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REVIEW

Participatory social housing retrofit: a semi-systematic review

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Abstract
Housing retrofit aims to enhance building standards across multiple dimensions and is integral to Europe's 2050 net-zero energy transition goals. The European Union and the United Kingdom identify social housing retrofit as key to the energy transition, combating fuel poverty, and improving tenants' wellbeing. Environmental upgrades are steadily increasing amid the climate transition and legislative energy performance requirements. Tenant participation should be examined to increase holistic sustainable outcomes, but how best to approach tenant participation throughout retrofit processes remains underexplored in the literature. This research aims to clarify the motivations of building owners to retrofit, identify how tenants can engage in retrofit design and implementation, and examine how tenant participation can improve outcomes. Using a semi-systematic review, this article examines how tenants have(not) been integrated in social housing retrofit. A thematic analysis identified three themes responding to the research objectives: (1) *motivations* of housing associations, (2) the *retrofit process,* the methods of decision-making, and (3) the *social impact* retrofit has on its stakeholders. The analysis revealed that insufficient tenant participation can detrimentally affect the sustainability of social housing retrofit. Findings were synthesised into 12 insights for social housing retrofit stakeholders to engage tenants in decision-making processes.

Keywords Social housing · Renovation · Tenant engagement · Tenant participation · Retrofit

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1 Introduction

Energy retrofitting homes is considered critical to reaching Europe's 2050 net-zero energy transition goals. Environmental upgrades are steadily expanding due to the climate transition and legislative energy performance requirements. Specifically, the EU Energy Performance of Building Directive (EPBD), recast in 2024 as Directive (EU) 2024/1275 (European Parliament, & Council of the European Union, 2024), and UK schemes including England's Social Housing Decarbonisation Fund (SHDF) and more recent Warm Homes Plan (Department for Energy Security and Net Zero & Fahnbulleh, 2024) target energy performance in social housing. These strategies aim to enhance energy efficiency, reduce carbon emissions, alleviate fuel poverty, increase green jobs, foster the retrofit sector, and improve tenants' wellbeing (Gov.uk, 2023). However, a comprehensive examination of tenant participation in social housing retrofit, to meet tenants' needs beyond energy performance, is currently lacking.

Social housing in the UK is formally defined under Sect. 68 of the Housing and Regeneration Act 2008 as low-cost rental and ownership accommodation made available to households whose needs cannot be adequately served by commercial markets (Housing and Regeneration Act 2008). This study focuses specifically on social rental housing, where dwellings are owned by housing associations or local authorities and rented to tenants at below-market rates—typically around 50% of market rent (Czischke & van Bortel, 2018; Wilson & Barton, 2021). Tenants hold secure or assured tenancies providing long-term housing security but lack ownership and decision-making power over housing improvements (Gov.uk, 2019). Therefore, this article refers to 'tenants' rather than 'residents' to acknowledge this distinct tenure arrangement and the unique power dynamics in social rental housing retrofit.

Elkington's (1997) triple bottom line framework emphasises multi-dimensional approaches to sustainability that incorporate environmental, social, and economic dimensions. Thuvander et al.'s (2012) investigation into established building assessment methods found that comprehensive environmental evaluation addresses materials, construction phase impacts, land use and ecology, water, waste, and management alongside operational energy consumption and life cycle assessment indicators such as global warming potential. Their analysis revealed, however, that environmental and technical dimensions receive more extensive indicator development than economic and social considerations. Other studies (Kristoffersen et al., 2024; Rodger et al., 2020; Wandahl et al., 2019) agree that social sustainability is currently the least developed sustainability criteria. Similarly, Rodger et al. (2020) found that current housing retrofit prioritises economic considerations over people, arguing that socioeconomic sustainability should protect tenants and the environment without adding financial pressures to those at-risk of vulnerability.

Incorporating all sustainability categories into decision-making has been termed 'holistic' retrofit (Rodger et al., 2020). Rodger et al. (2020) define holistic retrofit as incorporating both energy efficiency and health adaptations within social housing improvements, moving beyond narrow environmental or economic metrics. Yet their research reveals significant barriers to achieving such integration in practice, including fragmentation across sectors, inadequate tenant engagement, and governance structures that prioritise end-point performance outcomes over long-term tenant needs. This integrated approach is particularly important in social housing retrofit where tenant priorities often emphasise non-energy ben-

efits (NEBs) including comfort, health, safety, aesthetics, modernity, and gardens, alongside environmental performance (Broers et al., 2022; Santangelo & Tondelli, 2017). According to Santangelo and Tondelli (2017) a preference for NEBs over energy performance is particularly pronounced among social housing occupants, whose specific circumstances necessitate practical approaches distinct from those applied to owner-occupied properties (Sunikka-Blank et al., 2018). Further, recently recast EPBD proposals aim to highlight long-term renovation strategies, including NEBs related to health, comfort, quality of life, social inclusion, adaptation, job creation, and the economy of retrofitted buildings (European Commission, 2021; Hernandez-Cruz et al., 2024). Inadequate tenant participation and governance structures prioritising end-point performance targets are, therefore, central obstacles to holistic retrofit, particularly given that social housing tenants prioritise outcomes that energy-focused processes overlook.

Enhancing existing buildings is described using multiple terminologies including adaptation, renovation, refurbishment, and retrofitting (Grecchi, 2022). Throughout this article, 'retrofit' has been selected to highlight the process of raising buildings to higher standards across multiple dimensions that include energy efficiency improvements, consistent with terminology adopted by other scholars (Furman & Hadjri, 2025; Grecchi, 2022; Thuvander et al., 2012). While 'regeneration' encompasses broader area-wide transformations that deliver social, environmental and economic change (Levelling-up & Regeneration Act, 2023), this research focuses specifically on retrofit interventions at the individual building scale, which can represent a component within larger regeneration programmes. Energy-focused retrofit aims to diminish both energy consumption and greenhouse gas emissions (European Commission, 2021) by typically applying three technical interventions: enhancing building fabric thermal properties, improving systems efficiency, and integrating renewable energy sources (Institute for Sustainability & UCL Energy Institute, 2012). These technical strategies vary from deep energy retrofit, which combines technologies for a 60–90% energy consumption reduction compared with pre-retrofit energy performance, to partial retrofit and over-time retrofit approaches (Fawcett, 2014; Femenías et al., 2018). Meaningful tenant participation in decision-making therefore offers a critical mechanism to broaden energy-focused retrofit towards the holistic sustainability outcomes that purely technical approaches cannot achieve.

Performance gaps further complicate retrofit outcomes. Traynor (2019, p.6) explains that the gap 'between energy consumption as predicted against actual can be as much as five times'. These performance gaps reveal a disconnect between technical predictions and lived reality, indicating that purely technological approaches are insufficient for achieving retrofit targets. Significantly, occupant behaviour (including prebound and rebound effects) emerges as a key contributor to these gaps, alongside simulation inaccuracies and installation mistakes (Gupta & Gregg, 2015; Hernandez-Cruz et al., 2024; Sunikka-Blank & Galvin, 2012; Traynor, 2019). Social housing tenants possess unique 'situated knowledge' (Haraway, 1988) derived from daily interaction with their homes, providing expertise that technical assessments alone cannot capture. Understanding how tenants can be meaningfully engaged in retrofit decision-making processes may offer pathways to reduce performance gaps while simultaneously addressing tenants' priorities beyond energy performance.

This review applies 'participation' as an umbrella term encompassing various collaborative approaches with tenants in retrofit practice. Under this umbrella, the literature reveals diverse methodologies for participation, including (among others): co-design, where both

designers and users not trained in design actively develop design solutions (Sanders & Stappers, 2008; Voorberg et al., 2015); co-production, engaging tenants as collaborative partners throughout service implementation (Voorberg et al., 2015); and post-occupancy evaluation (POE), conducted to measure actual and perceived project outcomes and compare results to anticipated objectives (Boissonneault & Peters, 2022). Each approach represents different degrees and stages of engagement, while tenant 'participation' can be used to capture engagement to any extent. For instance, co-design and co-production inherently involve participatory processes throughout project development, while POE may incorporate participatory elements but typically focuses on post-completion assessment. As Voorberg et al. (2015) explain, participation is a broad term that can range from passive involvement to active collaboration. Given that this study focuses on the full extent of tenant engagement in social housing retrofit, 'participation' is adopted as an overarching term capturing this spectrum of engagement practices.

Despite recognition that tenants prioritise NEBs over energy performance and possess valuable situated knowledge about their homes, comprehensive examination of how to meaningfully integrate tenant participation in social housing retrofit decision-making remains lacking. Currently, performance gaps demonstrate that purely technological solutions are insufficient, yet inadequate tenant engagement underutilises their expertise. These gaps often arise from the disconnect between technical predictions and lived reality, suggesting that excluding tenant knowledge from decision-making undermines retrofit effectiveness. The urgency of meeting climate targets while ensuring social equity demands approaches that bridge technical performance requirements with tenant needs. Understanding how to effectively engage tenants throughout retrofit processes could reduce performance gaps and simultaneously prioritise more holistic home improvements by incorporating tenants situated knowledge and NEBs. To address this critical knowledge gap, this study is guided by the following research question: *What is the current state of knowledge on tenant participation in social housing retrofit, and what factors enable or constrain meaningful tenant engagement throughout the retrofit process?* This overarching question is explored through three sub-questions:

1. What motivates housing associations to engage tenants in retrofit processes?
2. How and when should tenants be integrated into retrofit decision-making to enhance holistic sustainability outcomes?
3. What social impacts does retrofit have on stakeholders when tenant participation is prioritised?

By comprehensively reviewing existing research on tenant participation in social housing retrofit and examining how greater tenant participation can improve sustainability outcomes, this semi-systematic review synthesises existing literature to offer practical insights for stakeholders seeking to meaningfully engage tenants and enhance the holistic sustainability of social housing retrofit.

2 Methodology

A semi-systematic literature review (Snyder, 2019) methodology was used in this investigation, following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) reporting guidelines (Page et al., 2021). Social housing retrofit with tenant participation spans multiple disciplines including policy, architecture, engineering, social sciences, and others, typically resulting in qualitative research outputs. A semi-systematic approach was, therefore, taken in two parts: (1) *the search*, a replicable systematic review identified articles through search terms, followed by (2) a *thematic analysis* to develop conceptual clusters through common themes. This review and analysis method was favorable because the resulting literature was heterogeneous and context-specific, making direct comparisons unsuitable. Qualitative analysis allowed key, recurrent themes in the literature to emerge.

2.1 The search

The search aimed to discover European social housing case studies, retrofitted after 2002, with tenant participation, inclusivity, and remained social housing. Five inclusion criteria were identified: (1) 'retrofit'; (2) 'social housing' (context for required articles); (3) 'case study' (for realised examples); (4) 'inclusivity' (for providing insight for collaboration with marginalised groups); and (5) 'participation' (how tenant engagement was practiced). The year 2002 was chosen because it was when the EU's EPBD was first published (Directive 2002/91/EC; European Commission, 2002), to improve building energy efficiency, thus spotlighting the need to upgrade substandard buildings. (Table 1).

Table 1 Keywords, Keyword Permutations & Syntax

(1)	retrofit	retrofit* OR renovat* OR remodel* OR rehabilita*
(2)	social housing	"social hous*" OR "social rental hous*" OR "council hous*" OR "public hous*" OR "government* hous*" OR "municipal* hous*"
(3)	case study	"case stud*" OR case OR reali?ed OR project OR "narrative data" OR sociotechnical OR qualitative
(4)	inclusivity	inclusiv* OR femini* OR wom?n OR female OR elderly OR age* OR aging OR "old people" OR "old person*" OR "frail person*" OR "frail people" OR senior OR immigra* OR migrant OR migrat* OR black OR asian OR "ethnic group" OR minority OR race OR vulnerab* OR LGBT* OR gay OR lesbian* OR "low income" OR "socio-economic" OR "socioeconomic" OR "mental health" OR homeless*
(5)	participation	participat* OR "community involv*" OR "community engage*" OR "neighbourhood engage*" OR "neighbourhood involve*" OR "neighbourhood participat*" OR user-centric OR consult* OR collaborat* OR co-design OR co-creat* OR "decision making"

A Boolean search of five databases was performed between December 2022 – January 2023: JSTOR, ProQuest, Scopus, and Web of Science, large multidisciplinary databases; and Avery, an architectural database. As shown in Fig. 1, a keyword search was conducted using permutations of the five inclusion criteria:

Permutations of 'retrofit', 'housing', and 'case study' were searched within article titles and abstracts; 'inclusivity' and 'participation' were searched within all article fields. The reason for this was twofold: (1) searching all keywords in the title and abstract yielded no results; and (2) if available, 'inclusivity' and 'participation' could be mentioned generically in the abstracts (e.g., 'use value' (Boess, 2022), 'tenants' opportunity to influence' (Mjörnell et al., 2022), etc.), with keywords appearing in the article. Search parameters limited results to European geographical constraints, English and Spanish language, peer-reviewed journals, and articles written since 2002.

Database results yielded n = 58 articles, which were entered into Excel and duplicates were removed (n = 10), leaving n = 48 articles for review. During the title and abstract review (Review 1), articles with the following exclusion criteria were eliminated: no tenant participation; and the retrofit process is a secondary focus. Full text sourcing of the remaining n = 12 articles (Review 2) with the same exclusion criteria, produced n = 9 articles for analysis: n = 2 theoretical case study articles, without results; and n = 7 realised case study articles. Theoretical articles are included in the analysis to compare with actualised findings and determine consistencies that can be used to advise future retrofit projects. The complete selection process is illustrated in the PRISMA flow diagram (Fig. 1).

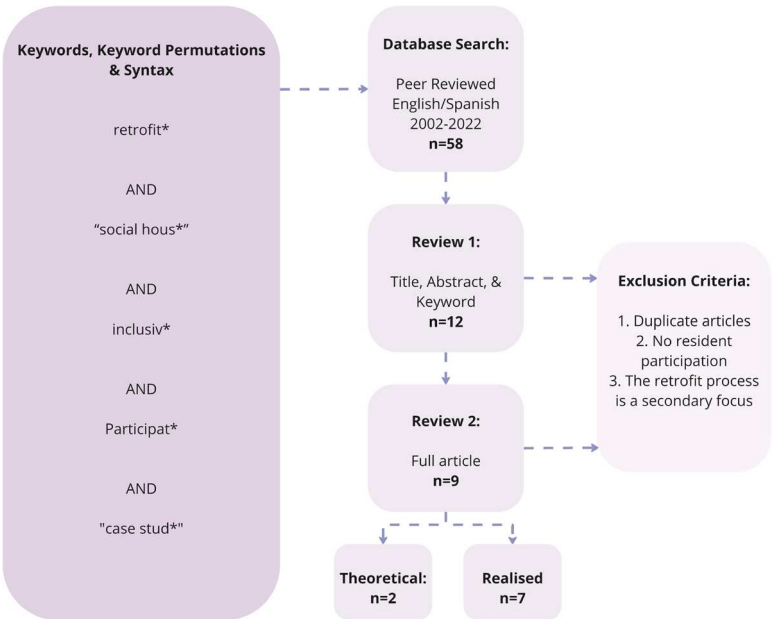

Fig. 1 PRISMA flow diagram illustrating the search protocol and phase of review (see also Table 1) (created with miro software)

2.2 Thematic analysis

A thematic analysis as developed by Braun and Clarke (2006) was undertaken with the n = 9 articles in six phases:

1. *Data familiarisation*—a content analysis was performed in two ways: automatic detection of common words, using the software program NVivo version 1.7.1; and detecting frequent themes through reading and highlighting.
2. *Generating initial codes*—sub-themes, patterns, and concepts were narrowed into code labels.
3. *Identifying themes*—by grouping sub-themes from code labels, data was gathered under broader themes.
4. *Reviewing themes*—themes were merged or divided, depending on evidence, to group into themes that best answer the research question.
5. *Labelling themes*—crafting detailed analysis of each identified theme.
6. *Synthesising findings*—completing the conclusive analysis and manuscript composition.

Themes emerged inductively from the six-phase process: initial word frequency analysis in NVivo (version 1.7.1) generated preliminary codes from across the nine articles, which were then grouped and iteratively refined into sub-themes through close reading; Miro was subsequently used as a visual mapping tool to spatially organise and review relationships between sub-themes, enabling their consolidation into the three overarching themes of *external context*, *the retrofit process*, and *social impact*. Results have been synthesised and considered in terms of decision-making power across time, to better identify when and how(not) to engage tenants in the retrofit process to increase sustainability.

3 Results and discussion

The resulting studies predominantly examined housing association-led retrofit rather than local authority housing in UK contexts, potentially reflecting that local authorities lag behind housing associations in participatory retrofit completion (Furman & Hadjri, 2025), or disseminate their work through non-academic channels. However, international cases from Sweden and Italy demonstrate municipality-led participatory retrofit approaches through publicly owned housing companies and regional housing entities. Across these diverse organisational contexts, thematic analysis revealed three major themes and associated sub-themes, identified in the literature as key considerations for tenant participation in social housing retrofit. The full list of themes, sub-themes, and factors are synthesised in Table 2.

Firstly, the *External Context* refers to the external factors that motivate social housing retrofit and thus determine the building owners' engagement with tenant participation. This included the need for energy efficient housing to meet Europe-wide green transition targets. Many papers also recognised retrofit as necessary to improve tenants' lives, highlighting user-needs. Thus, *External Context* can be encompassed by a single sub-theme, the motivations of building owners to retrofit.

Secondly, the *Retrofit Process* investigates the process of retrofit decision-making. This begins from the boundaries impacting what the housing associations can achieve. From

Table 2 Synthesis of the thematic analysis themes, sub-themes, and factors

Themes	Sub-themes	Factors
External Context	Motivations	Green Transition
		Human-centered
		Sustainability
Retrofit Process	Role of the Housing Association and Cost	Building owner
		Social landlord
		Partnered with other organisations
		Promote social role
		Part gov. subsidy
	Participation	Resident participation
	Energy related components	Energy audits
		Performance gap
		Heating & ventilation
		Renewables
		Passive strategies
Social Impact	Social Inclusion	Residents from marginalised groups
		Consider residents as experts
		Considers use-practice
		Social mix
	Timing of Engagement	Before design stage
		Timing not mentioned
	Feedback Loop	No integrated feedback
		Integrated feedback
		Monitoring
	Safeguarding Future Residents	Considers residents' futures

there, the extent of decision-making power afforded to tenants can be explored through their level of participation throughout the retrofit timeline. This impacts the technical energy performance upgrades applied throughout the retrofit process. This theme, therefore, encompasses both technical retrofit decisions and the stakeholder engagement processes that shape those decisions. While investigating *the retrofit process,* three sub-themes emerged and were examined: the role of the housing association and cost, participation, and energy related components.

Finally, *social impact* examines how the retrofit process directly affects the tenants living in-situ during the retrofit project and after completion. Four sub-themes emerged relating to *social impact*: social inclusion, timing of engagement, feedback loop, and safeguarding future tenants.

3.1 Motivations

Building owner motivation regarding social housing retrofit can be grouped into: green transition, human-centred motivations, and the triple bottom line of sustainability (Elkington, 1997).

All n = 9 articles prioritise retrofit to aid in Europe's green transition, including mentions of the renovation wave (Mjörnell et al., 2022) and meeting the EPBD directive (Gianfrate et al., 2017). This supersedes other retrofit motivations because of national and EU legislation

to achieve a 'sustainable climate' (Awwal et al., 2022, p.1). N = 8 articles are motivated to take human-centred retrofit approaches, but perspectives differ (see Table 3). Boess (2022) investigates how external facilitators 'create value for tenants' (p.98), while Awwal et al. (2022) allows internal social housing tenants to design, believing retrofit will reinforce 'psychological feelings of belonging [sic] contributing to social stability' (p.1). Awwal et al. (2022) and Boess (2022) focus on developing technical systems alongside tenants to help promote energy reduction, while Gustavsson and Elander (2016), Walker (2014), and to some extent Gianfrate et al. (2017), aim to adapt users' behaviour to new energy systems. Gianfrate et al. (2017) are motivated to reduce performance gaps, acknowledging the failure of 'building professionals to adequately recognise and take variations in occupant activities into account' (p.105) i.e., values, habits, and needs. Mjörnell et al. (2022) are motivated to balance social and economic sustainability amid the green transition but are limited two-fold by finances—the legal requirement to make profits and the rent increases the tenants can(not) afford to pay. Collaborating with tenants to shape designs that are energy saving, enhance user satisfaction, and influence user behaviour, is explored by Lucchi and Delera (2020) and van Hoof and Boerenfijn (2018), dually motivated by the green transition and raising social value for tenants.

Sustainability motivates all n = 9 articles. N = 4 articles discuss fuel poverty (Gianfrate et al., 2017; Hoppe, 2012; Lucchi & Delera, 2020; Walker, 2014), three in the introductions, highlighting reduced consumption as a key motivator to change user behaviour and enhance economic sustainability. Social sustainability is also discussed in terms of 'energy use' in n = 3 articles (Gianfrate et al., 2017; Gustavsson & Elander, 2016; Walker, 2014). These social housing companies seemingly prioritise environmental sustainability over social sustainability, exploring user-needs in terms of the green transition. Without social integration, however, environmental sustainability may not sufficiently improve energy performance. Further, two studies show that changing habits is unlikely to occur in isolation (Gianfrate et al., 2017; Walker, 2014).

Table 3 Inventory: motivations of housing companies to retrofit

		Key themes		
		Motivations		
Article	Realised Case Study	Green Transition	Human-centered	Sustainability: Social (S), Environmental (En), Economic (Ec)
Awwal et al., 2022		✓	✓	✓ En, S, Ec
Boess, 2022	✓	✓	✓ Project Managers of Housing Companies & Construction Companies	✓ En, S, Ec
Mjörnell et al., 2022	✓	✓	✓ Limited to tenants' ability to pay	✓ En, S, Ec
Lucchi & Delera, 2020		✓	✓	✓ En, S, Ec
van Hoof & Boerenfijn, 2018	✓	✓	✓	✓ En, S, Ec (long term)
Gianfrate et al., 2017	✓	✓	✓	✓ En, S, Ec
Gustavsson & Elander, 2016	✓	✓	✓ To change user behaviours	✓ En, S, Ec
Walker et al., 2014	✓	✓	✓	✓ En, S, Ec
Hoppe, 2012	✓	✓		✓ En, Ec

3.2 Retrofit process

The *Retrofit Process* examines the procedure and methods of retrofit decision-making, including boundaries restricting and enabling tenant engagement. This section explores the *role of the housing association and cost,* that impact decisions; the rationale, type, and scale of tenant stakeholder *participation*; and the *energy related components* in retrofit infrastructure (see Table 4 for further details on individual themes and corresponding approaches).

3.2.1 Role of the housing association and cost

The housing associations role as both building owner and social landlord gives them full decision-making power (Hoppe, 2012) within national legislation. Seventy percent tenant approval is required for retrofit in the Netherlands (Hoppe, 2012), affording tenants strong negotiating power. Conversely, in Sweden, legislation mandates that housing companies operate in a 'business-like manner' (p.2), creating a structural requirement for profit-driven decisions. These legislative requirements impact decision-making because they determine which stakeholders' needs to prioritise—tenants in the Netherlands to increase approval, and housing companies in Sweden to ensure profits.

Engaging stakeholders as partners rather than contractors can enhance collaborative decision-making, reduce hierarchy, and enrich projects. Additionally, studies show embedding collaboration early strengthens positive influence (Awwal et al., 2022; Boess, 2022; Gustavsson & Elander, 2016; Hoppe, 2012; Lucchi & Delera, 2020; van Hoof & Boerenfijn, 2018). Gianfrate et al. (2017) define an 'integrated approach' (p.102) to retrofit as promoting holistic sustainability. Van Hoof and Boerenfijn (2018) take this integrated approach by explaining that culture and opportunity variations require each retrofit project to 'start from scratch' (p.5). Partnering with local stakeholders can facilitate such transitions by leveraging local knowledge.

The collaborative methodologies of 'design-driven approaches' (Lucchi & Delera, 2020) and 'design-thinking' (Boess, 2022) represent intensive participatory processes wherein designers hold primary decision-making power to synthesise and incorporate stakeholders' requirements and lived experiences. Additionally, leading environmental upgrades with design can emphasise high 'quality housing standard[s]' (Lucchi & Delera, 2020, p.3; Gianfrate et al., 2017, p.102). A design-thinking partner, such as an architect, should advocate integrated approaches towards high quality retrofit.

Clear collective objectives can alleviate potential decision-making conflicts. The housing associations investigated by van Hoof and Boerenfijn (2018), Gianfrate et al. (2017), and Walker et al. (2014) apply various strategies to promote a social role: addressing Maslow's (1943) hierarchy of needs for future tenants and local communities (van Hoof & Boerenfijn, 2018); and reducing energy bills by raising energy awareness alongside technical solutions (Gianfrate et al., 2017; Walker et al., 2014). Objectives could be designed collaboratively (Awwal et al., 2022; van Hoof & Boerenfijn, 2018), set by government (Gianfrate et al., 2017; Gustavsson & Elander, 2016; Hoppe, 2012), or be a funding obligation (Gustavsson & Elander, 2016).

Social housing companies may help finance retrofit by increasing rents (Gustavsson & Elander, 2016; Mjörnell et al., 2022), but when cost drives decision-making, it should take a long-term view. Mjörnell et al. (2022) highlight that housing associations must function

Table 4 Inventory: retrofit process

Key Themes												
Retrofit Processes												
Role of the Housing Association and Cost							Participation	Energy related components				
Article	Realised Case Study	Building Owner	Social Landlord	Partnered with Other Organisations	Promote Social Role	Part Gov. Subsidy	Resident Participation	Energy Audits	Performance Gap	Heating & Ventilation	Renewables	Passive Strategies
Awwal et al., 2022		✓	✓	✓ Non-hierarchical Stakeholders			✓ User value to be integrated through mediated workshops					
Boess, 2022	✓	✓	✓				✓ Technology and users are interdependent		✓	✓ Heating & ventilation	✓ Solar PV & heat pump	
Mjörnell et al., 2022	✓	✓	✓				✓ Tenant choice with associated rent increase					
Lucchi & Delera, 2020		✓	✓	✓ University design Project			✓ Integrated design process	✓		✓ MVHR	✓ Solar PV & panels	✓ Low
van Hoof & Boerenfijn, 2018	✓	✓	✓	✓ Local Partner Organisations	✓		✓ All current and future residents at the forefront of plans and discussions			✓ MVHR	✓ 512 Solar PV	✓ Low
Gianfrate et al., 2017	✓	✓	✓	✓ Municipality	✓	✓	✓ "Information campaign" & meetings		✓	✓ Heating & ventilation		✓ High
Gustavsson & Elander, 2016	✓	✓	✓			✓	✓ Informative meetings & street poster seeking residents' opinions to architectural proposals			✓ MVHR	✓ Single wind turbine for teaching purposes	
Walker et al., 2014	✓	✓	✓		✓		A Interviews: pre- and post-retrofit, half the sample received an "information intervention"		✓	✓ Heating		
Hoppe, 2012	✓	✓	✓			✓	A Information, heat pump removed after residents' refusal	✓		✓ Heating	✓ Air pump (one case), solar thermal, cogeneration	✓ Low

according to a '"business-like manner" … [creating a] conflict between social sustainability for tenants and economic sustainability for housing companies' (p.2). To remediate this conflict, Van Hoof and Boerenfijn (2018) take a long-term approach to profit and loss. Van Hoof and Boerenfijn (2018) argue that decisions preventing demolition avoid the financial losses associated with vacant, decaying buildings and prevent the waste of materials and loss of affordable housing capital. When housing associations take a long-term view of costs—including the financial risks of vacancy and the social costs of displacement—profit-driven approaches may align better with holistic sustainability goals.

3.2.2 Participation

Early tenant participation enabled successful implementation of design-thinking (Boess, 2022), design-driven approaches (Lucchi & Delera, 2020), and user-centred design (Awwal et al., 2022; van Hoof & Boerenfijn, 2018). Hoppe (2012) acknowledges early investment in 'project orientated learning' (p.799) involving tenants in decision-making alleviates fears, engages tenants in the green transition, and improves trust. The literature found that embedding tenants in retrofit design increases sense of ownership (van Hoof & Boerenfijn, 2018), influence (Mjörnell et al., 2022), usability (Boess, 2022), and user-consciousness (Gianfrate et al., 2017). High user-consciousness and a commitment by retrofit stakeholders to consider tenants' dreams, expectations, thoughts, views, and opinions (van Hoof & Boerenfijn, 2018), encourages responsible energy behaviour (Gianfrate et al., 2017) and collaborative alterations to housing infrastructure.

Boess (2022) emphasises aligning design decisions with stakeholder communication. Tenant communication was prevalent in two of the cases with one successfully prototyping the retrofit to learn about building technologies and mutual expectations. Simultaneously, Boess (2022) illustrates how communication breakdown in a further study led to poor design, including underestimating tenants' maintenance reliability. Van Hoof and Boerenfijn (2018) incorporated current and future tenants, care professionals, and the local community, through numerous collaborative workshops developing integrated design. High levels of tenant integration may mitigate future problems including the performance gap, (mis)use of systems, and tenant satisfaction.

Boess (2022) found that technical systems and users are interdependent. Participation restricted to an 'information campaign' (Gianfrate et al., 2017, p.107) instructing tenants on operating alien systems seems unlikely to transform usage patterns or effectively address performance gaps (Boess, 2022; Gianfrate et al., 2017; Walker et al., 2014). Similarly, limiting tenant decision-making to predetermined options (Gustavsson & Elander, 2016; Mjörnell et al., 2022) tends towards 'tokenist' (Mjörnell et al., 2022) participation and may not reduce energy behaviour nor increase tenants' sense of ownership. Information should thus complement forms of more integrated participation.

3.2.3 Energy related components

A dichotomy exists between passive design strategies from historical architectural vernacular and active technical systems promoted to reach legislated energy performance standards. Energy retrofit is a priority in all nine cases, but passive strategies controlling comfort without fuel consumption are only considered in detail by one project (Gianfrate et al., 2017) and

to some extent three others (Hoppe, 2012; Lucchi & Delera, 2020; van Hoof & Boerenfijn, 2018). Gianfrate et al. (2017) reduce energy use through two passive interventions: (1) winter gardens with ventilated doors and operable ventilation in external walls, and (2) Trombe-Michel walls incorporating adjustable roller blinds to the winter gardens, stationary brise-soleil, and electrical fans. These interventions enhance winter heat flow, mitigate summer overheating, and can reduce or replace the role of mechanical systems.

Energy audits typically measure potential savings through technical interventions (Hoppe, 2012). Technology can predict, monitor, and evaluate building performance in relation to numerical targets (Boess, 2022; Gianfrate et al., 2017; Hoppe, 2012; Walker et al., 2014), affirming housing companies' commitment to the green transition. However, Lucchi and Delera (2020) explain that construction materials and technical systems require multicriteria assessments including environmental impacts, maintenance requirements, and life cycle assessment to ensure positive long-term building performance. Technical systems should, therefore, be combined with passive energy-reducing design strategies (Gianfrate et al., 2017), utilising a multicriteria approach that balances thermal and acoustic performance, reversibility, and environmental sustainability (Lucchi & Delera, 2020).

The analysis identified a range of renewable energy technologies. Solar photovoltaic (PV) systems were the most common renewable technology. N = 6 studies discussed and designed retrofit with PV, but they were finally implemented in four studies (Boess, 2022; Gianfrate et al., 2017; Hoppe, 2012; van Hoof & Boerenfijn, 2018). Of the other two, Lucchi and Delera (2020) have no construction results and Hoppe (2012) explained while three cases had specified PV, two cases later rejected it; in one case due to cost and poor roof orientation, and in the other, tenants' fears of cost and "teething troubles" (p.798). The case that did install PV also added solar thermal systems for water, and heat pumps were installed in two studies (Boess, 2022; Hoppe, 2012). Less commonly implemented technologies included battery storage for energy management (Boess, 2022), cogeneration systems (Hoppe, 2012), and a single small-scale wind turbine installed primarily to demonstrate environmental care to tenants (Gustavsson & Elander, 2016).

The performance gap though technical error, pre-bound, and rebound (Boess, 2022; Gianfrate et al., 2017; Walker et al., 2014), remains a challenge. Skilled workers are essential because retrofit 'requires specific design expertise and construction know-how' (Gianfrate et al., 2017, p.111). Further, technical error searching can be time-intensive and costly (Boess, 2022). Passive strategies are often low-tech but require some user consciousness, such as user-controlled shading devices (Gianfrate et al., 2017) and natural cross-ventilation (Lucchi & Delera, 2020). Incorporating tenants in decision-making that combines passive strategies with technical systems (Gianfrate et al., 2017) may facilitate learning, increase user consciousness, reduce reliance on technology, and reduce the performance gap.

Gianfrate et al. (2017) point out 'the majority of energy consumed in [sic] European residential buildings is used for space heating (57%)' (p.104). This focus on heating in the existing literature is reflected in the reviewed studies, where only the mediterranean cases, Gianfrate et al. (2017) and Lucchi and Delera (2020), simultaneously investigate cooling strategies. Amid rising global temperatures, however, both passive and active cooling strategies should be prioritised for all European housing.

3.3 Social impact

Social Impact investigates the impact retrofit has on associated stakeholders through the *social inclusion* of current and future tenants, the *timing of engagement* with tenants, the (dis)integration of a *feedback loop*, and the extent of *safeguarding future tenants*.

3.3.1 Social inclusion

The social housing tenants within the literature are often at-risk of vulnerability, with social problems, and from marginalised groups (*see* Table 5 *for further details*). Current and future tenants, therefore, have unique housing needs. Six of the nine articles agree tenants are experts in the occupation of their homes (Awwal et al., 2022; Boess, 2022; Gianfrate et al., 2017; Lucchi & Delera, 2020; van Hoof & Boerenfijn, 2018; Walker et al., 2014) and can, therefore, provide insights into their housing needs. By integrating social housing tenants' expertise into design with the aim to service their needs, these studies can enhance socially inclusive retrofit.

The literature shows tenants' expertise being utilised through product design (Awwal et al., 2022; Boess, 2022), collaborative design practice (Lucchi & Delera, 2020; van Hoof & Boerenfijn, 2018), and changing use-practice (Gianfrate et al., 2017; Lucchi & Delera, 2020; van Hoof & Boerenfijn, 2018; Walker et al., 2014). According to Awwal (2022), user-driven approaches 'can provide positive consequences if applied in the early stages of the design development process' (p.3), pursuing non-hierarchical stakeholder design relationships. Van Hoof and Boerenfijn (2018) continue to integrate thoughts, views, and opinions of tenants, beyond this early stage. Continuous collaboration can design spaces that satisfy tenants' current and future, social and physical needs.

Material change may support habitual change when the needs and use-practice of tenants are deeply understood. Gianfrate et al., (2017, p.105) (referencing 'Hong et al., 2016; Steemers and Yun, 2009; Yohanis, 2012') highlight that changing user habits can reduce energy consumption between 10–30%. Boess (2022) and Walker et al. (2014) agree that retrofit technology should 'amplify' existing habits; for example, instant hot shower water can deter baths. Embedding users in decision-making towards socially inclusive solutions can support learning, subsequently changing behaviour. Gianfrate et al.'s (2017) low-tech solutions are more socially inclusive than high-tech solutions, despite requiring high user-consciousness. They demand minimal technological expertise while offering additional advantages, such as winter gardens' natural daylight (Gianfrate et al., 2017). Walker et al. (2014) found the 'majority of tenants reported no change in energy use practice as a result of the technical intervention or information intervention' (p.105). Without social inclusivity in design, teaching tenants how to manage potentially unsuitable systems limits efforts to reduce performance gaps.

The identified literature does not incorporate racial diversity beyond Mjörnell et al. (2022) emphasising multi-lingual communication. Gustavsson and Elander (2016) also identify language as a barrier but provide no details. They do, however, criticise social mixing policies for not addressing social inequalities or discrimination and exempting the wealthy from social mixing demands. Nevertheless, three articles still strive for social mixing of some form. Lucchi and Delera (2020) idealise socially mixing migrants, students, and older people to 'avoid[sic] ghettoization and social degradation' (p.7) and 'bring vibrancy'

Table 5 Inventory: social impact

		Key themes					
		Social Impact					
		Social Inclusion				Timing of Engagement	
Article	Realised Case Study	Residents from Marginalised Groups	Consider Residents as Experts	Considers Use-Practice	Social Mix	Before Design Stage	Timing not mentioned
Awwal et al., 2022		✓ Low income	✓ User-valued innovation				
Boess, 2022	✓	Inclusive aim: user-interface	✓ For prototyping			✓ In 2 of 4 case studies	
Mjörnell et al., 2022	✓	✓ Low income				✓ Approx 3 months	
Lucchi & Delera, 2020		✓ Low income, older people, foreign & young migrants, social problems	✓	✓	✓	✓ Approx 3 months	
van Hoof & Boerenfijn, 2018	✓	✓ Elderly, mental & physical disabilities	✓	✓	✓	✓ 13 months	
Gianfrate et al., 2017	✓	✓ Low income, social problems	✓	✓			✓
Gustavsson & Elander, 2016	✓	✓ Low income, education, & employment; overcrowding; child poverty, multi-ethnic			✓ Raising existing residents' profiles to create social mix		
Walker et al., 2014	✓	✓ Low income	✓	✓			✓
Hoppe, 2012	✓	A Low income, stigmatised, spatial concentration of poverty, unemployment, lack of safety					✓

Table 5 (continued)

		Key Themes			
		Social Impact			
		Feedback Loop			Safeguarding Future Residents
Article	Realised Case Study	No Integrated Feedback	Integrated Feedback	Monitoring	Considers Residents' Futures
Awwal et al., 2022			✓ Planned workshops		✓ User-manual
Boess, 2022	✓	✓ Demo dwellings in 3 of 4 case studies		✓	✓ Manual (C1, C2), sophisticated digital system providing guidance (C3), touchpoint service application (C4)
Mjörnell et al., 2022	✓				
Lucchi & Delera, 2020			✓ Present designs		
van Hoof & Boerenfijn, 2018	✓		✓		✓ Ageing in place & reversible
Gianfrate et al., 2017	✓	✓		✓	✓ User-manual
Gustavsson & Elander, 2016	✓	✓			✓ Employing & upskilling residents
Walker et al., 2014	✓	✓		✓	
Hoppe, 2012	✓	✓ Iterative learning for the next project		✓	

(p.12). Social mixing among the not-wealthy should be carefully considered to avoid displacement (Gustavsson & Elander, 2016) and supplementary methods can improve success. Van Hoof and Boerenfijn (2018) prioritise their older tenants with a smaller number of young tenants obliged to uphold buddy partnerships and activity organisation. Gustavsson and Elander's (2016) housing association focuses on retaining and integrating existing social housing tenants through employment, income, language skills, and so on. Discouraging tenants from leaving once they become more affluent can boost social mixing from within neighbourhoods and improve collective socio-economic growth.

3.3.2 Timing of engagement

According to the literatures, engaging social housing tenants before retrofit design has many advantages. Early engagement can identify strategies to achieve optimal technology use and building performance (Gianfrate et al., 2017), help tenants understand intervention configuration (Boess, 2022), give tenants more control over rent increasing measures (Mjörnell et al., 2022), increase the 'emotional bond between people and place' (van Hoof & Boerenfijn, 2018, p.3), allow tenants to reach compromises (Gustavsson & Elander, 2016), and increase social sustainability. Lack of early design participation, however, can lead to misunder-

standing tenant needs and practice (Gianfrate et al., 2017), mistrust and miscommunication (Gustavsson & Elander, 2016), and costly delays in time (Boess, 2022).

Engagement before retrofit can better align stakeholder communication with design decisions (Boess, 2022). According to Boess (2022), 'time not spent in the design phase became time spent later' (p.104). While Case 2 and 3 of Boess (2022) began communication several years prior to retrofit, Van Hoof and Boerenfijn's (2018) participation strategy designed collaborative bespoke retrofit in 13-months. Despite a lengthier process, Boess (2022) merely communicated design decisions, while van Hoof and Boerenfijn (2018) afforded tenants extremely high decision-making power. This supported a 'new attitude and culture within the physical space' (p.5), increasing social sustainability. These studies show that while high levels of participation require lengthier processes, shallow participation does not necessarily reduce time.

Problems can occur when decision-making favours unrepresentative samples of tenants with time to participate. For instance, evening workers in Mjörnell et al. (2022) were unable to provide input at evening meetings. Hoppe (2012) even found difficulties convincing any households to participate, delaying plans and raising costs. Other delays created tensions between local authorities and housing associations, and exacerbated tenant distrust, sometimes requiring compensation (Hoppe, 2012).

Investing time in post-retrofit engagement strategies can streamline future repairs (Walker et al., 2014). The construction company project manager in Boess (2022) Case 2 remained to troubleshoot technologies and upskill two apt tenants, maintaining communication for complex issues. Issues continued in Boess (2022) Case 1, however, for two years, increasing project time and cost. Hoppe (2012) and Walker (2014) show that taking time to interpret unchanged user-habits can strengthen iterative learning for future projects.

Articles with informative participation only (*see* Table 4) omit time details of these activities (Gianfrate et al., 2017; Hoppe, 2012; Walker et al., 2014). Possibly, the time is negligible, comprising of some hours or the duration of placing advertisements in main entrances (Gianfrate et al., 2017). Walker et al.'s (2014) results demonstrate that information campaigns alone do not impact tenants' energy use. As such, Gianfrate et al. (2017) stress recognising 'variations in occupant activities' (p.105) and recommend tailored learning programs. Starting programs before retrofit can be used to increase tenants' decision-making power (Mjörnell et al., 2022; van Hoof & Boerenfijn, 2018), facilitate cross-learning (Awwal et al., 2022; Boess, 2022; Hoppe, 2012; Lucchi & Delera, 2020), and support integrated communication between all stakeholders (Boess, 2022; van Hoof & Boerenfijn, 2018), which may reduce the time taken to complete retrofit (Boess, 2022).

3.3.3 Feedback loop

Iterative design feedback, intermittently evaluated by tenants, can develop key retrofit design requirements (Awwal et al., 2022). Boess (2022) commends advanced prototyping and evaluating sociotechnical designs to 'create more innovation and certainty, and [sic] iterate on them to better fulfil needs and save time later' (p.105). This can empower marginalised groups (Gianfrate et al., 2017; Gustavsson & Elander, 2016; Lucchi & Delera, 2020) while mitigating disappointment risk if results go awry (Gustavsson & Elander, 2016). User-centred approaches in van Hoof and Boerenfijn (2018) periodically reintegrate tenant feedback during design and implementation. They describe the results as such:

> By taking full responsibility for future functionalities of the building and its prospective future tenants, the local community literally "stepped into" the building… today the institutional partners only provide the services that are required by the tenants, such as home care. (van Hoof & Boerenfijn, 2018, p.7).

Giving tenants autonomy over the use and function of building spaces, alongside consistently integrating their feedback to shape these spaces, imprints a sense of ownership and increases tenant empowerment.

A lack of integrated feedback may lead to performance gaps from construction changes, cleaning and maintenance issues, inconvenient product placement, and lack of user-awareness (Boess, 2022; Gianfrate et al., 2017; Walker et al., 2014), alongside tenant mistrust (Gustavsson & Elander, 2016). Demonstration dwellings can help identify technical systems, test their efficacy, and foster trust between contractors and tenants by demonstrating building capabilities (Boess, 2022). Adopting demonstration dwellings as early as possible has a lot of potential as participatory design studios, for managing expectations and communicating potential changes, and to better integrate tenant feedback into design processes (Boess, 2022). Tenant feedback in product design can help generate user-centred design, transfer stakeholder knowledge, and reduce performance gaps (Awwal et al., 2022). Energy use monitoring feedback after completion can also identify extreme performance outliers to investigate (Boess, 2022) and help iterate future retrofit projects (Hoppe, 2012).

3.3.4 Safeguarding future tenants

To safeguard future technology use, Awwal et al. (2022), Boess (2022), and Gianfrate et al. (2017) developed user manuals. Boess (2022) further established sophisticated digital systems and touchpoint services, in one case developing a new digital application. Gianfrate et al. (2017) emphasise the importance of 'simple (non-technical) and understandable language' (p.107) in manuals, dividing use and maintenance into: description, summer management, and winter management. This seasonal approach safeguards current and future tenants' ability to comfortably occupy their homes through variable climatic conditions. Upskilling existing tenants to aid technical use safeguards future tenants' learning (Boess, 2022) while also initiating a new social role. Without safeguarding practices, Walker et al. (2014) found energy use habits are unlikely to change. Misuse and poor understanding of technology can precipitate unsuccessful retrofit results (Boess, 2022; Walker et al., 2014).

Non-technical issues, such as social needs, are more complex to understand, measure, and therefore safeguard. However, in marginalised communities, they require attention to increase social sustainability (Awwal et al., 2022; Gustavsson & Elander, 2016; Mjörnell et al., 2022). Not safeguarding existing and future tenants' needs can exacerbate mistrust and displace low-income tenants from their neighbourhoods amid increased rents, unsuitable apartments, and new tenants' changing socio-economic status (Gustavsson & Elander, 2016). Van Hoof and Boerenfijn (2018) aimed to create the conditions for vibrant communities and encourage ageing-in-place; new apartment layouts are more spacious, adaptable to changing care needs, and reversible to safeguard new tenants upon vacancies. As tenants' circumstances change, new rental contracts determine price levels according to care and support needs (van Hoof & Boerenfijn, 2018). Gustavsson and Elander (2016) employed and upskilled existing tenants "to work with building, logistics, and transport" (p.18). This

raises the social conditions of the neighbourhood, safeguarding future generations through integration. In these cases, older people's care (van Hoof & Boerenfijn, 2018) and unemployment (Gustavsson & Elander, 2016) are targeted social issues. The reviewed cases suggest that to better safeguard tenants' needs, the retrofit design processes should define, target, and respond to a clear social issue.

4 Development since completing the SLR

Since completion of the semi-systematic literature review (December 2022-January 2023), five new studies meeting the inclusion criteria were identified; they demonstrate both convergence and evolution in understanding participatory social housing retrofit (as shown in Table 6). While strongly validating the review's emphasis on early engagement, communication, and tenant expertise, these studies introduce important theoretical frameworks (retrofit justice, relational economics, co-design dimensions), reveal deeper structural barriers (funding pre-determination, internalised disempowerment, energy poverty persistence), and provide more nuanced guidance (timing social interventions, stress buffering, health-behaviour linkages).

Most significantly, the new research challenges overly optimistic assumptions about participation, showing that even well-intentioned processes can be tokenistic when constrained by funding requirements (Saija et al., 2024), that tenants may feel powerless despite opportunities to engage (Charles et al., 2025), and that retrofit technical success alone cannot deliver justice without broader economic support (Charles et al., 2025; Hashemi & Dungrani, 2025). However, rather than negating the value of participation, these structural barriers underscore the critical need to leverage existing institutional systems and work within organisational frameworks to extend genuine decision-making power to tenants. For instance, Saija et al.'s (2024) finding that funding requirements predetermined technical choices demonstrates the importance of involving tenants during grant-writing phases. Similarly, Santarsiero et al. (2024) suggest a 10-step Integrated Assessment Methodology to systematically integrate social, structural, and energy considerations within assessment protocols, delivering both technical rigor and participatory outcomes.

The articles also reveal unintended health consequences of retrofit including overheating and poor indoor air quality (Hashemi). Additionally, Koops-Van Hoffen et al.'s (2025) finding that wraparound social services (such as debt counselling and referrals) may be most effective after physical renovation is complete suggests that housing providers should strategically sequence different types of tenant support throughout the retrofit timeline.

All five articles affirm that meaningful participation remains essential but requires: (1) genuine decision-making power not just consultation; (2) flexibility to adapt when full co-design is impossible; (3) dedicated facilitators to bridge expert-tenant divides; (4) attention to justice dimensions; (5) integration of health outcomes; and (6) honest acknowledgment of structural constraints. The research demonstrates participatory retrofit is necessary but not sufficient for addressing the intersecting challenges facing social housing tenants.

Table 6 Expansion of the review findings (n = 9, 2002–2022) through five new publications meeting inclusion criteria (2024–2025)

Themes	Sub-Themes	Factors	Contributions from five new publications
External Context	Motivations	Green Transition	- All five new publications
		Human-centered	- All five new publications
		Sustainability	- All five new publications
		Energy justice	- Charles et al., 2025
Retrofit Process	Role of the Housing Association and Cost	Building owner	- Charles et al., 2025 - Koops-Van Hoffen et al., 2024 - Saija et al., 2024 - Santarsiero et al., 2024
		Social landlord	- Charles et al., 2025 - Koops-Van Hoffen et al., 2024 - Saija et al., 2024 (mixed ownership) - Santarsiero et al., 2024
		Partnered with other organisations	- Koops-Van Hoffen et al., 2024 - Saija et al., 2024 - Santarsiero et al., 2024
		Promote social role	- Charles et al., 2025 - Koops-Van Hoffen et al., 2024 - Saija et al., 2024 - Santarsiero et al., 2024
		Part gov. subsidy	- Hashemi & Dungrani, 2024 - Koops-Van Hoffen et al., 2024 - Saija et al., 2024 - Santarsiero et al., 2024
		Funding as a structural constraint	- Saija et al., 2024 - Santarsiero et al., 2024
	Participation	Resident participation	- Charles et al., 2025 (Tokenism vs. genuine participation) - Charles et al., 2025 - Koops-Van Hoffen et al., 2024 (Gendered & intersectional barriers) - Hashemi & Dungrani, 2024 (Survey) - Saija et al., 2024 (Co-design spectrum, participation during grant-writing); - Santarsiero et al., 2024 (Participatory assessment methodology)
	Energy related components	Energy audits	- Hashemi & Dungrani, 2024 - Santarsiero et al., 2024
		Performance gap	- Hashemi & Dungrani, 2024 - Santarsiero et al., 2024 - Charles et al., 2025
		Heating & ventilation	- Hashemi & Dungrani, 2024 (indoor air quality) - Santarsiero et al., 2024 - Charles et al., 2025
		Renewables	- Charles et al., 2025 - Saija et al., 2024 - Santarsiero et al., 2024
		Passive strategies	- Hashemi & Dungrani, 2024 - Santarsiero et al., 2024

Table 6 (continued)

Themes	Sub-Themes	Factors	Contributions from five new publications
Social Impact	Social Inclusion	Residents from marginalised groups	- All five new publications
		Consider residents as experts	- Koops-Van Hoffen et al., 2024 - Saija et al., 2024 - Santarsiero et al., 2024
		Considers use-practice	- Hashemi & Dungrani, 2024 - Santarsiero et al., 2024
		Social mix	- Koops-Van Hoffen et al., 2024 - Saija et al., 2024
		Misrecognition & internalised disempowerment	- Charles et al., 2025 - Saija et al., 2024
	Timing of Engagement	Before design stage	- Saija et al., 2024 - Santarsiero et al., 2024 (assessment phase)
		Timing not mentioned	Early engagement essential: - Charles et al., 2025 - Koops-Van Hoffen et al., 2024 - Saija et al., 2024; - Santarsiero et al., 2024
		Strategic sequencing of social services	- Koops-Van Hoffen et al., 2024 (after completion)
	Feedback Loop	No integrated feedback	- Charles et al., 2025 - Saija et al., 2024
		Integrated feedback	- Hashemi & Dungrani, 2024 - Koops-Van Hoffen et al., 2024 - Santarsiero et al., 2024
		Monitoring	- Hashemi & Dungrani, 2024 - Santarsiero et al., 2024
	Safeguarding Future Residents	Considers residents' futures	- Charles et al., 2025 - Koops-Van Hoffen et al., 2024

5 Recommendations

These findings result from a semi-systematic literature study including a thematic analysis of the resulting tenant participation in social housing retrofit literature. The 12 insights summarise the key research findings from a focus on the three themes: *motivations* of housing associations to retrofit, *the retrofit process,* and *social impact*.

The 12 recommendations presented below distils the insights from the thematic analysis, into actionable guidance for social housing retrofit stakeholders. Each recommendation represents a synthesis of evidence from multiple case studies within the nine reviewed articles, with sub-recommendations reflecting distinct but related findings within each thematic cluster. Recommendations were derived by identifying recurrent findings, challenges, and successful practices across the three themes, then synthesising these into actionable guidance organised by project stage. Where multiple studies demonstrated similar outcomes or highlighted common barriers—such as the importance of early engagement or the role of demonstration dwellings—these converged into specific recommendations. Importantly, most recommendations draw from multiple themes and sub-themes simultaneously, reflecting the interconnected nature of participatory retrofit. For instance, the sub-themes within

Social Impact appear most frequently across recommendations, demonstrating that tenant-centered approaches should permeate all stages of retrofit.

These 12 recommendations integrate technical considerations, including *Energy Related Components*, with the social processes of *Participation* and *Social Inclusion*, and the organisational factors involved in the *Role of Housing Association & Cost* and *Motivations*. This reflects the finding that the success of technological solutions may be contingent on meaningful tenant engagement. While the recommendations are organised chronologically across four retrofit stages—*before retrofit begins, during design, during construction, after completion*—to provide practical guidance for practitioners, the thematic findings themselves cut across these boundaries. These recommendations respond to performance gaps and insufficient tenant participation revealed in the literature, translating thematic insights into concrete actions that housing associations can implement. These recommendations represent the synthesis and insights specific to this body of literature.

5.1 Before retrofit begins

(1) Partnering with other organisations: (i) Promoting different perspectives in decision-making processes, including a design-thinker, enhances integrated approaches and fosters diverse voices. (ii) It is important to define overall ethos and social goals, such as upskilling, particularly in non-hierarchical partnerships.
(2) Cost inclusion: Include future cost-savings from occupied buildings that may otherwise remain empty amidst increasing performance regulations, in cost calculations of participation and retrofit.
(3) Ensure user-centred approaches: (i) Consider social sustainability as important as environmental upgrades. (ii) The legislated green transition prioritises environmental sustainability through energy improvements. To promote social sustainability, add tenant participation in retrofit to legislation. (iii) Consider mandating early allocation of time to integrate tenant feedback, as a condition to receive subsidies. (iv) To change tenants' energy behaviour, apply user-centred design approaches that give tenants decision-making power throughout design. (v) Information campaigns and workshops may not have the desired attendance. Tenants are from marginalised groups, distrust housing companies, and lack homeownership. To increase tenant involvement, their decision-making power should also increase. (vi) Always consider social inclusivity—language barriers, equality, diversity, and inclusion (EDI), and representation within all stakeholders.

5.2 During retrofit design

(4) The retrofit infrastructure: (i) Useability of the infrastructure cannot be an afterthought but must be integrated and evaluated by tenants through continuous, structured feedback. For example, control locations. (ii) Cooler European climates should learn from the passive strategies of warmer climate retrofits amid rising temperatures. (iii) Prioritise passive retrofit strategies, supported by mechanical systems.
(5) Consider tenants as experts: (i) Employ design-thinking for technical products to increase useability. (ii) Identify non-technical energy saving opportunities, including easily

operable natural ventilation, by exploring how tenants live. (iii) Utilise non-technical, non-energy related upgrades that improve overall wellbeing, such as communal spaces and flexible layouts.

(6) Collecting information from tenants: (i) Hold meetings at various times of the day. (ii) Obtain tenants' 'needs and wishes' (van Hoof & Boerenfijn, 2018, p.7) through workshops, alongside inclusive, non-technical written exercises in multiple languages. These can also be placed in communal spaces and individual post boxes. (iii) Access as many tenants as possible. Early tenant engagement through various channels of communication and workshops can reduce delays and costs, and increase project awareness, understanding, and proper use, raising sustainable outcomes.

(7) Social mixing: (i) Create the conditions for integration, such as young tenants helping older tenants. (ii) Ensure new and existing tenants are engaged in the design process and decision-making throughout retrofit. (iii) Alternatively, focus efforts on integrating existing tenants through education, employment, language, and other qualities.

(8) Integrating tenant feedback into design: (i) integrate a feedback loop where stakeholders can respond to retrofit design at all stages. This brings tenants along the journey, offers opportunities to educate and compromise, and builds trust between tenants and housing companies. (ii) Demonstration dwellings better assist when used early, to integrate suggestions and evolve as a participatory tool.

5.3 During retrofit construction

(9) Skilled labour: (i) Technical errors can greatly impact take-back, rebound, and error-searching time and cost. Greater passive strategies could in-part mitigate this risk but retrofit must be performed by specialised, skilled workers. (ii) Occupied apartments during retrofit are furnished and may be cluttered. Contractors require social skills unnecessary during new build construction and need upskilling. (iii) The current skills shortage is an opportunity to upskill unemployed tenants and can be supported by other schemes and funding (Gustavsson & Elander, 2016).

(10) Stakeholder communication: (i) Embed honest and regular communication for queries, discussion, and updates, from the start of engagement between all stakeholders. This promotes good stakeholder relationships, manages expectations, communicates changes, reduces time taken to troubleshoot problems, and increases trust. (ii) Include on-site reference points for tenants to approach contractors. (iii) Use demonstration dwellings dynamically, to illustrate construction changes.

5.4 After retrofit completion

(11) Retrofit in-use: (i) Operation and maintenance strategies should include user manuals, designated energy agents from within the building tenants, and an external contact person. (ii) Hands-on advice and training should occur in tandem with monitoring tenant interaction with technologies and user-behaviour to help alleviate the performance gap. Sometimes, simple fixes can correct low performance, such as misuse of certain

technologies, turning off a switch, or blocking vents. (iii) Energy monitoring should be used to identify and fix outliers and apply feedback to future projects.

(12) Prepare the tenants: (i) Energy agents from within existing tenants can reduce technology misuse and provide a new social role within the forging community. Contractors need only respond to more challenging issues. (ii) When social mixing occurs, continually aid the transition with activities to promote the housing association's social role.

The thematic analysis revealed important patterns within these nine studies, illustrated in Table 7. Firstly, environmental sustainability is more thoroughly examined and implemented than social benefits of retrofit: recommendations derived from *Energy Related Components* connect to fewer recommendations. This supports Kristoffersen et al. (2024) and Rodger et al.'s (2020) findings that energy performance is more highly prioritised in retrofit practice than social outcomes, and therefore better researched, implemented, and achieved. Secondly, the findings demonstrate that *Participation* influences large numbers of recommendations, seemingly bridging the divide between process and social impact—participation can lead to greater social inclusion but should be deeply integrated into the retrofit process itself. Thirdly, the prominence of *Safeguarding Future Tenants* (facilitating 14 recommendations) demonstrates that participatory retrofit should prepare for future occupants and changing conditions including climate change, technology evolution, and demographic shifts. Fourth, *Timing of Engagement* and *Feedback Loop* appear together frequently (in recommendations 3(iii), 3(v), 4(i), 8(i), 8(ii), 10(i)), revealing that engagement should occur within the project stages that allow tenants' feedback to be integrated; if tenant engagement occurs after key technical and design decisions have already been made, it risks becoming tokenist. The finding that "time not spent in the design phase became time spent later" (Boess, 2022) underscores that early participation can be cost-effective as well as ethically sound. Fifth, *Social Inclusion* connects to the most recommendations (16), appearing across all four project stages. This pattern indicates that integrating marginalised tenant needs and situated knowledge (Haraway, 1988) is not a one-time task but should be maintained throughout the entire retrofit process—from partnership formation to post-completion support. Finally, while *Motivations* appear in only six recommendations concentrated in the *Before Retrofit Begins* stage, this suggests that institutional motivations and values set the foundation for participatory retrofit. However, it must be operationalised through specific process mechanisms (*Participation, Feedback Loop*) and social considerations (*Social Inclusion, Safeguarding*) to achieve meaningful outcomes. Taken together, these patterns reveal that most recommendations (especially 3(v), 4(i), 10(i)) draw from four sub-themes simultaneously, reflecting that effective participatory retrofit should not compartmentalise technical, social, and organisational considerations. They should be integrated holistically.

6 Conclusions

This semi-systematic review of nine articles regarding social housing retrofit with tenant participation, since 2002, explored the *motivations* of housing companies to retrofit, how the *retrofit process* was approached, and the *social impact* of retrofit decisions. The analysis has revealed that insufficient tenant participation was associated with detrimental sustainability outcomes, including performance gaps and exacerbated social issues that increased costs.

The findings from these cases suggest potential approaches to engage tenants in social housing retrofit processes at multiple stages: *before retrofit begins, during retrofit design, during retrofit construction,* and *after retrofit completion*. Across the reviewed literature, tenant participation during and after construction was limited because most decision-making processes were completed before construction. Therefore, the reviewed research findings were weighted towards design processes, which may reflect both the focus of published research and the practical reality of retrofit timelines.

This review addressed its central research question—*what is the current state of knowledge on tenant participation in social housing retrofit, and what factors enable or constrain meaningful tenant engagement throughout the retrofit process?*—by synthesising findings from nine studies into a thematic framework organised across project timelines. The analysis revealed that the current state of knowledge demonstrates variation in how tenant participation is implemented: enabling factors include early engagement, clear institutional motivations, dedicated facilitators, and integration of tenant expertise; and constraining factors include legislative requirements prioritising profit over social outcomes, funding structures that predetermined technical choices, insufficient time allocated for participation, and tokenistic consultation processes. The thematic analysis addressed the study's three research sub-questions by viewing findings through the lens of decision-making power across time. Regarding the first sub-question—what motivates housing associations to engage tenants in retrofit processes—the analysis identified that housing associations were primarily motivated by meeting green transition targets, with human-centred motivations and social sustainability emerging as secondary drivers. These motivations predominantly shaped decisions in the *before retrofit begins* phase, establishing the foundation for participatory processes. The second sub-question—how and when tenants should be integrated into retrofit decision-making to enhance holistic sustainability outcomes—was addressed through the staged framework itself. The reviewed literature demonstrated that early engagement during the *before retrofit begins* and *during retrofit design* phases afforded tenants greater decision-making power and better aligned technical solutions with tenant needs. Participation opportunities *during construction* and post-completion phases were more limited, however, but still important for safeguarding outcomes. The third sub-question—what social impacts does retrofit have on stakeholders when tenant participation is prioritised—was answered through the identification of four sub-themes (social inclusion, timing of engagement, feedback loop, and safeguarding future tenants) that emerged across all project stages. This revealed that meaningful participation can enhance tenant trust, reduce displacement risks, and improve technical performance and social sustainability; these benefits do, however, depend critically on the quality and timing of engagement.

The conceptual framework developed from these nine studies could be tested in future retrofit case studies with tenant engagement, including integrated feedback mechanisms and tenants' information collection through surveys and focus groups. The literature also suggests that facilitating social mixing through organised events within newly retrofitted social housing warrants practical testing.

The 12 recommendations distilled from this review offer social housing retrofit stakeholders' strategies to encourage tenant participation in decision-making throughout four project stages: *before retrofit begins, during retrofit design, during retrofit construction,* and *after retrofit completion*. Based on the reviewed cases, early and sustained tenant participation can streamline retrofit design and construction processes, increase holistic sustainabil-

Table 7 Table of recommendations and associated sub-themes

Recommendation	External Context	Retrofit process		Social impact				
	Motivation	Role of the HA & Cost	Participation	Energy related components	Social Inclusion	Timing of Engagement	Feedback Loop	Safe-guarding Future Residents
Before Retrofit Begins								
1 (i)		✓	✓					
1 (ii)	✓	✓			✓			✓
2	✓	✓						
3 (i)	✓	✓						
3 (ii)		✓	✓					
3 (iii)		✓	✓			✓	✓	
3 (iv)	✓		✓		✓			
3 (v)			✓		✓	✓	✓	
3 (vi)					✓	✓		✓
During Retrofit Design								
4 (i)			✓	✓		✓	✓	
4 (ii)				✓				✓
4 (iii)				✓				
5 (i)			✓	✓	✓			
5 (ii)				✓	✓			
5 (iii)	✓				✓			✓
6 (i)					✓	✓		
6 (ii)			✓		✓	✓		
6 (iii)			✓		✓	✓		
7 (i)					✓			✓
7 (ii)			✓			✓		✓
7 (iii)					✓			✓
8 (i)			✓			✓	✓	

Table 7 (continued)

Recommendation	External Context	Retrofit process		Social impact				
	Motivation	Role of the HA & Cost	Participation	Energy related components	Social Inclusion	Timing of Engagement	Feedback Loop	Safe-guarding Future Residents
8 (ii)			✓			✓	✓	
During Retrofit Construction								
9 (i)				✓			✓	
9 (ii)			✓		✓			
9 (iii)	✓				✓			✓
10 (i)		✓	✓			✓	✓	
10 (ii)			✓				✓	✓
10 (iii)							✓	
After Retrofit Completion								
11 (i)								✓
11 (ii)				✓			✓	✓
11 (iii)				✓			✓	✓
12 (i)					✓			✓
12 (ii)					✓			✓
TOTAL (of 34)	6	7	15	8	16	11	11	14

ity, and reduce future problems from performance gaps, use-practice, and tenant distrust. While stakeholder involvement varies at different project stages, the reviewed literature consistently positioned tenants as expert stakeholders whose involvement should be maintained throughout the process. The five subsequent studies meeting the inclusion criteria (see section four) validate these recommendations while also revealing that structural barriers—including funding constraints, tenant disempowerment, and energy poverty—can limit the effectiveness of even well-implemented participatory processes. This suggests that the recommendations alone may not be enough to overcome the systemic challenges facing social housing tenants.

The reviewed case studies demonstrated that effective retrofits are context specific, accounting for variations in language, culture, climate, institutional context, and building infrastructure. Infrastructure choices in these cases depended on local conditions, the state of disrepair, climate requirements, and striking a balance between active and passive strategies. Across diverse geographical and institutional contexts, building trust between tenants and property owners remains imperative, with the reviewed literature emphasising early and deliberate engagement practices that prioritise the unique needs of marginalised groups of tenants.

7 Limitations

The key aim of this search was to identify patterns in tenant participation of social housing retrofit. The examined literature resulted from a meticulous methodology integrating synonyms and alternate spellings in keyword permutations (Table 1). Some references could have been missed, however, including those published in highly specialised journals or in languages other than English and Spanish. The search was also limited to European contexts; therefore, participatory retrofit practices operating under different regional policy frameworks, housing tenures, and cultural norms are not represented. The analysis was undertaken on selected themes and could not take contextual differences, including legal context and climate challenges across countries, into account. The reviewed cases were initiated since the 2002 EPBD, reflecting the current dominance of energy-driven funding and legislation in retrofit practice. While present in some reviewed cases, broader retrofit dimensions including structural fabric, accessibility, materials, and lifecycle considerations remain underrepresented relative to energy-focused interventions in the participatory retrofit literature. This represents a gap for future research as retrofit agendas broaden beyond decarbonisation targets. This review is based on nine papers; therefore, the findings cannot be generalised beyond the specific contexts examined. The recommendations represent patterns identified within this limited corpus rather than universal principles. Throughout the search process, a conscious effort was dedicated to maintaining objectivity.

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Declarations

Conflict of interest The authors declare no competing interests.

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