

Research article

Policy Choices for Glasgow Traditional Tenements Retrofitting for Sustainable and Affordable Carbon Reduction

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Abstract

A particular challenge for Scottish housing is the sustainability of its older tenemental housing stock. Nearly 200,000 such properties exist in the main cities and towns of Scotland. Many of these properties are in poor repair, which makes it particularly hard to retrofit in order to meet carbon reduction targets that seek to tackle climate change. Through examination of a specific case study, this paper reviews policy options for funding and delivering such retrofitting in the context of specific initiatives already underway in Glasgow. The paper considers technical but primarily also the financial, economic and policy choices and trade-offs facing older tenement retrofit. The carbon reduction challenge has, additionally, to be understood alongside the wider tenemental conservation argument and the underlying long-term problems relating to conditions and multiple ownership of the tenement stock.

Keywords: net zero; tenement housing; retrofit; evaluation; knowledge mobilisation.

Introduction

Traditional tenement housing is an important and iconic form of housing throughout urban Scotland, especially in Glasgow. In the 2019 Scottish house condition survey just under a fifth of all property was built before 1919 and seven per cent of all homes were pre-1919 tenements (totalling 182,000 units in 2017). Including modern tenement flats, the tenement may account for one in four homes in Scotland. According to the city council, Glasgow in 2021 had 73,000 pre-1919 traditional tenement flats. These are primarily three- or four-storey red or yellow sandstone properties with single walk up closes. They vary considerably in unit size and quality but include areas of high demand and often mixed tenure arrangements within individual tenement buildings. Iconic is an over-used word but is warranted in this case because of the aesthetic quality of high-density sandstone tenement neighbourhood, the principal reason for the strong conservation heritage lobby that argues for their retention and protection. The volume of

the properties across large parts of the city also makes tenements strategically important in housing and spatial planning terms and is also where affordable housing can be found for workers and new households.

While much of the city's tenements was demolished through post-war clearance and redevelopment programmes, policy shifted in the 1970s and 1980s towards rehabilitation and renewal. More than 60 local or community-based housing associations and co-operatives now operate in the city, many of whom are primarily the owners, managers and often factors of inner city tenemental housing. During this period many properties were taken over by the Council and then transferred via 100 per cent grants to these fledgling housing associations. They then received further grant funding to remodel, refurbish and greatly improve the tenements properties. It is generally held that in the 2020s much of the stock, particularly in the private sector, now requires significant further remedial work for longer term life cycle and catch-up repairs (Robertson, 2019; Flynn, 2018; Scottish Parliament Working Group on Tenement Maintenance, 2019).

Specific neighbourhoods in Glasgow, for instance in both the West End and the South Side, are tenements of home ownership, both for cheaper end first-time buyers but also for significant and expensive family housing. At the same time, many tenements are now privately rented and owned by many thousands of buy to let investors. This complex multi-tenure housing provision is equally found in specific tenement blocks as it is at neighbourhood level and at the aggregate level across the city. One of the key challenges for national and local policy toward tenements and their maintenance and sustainability therefore is to confront the problems of multiple ownership and multi-tenure provision. This has long manifested itself in the under maintenance of the common parts of tenements and has been the subject of several studies and enquiries most recently by the Scottish Parliament Working Group on Tenant Maintenance (2019). It also featured in the recent (Scottish Government, 2021) *Housing to 2040 Route Map* for long-term policy development for housing in Scotland.

These chronic problems have now been crystallised by national and city level commitments to net zero carbon and the decarbonisation of the existing housing stock. Sandstone traditional tenement housing are characterised by often poor insulation levels and high energy demands, requiring relatively expensive retrofit (costs and benefits of such retrofit are discussed further later). This is a financial, logistical and political challenge. There is a real danger of parts of the city losing its tenements because of policy failing to find workable solutions at scale. Work carried out for Historic England (Organ et al., 2020) suggests that pre-1919 housing should be retained because not only is it popular but demolishing and redeveloping will be expensive, not least in embodied carbon.

The core idea of this paper is that retrofit of pre-1919 tenements may well be resolvable with political, and financial commitments as well as good policy design but it also needs to be situated in the wider legal reform of how tenements work and where they are situated within multiple meanings of sustainability. The paper's objectives are, first, to clarify what these challenges are and, second, to consider the policy dilemmas arising from the desire to retain tenement stock but at the same time deliver credible ways to achieve decarbonisation through retrofit. The third objective is to capture lessons from a holistic evaluation underway of a demonstration project that is undertaking net zero decarbonisation (EnerPHit) retrofit of a typical pre-1919 tenement close in Glasgow. The paper combines historical and policy analysis with a multifaceted evaluation of a case study. In so doing, it hopes to shed light and raise further research questions for the retrofit strategies being developed in Glasgow and elsewhere.

The paper starts by sketching the history and fundamental issues relating to traditional urban tenements. The challenges of green tenement retrofit are then

introduced. This is set against the likely suite of policy initiatives and the hurdles that they must overcome. The paper next considers possible and more likely interventions in the law of the tenements which may improve the basis for maintenance and investment work. The paper also draws on a case study of a high-level tenement retrofit currently underway in one close in the south side of Glasgow. This case study generates several lessons, both scalable and non-scalable. The final section concludes.

Scottish Tenements: A Recurring Challenge and Opportunity

Historical Sweep

The traditional tenements that dominate contemporary inner-city Glasgow, by definition, all more than 100 years old, shape how the city looks and how it works as a system. They certainly vary in quality and popularity but can be archetypes across all main housing tenures. Their density and links to public transport are also essential to delivering local, accessible cohesive neighbourhoods. Any such longstanding building type has been through several, multiple phases of birth, maturity, decline and renewal (Gibb, 1983; Robertson, 1989; 1992; Maclennan and Gibb, 1988; and Young, 2013). This is certainly true of the Glasgow tenements, for which we can identify four distinct eras:

- Phase 1 mass building mainly from the late 1890s (after the city recovered from a major banking collapse in the early 1880s –Meen, et al, 2016) though a few buildings remain in Glasgow that pre-date this period. Tenement investment was also characterised by the peculiar economics of the rapidly growing Victorian and Edwardian tenement city which initially involved several evolving stages of high density apartment building around single closes moving away from often very low standards and overcrowding but premised on a range of quality in terms of size, building standards and amenity (e.g. the scarcity of indoor private toilets). Building was often financed through selling *feus* (rights to ground rents), and these could be resold into thriving secondary markets. A feature of tenement life however was considerable under-investment and inadequate maintenance, despite the widespread use of *Factors* to manage common repairs on behalf of the owners of the housing. After 1918 the sector was allowed to deteriorate and over time the worst parts of the stock became a visible and chronic problem for Glasgow. After the second world war, this was to prove fatal for much of the poorer quality stock.
- Phase 2 clearance and comprehensive redevelopment. After the war the city moved into a sustained though episodic process of slum clearance, mass council house building in increasingly non-traditional modes (such as high towers) and area-based comprehensive redevelopment of many existing inner-city neighbourhoods. This often involved demolishing large volumes of mainly older poor quality tenement stock. Of course, some of the closed stock passed their tipping point because they were left derelict and decaying for years before redevelopment actually took place (e.g., the neighbourhood of Anderston, discussed in Meen, et al, 2016). It was still the case by the 1970s that much of the retained stock was poorly performing in terms of size and basic amenities and was viewed as increasingly problematic. Yet at the same time neighbourhoods in areas like Partickhill in the west end were seen as high quality and sought-after bastions of high quality tenemental home ownership for the middle classes.
- Phase 3 community ownership and rehabilitation. The city faced huge tenement repairs from a major hurricane in 1968, remedial work on which extended well into the 1970s, public resources for council housing were straitened and, as across the UK, there was a retreat from non-traditional council building. Alongside

these factors, a bottom-up campaign to develop community-based solutions flourished, retaining the built form and improving or rehabilitating the tenement stock facilitated by new funding streams for housing associations and dynamic leadership from tenants and professionals alike (Maclennan and Gibb, 1988; Robertson, 1989; 1992; Young, 2013, Gibb, et al., 2017). The city council embarked on a multi-stage programme to transfer much tenement and later more recently built council housing neighbourhoods into 'community ownership' through the development of new locally-based housing associations based on tenant dominated boards and professional staff. This was made possible by 100% grants to transfer unimproved stock to the new associations followed by further refurbishment grants. Looking back, this radical experiment in bottom-up public investment in local communities is still remarkable and at a scale never since repeated anywhere in the UK. Many of these associations became community anchors, involved in wider activities, often acting as factors for other tenures in their tenements. The refurbishment also included considerable remodelling of properties within tenements to bring amenities and conditions up to modern standards.

- Phase 4 reinvestment and multiple resource claims. Refurbishment typically has a thirty years' life and properties mature and so many housing associations now face coming further rounds of investment which involves further borrowing and rent level implications. Many of the more than 60 local associations are also developers or have taken over stock through stock transfer initiatives after 1990, which means that their ability to asset manage tenement stock is also hampered by other investments they have made. At the same time, social landlords have further demands on their resources as a result of their contributions to energy efficiency improvements and their ability to participate in new build mixed funding schemes within broader Scottish affordable supply programmes (Gibb and James, 2021). However, Robertson (2019) reports that much of the tenement problems today are through deteriorating private sector stock. Owners continue to experience mixed fortunes regarding the management of common repairs and at the same time, tenements have been a key site for the return to growth of the private rented sector.

Underlying Challenges

What are the key underlying challenges that tenements face? There is a spectrum of quality, need and investment required across specific places and for certain landlords. While the built form is inherently durable, Extending the life of the traditional tenement requires a new round of property survey/assessment and consequent capital investment to secure the longer-term improvements achieved 30 or more years ago. For some this will be a major and costly reinvestment and will need to be consistent with government thinking in *Housing to 2040* (Scottish Government (2021) which includes, among other things, ambitious minimum standards for all housing and all tenures.

Recent data from the 2017 Scottish House Condition Survey reported in (Robertson, 2019: 15), noting a reduced sample size, suggests that two thirds of Scottish pre-1919 tenements are in critical disrepair. This has slightly improved in recent years but is thought to be largely a consequence of the Scottish social housing quality standard and that, as a result, problems with disrepair are now more crowded into the private sector.

Second, there is considerable challenge created by multiple ownership in individual blocks, which is closely linked to underinvestment in collective or common areas maintenance. These reflect economic problems of non-co-operative game theory, the failure to internalise externalities and the difficulty in making collective solutions work

consistently (Robinson, 1979). There may be multiple tenures and property rights operating in a single block; or there may just be owner-occupiers or private rented housing. The problems are manifested in individual owners not participating in group schemes to undertake major repairs, or accepting valuations and repair requirements, challenges often not crystallised till the owner contemplates moving to a new home. Factoring may be present formally but that does mean the system works or indeed owners make the contributions required. A recent infamous example of the system breaking down occurred within council-led factoring in Edinburgh (Robertson, 2019). Clearly, there are legal and financial/affordability issues intertwining and an urgent need, if tenements are to have a future, to find credible and sensible solutions that works with multiple ownership patterns.

The Scottish Parliament Working Group on Tenant Maintenance (2019) for the Scottish Parliament's Cross-Party Group on housing) called for clear legislative proposals that would tackle what they saw as the three primary gaps in the law which would allow Scotland's tenements to enjoy the same broad legal footing as successful apartment condominium type schemes elsewhere e.g., in Canada and Norway:

1. Regular mandatory property inspection.
2. Legal ownership associations for each block that will confirm and organise common repairs and have legal powers to extract contributions.
3. Establishing of sinking funds to support funding repairs from property owners within blocks.

These are broad ideas where considerable detail is yet to be thrashed out, institutions to be designed and means by which these can then be effectively made to work. Robertson's (2019) shows how difficult this can be in practice, helps explain why it has been so long in development and that any future legislation will have to decisively overcome genuine trade-offs and complexities., *Housing to 2040's* route map pledged the Scottish Government to enact reform of tenement law based around the above three principles. This is vital to the future of the tenement but will not be simple law-making. Gibb and James (2021) argues that non-trivial pre-legislative work will be required on all three fronts 'regarding transitional support, mechanisms to make sinking fund arrangements [including] low cost, transparent and secure for all investors (e.g., trusted third parties to run such finds at cost providing clarity on low cost reliable property inspections and bringing forward Scottish tailored versions of internationally respected models of ownership organisations suitable for the tenement built form' (p.18).

If this were not immensely challenging and risk-laden enough, the issues have been further exposed and exacerbated by the climate emergency and the development of strategies to reduce carbon emissions from the building stock towards targets to achieve net zero by 2045 in Scotland (and for the city council by 2030 in Glasgow). The next section moves on to consider green tenement retrofit.

Green Retrofit

Policy Settings

The wider housing debate is disproportionately concerned with new supply (Gibb and James, 2021), and much of the housing discussion about net zero has focused on new build and building standards, on energy systems and the embodied carbon associated with the development process. However, the pace of building in the UK means that 80 per cent or more of the housing stock that will be in place in 2045 is housing that already exists today (Scottish Government, 2021). This means that finding retrofit solutions for

the existing stock that reduces its carbon emissions is essential and a key element of the overall net zero ambition. The problem is essentially two-fold – first, how to deliver *renewable* energy system to replace fossil fuel systems such as gas and traditional electricity generation modes; second, how to organise and deliver appropriate *fabric* renewal of the property to reduce energy demand. Greater energy efficiency through such dual investment can also produce important affordable warmth benefits reducing fuel poverty.

Retrofit Strategies and Policy Instrument Choices

The policy goals and mechanisms involved are immensely challenging and enacting solutions increasingly urgent (Grant Thornton, 2021). On the renewables side the UK needs to rapidly scale up a new industry that will design, manufacture, install and maintain/service new domestic energy systems such as air source heat pumps (and other local solutions) and deliver these at an acceptable cost. Green finance and subsidy/deferred payment mechanisms are essential (Green Finance Institute, 2020). Large-scale reskilling and training is required and providers of these systems need to be encouraged into the market at scale. As in other areas of rapid economic transformation, purposive change needs coherent and concerted government action to support and facilitate change. At the same time, we also need a shift by construction sector leaders to support the development of an industry response to undertake the large scale of fabric renewal that is also required – this also requires change within skills and training, on demand side funding and promotion of good practice and innovation exemplars.

The reports by Grant Thornton (2021) and Green Finance Institute (2020) help provide a framework for thinking about strategy, policy choices and the required interlocking programmes. Grant Thornton was commissioned by the Glasgow City Region to scope out a housing retrofit programme for the city region (achieving EPC 'C' throughout¹), its funding, archetype-based programmes and a series of investment appraisal cases (e.g., business, strategic, financial, economic, etc.) along Green Book lines. A range of policy measures were assumed based on existing and proposed interventions set against examples of archetype-level interventions across different parts of the housing stock (including tenements). This in turn allowed Grant Thornton to estimate the scale of the supply-side response required in terms of gearing up and redeploying installers, maintenance and manufacturing from fossil fuel to renewables, as well as reshaping the construction effort towards a larger proportion of work on fabric first renewal. Critically, they identify the need for local one stop shops to provide information and support for property owners considering how to finance and implement affordable ways to undertake retrofit.

Creating incentives for private owners is a key constraint. The Green Finance Institute (2020) seeks to identify the drivers required to scale up retrofit work. To do this they examine each part of the housing system in detail to better understand the blockages and barriers that pertain in each case. This leads to a lengthy checklist of actual and potential measures with which to intervene. The analysis reiterates the need for a co-ordinated and coherent array or menu of policies that can be chosen from, backed by evidence of what works and in what circumstances. This is a mixture of identifying suppliers, financial and subsidy tools (e.g., grants versus equity loans and cheaper green finance, etc.), as well as also considering ideas like local information hubs to help individuals (and potentially groups of owners) how to undertake retrofit (and these sorts of models could work alongside third sector organisations already supporting private owner retrofit in cities like Manchester and in Glasgow's case, by Loco Home Retrofit).

We can distinguish between different kinds of policy instruments. *Regulatory fiat* e.g., mandatory dates by which policies have to be achieved and what success looks like (e.g.,

a target EPC band). Second, there are potentially a range of *financial measures* including grants, loans and green finance targeted at private households and landlords, as well as financial or business penalties for non-compliance. Government funding is also promoting social housing net zero investments as beacons and places to support industrial innovation. The cross-sector zero emission social housing taskforce (ZEST) reported in 2021 and argued for a fabric first approach, sufficient budget, clear metrics about monitoring progress, commitment to effective partnership working and developing the required new workforce.

Financial and Economic Considerations

Retrofit raises challenges for delivery because of the upfront capital cost and payback period. How does one incentivise owners and landlords to take up this additional burden (so-called *split incentives* between landlord and tenant in the private rented sector), and how is it made affordable and the transition just or fair? How should the trade-off be managed between more affordable warmth for social tenants and the cost of high rents repaying investment loans? These questions are now being forced by setting time periods by which private landlords have to secure Energy Performance Certificates (EPC) band 'D' then later 'C' ratings, otherwise they will not be able to let and face financial penalties too. The Scottish Government is consulting over a similar EPC 'C' rating mandate for all property sales after 2024. Alongside these measures are, of course, the phasing out of new and, ultimately, all gas boilers. What is less clear are the design and level of financial carrots to support a smooth and fair transition. Gibb and Jsmes (2021) conclude that, such is the complexity of the challenge, there needs to be a UK wide what works centre for retrofit policy design and evaluation.

Housing to 2040's route map places the green housing retrofit challenge in the wider policy reform programme for housing in Scotland. It estimates that the public and private housing programme to retrofit Scotland would cost £33 billion. It charts an ambitious developing plan, not all of which can yet be detailed or mechanisms laid out. An early start has been made with the short life working group on net zero for social housing (ZEST, 2021) but, unlike ZEST, the focus of the *Housing to 2040* document's retrofit analysis seems much more focused on renewables than with fabric. This may be in keeping with the logic of achieving EPC 'C' or better but fabric renewal is often essential. Nowhere is this more clear than with traditional tenements.

Retrofitting Tenements

Porous Sandstone traditional tenements are significant carbon emitters. They are also often not well insulated and their age means often that properties can be draughty and not well sealed around windows. They can cost a lot to heat. Retrofit will often need fabric renewal and upgrades if the benefits of new renewable energy systems are to be achieved. Such works may be expensive simply because of the needs of the building form and its materials. As we discuss below, residents need to understand how to get the most from the retrofit and then actually follow through in their behaviour as to how they use their property.

There is a real danger that parts of the tenement stock will become blighted in the housing market if affordable and technically sound retrofit solutions are not developed and implemented. Furthermore, we also need to recognise that demolition and redevelopment, however unpalatable that would be for the city and for the conservation/heritage movement, also brings with it significant embodied carbon costs. The retrofit imperative reinforces the need to quickly solve the institutional and market failures that too often inhibit progress with tenement quality and sustainability more

generally. Retrofit may therefore be an opportunity to force the need to change the tenement law to facilitate common repairs and collective responses both to general repairs and to achieve net zero. This was clearly in the thinking of the Scottish Government, but it is one thing to have the aim; it is another to have a timely delivery plan.

Tenements may be the hardest nut to crack for workable retrofit solutions in the Scottish cities where they make up substantial proportions of the overall housing stock and dominate specific neighbourhoods. There is likely to be a level of transaction and idiosyncratic costs involved with specific tenement blocks that will reduce scalability of solutions in a context where fabric renewal and not just green energy systems will be required – even to reach EPC ‘C’. It is in this context that we explore a specific case study of tenement retrofit, Niddrie Road, Glasgow.

The Niddrie Road Case Study

Figure 1: Unimproved Tenement Retrofit site, 2020, Niddrie Road, Glasgow (building owned by Southside housing association)



The Tenement

The tenement building at the centre of this case study is in the inner south side of Glasgow between Strathbungo East and Govanhill. It is located directly adjacent to one of the exits from Queens Park railway station. The property is a traditional sandstone tenement of four floors and eight one bed flats within a single close. One third of a larger tenement block, the property is essentially unimproved and is characterised by having a gable end to one side of the property which means that it is exposed at one side as well as the front and rear.

The project arose because of an echo of earlier Glasgow tenement policy. The council has been strategically purchasing privately rented tenement blocks in parts of inner-city Glasgow that are subsequently then transferred to housing associations, thereby injecting association management and social housing into specific small-scale neighbourhoods with private renting management problems and poor housing conditions. In this case the property was transferred to Southside Housing Association. The plan was to refurbish the properties and to let them out to social tenants. However, the association then became aware of a Scottish Funding Council climate emergency research competition which looked for innovative research on important climate change in Scotland. The author agreed to lead a project evaluation of the retrofit work that was to be planned in addition to normal refurbishment works (Gibb, 2021).

The housing association formed a partnership with the city council and with a conservation architecture practice (John Gilbert Architects) to deliver a high level of retrofit, known as EnerPHit (the existing housing stock version of near Passivhaus - John Gilbert Architects and MEARU, 2013), in order to test out and learn from the practice of undertaking such a project with the traditional tenement in order to provide learning for the wider city's tenemental housing strategy.

The evaluation project involved a partnership between the Housing Association, the architects, the city council, academic researchers, as well as the construction firm (CCG Ltd) who undertook the contracting work. The plan was to undertake this construction project with a parallel evaluation running alongside it from March 2020. Of course, the Covid-19 pandemic intervened which stopped construction in the city for several months, also hindering the working arrangements of many of the project partners. As a result, construction finally began in April 2021 after considerable work in the background on the actual shape and nature of the retrofit project, its funding and delivery. The project featured prominently at the November 2021 Glasgow COP26 conference. It is scheduled for handover to new Southside Housing Association tenants in May 2022. The evaluation will complete in 2023.

The research project consists of interlocking evaluations. First of all, a record has been maintained of decision-making through the life of the construction project given that other tenemental projects will also face similar decision-making processes. Second, an evaluability assessment (What Works Scotland, 2018) was carried out working with partners to agree a theory of change, who benefits and what the different options for the evaluation might take (see Appendix 1). Third, a technical evaluation of the building's performance is being undertaken, looking at how the actual performance of the works contrasts with the theoretical expectations of carbon reductions. Fourth, a cost benefit evaluation has been completed which takes full account of the monetary value of the carbon reductions as well as estimating the lifetime costs of the project work and its benefits as well as comparing with the counterfactual alternatives. Finally, the evaluation includes a behavioural pre- and post-occupancy assessment of how the new social tenants selected for the retrofitted property experience the retrofit of properties and make use of the properties in real-time over the first winter of their tenancies.

A key task is to explore the learning from this single project for wider tenement retrofit in Glasgow. What is replicable and what is unique about the Niddrie Road project? This is a relatively straightforward project to implement because the properties are empty and under the sole control of the housing association. This of course will not be the case where tenants, private landlords and owner occupiers live in such properties. The properties are also small and in a relatively low value neighbourhood. This is a very different context to some of the much higher value and larger properties found in other parts of the city. Also, the financing of the project was done through capital grants and private finance funded from rents and is rather different from the wider range of sources

that might be anticipated where there is multiple ownership. Nonetheless, there will be much learning from the project for the city and for policy development.

The Retrofit Project and Initial Findings

The diagram below was used as the site poster for the project. It also summarises the retrofit work underway, including: roof repairs; triple glazed windows; improved internal layouts; stone repair and repointing; external wall insulation to the rear and gable ends; internal insulation; loft insulation; waste water heat recovery; air source heat pump renewables (combined with flats within the block retaining gas boilers for extra comparison purposes) and, renewal of floor joists. Providing airtight high-quality insulation along with efficient mechanical ventilation, as well as other complementary retrofitting measures, can significantly reduce energy demand (80-90 per cent reductions in fuel bills are not unexpected) and this is in turn combined with decarbonised energy systems.

Figure 2: Board Poster for Retrofit Project, 2021



What are the initial findings?

First, Partnership working has been both necessary for delivery and informative for lesson-learning (Gibb, 2021). The partnership produced an entirely novel refurbishment and retrofit project for tenement housing to a standard never before attempted. The partnership had to withstand many stresses and strains, none more so than the impact of the pandemic on each individual partner and capacity to deliver the project as planned. The delays had the unexpected effect of bringing the academic team more into discussions around some of the finer details (and a few major decisions) while refining and confirming the ultimate shape of the project. This led to a greater evaluation focus on recording and understanding decision-making on the project's retrofit attributes. This tracking of decisions in real time may turn out to be one of the critical lessons from Niddrie road – even if it is one that reinforces the uniqueness of individual buildings and project developments.

Second, partnership require the developing of trust. The opportunity to regularly discuss the project, sticking points and choices between the housing association, architect and the two leading academic evaluators allowed the relationships to grow away from transactional toward more progressive and collaborative working styles.

Excepting the lead academic on the evaluation, the others had pre-existing sets of bilateral relationships, which also helped considerably. The evaluability assessment allowed a closer discussion of the project's theory of change among a wider set of partners. It is important to recognise that these matters of trust, the evaluability workshops and the close sustained partnership work arising from the externally-induced delays were all time-consuming but invaluable.

Another aspect of trust is the relationship between the retrofit of traditional tenements and conservation activism. The heritage lobby in Scotland and Glasgow is a positive contributor to net zero, built environment and retrofit debates. Both parties want to save tenements and particularly their sandstone frontage and design features. Both recognise the heritage and wider costs of losing large swathes of these properties but there are still points of conflict e.g., the risks that internal works will damage or remove internal features such as coving and woodwork. There will also be voices opposed to external insulation and other features of the work – but the historic and idiosyncratic nature of specific dwellings means that it the ability to overcome these sorts of disagreements will be to an extent non-scalable.

Third, the evaluation undertook a cost-benefit analysis (CBA) drawing on broader cost-effectiveness templates, associated with the PAS2035 standards for achieving EnerPHit retrofit levels. These measure the cost-effectiveness of the specific retrofit works and a detailed set of standard assumptions about the carbon savings from retrofit components and their interaction (Higney and Gibb, 2022). This is based on the operational project costs and embodied carbon savings associated with not pursuing the most likely counterfactuals (a retrofit standard known as EESSH2 for social housing which will achieve EPC 'B', as well as a third counterfactual: the demolition and rebuild of a new block of flats). The CBA is designed along orthodox Green Book analysis (incorporating monetised carbon figures and items reflecting lifetime costs e.g., maintenance of the retrofit components). It sets out the key assumptions made (e.g., 30 year working life, 3.5% discount rate, optimism bias, rebound effects, etc.), explains the specific costs and benefits measured and undertakes sensitivity analysis.

The CBA found that, in net present value terms, the high-quality EnerPHit retrofit performs similarly to the less expensive, but also less energy efficient EESSH2 counterfactual. The choice between them is sensitive to the assumptions used. The analysis also finds that the other counterfactual (demolition and new build) has a much lower net present value than retrofitting existing buildings, and this is not sensitive to assumptions. Retrofitting is a better social investment than demolition and new building but the optimal retrofit in terms of efficiency and investment is uncertain, though the EnerPHit model alone can achieve the net zero target and consequently generate major energy savings for lower income households.

Fourth, another product of the discussions during the delay was to shift focus by adding a further evaluation component in the form of pre- and post-occupancy surveying of the tenants who will move into the properties towards the end of 2021. This will complement building performance monitoring and cover the first winter of occupancy. This behavioural component will be primed by pre-occupancy training guidance and interview, and tenants will be asked to keep an energy consumption diary as well.

Fifth, the project sets several precedents (Gibb, 2021). It directly seeks to find a way through rubbing points at ground level that often emerge and will continue to do so until precedent and policy evolve one way or another to provide a set of rules by which retrofit can proceed. This was apparent when different parts of the council came to terms with the project. In particular, while not in a conservation area, the planning service's assumptions about what could and could not be done to retrofit any traditional tenement were material considerations (e.g. initially, planning policy did not allow external wall

insulation of the gable or rear of the building, use of air source heat pumps sited on external walls or larger guttering) but eventually were resolved (external insulation was allowed, ASHPs situated in the back area were allowed, though the wider guttering was not).

Finally, while the project does imply that a net zero solution can be found for traditional tenements, much of the learning is not scalable, though arguably several elements and principles are (Gibb, 2021). Each tenement has path dependent idiosyncratic features including its mix of owners and tenures, but also condition, quality and the carbon deficit that needs to be reduced. Niddrie road was expensive and funded by a combination of grants from council and government, as well as private loans that will ultimately be paid by housing association tenants. Lesson-learning is already underway with neighbouring housing associations exploring slightly less exacting or expensive but nonetheless deep retrofit of their tenements. Decanting is a big problem but not all properties will require the depth of remedial work found in the case study. This could well open phasing options for block scale retrofit done in stages which could significantly reduce time away from the property. Moreover, lessons are being learnt about airtight insulation and mechanical ventilation which can be applied to other property archetypes and indeed is working well in other properties in Glasgow including multi-storey flats in the Woodside part of the city.

Discussion and Conclusions

Scottish housing must confront the challenge of finding ways to sustain its older tenemental housing stock. Tenements have proven to be (and remain) highly popular cross-tenure ways of delivering high density and amenity-rich neighbourhoods. The carbon reduction challenge has, additionally, to be understood alongside the wider tenemental conservation argument and the underlying long-term problems relating to conditions and multiple ownership of the tenement stock.

The scale of the problem is immense given the timescales and the likely private and public costs of addressing the retrofit requirement from the tenement sector. However, not engaging in this agenda will surely accelerate the demise of the core at-risk parts of the sector which would be a major long-term loss to the city and to its citizens. The paper argues that critical to success will be comprehensive tenement law reform but that this is neither easy or obvious at the level of detail required (Robertson, 2019) even if the three main elements (inspection, owner associations and sinking funds) are broadly agreed (though more detailed evidence on applying international models that work in other contexts need to be closely examined to confirm their appropriateness for Scotland's tenements).

Co-ownership law in France may also be a useful guide to the challenge in this regard.² Evidence indicates that multiple practical problems (e.g., codifying common repairs, maintenance and management charges, and absent shared purpose among co-owners) - all creates difficulties and disproportionately so for lower income owners (Bettini, 2017; Ads of Brands, 2022). These problems also need to be overcome in any legal reform process for Scotland's tenements. There is a strong case for new research to fill gaps on the micro politics and ethnography of how owners in Scottish tenements co-operate and manage conflict. Even if all of this can be addressed, law reform must proceed at pace if retrofit is to be unlocked.

Alongside these legal reforms is the necessity to strengthen regular and responsive repairs to help reduce the long-term costs of disrepair into the future. House condition survey points to high levels of private sector disrepair and local housing associations and

their representatives (e.g., Scottish Parliament Working Group on Tenement Maintenance, 2019) report that their stock also requires investment. Across the housing system, tenement owners need to fund and lock-in repairs for the future. Can policy and regulation help? In fact, there needs to be a wider suite of financial and regulatory interventions offering both carrots and sticks that are demonstrably fair to those affected (moderating upfront costs, shared equity solutions, deferrals, green lending; retrofit grants, etc.). At the same time, government and the private sector, the built environment, economy and labour training and skills – all have to co-operate to develop the new economic sector required to deliver retrofit at scale. This is still in its infancy.

The Grant Thornton (2021) research and the scaling-up thinking by the Green Finance Institute (2020) identify many of the issues around policy choices and implementation that are essential to the grand ambitions of programmatic comprehensive retrofit. As in other areas of policy innovation, the State clearly has an important role in helping create early demand for retrofit work – both renewables and fabric first retrofit. This is the stimulus required to support the supply system. The menu of subsidy and financial support for individual owners is also clearly essential, as is local expertise available to help provide accurate information, make decisions, advise on finding and access to local suppliers. It is also highly likely that there will be elements of regulatory fiat or compulsion to make changes that facilitate the greening of energy e.g., the phasing out of gas boilers and financial penalties for not improving EPC levels: sticks as well as carrots. It is vital that this menu of options alongside regulatory policies are clarified, tested and rolled out.

Looking at the case study, which is both uncommonly straightforward and complex because it is an early adaptor and a precedent-setting project, important lessons have been generated already and more will be uncovered as the project moves to completion and is then fully evaluated. This focus on tenement retrofit is very context- and location-specific but its degree of difficulty speaks to wider retrofit research agendas. How can comprehensive housing retrofit be achieved and what are the key barriers and enablers? What does this mean for the local and regional economy? What do we know about the micro-relationships between owners in specific tenements confronting these choices? Alongside this there must also be research on assessing and responding to the pattern of winners and losers that will emerge for the shift to a new economy focused on carbon reduction and retrofit.

Finally, government policy across the UK often focuses on achieving EPC rating 'C' or better. If this is the underlying focus it is likely to lead to an emphasis on renewables rather than fabric, although there is evidence that social housing providers are wary of energy system technologies and are consequently favouring fabric first solutions (ZEST, 2021). This is another area where consensus and critical mass may in time produce a more joined up sector approach. A focus on renewables primarily may be less expensive but it is also likely to be less effective than fabric and renewables combined, in terms of reducing carbon emissions, extending the life of tenements or positively impacting on fuel poverty.

Notes

1 EPCs are an official measure of energy performance with 'C' a target widely promoted by government as a minimum goal of policy, and it is widely known (e.g., Grant Thornton, 2021) that older properties are disproportionately in worse bands requiring remedial investments. However, critics note that there is no necessary link between achieving high EPC ratings and achieving or even moving significantly towards net zero (Kelly, et al, 2021).

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Appendix 1

Figure 1: Retrofit Demonstration Project Logic Model

