) Chipboard flooring over rigid insulation: If the original floor doesn't need replacing, rigid insulation can be laid on top of the concrete, followed by chipboard flooring. This may require adjustments to doors, skirting boards and electrical sockets due to the raised floor level.

For traditional buildings with suspended timber floors, Historic Environment Scotland provides useful guidance in its [Short guide 1: in Traditional Buildings: 3.2 Floors provides useful guidance](#) [86].

According to this guide, effective insulation is best installed below a timber floor and a vapour permeable material should be used to avoid accumulation of moisture, which may lead to rot or other forms of damage. Hemp batts and wood fibreboard have been shown to be appropriate for the insulation of timber floors. The method used for the installation of the

insulation will be determined by the access available underneath the floorboards.

It may be that due to the disruption and potential damage involved, this work is not possible.

6.6.6 Building professionals

Some basic ground floor insulation work might be carried out by owners themselves, e.g. insulation placed upon the floor of the building. The extent to which building professionals are required depends on the capabilities of the owner and the technical difficulty of applying the insulation. Professional should also be able to advise on appropriate materials.

- Explore Royal Institution of Chartered Surveyors ([RICS](#)) [69] to find local building surveyors.

6.6.7 Possible financial support

Home Energy Scotland [Grant and Loan Scheme](#) [16] provides partial funding for underfloor insulation [13].

Warmer Homes Scotland also provides support for draughtproofing for those on a low income. Details can be found on the dedicated [Home Energy Scotland webpage](#) [18].

ECO4: Solid floor insulation and underfloor insulation are eligible, subject to other scheme rules detailed in the [ECO4 Guidance Document](#) [27].

Great British Insulation Scheme (GBIS): Solid floor insulation and underfloor insulation are eligible, subject to other scheme rules detailed in the [ECO4 Guidance Document](#) [27].

See Section 2.2 for more details on the funds.

6.7 Roof insulation

6.7.1 Explanation: What does roof insulation mean?

Installing insulation in the roof space or attic to reduce heat loss and improve overall energy efficiency.

6.7.2 Possible trigger point

A roof has developed a leak or the roof is damaged (e.g. during a storm).

6.7.3 Responsibility

Ownership of the roof and roof space can vary considerably in property titles. It is therefore important to check your property titles about the ownership of the roof and the airspace under the roof and, where titles are silent, consult the [Tenement Management Scheme](#) [92].

- See the guide to roof space ownership and responsibility [here](#) [93].

6.7.4 Building professionals

At the outset of a project, either a building surveyor or an architect should be commissioned to conduct a building condition survey of the roof to establish the extent and cost of what is required to get the roof retrofit ready.

Due to the complexity and potential hazards of working on roofs or in roof spaces it is critical to contact professionals for roof insulation.

- Explore Royal Institution of Chartered Surveyors ([RICS](#)) [69] to find local building surveyors.
- Connect with prospective roofers and roof insulation installers through [Trusted Trader](#) [84].

6.7.5 Scaling up roof retrofit

In their [Final Report on Energy Efficiency and Zero Emissions Heating](#) [94], the Tenements Short Life Working Group recognises that improving the energy efficiency of tenements requires upgrade works (fabric

improvements) to happen at the same time and across the whole tenement or tenement block, for them to be both cost-effective and viable.

- Consider that the more roofs that can be combined into a consolidated programme of improvement works, the better the chance that owners can access local government funding and benefit from economies of scale.
- Consider working together with other owners operating in the same block and neighbourhood to pursue options for area-based funding.

6.7.6 Material selection

According to [Energy Savings Trust](#) [95], for lofts with easy access and regular joist spacing, mineral wool insulation rolls may be suitable. Installation might be done without a contractor if owners are confident to undertake the work.

According to [Historic Environment Scotland](#) [86], natural materials such as sheep's wool or hemp fibre board should be used in traditional tenement roofs, as they are better able to buffer moisture and prevent condensation.

6.7.7 Flat roofs: a special case

According to [Energy Savings Trust](#), flat roof insulation is best installed from above, using rigid insulation boards topped with a weatherproof layer [95]. Insulating from underneath is possible but risks condensation issues if done incorrectly. Savings are comparable to loft insulation and depend on the extent of the flat roof.

6.7.8 Possible financial support

- **The Home Energy Scotland Grant and Loan Scheme** [16]
- The [Warmer Homes Scotland scheme](#) [18]
- **ECO4** and the [Great British Insulation Scheme](#) [30]

See Section 2.2 for more details on the funds.

6.8 Wall insulation

6.8.1 Explanation: What does wall insulation mean?

Enhancing thermal performance by adding insulation to external walls, reducing heat loss.

6.8.2 Possible trigger point

Damage, deterioration or mould within the tenement walls might trigger works that might include wall insulation.

6.8.3 Responsibility

The external walls are regarded as being common property [92] unless otherwise stated in the property's titles. Therefore, insulation added to external walls would be considered a shared responsibility.

As insulation is considered a maintenance measure in the Tenement Management Scheme (see Section 3.1.1), a simple majority of owners is required to make a decision to install wall insulation.

6.8.4 Practicalities of installing wall insulation in tenements

A tailored approach for wall insulation is required for each construction archetype. It is advisable to consult a building surveyor, architect or retrofit designer, who will ascertain the property's construction and recommend the materials and methods appropriate for the property.

- Explore the Royal Institution of Chartered Surveyors (RICS) [RICS](#) [96] and [Royal Incorporation of Architects Scotland \(RIAS\)](#) [97] to find local consultants.

The RICS has produced a professional standard for domestic retrofit advice, which acts as a clear flexible framework through which retrofit providers can deliver high quality services that property owners can recognise and trust. It also provides useful information for property owners and their advisers about partly or fully publicly funded retrofit installations,

which may involve organisations such as Ofgem, TrustMark or similar, with specific requirements for accreditation, competence and monitoring.

- Learn about the new [Residential Retrofit Standard](#) [98].

6.8.5 Where insulation is applied: cavity, internal and external insulation

There is some guidance on installing cavity wall insulation [here](#) [99] and [here](#) [86].

However, for many types of homes (especially older homes) walls will have no cavities (the walls will be solid, e.g. built of stone) and therefore cavity wall insulation is not an option. In these cases, internal and external insulation are the only options.

Some guidance on internal and external wall insulation is provided by [Energy Savings Trust](#) [100] and [Historic Environment Scotland](#) [86].

6.8.6 Special case: Pre-1919 traditional stone tenements

Pre-1919 traditional stone tenements have constraints in terms of heritage preservation and the risk of damaging the existing stone fabric by applying inappropriate insulation measures.

The installation of appropriate insulation in heritage buildings must carefully account for moisture dynamics. Moisture may originate internally as water vapour or externally as rain. If not allowed to evaporate, moisture can potentially lead to significant damage, such as damp, rot or structural degradation. To mitigate these risks, the design should ensure that vapour can move freely in both directions, allowing inward drying during winter and outward drying during summer, thereby maintaining the building's integrity and preventing moisture-related issues. Further details on the vapour permeability of insulating materials can be found [here](#) [101].

Historic Environment Scotland has significant information about installing wall insulation to historic buildings. Encourage affected owners to consider

arranging a building inspection at the same time, to kickstart exploring options for a whole building retrofit.

6.8.7 Possible financial support

- The **Home Energy Scotland** [Grant and Loan Scheme](#) [16]
- The [Warmer Homes Scotland scheme](#) [18]
- **ECO4** and the [Great British Insulation Scheme](#) [30]
- **Local Authority Area Based Schemes**

See Section 2.2 for more details on the funds.

6.9 Ventilation

6.9.1 Explanation: What does ventilation mean in retrofit?

Introducing or improving ventilation systems (to manage the flow of air in and out of the tenement) to maintain air quality while minimising heat loss.

6.9.2 Possible trigger point

Should be considered as part of a larger project involving insulation and draughtproofing.

6.9.3 Responsibility

Ventilation measures in flats are the responsibilities of individual owners. However, more complex measures may impact upon common parts of the building (e.g. chimney stacks) and hence require cooperation between co-owners.

6.9.4 Compensatory ventilation measures

Any measures involving draughtproofing and insulation will have an impact on the internal climate of a room. This has implications for both potential overheating and air quality.

Hence, any reduction in air flows from the elimination of draughts may require compensation elsewhere, e.g. through the reinstatement or introduction of controllable openings or as a background ventilator through the external wall.

6.9.5 Mechanical or natural ventilation

Given the complexities of ventilation, it is recommended that reputable specialists are consulted, such as [Loco Home Retrofit](#) [45] or [EdinBRIC](#). [44]. The level of construction airtightness will determine the system selection.

Sustainable Renovation: A Scottish Ecological Design Association (SEDA) [guide to best practice](#) [102] provides a good overview of issues relating to ventilation (in Section 4.9).

In buildings that are relatively airtight, a mechanical system may be the only practicable means of ensuring adequate ventilation.

Mechanical Ventilation and Heat Recovery (MVHR), is required for the most airtight homes. It works by continuously extracting warm, moist stale air from wet rooms via ducts, passing it through a heat exchanger and expelling it to the exterior via another duct. A balancing supply of fresh air is drawn from outside via other ducts, filtered and passed through the heat exchanger to warm it and supplied to the living spaces and bedrooms via further ducts. MVHR requires skilled commissioning and the frequent cleaning and replacement of filters, but if designed, installed and maintained well, can make a significant improvement on comfort and energy consumption overall.

Centralised Mechanical Extract Ventilation (CMEV) works by continuously extracting warm, moist stale air from wet rooms via ducts and exhausting it to the exterior via another duct, using a single central fan that is usually located at the top of a service cupboard. CMEV requires less than half the ductwork as MVHR, so can be more easily fitted into space-constrained homes. It is almost maintenance free and can be demand controlled, which means that the ventilation rate, rather than being fixed and constant for all areas of the home, can be varied in response to higher humidity, temperature and CO2 levels through the introduction of humidity sensitive inlets or trickle vents which open more when humidity is higher, providing greater fresh air supply when the need is greatest.

The best-known demand-controlled ventilation system is by Aereco. The company offers a free design service and extended warranty. The system has been proven to work well in a tenement application, as demonstrated [here](#).

For less airtight homes, more passive means of ventilation can be considered, such as:

Passive Stack Ventilation (PSV) consists of ducts from wet rooms to terminals on the roof through which warm, moist stale air rises by its buoyancy, assisted by the venturi effect of the wind across the roof creating negative pressure thus sucking the air out and in turn causing fresh air to be sucked in via background ventilators in window heads. To be effective, the passive ducts need to be as straight and near vertical as possible and they need to be insulated when passing through unheated roofspaces to reduce the risk of condensation build up; therefore this may only be suitable for top level flats.

Intermittent Extract Ventilation (IEV) consists of extract ventilation fans in wet rooms and trickle ventilators in living spaces and bedrooms. The role of the trickle ventilators is to admit a supply of fresh air when the fans are working and to facilitate wind-driven air infiltration and air leakage when they are not. The air pathway from the trickle vents to the fans is created by undercutting doors on the route by 10mm, so that even if doors are closed at night, for example, sufficient air flow remains possible beneath the doors. It is worth noting that there are potentially contradictory regulations in properties where there is a central hallway onto which rooms may require fire resistant doors. In these cases, the doors themselves are more robust and sealed precisely to resist the passage of fire, but 10mm gaps beneath are considered acceptable and the most common way to adhere to both sets of requirements. Intumescent (a substance that swells as a result of heat exposure) grilles may also be acceptable being open generally, but closing up in the event of fire.

Controls are usually manual, with fans in bathrooms linked to light switches or relative humidity sensors. IEV systems are inexpensive, relatively simple to install and well understood by users, however they have a short lifespan, often needing replacing after about six years.

Further detail on ventilation systems can be found [in section 4.9 of this guide](#).

Trickle ventilation pathways in traditional windows

- Read and share p.8-9 of this [short HES guide](#) [82] which describes how new trickle ventilation pathways can be neatly integrated into a traditional sash and case window without altering the aesthetics of the window or compromising the integrity of the window sections.
- Read and share this guide on [Indoor Air Quality and Airtight Homes](#) [103].

6.9.6 Possible financial support

- The **Home Energy Scotland** [Grant and Loan Scheme](#) [16]
- The [Warmer Homes Scotland scheme](#) [18]
- **ECO4** and the [Great British Insulation Scheme](#) [30]

See Section 2.2 for more details on the scheme.

6.10 Energy for heating

6.10.1 Explanation: what does energy for heating mean in retrofit?

Energy for heating in retrofit refers to upgrading to clean heating systems that minimise environmental impact by reducing or eliminating the use of fossil fuels. A clean heating system is defined by the Scottish Government as a system that produces zero direct emissions at the point of use, i.e. there are no emissions from the heating system from the building where the heating is being used [104].

6.10.2 Possible trigger point

When an existing boiler becomes dysfunctional and breaks, owners might consider replacing this with a clean heating option. When owners have agreed to pursue a communal heating option, perhaps in response to high bills or changing building standards. When connection to a district heat network is available.

6.10.3 Responsibility

Individual clean heating systems are the responsibility of individual flats. Communal clean heating for the entire tenement is the responsibility of all co-owners of the tenement.

Responsibility as it relates to a district heating scheme is a complex area and it is advised to source professional help should such a scheme be made available locally.

Responsibility for connecting to a district heating system (which supplies heat to a larger area) will depend on structure of the heating system; it may be possible for some owners to opt-in while others opt-out.

[The Heat Networks \(Scotland\) Act 2021](#) [105] promotes district heating but it is not stated that whole-building participation is a requirement. However, it may be impractical for one flat in a tenement to be connected to the scheme. For example, if the district heating system requires changes to

common parts (such as pipes running through communal areas), consent from all owners in the tenement may be needed under the Tenement (Scotland) Act 2004 [92].

6.10.4 Heating professionals

The technical challenges and legal compliance issues involved in installing heating systems mean that building professionals will be required to carry out the work. While traditional boiler replacements can be undertaken by standard heating engineers, more modern zero-carbon systems (e.g. heat pumps) typically require specialists with expertise in these technologies.

- For reputable traditional heating engineers [Trusted Trader Scheme](#) [77] or [SELECT](#) [78]
- Specialists in low carbon heating include [Loco Home Retrofit](#) [45] or [EdinBRIC](#). [44].

6.10.5 Types of clean heating

Clean heating systems can be grouped as follows:

District heat networks

These supply heat from a central source to multiple properties via a network of underground pipes carrying hot water (sometimes called 4th generation heat networks) or ambient water to be heated by a small heat pump in the property (sometimes called 5th generation heat networks).

- For more information on the national heat network delivery plan, read this [progress report](#) [106].

It should be noted that currently many 4th generation heat networks are currently powered by natural gas. These will need to use heat from low or zero emissions sources, such as surplus or waste heat or large-scale heat pumps, by 2040-2050 [107].

Heat pumps

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Heat pumps provide a highly efficient and eco-friendly method for heating your home and hot water. They operate by extracting heat from the environment and transferring it to a fluid, which is then compressed to raise its temperature. This heat is subsequently delivered to your central heating system for both space heating and hot water.

The key distinction between the two main types of heat pumps lies in their heat source: air source heat pumps (ASHPs) draw heat from the air, while ground source heat pumps (GSHPs) extract heat from the ground.

- Read more about different types of heat pumps [here](#) [108].
- For trustworthy advice, owners might approach specialist social enterprises, such as Loco Home Retrofit [36] for guidance on heat pumps.

Electric boilers work in a similar way to gas boilers except that they heat water by passing an electric current through a heating element instead of burning gas. They can be connected to existing central heating and hot water systems, however they are more costly to run due to current electricity prices and are much less efficient than heat pumps.

- Read about the pros and cons of electric boilers [here](#) [109].

Heat battery boilers, which work like a battery to store energy as heat until it is needed. They are heat-only boilers but can be paired with smart water cylinders taking advantage of cheaper night electricity rates or with a PCM (phase change material) store, which heat water on demand, rather than storing water as a cylinder would. They can also store energy from solar panels.

- Suggest owners explore this type of system [here](#) [110].

Modern efficient electric storage heaters, which generate heat overnight at cheaper electricity rates and release it during the day like traditional storage heaters but with higher heat retention, better insulation and smarter controls.

- Seek advice on modern storage heaters [here](#) [111].

Infra-red fabric, [112] which is a thin film that conducts low voltage electricity and emits infrared heat. It has the advantage of being able to be installed on a room's ceiling or walls (like wallpaper) making installation very simple in any property, irrespective of its construction, shape or size. However, research has yet to support its efficacy and there is some scepticism about its potential [113]. It is currently being [piloted](#) in tenement properties in Glasgow [112] with an independent assessment report to follow in Spring 2025.

6.10.6 Preferred heating options depend on local circumstances

Connection to a district heat network is an option for tenements that are in areas which have been identified as potentially being served by district heat networks in their Local Heat and Energy Efficiency Strategy (LHEES). There is no obligation to connect if owners have another plan for clean heating.

A whole building (or communal) clean heating system is an option for tenement buildings which have not been identified as potentially being served by district heat networks in their Local Authority's LHEES. It is also an option in heat network areas as an alternative to connecting to a district heat network.

- Explore [Heat Network Support Unit](#) [114] for the latest on heat networks. Detailed [resources](#) [115] are available in relation to policy, planning, technical, finance and procurement.

Individual systems that serve one flat are an option for flat owners, the selection of which will be determined by location and proximity to an outdoor space (ground or veranda) or roof, as well as on the nature of their existing heating system (wet or dry).

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6.10.7 Whole-building approach

The Tenement Short Life Working Group recommends that a whole building approach for clean heating should be developed for tenements.

Shared external units serving multiple flats may be more cost effective (including in terms of initial expenditure and maintenance costs) than separate systems serving individual flats, both for installation and maintenance.

- Familiarise yourself with the Heat Network Zones defined in the LHEES published by the local authorities in which you operate. This will help you discuss with co-owners any opportunities for communal heating systems that become available for your tenement.
- Read and share [this](#) [116] case study of a communal Ground Source Heat Pump project in Edinburgh.
- Consider that the property titles may have to be altered to ensure shared responsibility for a tenement scale communal heating system.

6.10.8 Consultation

Tenement owners will need to engage building professionals to produce some key documents to take forward clean heating proposals for flats (for both individual and communal options): typically a feasibility study followed by a more detailed options appraisal.

A feasibility study is an assessment of economic viability, potential constraints and opportunities, while an options appraisal is an assessment of a number of potential options available, before developing designs for the preferred option.

A surveyor or architect can co-ordinate allied professionals (Structural and Civil (S/C) Engineers, Mechanical, Electrical and Plumbing (MEP) Engineers, Renewables Specialists and a Quantity Surveyor as required, to work together to design and cost the system and prepare details for any builder's work associated with its installation.

These documents can then help flat owners reach an informed decision on how to proceed. Also, these document may be required by funding bodies.

Once the system has been designed, costed and approved, an application for a building warrant will need to be made by the consultant on behalf of the owner group.

- Note that any work to listed tenements or tenements in conservation areas will require a conservation accredited architect and may require following additional regulations.
- Explore [RIAS](#) [97] to find a local architect.
- Share this [guide](#) [117] to architectural appointments and services.
- Ask any potential architects if they will follow the [Plan for Use](#) [118] and the [Sustainable Outcomes](#) [119] guides embedded in the [RIBA Plan of Work 2020](#) [120].

6.10.9 Statutory authorities

A new heating installation within an apartment building will usually require a [Building Warrant Application](#) [121].

- Check with the Local Authority Building Standards department.

Permitted Development planning rights apply to the installation of heat pumps, subject to compliance with the parameters in the Scottish Government [guidance](#) [122].

6.10.10 Community-led clean heat projects

Community-led energy projects can involve clean heating (e.g. ground source heat pumps), alongside micro-generation (e.g. wind turbines or solar panels) or green transport infrastructure (e.g. electric vehicle charging points) or a combination of these.

An example, which may be of interest to owners living near vacant or underutilised open spaces, is the [ParkPower project by Greenspace](#) [123],

which uses various data sources to map the 'natural viability' of open spaces for clean heating technologies.

- Explore community-led heating options and share the idea with co-owners.
- Read and share this [report](#) [124] on Leveraging local and community energy for a just transition in Scotland

6.10.11 Possible financial support

- The **Home Energy Scotland** [Grant and Loan Scheme](#) [16]
- The [Warmer Homes Scotland scheme](#) [18]
- [Community and Renewable Energy Schemes](#) (CARES)
- **Scotland's Heat Network Fund** (SHNF) [22]
- **ECO4** In-fill measures [30]

See Section 2.2 for more details on the schemes.

6.11 Microgeneration

6.11.1 Explanation: What does microgeneration mean?

Installing renewable energy systems, like solar panels, on the roofs of tenements.

6.11.2 Possible trigger point

Solar PV installation on a tenement roof might be considered as part of larger project, e.g. to repair the roof or provide energy for new stair and backcourt lighting.

Solar PV installation might also be combined with battery, EV charging [125] or heat pump installation [126] to maximize energy and cost savings.

Larger community projects (see below discussion on REScoops) will be triggered by the development of local community-led schemes in the local area.

6.11.3 Responsibility

The responsibility for rooftop solar PV depends on the arrangements for ownership of the roof. Assuming the property title deeds are silent on the issue of solar panels, the [Tenement Management Scheme](#) [92] states that all owners in a tenement building are responsible for any changes or alterations made to the roof. Ownership of the roof and roof space can vary considerably in property titles. See the guide to roof space ownership and responsibility [here](#) [93].

- Check your property titles about the ownership of the roof, as this can vary.
- Where titles are silent on the roof and roof space, to consult the [Tenement Management Scheme](#) [127] to determine responsibility.

Larger community schemes (see below) are individual arrangements with a local community energy generator.

6.11.4 Challenges with solar PV on tenement roofs

When all owners agree to share the costs of installing solar panels on a tenement roof it can make the up-front costs more affordable. However, where the panels are jointly owned then the cost and energy saving benefits of having the solar PV are also spread amongst owners.

Not all roofs might be suitable for solar PV installation. The roof must be assessed for its ability to support the weight of solar panels and mounting systems. Also, it must be ensured that there is safe and practical access for future maintenance.

Before proceeding with solar PV installation it is necessary to consult specialists to help fully evaluate the practicalities, costs and energy efficiency savings.

- Source reputable organisations which can assist with the processes, legalities and funding of microgeneration, batteries and storage. This might include [Changeworks](#) [128], the [Energy Saving Trust](#) [125] and [Home Energy Scotland](#) [129].
- Explore [this](#) guide to how to install solar panels in tenements [130].

6.11.5 Neighbourhood Scale 'Renewable Energy Source Co-op (RES Co-ops)'

Where solar PV on tenement roofs would be problematic, there is an established model for siting citizen-owned PV panels locally: the [REScoop](#).

A REScoop is a community-based cooperative that develops, finances and manages renewable energy projects, allowing members - typically local residents or businesses - to collectively own and benefit from renewable energy generation [131].

[Energy4All](#) [132], a UK member of The Federation of Renewable Energy Source Co-operatives [131] has enabled [Edinburgh Community Solar Co-operative](#) [133] and [Glasgow Community Energy](#) [134] in partnership with their respective City Councils. The approach has the benefit of providing a

means to raise funds for collective fabric interventions, such as window improvements and draughtproofing.

- Explore options for establishing a REScoop amongst owners of tenements in your area. Owners might benefit from discussing the idea with a community energy development social cooperative, e.g. Energy4All.
- Explore if there are any REScoop's operating locally and contact them to ask how you and your co-owners might contribute and benefit.

6.11.6 Possible financial support

Local Energy Scotland [Community and Renewable Energy Schemes](#) (CARES) [21].

For EV Charging: Transport Scotland [Grants and Loans](#) [135].

6.12 Post-retrofit evaluation

6.12.1 Explanation: What is post-retrofit evaluation?

The post-retrofit evaluation stage relates to the time when the whole building has reached its maximum level of energy efficiency.

This final section draws on the RIBA [Plan for Use](#) [136] guide. It outlines options for when bigger communal tenement retrofit projects have completed their implementation phase and move to 1) handover and 2) in-use performance evaluation.

6.12.2 Possible trigger point

Consideration of the post-retrofit evaluation phase is helpful to ensure retrofit interventions meet expectations. Post-implementation evaluation can help owners hold traders accountable for substandard work and seek financial compensation if the trader refuses to address any issues.

6.12.3 Responsibility

Each owner has responsibility in assessing how the interventions are affecting their flat. The entire group of owners will have responsibility in ensuring that the interventions affecting common areas of the tenement have been delivered and are working as promised.

It is important to differentiate clearly between responsibilities for operation (owner/occupier), defects (main contractor) and routine maintenance (maintenance contractors).

6.12.4 In-use performance evaluation

It is best practice to plan in-use performance from the earliest stages of the project.

- Recognise the importance of thinking about and planning for post-retrofit evaluation at the outset of the project.

For the evaluation stage it is beneficial to appoint an experienced consultant, not closely involved in the project, for an unbiased evaluation.

- Engage an evaluation specialist for the post-retrofit evaluation stage of the work.

The in-use performance evaluation phase involves monitoring and measuring the performance of the whole building and may include the following:

- Conducting informal interviews with users about how systems are performing.
 - Collecting sample data on temperature and humidity.
 - Performing thermal imaging on cold days.
- Read and share this introduction to the key things to consider and steps to take for post-retrofit evaluation [here](#) [137].

6.12.5 Handover

When the interventions are handed over it is important to make sure that there is enough information provided so that owners can best benefit.

- The group of owners collectively should ensure that those responsible for undertaking the retrofit work in common areas have provided enough information (e.g. operating manuals).
- Co-owners should be encouraged to participate in a "building walkabout", ideally with the installers, to gain insight into how they will engage with the new systems and to identify any shortcomings in the installation.

Decisions will have to be made about how maintenance will be organised and who will be contracted to provide it:

- Ensure there are proper process in place (e.g. heating maintenance contracts) for the maintenance of the retrofit interventions.

Efforts should be made to encourage behaviour to make the systems work well. To give some examples, insulation in the stairwell will be ineffective if close doors / windows are left open. Owners will have to put measures in place (e.g. putting signs up on the doors) to ensure that doors are closed in the colder months. For common heating systems, owners can support each other in understanding how to optimise their functioning.

- Host an owners' association meeting to share knowledge on the retrofit work and discuss / share knowledge about how best to run the systems for maximum benefit.
- Owners should be encouraged to notify the relevant parties (e.g. installers, maintenance contracts, property factors) quickly if installations are not working as anticipated. Post installation this is crucial to make sure that any shortcomings are fixed and in the longer term to ensure the proper functioning of the systems.

7 Conclusion and Next Steps

This toolkit serves as an important resource for tenement flat owners navigating the evolving landscape of tenement retrofitting. By offering an introduction to best practices, key concepts and visualisations of the tenement retrofit process (e.g. the Tenement Retrofit Dashboard), the document equips owners to respond to the emerging energy efficiency agenda.

The guidance provided across Sections 1 to 6 not only helps owners understand their role and responsibilities but also supports them to collaborate with local actors in the retrofit sector. By leveraging the insights and strategies outlined in this toolkit, owners should be better placed to deliver greater energy efficiency in their buildings, saving energy and money on heating.

The authors of this toolkit recognise that there are many challenges associated with delivering retrofit efforts in Scottish tenements. Hence, the authors have produced or are in the process of developing several complementary resources:

- Factoring in Tenement Retrofit: A Toolkit: A dedicated toolkit for property factors to support their role in retrofit initiatives.
- Guidance for Flat Owners: Content on the *Under One Roof* website to help flat owners engage effectively with property factors and drive retrofitting efforts in their buildings (link [here](#) [138]).
- Policy Briefing: A briefing designed to inform ongoing debates around compulsory owners' associations, ensuring any new policies that emerge are structured to effectively support tenement retrofitting.
- 'Democratic Skills' Toolkit: A resource aimed at tenement residents, both owners and tenants, to develop 'soft skills' such as negotiation and consensus-building, fostering collaboration and advancing retrofit efforts in their homes.

All these resources are or will be made freely available on the *Under One Roof* website in the near future. However, it should be noted that these guidance documents provide high-level information intended to support owners, including in conversations they may have with contractors. Owners

are reminded that any complex interventions (such as those involving insulation or alterations to the building fabric) should only be undertaken following advice from qualified building professionals. Moreover, surveyors or architects should be consulted before appointing contractors or beginning works, to ensure that proposed interventions are appropriate, safe and compliant with relevant standards.

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