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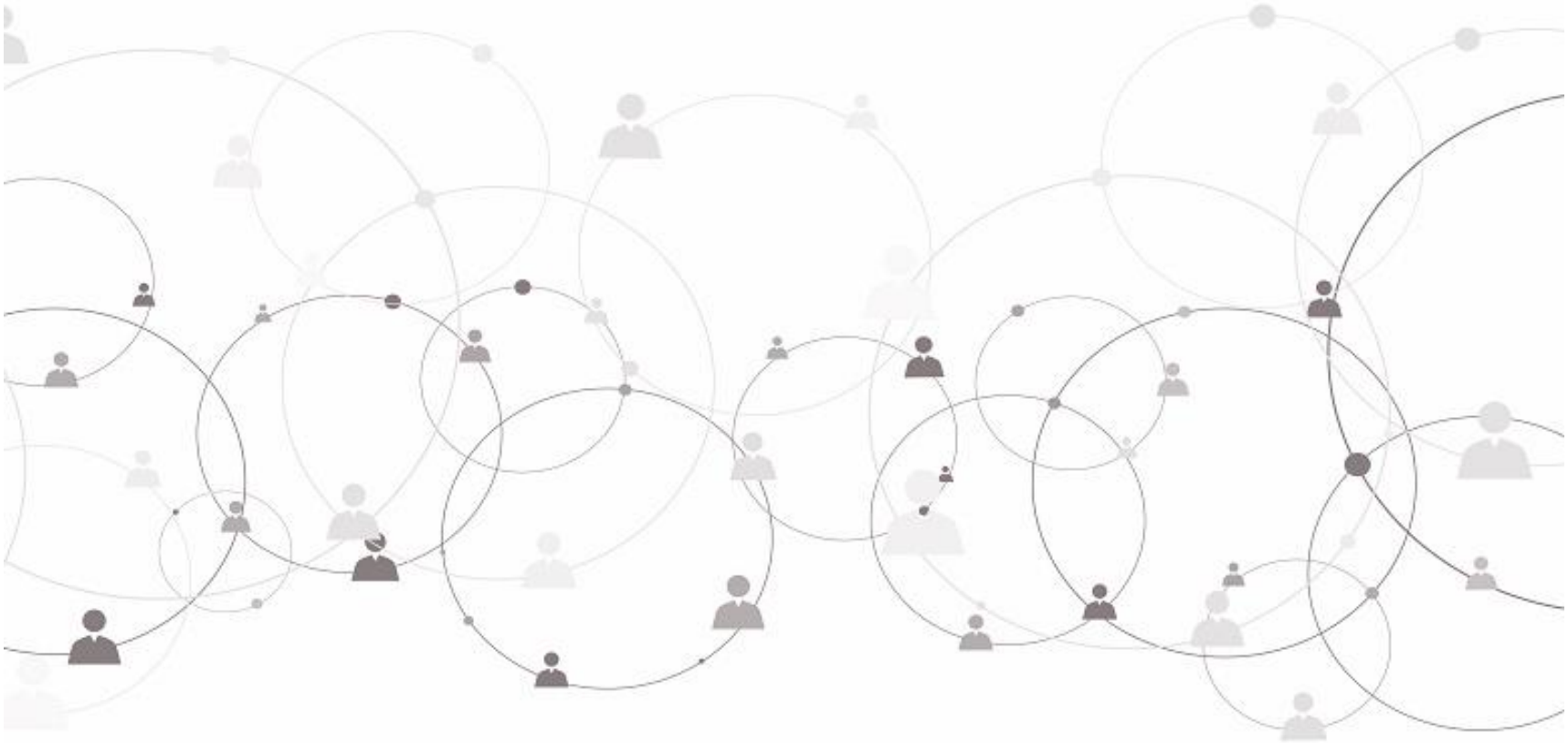

Factoring in Tenement Retrofit: A Toolkit

SEIZING THE OPPORTUNITIES OF 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 University of Strathclyde's Impact Accelerator Account.

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 property factors together with flat owners' representatives, technical specialists, local authority housing officers, solicitors and other housing professionals to explore the challenges and opportunities for property factors to play an enhanced role in tenement retrofit.

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

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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.

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

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Executive Summary

As the demand for retrofit services from tenement owners increases in response to stricter energy efficiency regulations and growing awareness among flat owners, property factors will need to be become more knowledgeable about retrofit. Doing so will enable them to maintain a competitive advantage and / or capitalise on the opportunities presented by this transformative shift in the housing sector.

This toolkit is designed to support property factors on this journey. It offers an introduction to current best practices in energy efficiency upgrades for tenements and directs users to key resources for further learning. As such, much of the content will also be helpful to flat owners as well as other building professionals.

The toolkit is introduced, in Section 1.0, with an outline of why such a toolkit is necessary and how it can be used. Section 1.0 also provides definitions of the key terms which are used in the document: tenement, retrofit, relational work, people skills, owners' association, maintenance and improvements.

Section 2.0, 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 an outline of 'tenement typologies' used in retrofit and highlights the key varieties of approaches to retrofit. The section concludes by underlining the importance to factors of connecting to local actors in the retrofit sector within local communities, to become more informed about and involved in retrofit.

Section 3.0 discusses the responsibility factors have in advancing retrofit in tenements in terms of: 1) contractual obligations and 2) moral responsibility. Within this section, the 'Spectrum of Property Factor Engagement with Retrofit' is provided as a helpful tool to prompt factors to consider where they might choose to position themselves in respect to retrofit, taking into consideration both their legal and moral obligations. The section concludes with a note on the potentially powerful role of factors as intermediaries between flat owners and retrofit specialists.

Section 4.0 highlights collaboration between tenement co-owners as key to drive retrofit in tenements and to provide clear direction to factors. It provides suggestions for how factors can support owners to work together better.

Section 5.0 introduces the Tenement Retrofit Dashboard tool, designed to help factors visualise their role in supporting owners 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 and factors work together to plan that journey. The Tenement Retrofit Dashboard is complemented by the Detailed Table of Relational Work (see Appendices B and C). By using the Detailed Table of Relational Work in tandem with the dashboard, factors are able to understand how prepared their organisation is to be a market leader in sustainable property management.

Section 6.0 provides a generalist's overview of what is involved in implementing each of the identified 'aspects of retrofit' in a tenement. The aspects discussed in Section 6.0 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 relevant aspect of retrofit and where factors may be able to add value.
- 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 7.0 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.

Throughout the toolkit the focus is retained on how factors can make a contribution to tenement retrofit in a way that is in keeping with their existing skillsets and position within social networks of building professionals.

1.0 Introduction

1.1 Why a toolkit for property factors?

This toolkit was designed for practising property factors. As demand for retrofit services grows in the coming years, in response to higher energy efficiency regulatory standards and rising awareness amongst tenement owners, property factors will increasingly be approached by flat owners for assistance. These developments present many options for property factors to position themselves strategically to take advantage of the opportunities afforded by the transition to net zero buildings.

Opportunities might include:

- **Enhancing reputation and market position:** factors who successfully engage with retrofit can position themselves as leaders in sustainable property management.
- **Diversification:** factors are well positioned to exploit new revenue streams, e.g. fees from project coordination, application support or green maintenance contracts.
- **Accessing new funding streams:** positioning factoring as a green job can open up opportunities for accessing enterprise funding or green apprentices (see Section 3.4).
- **New Partnerships:** partnering with respected local community organisations or pioneering green enterprises can increase company visibility, and reputation, and open up further opportunities.

To support factors through this transition and to help them take advantages of opportunities, this toolkit will provide a range of resources which will enable factors to engage knowledgeably with tenement flat owners on the topic of retrofit, energy efficiency, and the Scottish housing sector's transition to net zero.

It can be noted that while this toolkit it primarily aimed at factors, there will be other relevant parties, particularly flat owners, who are likely to find the toolkit useful.

1.2 How to use this toolkit

Property factors 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 in response to client queries. It provides research-backed information and the references are provided for further reading for those who wish to understand a topic in more detail.

➢ Throughout the document suggested action points are indicated by arrow bullets points, like this.

Following this introduction, Section 2.0, 'Understanding Retrofit in Tenements', provides an overview of current thinking and key resources about retrofit.

Section 3.0 discusses the responsibility factors have in advancing retrofit in tenements in terms of: 1) contractual obligations and 2) moral responsibility.

Section 4.0 provides suggestions for how factors can support owners to work together better to enable retrofit.

Section 5.0 introduces the Tenement Retrofit Dashboard tool, designed to help factors visualise their role in supporting owners through a tenement retrofit journey.

Section 6.0 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 and highlighting where factors might provide support.

1.3 Key terms

Tenement: In this toolkit, the term **'tenement'** follows the definition set out in the Tenements (Scotland) Act 2004 [2] 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 [3] 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.

Relational work: A term derived from relational sociology that encompasses network building, communication management, business negotiation, information sharing and decision-making support [4]. Property factors, due to their role managing the communications between owners and often with contractors, are well positioned to help owners navigate their retrofit journey, connecting owners to the right means of support at the right time.

People skills: Relational work requires **'people skills'** – an umbrella term used in social psychology to cover a range of competencies - including communication, rapport building and collaboration - which are associated with avoiding misunderstandings, winning support, resolving conflict and improving customer support.

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"* [5].

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"* [6].

2.0 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) [7]. 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.

- Prompt owners to explore the online material of the National Retrofit Hub (NRH) [8] and follow content updates on the useful resources page [9].

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'* [10].

1. Visit and share the website of Built Environment ~ Smarter Transformation (BE~ST) [10].

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 the website of Energy Saving Trust [11].

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 the website of Home Energy Scotland [12].

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 herniate buildings on its website.

- Visit and share the website pages of Historic Environment Scotland dedicated to energy efficiency [13].

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 the website pages of Under One Roof dedicated to energy efficiency [14].

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 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 a poor energy rating of the home, tax band A-F, and a resident being the recipient of certain benefits. It is administered by Home Energy Scotland.

- Find out more about Warmer Homes Scotland here [16] and signpost potential applicants here [17].

Area-Based Schemes (ABS) [18] 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.

- Advise owners that to find out more about the schemes they can contact Home Energy Scotland [19].

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.

- Advise owners to find out more about CARES visit the Local Energy Scotland website [20].

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.

- Advise that owners can find out more about the fund and begin the application process here [21].

Historic Environment Scotland offers a 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 and share the 'Grants refresh' page of Historic Environment Scotland's website [22].

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 [23]. 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.

- Advise owners to contact their 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 [24]. 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 [19], their local council, or an approved contractor. The council helps with assessment of eligibility criteria.

- Prompt owners to explore the Ofgem website [25] for further information and guidance documents [26].
- Prompt owners to 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 should be 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 on the same street or within the same building or block as households that do meet those criteria. These measures are referred to as 'in-fill' [27]. 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.

- Introduce flat owners to the possibility of exploring a whole building upgrade, leveraging the eligibility criteria of the full tenement community.

The **Great British Insulation Scheme** (GBIS) is designed to complement ECO4 [28]. 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.

- Prompt illegible owners to owners to visit this page to check on their eligibility for GBIS or initiate an application [29].

2.3 Understanding tenement typologies

Tenements can include the following categories of flatted buildings [30]:

- 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 [31]. For more modern buildings find information here [32].Click or tap here to enter text.

2.3.1 An Archetype Approach

At the University of Edinburgh academics have been leading the development of an archetype-centric approach [33] 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.

2.4 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.

2.4.1 Repair First…

The Tenement Short Life Working Group [34] 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 heat.

Separately, the Retrofit Roundtable Group [35] 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.

2.4.2 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'. More info on this approach can be found in this briefing note [36].

2.4.3 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, 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. Such a strategy is likely to be acceptable to many on pragmatic grounds, provided that grid constraints do not necessitate minimising electricity consumption to the point that fabric fifth becomes impracticable. This detailed proposal was first aired by energy expert Nigel Banks in his article [37] on LinkedIn.

More info on this approach can be found on an episode of the Zero Ambitions podcast [38].

2.4.4 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.

There is an opportunity here for property factors to add value as generalist advisors. 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' [39].

2.5 Connecting with local retrofit actors

Scotland's city authorities are members of the Global Covenant of Mayors for Climate and Energy [40] which shares a vision of supporting voluntary action to combat climate change. The volunteer led Scottish Communities Climate Action Network [41] oversees a growing number of regional hubs supporting groups such as the Edinburgh Building Retrofit and Improvement Collective [42]. 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 Hom Retrofit [43] is advancing a community-based approach and provides a service tailored to tenements.

- Research and connect with local climate action groups.

3.0 Responsibility for tenement retrofit: the role of factors

3.1 Overview of responsibility in tenements

Individual flat owners are responsible for energy efficiency in their own flats. And flat owners are collectively responsible for the energy efficiency of the tenement as it is affected by the common parts (e.g. stairways and hallways) of a tenement.

However, there are two main ways in which factors have an important role in retrofit in tenements.

3.2. Contractual obligations

Factors may have a contractual obligation to owners to undertake some actions related to retrofit. Owners are entitled to appoint a factor. Factors are responsible for managing common parts of tenements, as is laid out in their written statement of services and underpinned by Code of Conduct for Property Factors [44]. Where an energy efficiency intervention effects common parts, factors can be expected to take an active role where the action is within their terms of service. For example, owners can ask a factor to help assess the support amongst co-owners for an installation of energy efficient windows in the communal stairway.

For factors to meet their contractual obligations it is necessary that they have an understanding of how to determine which parts of the tenement are an individual responsibility and which parts are a common responsibility, and this is an area in which many factors have developed considerable expertise.

Responsibility for common parts of the tenement is established by two key documents. First are the ‘titles’, the official records relating to a particular property. However, the titles often provide incomplete guidance on all aspects of co-ownership and decision-making. For example, the titles might omit some of the common areas, be unclear about how decisions should be made or how costs should be apportioned.

In which case, the second key document should be consulted. The second key document is the ‘Tenement Management Scheme’, which appears in Schedule 1 of the Tenement (Scotland) Act 2004 [45]. The Tenement Management Scheme sets out defaults designed to give owners clarity where the titles fail to provide it.

3.2.1 Tenement governance, factors and retrofit

As factors are involved in actioning decisions regarding retrofit made by co-owners of a tenement, they need to be aware that different voting thresholds of tenement owners are required for different aspects of retrofit.

For example, 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). The Tenement Management Scheme also sets out what is considered maintenance and what is considered improvement (see Section 1.3).

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]).

3.3 Moral responsibility

The Companies Act 2006 states that directors must oversee their companies with regard for “the impact of the company's operations on the community and the environment” [48]. Moreover, given the declaration by the Scottish Government in 2019 [49] of a climate emergency, it is increasingly recognised that companies have an obligation to act in such a way as to protect the environment.

Drawing on Wilson’s model of Corporate Social Responsibility [50], Figure 1 presents a ‘Spectrum of Property Factor Engagement with Retrofit’, to

help factors consider their responsibilities for energy efficiency in tenements.

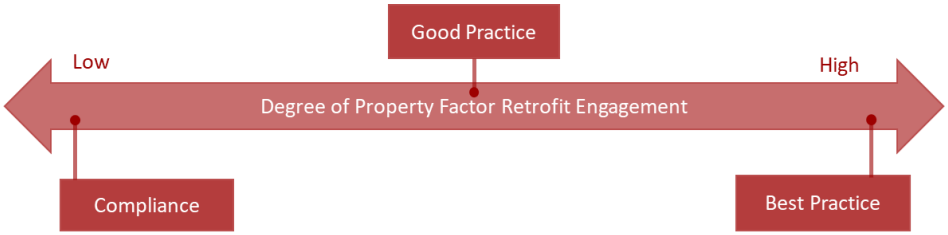

Figure 1 - Spectrum of Property Factor Engagement with Retrofit

In order to illustrate the breadth of the spectrum, three key points are highlighted: 1) Compliance, 2) Good Practice and 3) Best Practice. Compliance is defined as 'abiding by regulatory standards of the property factor industry'. Good Practice is defined as including Compliance but in addition, 'sharing key information and knowledge, signposting resources'. Best Practice is defined as including both Compliance and Good Practice but also 'being proactive, aiming to increase the scale and frequency of retrofit projects and developing a reputation for energy efficiency excellence'.

This toolkit was created from the perspective that factors may wish to (and often do) make a positive contribution for their clients in ways which are examples of 'Good Practice' and 'Best Practice', i.e. not strictly speaking within the factor's contractual remit. Indeed, as factors are not responsible for the energy efficiency of the tenement buildings of their clients, much of the contributions they make are understood in terms of Good and Best Practice. Resultantly, the action points in this toolkit are typically examples of 'Good Practice', with some examples of 'Best Practice'.

It is not the intention to suggest that factors must aim to exhibit best practice in every aspect of retrofit. And it is certainly not the intention to encourage factors to overreach beyond their capabilities.

Instead, the toolkit is designed to be useful to factors for increasing the effectiveness of their engagement with retrofit in ways that are consistent with their existing skills sets, expertise and competence (around 'people skills', communications and coordination). Within this context, the 'Spectrum of Property Factor Engagement with Retrofit' is designed to prompt factors to consider where they might choose to position themselves in respect to retrofit, taking into consideration both their legal and moral obligations.

3.4 Promoting 'people skills'

Retrofit is not all about technical skills but also about 'people skills' (see Section 1.3). These skills are in demand as they are essential for the relational work involved in the net zero energy transition. And these are skills which are central to factors' offering to their clients and, hence, it is through these skills that factors have the most potentially powerful role in assisting their clients with tenement retrofit. For example, an important role for factors will be as 'retrofit connectors' (as described in Section 2.4.3), connecting owners to local specialists at the right time.

Factors may not think of factoring as a 'green job' but there is potential value in doing so. Framing the role of property factors as a '*green emerging occupation'* could help to leverage enterprise funding [51] to support the development of the role and the future recruitment of green apprentices [52] as demand increases.

- Explore how you might frame the roles within your property factor business as a 'green jobs' and how this might benefit your business.

4.0 Getting started: supporting owner collaboration

Owners' associations

To retrofit tenements, owners will need to be organised to make decisions on what steps to take. Owners' associations support factors by creating clearer lines of communication between factors and owners, helping the owners to speak to the factors with a coherent voice. See a Definition of Owners' Association in Section 1.3.

- Encourage clients to organise themselves into owner associations.
- Signpost owners to Under One Roof's guide to setting up an owners' association [53].

Escrow accounts

There are other steps factors can take to help owners better organise themselves.

Currently, an owners' association is not a recognised legal entity. This means that payments for any professional services in connection with retrofit (or any other building work) will still need to be made through an individual, or through the property company. To help owners, a dedicated escrow account can be used, which allows funds to be held in trust whilst the parties complete a transaction:

- Signpost clients here [54] to find out more about escrow accounts.

Building reserve funds

Owners should also be encouraged to set up a building reserve fund, to avoid the need to come up with a large amount of money for renovations in a short period of time.

- Signpost clients to Under One Roof's recommendations for Building Reserve Funds [55].

Improving communications

Setting up a private messaging group can ease and speed up owners' communication.

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

Novoville Shared Repairs 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. The retrofit version, Novoville Shared Works [56], offers flat owners personalised 30-year retrofit plans for their homes.

- Encourage owners to make use of the Novoville Shared Works platform [56].

Regardless of such emerging applications, there is value for flat owners in having someone on hand who knows them and their building. An important role is to connect owners to local specialists as and when opportunities arise for building improvements. Here property factors can position themselves as a *'retrofit connector'* (as described in Section 2.4.3).

5.0 Visualising the factor’s role in tenement retrofit

5.1 Tenement Retrofit Dashboard

The tenement retrofit dashboard (full page version available in Appendix A) is designed to help property factors visualise tenement retrofit as a process that is likely to take place in several phases (e.g. involving different 'aspects of retrofit' from 'baseline assessment', shown bottom left, to a 'post retrofit evaluation', bottom right) and the important role that factors might play in that process.

To provide an overview, the dashboard illustrates how factors can work with owners on each aspect of retrofit, assisting owners connect with the building specialists needed for each phase of the retrofit journey.

In the following subsections the different elements of the dashboard are explained in detail.

The Tenement Retrofit Dashboard is complemented by a Detailed Table of Relational Work (discussed in Appendix C).

As described in the following subsections, by using the Tenement Retrofit Dashboard (in tandem with the Detailed Table of Relational Work), factors are able to understand how prepared their company is to be a market leader in sustainable property management.

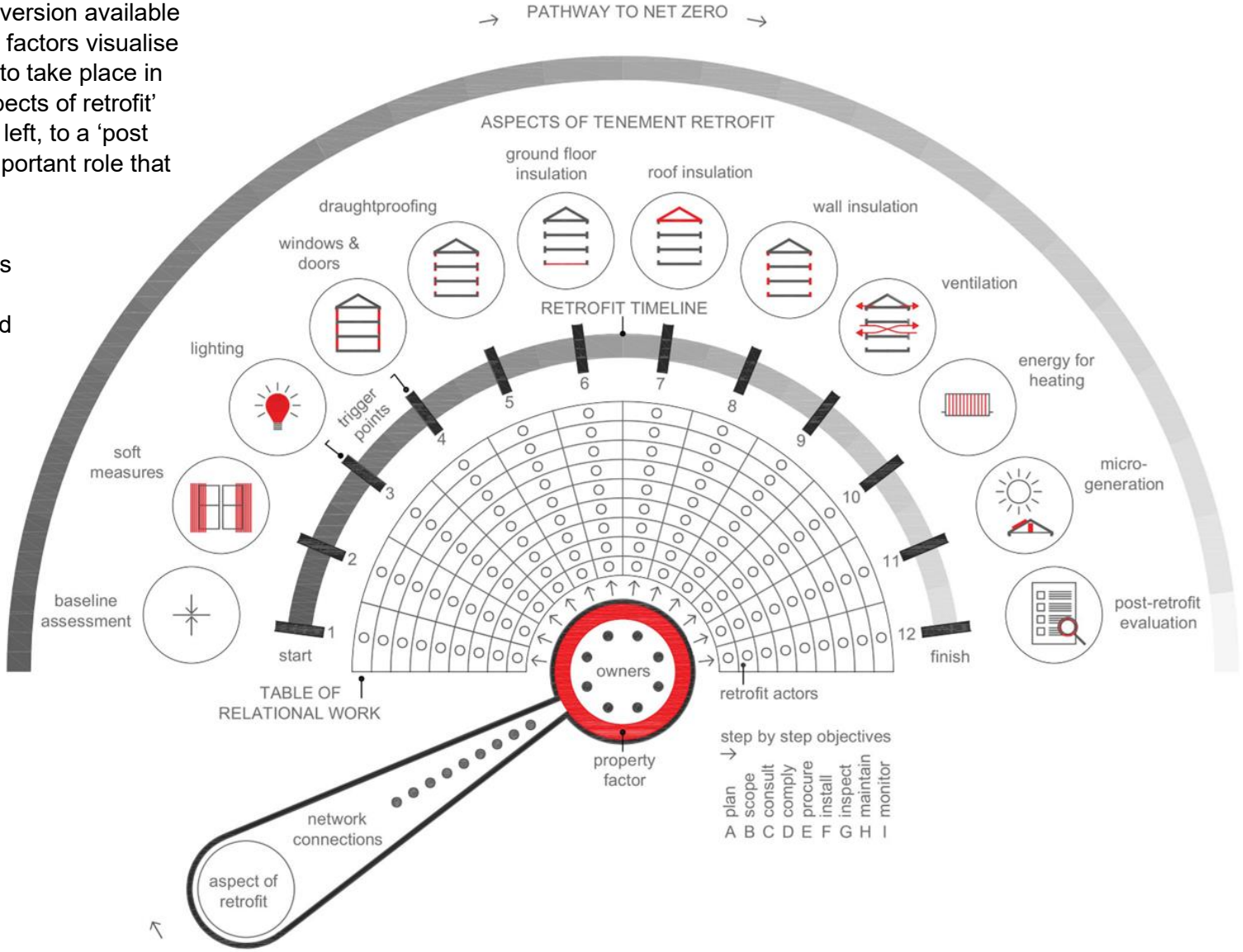

Figure 2 - Tenement Retrofit Dashboard

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 3). These are arranged left to right, staring with ‘baseline assessment’ (bottom left) and ending with post-retrofit evaluation (bottom right). The aspects of retrofit are explained in detail in Section 6.0.

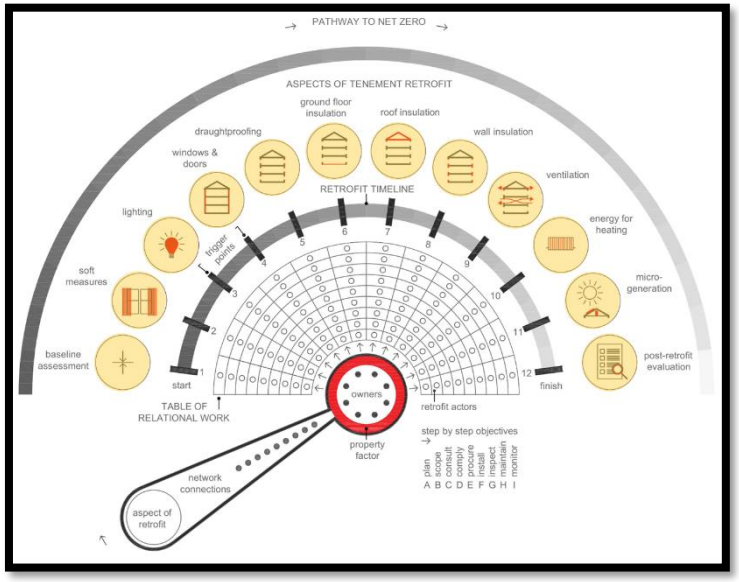

Figure 3 - Sequence of retrofit interventions

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 how property factors 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 4).

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

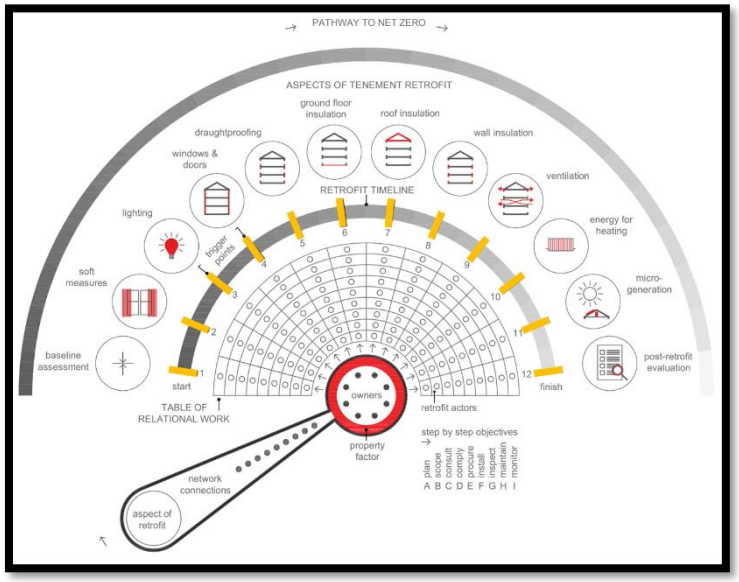

Figure 4 - Trigger points

In this toolkit in Section 6.0 trigger points are highlighted for each aspect of retrofit that are of relevance to the property factor (e.g. building maintenance or improvement issues). The inclusion of these types of trigger points is designed to prompt property factors to view such events as opportunities to open up dialogue with owners about retrofit.

5.3 Table of Relational Work

The dashboard also contains a semi-circular table, the Table of Relational Work, to illustrate the relational work (see Section 1.3) associated with each aspect of tenement retrofit (highlighted in Figure 5).

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 intersected by 9 arch-shaped bands (corresponding to key objectives that need to be realised to deliver retrofit, e.g. planning, scoping, consulting). The sequence of the objectives is broadly aligned with the RIBA Plan of Work [58] stages. Drawing on the RIBA Plan of Work, each objective is defined in Table 1.

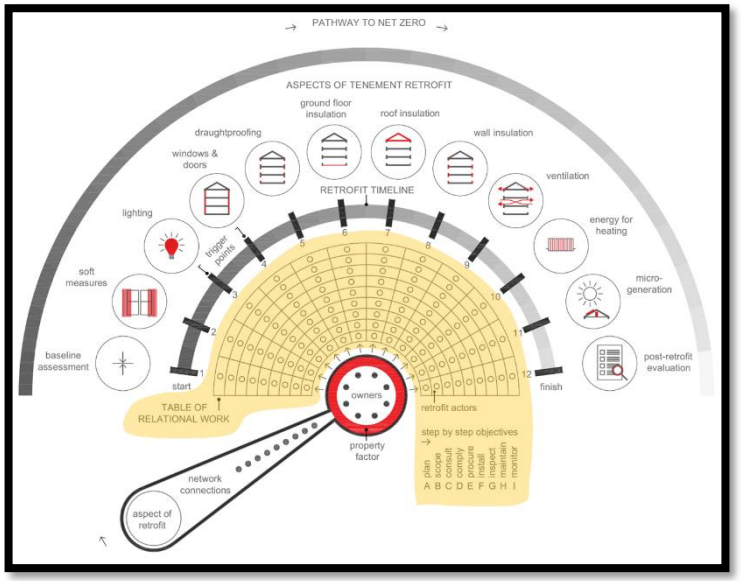

Figure 5 - Table of relational work

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. for 'soft measures' (see Section 6.2). However, owners will still need reliable sources of information to help them take the most effective action. 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 circles, representing specialists appropriate for each aspect and objective of retrofit.

Table 1 – 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

In Table 1 examples of the types of actors necessary to undertake each aspect of retrofit are provided.

The Table of Relational Work in the dashboard is complemented by a Detailed Table of Relational Work, which can be filled in for each aspect of retrofit, as described in Appendix C.

5.4 Visualizing the role of property factors

Owners are situated at the centre of the dashboard, illustrating their ultimate responsibility as decision makers in tenement retrofit (Figure 6). The owners are represented by 8 black dots arranged in a cluster, representing the formation of a single group entity (e.g. owners association). Regardless of their level of organisation, they still need to navigate the sea of resources available to them.

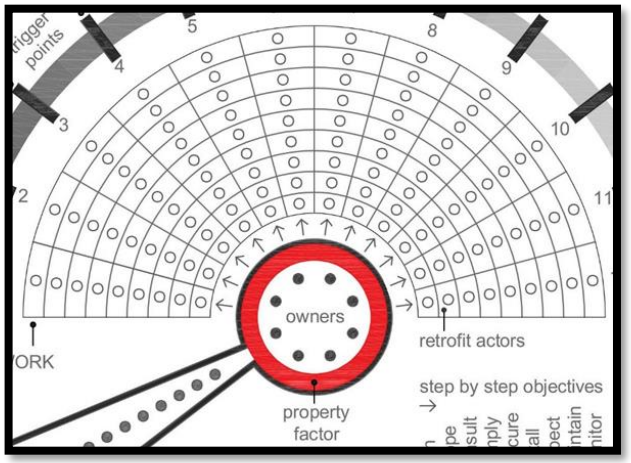

Figure 6 - The role of property factors

This is where the property factor comes in. Property factors are marked red and placed between the owners and the Table of Relational Work (see Figure 6), illustrating how factors can provide value as intermediaries between owners and renovation specialists (e.g. signposting owners to resources or contracting specialists on behalf of owners). Around the owners and factors are twelve arrows, illustrating the relational work that owners and factors must undertake to engage the relevant specialists for each aspect of retrofit.

In the dashboard factors and owners are also shown connected to a ‘rotating needle’ (Figure 7).

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

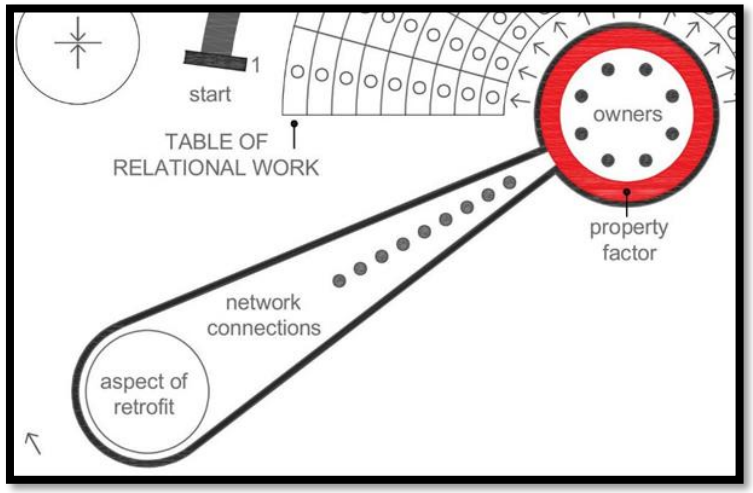

Figure 7 - Rotating needle

To deliver tenement retrofit, the property factor acts as a ‘rotating gear’, helping to sweep the needle around the dial (Figure 8).

As they do so they can colour in the circles in the Table of Relational Work indicating if they have relevant points of contact for the aspects of retrofit within their network. These are coloured in green (indicating a relevant contact), amber (indicating partial contacts) and red for no contact (for guidance on the colouring of the circles see Appendix C).

By looking at the completed dashboard, factors will be able to see at-a-glance what gaps there are in their energy efficiency networks.

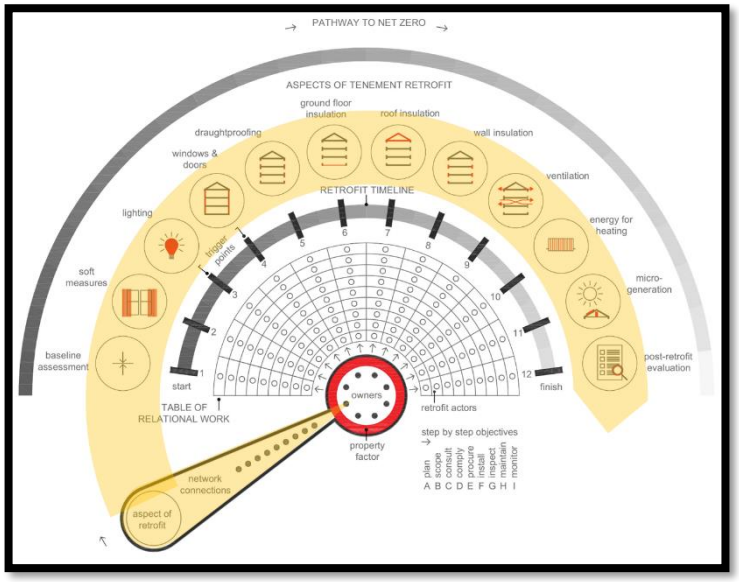

Figure 8 - Sweeping the needle around the dashboard

Appendix C presents a Detailed Table of Relational Work to complement the Table of Relational Work in the dashboard. Completing the Detailed Table of Relational Work for each aspect of retrofit will ensure that the table in the dashboard is filled in as accurately as possible.

After going through the steps indicated in Appendix C, a completed Tenement Retrofit Dashboard acts as an indicator of the property manager’s capacity to support energy efficiency renovation in tenements Any factor that can colour in all of the circles in the Table of Relational Work in the dashboard either green or amber (indicating the strength of the factor’s engagement with relevant actors in the retrofit sector) can be confident that they are in strong position to be a market leader in the support they can offer to flat owners for tenement retrofit. See the positive example in Figure 9.

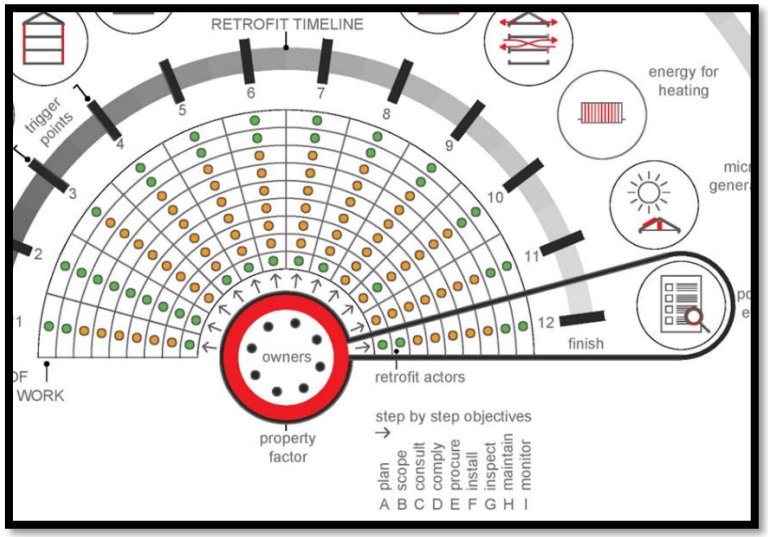

Figure 9 - Completed Dashboard Table of Relational Work

To support property factors identify appropriate contacts for different aspects of retrofit, Section 6.0 of this toolkit provides useful information and links.

6.0 Aspects of tenement retrofit

6.1 Baseline assessment

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.

Possible trigger point

Owners might have worries about the high cost of energy or environmental concerns and have contacted their factor as they consider their options.

Responsibility

Flat owners are responsible for assessment in their own flats and co-owners for assessment in the common parts of the building. Property factors may be asked to provide assistance in sourcing specialists for energy assessments where these relate to the common parts of a tenement.

The value 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 and smaller sizing of heat pumps or other appropriate technologies.

- Encourage flat owners to document (or prompt landlords to ask tenants to 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.

Three aspects of baseline assessment

There are three key aspects of Baseline Assessment:

1) Citizen science

Retrofit is more likely to happen if people are engaged and knowledge about it [59]. In this context, citizen science (public participation in research, data collection, and analysis) can be supportive of retrofit in tenements.

- Encourage flat owners to 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.
- Explore the monitoring device market (e.g. Huma-I [60], or Inkbird [61]) and offer to bulk-buy monitoring devices on behalf of flat owners, to get everyone involved and comparing notes.

2) Building Surveying

The Scottish Parliamentary Working Group on Tenement Maintenance [62] 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 [63].

- Factors can signpost owner groups to RICS [64] to find local building surveyors and offer to help review the quotations and provide recommendations.
- Property factors interested in offering logbook record keeping as part of their service can contact the Residential Log Book Association [65].

3) Assessing the 'social context' of the building

- Ask owners to consider / discuss with co-owners:

  - How much money they have / are 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 your tenement listed or situated in a conservation area?
- Do you have a garden?
- Would you 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 you have any concerns about fire safety?
- What state are the building services installations in?
- Has your water system been checked for the presence of old lead pipes?
- Would you consider collaborating with your wider 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?

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 [43] in Glasgow in EdinBRIC [42] in Edinburgh). That plan can take a phased approach.

- ➢ Encourage co-owners to develop a whole building plan with support from independent specialists.

6.2 Soft measures

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.

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 and have contacted their factor as they consider first steps.

Responsibility

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

Therefore, property factors have limited scope to help owners with this aspect of retrofit. However, where property factors have been contacted about any energy efficiency inquiry, they are well placed to advise owners on the 'easy wins' of soft measures.

- Encourage owners to explore soft measures, such as:

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 this article for more detail about the energy savings potential of clothing.

Soft furnishings

Laboratory tests [66] have demonstrated that simple soft furnishings can reduce heat loss from window areas as follows:

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 [67] can be achieved using a wool chimney draught excluder [68]. Rugs and carpets (as opposed to exposed floorboards) may also help to make you feel warmer [69].

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 [70]) and indoor air quality (air purifiers [71]) may be required.

However, dehumidifiers and air purifiers neither remove CO_2 nor supply O_2, 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

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.

Possible trigger point:

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

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 [72]).
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.

- ➢ Prompt owners to check the details of local authority close and back court lighting services.
- ➢ If owners are responsible for maintenance related to lighting, explain to the owner group that they 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.
- ➢ Check whether the owner group is happy to make these arrangements themselves, or to instruct their property factor to do so on their behalf.
- ➢ If they are happy to make their own arrangements, signpost to directories for reputable electrical contractors, who will also be needed to obtain the security driver and keys: Trusted Trader Scheme [73], or SELECT [74] and NICEIC Find a Contractor [75].

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 whether the owner 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.

Material interventions

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

- ➢ Read and share with owners this guide [76] on switching to LED lighting.
- ➢ Read and share this price guide [77] for LED lighting.
- ➢ Investigate bulk buying options within supply chain networks.

6.4 Windows and doors

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.

Possible trigger point

Windows are in need of repair, e.g. the window frame is damaged.

Responsibility

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

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.
- Propose to offer window health checks on an individual flat basis.
- Propose to combine checks on stair windows and flat windows.

For traditional sash and case windows a helpful guide is Historic Environment Scotland: A Short Guide on Sash and Case Windows for Homeowners [78].

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 [79]. 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.

- Ask if owners are interested in exploring a bulk order option for windows and doors (e.g. in adjacent tenements).
- Advise owners to connect with prospective installers through Trusted Trader [80].
- Arrange no-obligation free surveys.

One organisation that could be helpful for flat-owners in conservation areas is Gecko Glazing [81], specialising in timer framed windows for heritage homes.

Shutters

Laboratory tests [66] 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.

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 [82] for information on improving the thermal performance of external doors.

Possible financial support

Home Energy Scotland: Loan Scheme [15] 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 [83].

City Heritage Trusts: a Retrofit Grant [23] 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

Explanation: What does draughtproofing mean?

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

Possible trigger point

Owners might complain about draughts / cold from the stairwell.

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

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) and, therefore, an area where property factors might provide support.

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) [84].

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.

- Raise awareness of the key sources of draughts.

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.

Thermal imaging is something that property factors may wish to develop inhouse to add value to their service, and they may be eligible for a government business grant [85] to purchase the equipment and training.

- More details about thermal imaging can be found here [86].

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.

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 [78] with flat 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.

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 owners this case study [78] on window upgrades.
- Read and share this Quick Start Guide [87] with owners in heritage buildings on Sash and Case Windows.

If 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.

- Establish whether flat owners are interested in exploring the potentially significant economies of scale of combining individual scopes of repairs and draughtproofing works into a single programme.
- Signpost to funding streams.

Possible financial support

Home Energy Scotland Grant and Loan Scheme [15]: 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 [17].

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

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.

Possible trigger point

Bottom floor flat-owner occupiers may complain about the discomfort of 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.

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 [88]. 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 3.1.1), 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.

- Prompt owners to check their titles about responsibility for ground (solum) and the airspace below it.

Scaling up a ground floor insulation project

A factor could assist with keeping costs to a minimum by coordinating work in multiple ground floor properties at the same time where the insulation is applied underneath floorboards.

- Ask all ground floor flat owners in the tenement if they are interested in exploring a ground floor insulation project.
- Consider working together with fellow property factors operating in the same block and neighbourhood to create a larger scale project.

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 [69] 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 [82].

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.

Possible financial support

Home Energy Scotland Grant and Loan Scheme [15] 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 [17].

ECO4: Solid floor insulation and underfloor insulation are eligible, subject to other scheme rules detailed in the ECO4 Guidance Document [26].

Great British Insulation Scheme (GBIS): Solid floor insulation and underfloor insulation are eligible, subject to other scheme rules detailed in the ECO4 Guidance Document [26].

See Section 2.2 for more details on the funds.

6.7 Roof insulation

Explanation: What does roof insulation mean?

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

Possible trigger point

A roof has developed a leak or the roof is damaged during a storm.

Responsibility

Ownership of the roof and roof space can vary considerably in property titles. See the guide to roof space ownership and responsibility here [89].

- Prompt owners to check their property titles about the ownership of the roof and the airspace under the roof.
- Where titles are silent, prompt owners to consult the Tenement Management Scheme [45] .

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 highly recommended to contact professionals for roof insulation.

- Factors can signpost owner groups to RICS [64] to find local building surveyors, and offer to help review the quotations and provide recommendations.
- Advise owners to connect with prospective roofers and roof insulation installers through Trusted Trader [80].

Scaling up roof retrofit

In their Final Report on Energy Efficiency and Zero Emissions Heating [90], 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.

- Recognise 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 fellow property factors operating in the same block and neighbourhood to pursue options for area-based funding.

Material selection

According to Energy Savings Trust [91], 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 [82], 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.

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 [91]. 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.

Possible financial support

- **The Home Energy Scotland** Grant and Loan Scheme [15]
- The Warmer Homes Scotland scheme [17]
- **ECO4** and the Great British Insulation Scheme [29]

See Section 2.2 for more details on the funds.

6.8 Wall insulation

Explanation: What does wall insulation mean?

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

Possible trigger point

Owners may raise concerns about damage, deterioration or mould within the tenement walls.

Responsibility

The external walls are regarded as being common property [45] unless otherwise stated in the property's titles. Therefore, insulation added to external walls would be considered a shared responsibility, and, therefore, something for which factors might provide support (depending on factor's terms of service).

Moreover, as insulation is considered a maintenance measure in the Tenement Management Scheme (see Section 3.1.1), according to the scheme a simple majority of owners is required to make a decision to install ground floor heating.

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 and its owner or occupier.

- Signpost owner groups to the Royal Institution of Chartered Surveyors (RICS) RICS [92] and Royal Incorporation of Architects Scotland (RIAS) [93] 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.

- Signpost owner groups to the new Residential Retrofit Standard [94].

Where insulation is applied: cavity, internal and external insulation

There is some guidance on installing cavity wall insulation here [95] and here [82].

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 [96] and Historic Environment Scotland [82].

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 [97].

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.

Possible financial support

- The **Home Energy Scotland** Grant and Loan Scheme [15]
- The Warmer Homes Scotland scheme [17]
- **ECO4** and the Great British Insulation Scheme [29]
- **Local Authority Area Based Schemes**

See Section 2.2 for more details on the funds.

6.9 Ventilation

Explanation: What does ventilation mean in retrofit?

Introducing or improving ventilation systems to maintain air quality while minimising heat loss.

Possible trigger point

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

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 and, hence, potentially support from property factors.

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.

Mechanical or natural ventilation

Given the complexities of ventilation, it is recommended that reputable specialists are consulted, such as Loco Home Retrofit [43] or EdinBRIC. [42]. The level of construction airtightness will determine the system selection.

Sustainable Renovation: A SEDA guide to best practice [98] 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 [78] 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.

Ventilation health check

- Consider developing an inhouse ventilation health check service – using the ZapCarbon / Healthy Homes / Zap IoT sensors [99] as an exemplar.
- Alternatively connect with a known assessment provider to offer this type of service to clients.
- Read and share this guide on Indoor Air Quality and Airtight Homes [100].

Possible financial support

- The **Home Energy Scotland** Grant and Loan Scheme [15]
- The Warmer Homes Scotland scheme [17]
- **ECO4** and the Great British Insulation Scheme [29]

See Section 2.2 for more details on the scheme.

6.10 Energy for heating

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 [101].

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.

The Scottish Government is proposing three trigger points [102] at which property owners will be required to end their use of polluting heating systems such as gas boilers, oil boilers LPG and coal, within a grace period following a property purchase, when a district heating system becomes available, and at the very latest, by 2045.

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 and, therefore, may require support of a factor.

Responsibility for connecting to a district heating system (which supplies heat to a larger area) depends on several issues, such as building governance and the structure of the heating system.

The Heat Networks (Scotland) Act 2021 [103] promotes district heating but does not mandate whole-building participation. 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 [45].

Given the potential complexities, a factor may have an important role in aiding communication and understanding between co-owners in order to support uptake of district heating.

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 [104].

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 [102].

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.

- Prompt owners to read more about different types of heat pumps here [105].

- Signpost owners in Glasgow to a suitable organisation such as Loco Home Retrofit [36] for advice 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.

- Prompt owners to read about the pros and cons of electric boilers here [106].

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 store energy from solar panels.

- Suggest owners explore this type of system here [107].

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.

- Prompt owners to seek advice on modern storage heaters here [108].

Infra-red fabric, [109] 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 [110]. It is currently being piloted in tenement properties in Glasgow [112] with an independent assessment report to follow in Spring 2025.

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.

- Signpost to Heat Network Support Unit [111] for the latest on heat networks. Detailed resources [112] 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).

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 guide owner groups to the options available to them, which are primarily dependent on their proximity to a Heat Network Zone.

- ➢ Read and share this [113] case study of a communal Ground Source Heat Pump project in Edinburgh.
- ➢ Advise owners that the property titles may have to be altered to ensure shared responsibility for a tenement scale communal heating system.
- ➢ Offer to manage the maintenance of the new communal heating system.

Consultation

Flat 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.
- ➢ Signpost owners to RIAS [93] to find a local architect.
- ➢ Share this guide [114] to architectural appointments and services.
- ➢ Recommend owners to check that the architect will follow the Plan for Use [115] and the Sustainable Outcomes [116] guides embedded in the RIBA Plan of Work 2020 [58].

Statutory authorities

A new heating installation within an apartment building will usually require a Building Warrant Application [117] .

- ➢ 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 [118].

Community-led clean heat projects

Community-led energy projects can involve clean heating (ground source heat pumps or mine water heating), alongside micro-generation (wind turbines or solar panels) or green transport infrastructure (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 [119], which uses various data sources to map the 'natural viability' of open spaces for clean heating technologies.

- ➢ Read and share this report [120] and encourage owner groups to explore community-led heating options.

Possible financial support

- The **Home Energy Scotland** Grant and Loan Scheme [15]
- The Warmer Homes Scotland scheme [17]
- Community and Renewable Energy Schemes (CARES)
- **Scotland's Heat Network Fund** (SHNF) [21]
- **ECO4** In-fill measures [29]

See Section 2.2 for more details on the schemes.

6.11 Microgeneration

Explanation: What does microgeneration mean?

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

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.

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

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 [45] 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 [89].

- Prompt owners to check their property titles about the ownership of the roof, as this can vary.
- Where titles are silent on the roof and roof space, prompt owners to consult the Tenement Management Scheme [121] to determine responsibility.

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

Expert Opinion

In its consultation response [122] to the Heat in Buildings Bill, Solar Energy UK makes a case for the early introduction of microgeneration and storage, on the basis that pairing solar PV with electric heating and battery storage can generate power at a lower cost than grid electricity, based on current prices, which would make electric heating more affordable during the transition to clean energy. This would accelerate home decarbonisation and the shift away from polluting heating systems. Solar hot water systems, solar PV, and battery storage could immediately make home energy production and usage more efficient.

Complementary technologies

The installation of batteries and electric vehicle charging can be integrated into the solar PV installation project. Fitting a solar panel and a battery at the same time allows owners to store excess energy generated during the day, maximizing self-consumption and reducing reliance on the grid, which enhances energy efficiency and cost savings [123].

Installing an EV charging point alongside solar PV allows electric vehicles to be charged with renewable energy, reducing running costs and carbon emissions while making the most of solar power generation [123].

Installing batteries or an electric vehicle charging point will depend on where the installation is cited (i.e. in an individual flat or on common parts of the tenement).

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.

- Signpost owners to reputable organisations which can assist with the processes, legalities, and funding of microgeneration, batteries and storage. This might in include Changeworks [124], the Energy Saving Trust [123], and Home Energy Scotland [125].
- Signpost this guide to how to install solar panels in tenements [126].

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 on other roofs within the neighbourhood.

Tenement flat owners could club together to form a Renewable Energy Source Cooperative (REScoop) [127]. 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. REScoops promote democratic decision-making, local economic benefits, and the transition to sustainable energy.

Energy4All [128], a UK member of The Federation of Renewable Energy Source Co-operatives [127] has enabled Edinburgh Community Solar Co-operative [129] and Glasgow Community Energy [130] 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.

- Consider working with your fellow property factors in the neighbourhoods in which you operate, to 'sell' the REScoop idea to your owner groups and local authorities.

Possible financial support

Local Energy Scotland Community and Renewable Energy Schemes (CARES) [20].

For EV Charging: Transport Scotland Grants and Loans [131].

6.12 Post-retrofit evaluation

Definition: What is the 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 [132] guide. It outlines how property factors might assist owners when bigger communal tenement retrofit projects have completed their implementation phase and move to 1) handover and 2) in-use performance evaluation.

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. It is typically advantageous to consider quality assurance at each stage of the project (e.g. through choice of accredited traders).

Responsibility

Property factors will have some responsibility in post-retrofit evaluation because this is an evaluation of the entire building, including its common parts. In particular, the proposed role for property factors *as retrofit connectors* (see Section 2.4.3) could play a part in ensuring that retrofit interventions deliver as expected, e.g. by making sure that those responsible for undertaking the retrofit work in common areas have provided enough information.

More generally, managing maintenance services is part of many factors' terms of service. Hence, there is a key role for factors to provide valuable ongoing support for the maintenance of net zero buildings.

Handover

Property factors might help with handover to clients in a variety of ways:

- Participate in a "building walkabout" to gain insight into how users or occupants engage with the new systems and to identify any emerging issues that could impact their performance.
- Property factors can support owners differentiate clearly between responsibilities for operation (owner/occupier), defects (main contractor), routine maintenance (maintenance contractors), and aftercare activities (property service specialist).

In-use performance evaluation

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

- Advise clients of 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.

- Advise clients of the option of engaging 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 [133].

7.0 Conclusion and Next Steps

This toolkit serves as an important resource for property factors navigating the evolving landscape of tenement retrofitting. By offering an introduction to best practices, key concepts, and actionable tools like the Tenement Retrofit Dashboard and Detailed Table of Relational Work, the document equips property factors to respond effectively to the growing demand for energy efficiency upgrades.

The guidance provided across Sections 1.0 to 6.0 not only helps factors understand their role and responsibilities but also supports them to collaborate with flat owners and local actors in the retrofit sector. By leveraging the insights and strategies outlined in this toolkit, property factors can position themselves as leaders in sustainable property management while fostering meaningful change within their communities.

The authors of this toolkit recognise that property factors in Scotland cannot deliver retrofitting efforts in isolation. To address this, the authors are also developing several complementary resources:

- 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 [134]).
- Tenement Retrofit Toolkit: A dedicated toolkit for tenement owners' associations to support their role in retrofit initiatives.
- 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 will be made freely available on the *Under One Roof* website in the near future.

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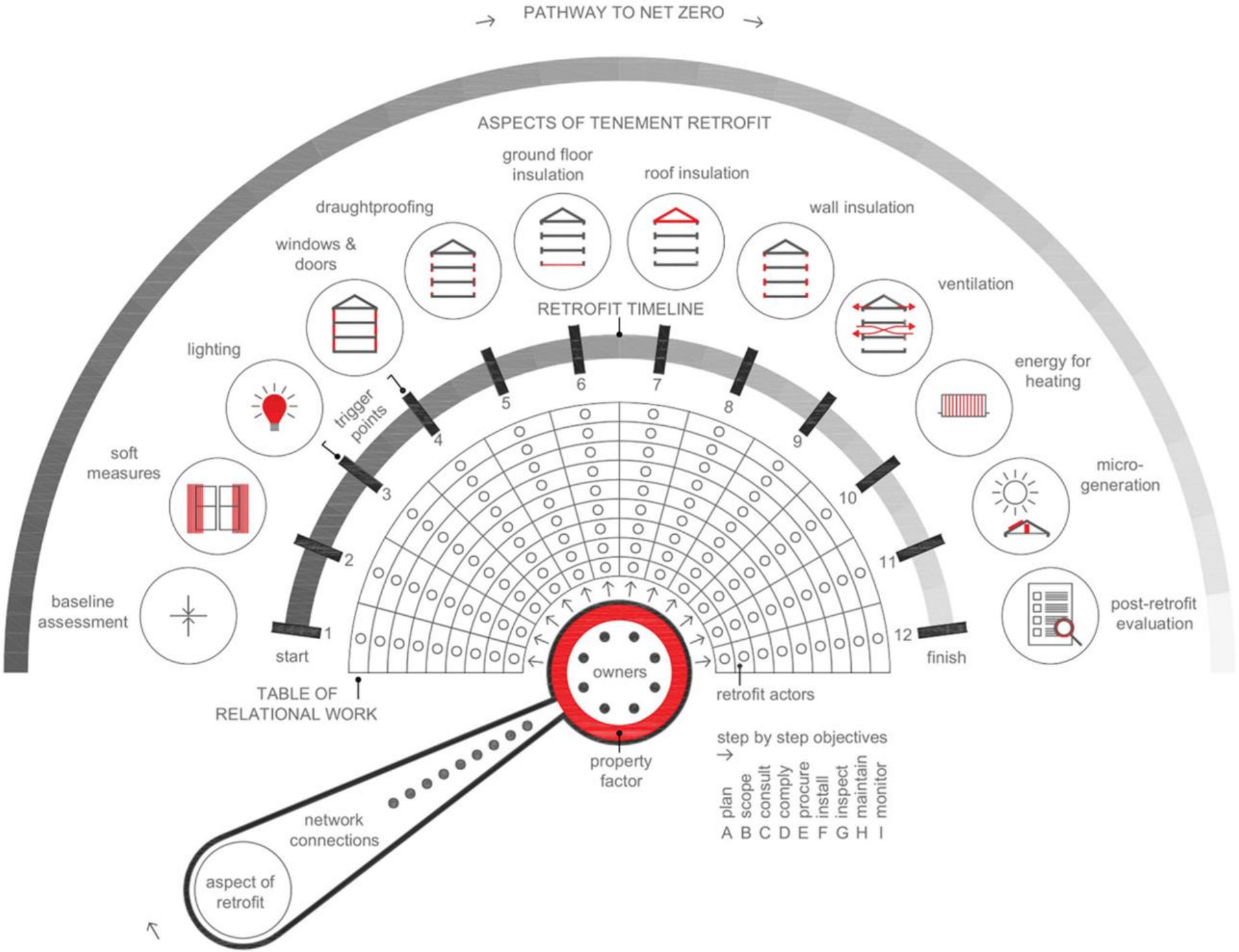
Appendix A – Tenement Retrofit Dashboard



Appendix B – Detailed Table of Relational Work

Aspect of Retrofit: (enter retrofit aspect here, e.g. Baseline Assessment).								
Objective	Task	Retrofit actors					Relational work	
		Organisation type	Specific organisation	Further information	Contact name	Contact details	Network	Action
Plan								
Scope								
Consult								
Comply								
Procure								
Install								
Inspect								
Maintain								
Monitor								

Appendix C – Worked Example of the Detailed Table of Relational Work

This Appendix provides a description and explanation of how to use the Detailed Table of Relational Work (see Appendix B), which complements the Table in the dashboard. A worked example is provided to illustrate the Detailed Table's use. Appendix C finishes with an explanation of how to summarise the Detailed Table in the Table of Relational Work in the dashboard.

Description of the Detailed Table of Relational Work

The Detailed Table of Relational Work expands upon the Table of Relational Work in the dashboard. The Detailed Table of Relational Work is designed to allow a factor to map out the specialists necessary for each aspect of retrofit, appreciate any relevant gaps in their professional networks and note what relational work is required to help move a retrofit project forwards on behalf of clients.

In the Detailed Table of Relational Work, the entire table represents a single column from the Table of Relational Work in the dashboard (corresponding to just one of the 12 aspects of tenement retrofit). In the Detailed Table of Relational Work, each aspect of retrofit is subdivided into a further 10 columns (making 11 in total). These allow more detail to be added about the specialists needed for each aspect. In Table 2, below, an explanation is provided for what information is inputted by the factor in each column.

When a factor has completed a Detailed Table of Relational Work for one aspect of retrofit, he or she will not only be more aware of any significant gaps in their social networks for that aspect but may also become aware of where specific service providers might provide multiple tasks. Identifying key points of contact who can perform multiple tasks will reduce the relational work in the future for the factor (and owners).

Table 2 - What details to input into the Detailed Table of Relational Work

Task	In this column the factor inputs any tasks required to realise the objective for this specific aspect of retrofit. Section 6.0 of this toolkit provides some guidance on some of the tasks involved.
Organisation type / service provider	In this column the factor inputs the type of organisational actor responsible for the action, e.g. local government department, architect, surveyor. Section 6.0 of this toolkit provides some guidance on the types of organisations which may be relevant to each objective.
Specific organisation / service provider	In this column the factor inputs the name of a specific organisational actor to undertake the task.
Further info (e.g. website):	In this column the factor inputs any important details about the specific organisational actor (e.g. their website)
Contact person	Here the factor writes the name of the relevant contact person in the organisation.
Contact details	In this column the factor inputs the phone number or email of the contact person.
Part of the factors' network	Here the factor indicates whether this person is in his or her own professional (or social) network or in the professional (or social) network of someone else in the factor's network. Being in someone's network means that some previous interaction with that person (e.g. by phone or email) has already taken place on a previous occasion not related to the current project.
Action	Here the factor inputs what relational work s/he intends to perform to support this specific objective of the aspect of retrofit. This could mean, for example, passing on the details of someone already in his or her network to a flat owner or reaching out to a new organisation or individual on behalf of owners. It might also involve sourcing opinion from owners about which service providers might be approached or whether contracting a particular service provider is advisable. It might also mean replying to an owner to say that the factor will not or cannot help. The precise action the factor chooses to undertake will depend on where the factor chooses to place him or herself on the Spectrum of Property Factor Engagement with Retrofit, outlined in Section 3.3.

Worked example

Scenario

The following Detailed Table of Relational Work has been filled in as an example of how such a table might be used by a property factor. The example chosen is for the successful installation of a communal heating system in a single tenement. This example has been chosen because of the complexity of the process, involving multiple objectives and actors, to fully illustrate the use of the Detailed Table. It should be noted that for many aspects of retrofit completing the table will be far simpler (because there will be fewer actors involved and less relational work).

Fictional names of individuals and organisations have been used where appropriate and marked with an asterisk (*).

In this example the tenement is managed by 'Sustainable Property Management Ltd'* a proactive factor aiming to be a market leader in sustainable property management. The property is a traditional sandstone tenement in Glasgow at 36 Woodfield Avenue*, which is in a conservation area. The project was initiated by an owner who had watched a webinar on community heating in Germany and would like to explore the possibly of getting a communal heating system for her tenement. Apart from the basics from the webinar, the owners know little about the process or how it might take place in the Scottish context.

The owners have a constituted owners' association. They have gone through the aspects of retrofit as indicated in the dashboard and are now at a stage where they wish to progress with the installation of a communal heating system. The factor has some useful contacts in her network, including Jim, an employee of Glasgow Retrofit Co-operative*. As the factor explores the various options s/he inputs the details into the table as s/he takes the following steps:

Plan

1) The factor rules out district heating (from the sustainability@glasgow.gov.uk website it can be understood that there was none planned for the area).
2) The factor rules out a community initiative (by checking with the Glasgow City Council and prompting the owners to check with other local actors).
3) Initiating a block level scheme is ruled out. The factor checks with other owners that are in the block that are serviced by them. The factor asks owners to check with other owners of adjacent buildings. There is no appetite or such a project from neighbours.
4) The factor prompts owners to approach Local Energy Scotland (LES) for advice and to explore funding options (e.g. from CARES). LES provide funding for a feasibility study. Funding was currently not available from LES or any other government funds but LES offer to provide contacts and advice. The owners decide to self-fund the project.

Scope

5) The factor calls Jim at Glasgow Retrofit Co-operative*, from their own network, to ask advice on putting together the project team and relays the feedback to the owners. Quotes are sought from 3 different potential lead consultants. John Taupe Architects, from Jim's network, is selected as the project managing architect.

Consult

6) Following both Jim and the factor's recommendation, the factor recommends the owners appoint an architect and sub-consultants to consult on the project.
7) The factor makes sure that payment is received by the architect and sub-consultants as agreed in the contracts. This will typically involve only payment of the project managers' fees (in this case the architect) plus any subconsultants not included within the project manager's package of work.

Comply

8) The factor checks that John Taupe Architects has engaged with planning service, that planning permission has been granted and that a building warrant application has been approved.

9) Following John Taupe Architects advice, the factor recommends that the owners' association appoints a Mechanical and Electrical clerk of works to check work meets specified standards.

10) On behalf of the owners, the factor arranges with a lawyer to alter the title deeds to specify communal ownership of the new heating system.

Procure

11) John Taupe Architects, the owners and the factor suggest a range of specialists. The delivery team is selected.
12) The factor ensures that the owners' association has been given enough information to confirm that work can proceed.
13) Contracts are put in place for contractors and subcontractors and the factor ensures that there is agreement about payment of the contracts by the owners.

Install

14) Relationships with the subcontractors are managed by John Taupe Architects with little input form the factor.
15) The factor helps with communicating with all the owners about when the installation will take place and any issues of access.

Inspect

16) The factor checks with the architect that all required certifications are in place and relays this information to the owners.

Maintain

17) The factor offers to arrange a maintenance service for the new communal heating system and negotiates an appropriate fee.

Monitor

18) The factor recommends monitoring services supplied by trusted specialists from their own network.

Table 3 – Worked example of the Detailed Table of Relational Work

Aspect of Retrofit: Energy for Heating								
Objective	Task	Retrofit actors					Relational work	
		Organisation type	Specific organisation	Further information	Contact name	Contact details	Network	Action
Plan	Locate property in indicative heat network zone (IHNZ) within local heat and energy efficiency strategy (LHEES)	Local authority	Glasgow City Council LHEES Office	glasgow.gov.uk/LHEES	Unknown	sustainability@glasgow.gov.uk	Factor's own	Consult the [webpage] to rule out there being a district heating networked planned for the area.
	Locate property in local place plan (LPP)	Local authority: Development Management Team	Glasgow City Council: Development Management Team (DMT)	glasgow.gov.uk/localplaceplans	Unknown	development@glasgow.gov.uk	Factor's own	Ask flat owner to find out whether a local place plan has been developed with a local community body (e.g. Community Development Trust or Community Council) to rule out proposals for linking up with a larger community heating scheme.
	Check on complementary plans in local area	Community council	Shawlands & Strathbungo Community Council	https://shawlandsstrathbungocc.uk/	Unknown	shawlandsStrathbungoCC@gmail.com	Not currently in networks	Ask owners to contact the community council to check they know if any other complementary projects in the area.
	Check on complementary plans in local area	Relevant third sector organisations	South Seeds	https://southseeds.org/	Unknown	Unknown	Not currently in networks	Ask owners to contact South Seeds to check they know if any other complementary projects in the area.
	Check on complementary plans in local area	Owners of neighbouring tenements.	n/a	n/a	n/a	n/a	Owners' networks	Factor prompts owners to check with the owners of neighbouring tenements.
	Check on complementary plans in local area	Local authority representatives	Local councillors	https://onlineservices.glasgow.gov.uk/councillorsandcommittees/addressSearch.asp	Unknown	joecouncillor@glasgow.gov.uk*	Not currently in networks	Ask owners to contact the councillor Joe to check they know if any other complementary projects in the area.
	Explore finance for communal clean heating	Government funding administrator	Local Energy Scotland	localenergy.scot	Hannah Silver*	hannah.silver@localenergy.scot*	Factor's own	Ask owner to contact Hannah to check eligibility of a communal heating system for development funding.
	Consider and select an option for communal clean heating.	Independent community energy organisation	Community Energy Scotland	communityenergyscotland.org.uk	Unknown	info@communityenergyscotland.org.uk	Community Energy Scotland network	Recommend to chair of owners' association that they join the CES member network to get specialist advice
Scope	Develop and finalise the detailed project brief and objectives.	Independent retrofit intermediary	Glasgow Retrofit Co-operative*	glasgowretrofitcooperative.scot*	Jim White*	jim@glasgowretrofitcooperative*	Factor's own	Phone Jim – does he get involved with communal GSHP? Could he recommend a design team from their network?
Consult	Form design team to prepare feasibility study	Lead consultant and project manager	John Taupe Architects*	johntaupearchitects.co.uk*	Chris Black*	c.black@johntaupearchitects.co.uk*	Glasgow Retrofit Co-operative's network	Recommend to chair of owners' association that they appoint architect and sub-consultants. The factors discusses payment with consultants and owners.

	Design communal GSHP system	Services engineer	Plum*	plumengineering.co.uk	Gary Green*	gary@plumbengineering.co.uk*	John Taupe Architects network	Relationship managed by architect
	Check impact above and below ground	Structural / civil engineer	Gray Associates*	grayassociates.co.uk*	Iain Brown*	i.brown@grayassociates.co.uk*	John Taupe Architects network	Relationship managed by architect
	Provide costings	Quantity surveyor	W.H.Red*	whredqs.co.uk*	Karen Primrose*	k.primrose@whredqs.co.uk*	John Taupe Architects network	Relationship managed by architect
Comply	Determine required planning consent/s	Project architect	John Taupe Architects*	johntaupearchitects.co.uk*	Violet Blake*	v.blake@johntaupearchitects.co.uk*	Glasgow Retrofit Co-operative's network	Check that owners' association's architect has engaged with planning service
	Secure planning permission	Project architect and engineers	John Taupe Architects*	johntaupearchitects.co.uk*	Violet Blake*	v.blake@johntaupearchitects.co.uk*	John Taupe Architects network	Check with the architect that planning permission has been granted
	Secure building warrant	Project architect and engineers	John Taupe Architects*	johntaupearchitects.co.uk*	Violet Blake*	v.blake@johntaupearchitects.co.uk*	John Taupe Architects network	Check with the architect that building warrant application has been approved
	Amend property titles to include joint ownership of communal heating system	Property lawyer	Blake and Whyte Solicitors*	Blakeandwhytesolicitors*	Eric Whyte*	e.whyte@blakeandwhytesolicitors.co.uk*	Factor's own	Phone Eric to discuss amending the property titles. Provide feedback to owners.
	Appoint a Mechanical and Electrical clerk of works to check work meets specified standards and add design team.	Mechanical and Electrical clerk of works	Blackwatch*	blackwatch.co.uk*	JoeTeal*	jteal@blackwatch.co.uk*	John Taupe Architects network	The factor recommends that the owners' association appoints a Mechanical and Electrical clerk of works to check work meets specified standards and add design team.
Procure	Select the contractors	Project manager, factor and owners.	John Taupe Architects*, factor and owners.	n/a	Violet Blake*	v.blake@johntaupearchitects.co.uk*	Multiple	Manage communication between parties to narrow down contactor team.
	Put contracts put in place	Project manager, factor and owners.	John Taupe Architects*, factor and owners.	n/a	Violet Blake*	v.blake@johntaupearchitects.co.uk*	Multiple	Ensure that the owners' association has been given enough information to confirm that work can proceed Ensure terms payment are agreed.
Install	Carry out builders' work	Contractors	Blue Brothers*	bluebrotherbuilders.co.uk*	Bill Blue*	bill@bluebrothersbuilders.co.uk*	Plum, services engineer's network	Relationship managed by John Taupe Architects.
	Install GSHP system	Installer	NRG Renewables*	nrgrenewables.co.uk*	Bob Pink*	bob@NRG.co.uk	Plum, services engineer's network	Relationship managed by John Taupe Architects.
	Manage communication around the installation process	Factor	Sustainable Property Management Ltd	sustainablepropertyfactors.co.uk*	Jay Gold*	j.gold@sustainablepropertymanagement.co.uk*	Factor's own	Communicating with all the owners about when the installation will take place and any issues of access.
Inspect	Check project when completed meets project plan	Clerk of works	Blackwatch*	blackwatch.co.uk*	Joe Teal*	jteal@blackwatch.co.uk*	Plum, services engineer's network	Relationship managed by John Taupe Architects.
	Certify completion	Architect	John Taupe Architects*	johntaupearchitects.co.uk*	Violet*	v.blake@johntaupearchitects.co.uk*	Factor's own	Check all certification is in place
Maintain	Arrange maintenance	Factor (us)	Sustainable Property Management Ltd	sustainablepropertyfactors.co.uk*	Jay Gold*	j.gold@sustainablepropertymanagement.co.uk*	Factor's own	Offer maintenance service to owners' association.
Monitor	Monitor performance	Independent	Systemschecks*	systemschecks.scot*	James Small	james@systemschecks.scot*	Factor's own	Recommend monitoring service

Summarising the Detailed Table of Relational Work in the Dashboard.

When a Detailed Table of Relational Work has been completed for an aspect of retrofit this can be inputted into the Table in the Dashboard by colouring in the circles in the simple table red, amber or green (explanation below). When this is done the simple table acts as a summary of the detailed table. In Figure 9 there is an example of how the dashboard would be coloured in for be filled in for the worked example above.

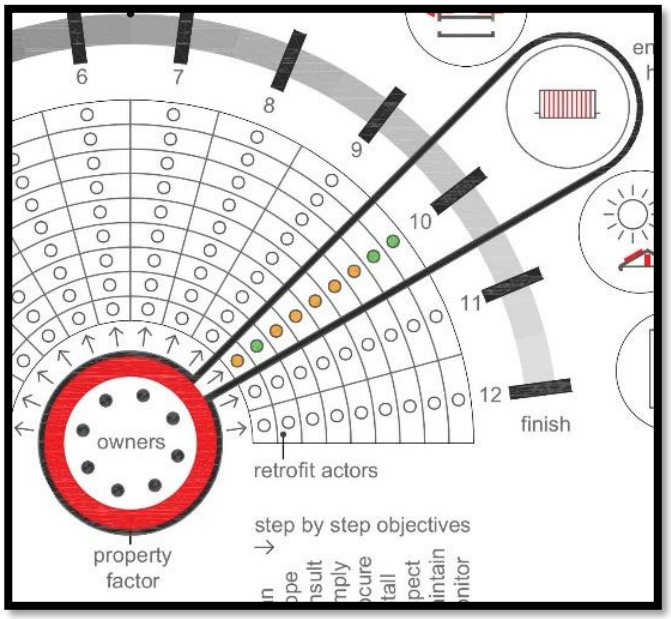


Figure 10 - Summary of factor contacts for 'Energy for Heating' aspect of retrofit

To input the information in the Detailed Table of Relational Work into the dashboard follow the following rules (an explanation of how these apply to the case in the worked exampled are provided in boxes).

1) When to colour a circle red.

- If the factor has no relevant contact for an objective the circle should be marked 'red'. Note, as described above in table 2, having a contact means that the factor has had some previous interaction with that person (e.g. by phone or email) for reason's not related to the retrofit project in question. As such, if the factor knows only the name of the organisation but not an individual point of contact that s/he has had previous interaction with, the circle should be marked red.

In the worked example above none of the objectives would be marked red, since the factor has managed to source all contacts, either directly or indirectly.

2) When to colour a circle amber.

- If the factor has only some relevant contacts for an objective the circle should be coloured in 'amber'.
- If the factor has only an indirect contact for an objective (i.e. the person is the contact of someone else in the network) the circle should be marked amber. As such the factor is dependent on another point of contact.

In the worked example above: plan, consult, comply, procure, install and inspect would be marked amber.

- Plan is amber because: only three of eight actors are within the factor's network. And the factor does not have an existing contact for each of tasks.
- Consult is amber because: only one of the four actors for the tasks are within the factor's network. The others are in the architect's network.
- Comply is amber because: only one of five actors are within the factor's network.
- Procure is amber because: multiple networks are required (not just the factor's) to reach all possible actors.
- Install is amber because: only one of three actors for this objective are within the factor's network.
- Inspect is amber because only one of two actors two for this objective are within the factor's own network.

3) When to colour a circle green.

- If the factor has all the contacts needed for every task needed to reach a retrofit objective the circle should be coloured green.

In the worked example above: scope, maintain and monitor would be marked green, as all relevant contacts are within the factor's network.

As can be noted from the above example, it will be very difficult for a factor to have all of the appropriate contacts for an aspect of retrofit. It would be unrealistic to expect a factor to be able to colour in every circle green because it would be unrealistic for every factor to be personally familiar with every actor needed to realise an objective of retrofit.

Hence, a 'good result' for filling in the Dashboard would be a mix of amber and green dots. Such cases indicate that the factor may not know everyone needed to get the whole project completed but he or she does know some important actors relevant to the retrofit industry and who to go to in order to find out more.

Where there are many red dots, this indicates that the factor may struggle to support tenement retrofit. The more green dots the factor has filled in, the stronger position the factor will be in to to be a market leader in sustainable property management.