PEER REVIEWED

FINAL REPORT NO. 397

Sustainable social housing retrofit? Circular economy and tenant trade-offs

From the AHURI Inquiry: Inquiry into housing in a circular economy

Authored by

Emma Baker, University of Adelaide
Trivess Moore, RMIT University
Lyrian Daniel, University of Adelaide
Rachel Caines, University of Adelaide
Hector Padilla, RMIT University
Laurence Lester, University of Adelaide

Publication Date May 2023
DOI 10.18408/ahuri3128301

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Title

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Authors

Emma Baker, University of Adelaide
Trivess Moore, RMIT University
Lyrian Daniel, University of Adelaide
Rachel Caines, University of Adelaide
Hector Padilla, RMIT University
Laurence Lester, University of Adelaide

ISBN

978-1-922498-65-6

Key words

Social housing, rental, retrofit, sustainability, circular economy.

Series

AHURI Final Report

Number

397

ISSN

1834-7223

Publisher

Australian Housing and Urban Research Institute Limited
Melbourne, Australia

DOI

10.18408/ahuri3128301

Format

PDF, online only

URL

https://www.ahuri.edu.au/research/final-reports/397

Recommended citation

Baker, E., Moore, T., Daniel, L., Caines, R., Padilla, H. and Lester, L. (2023) *Sustainable social housing retrofit? Circular economy and tenant trade-offs,* AHURI Final Report No. 397, Australian Housing and Urban Research Institute Limited, Melbourne, https://www.ahuri.edu.au/research/final-reports/397, doi: 10.18408/ahuri3128301.

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Acknowledgements

This material was produced with funding from the Australian Government and state and territory governments. AHURI Limited gratefully acknowledges the financial and other support it has received from these governments, without which this work would not have been possible.

AHURI Limited also gratefully acknowledges the contributions, both financial and in-kind, of its university research partners who have helped make the completion of this material possible.

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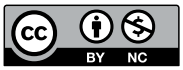

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Acronyms and abbreviations used in this report

ACT	Australian Capital Territory
AHURI	Australian Housing and Urban Research Institute Limited
AIHW	Australian Institute of Health and Welfare
CE	circular economy
CHPs	community housing providers
DCE	discrete choice experiment
HEEUP	Home Energy Efficiency Upgrade Program
NatHERS	Nationwide House Energy Rating Scheme
NCC	National Construction Code
NSW	New South Wales
RQ	research questions

Glossary

A list of definitions for terms commonly used by AHURI is available on the AHURI website ahuri.edu.au/glossary.

Executive summary

Key points

- **Retrofit is often used as a strategy to improve dwelling performance but often not linked to minimum quality and dwelling condition considerations.**
- **There is limited understanding of what tenant households prioritise for quality, condition and performance—and tenants' retrofit preferences are different to the priorities of housing providers.**
- **Recipients of retrofit programs prioritise liveability and affordability over energy efficiency and circular economy (CE) considerations.**
- **Social housing providers face challenges to balance their business obligations with their social obligation to help their residents.**
- **Retrofit program objectives are rarely explicit, and vary greatly between stakeholders.**

Key findings

To a significant extent, the focus of retrofit activity in the housing market has been driven by circular economy (CE) sustainability goals. As a result, retrofit interventions have focussed on energy efficiency, alternative energy technologies, construction waste, and extending the life of dwellings, thereby overlooking the fact that many people in our community lack access to even a basic quality of housing; for example, a home that is safe and warm, that doesn't leak when it rains, and that supports the daily functions of cooking or cleaning. Furthermore, sustainability focussed retrofitting has largely been piecemeal and applied to individual dwellings. This has limited consideration of the scale, process and systematic industry and innovation opportunities for delivering large-scale retrofit that would support a circular economy approach across all social housing.

- The discrete choice experiment (DCE) found that households' preferences for housing retrofit and upgrade options did not necessarily align with evidence of optimal retrofit priorities, nor with the activities which receive funding (except for solar panels).
- The interventions often found to have the highest cost-benefit outcomes, such as draft sealing and ensuring appliances are operating efficiently, were not preferred. Often these options are less 'visible' and the benefits may not be immediately evident or well communicated to householders.

- Consumer households' preferences are at odds with typical activities associated with CE objectives, for instance, the low-cost, high-impact activities aimed at improving the life-span and performance of the existing dwelling and appliances.
- Social housing providers face challenges to balance their business obligations with their social obligation to help their residents. They must maintain what is often poor-quality dwelling stock, improve it, build more—and remain within their budgets. These competing obligations are fundamental, and although there is ambition to embrace environmental sustainability and CE, these are secondary considerations. One panel participant provided an example to illustrate this. In a recent new build development, they had '*hoped we would have enough surplus to build 6 star, but with a smaller surplus* [due to the recent rise in construction costs] *we just do the best we can*'.
- Social housing providers also rely on access to tied government funding to maintain or improve the quality of their stock—the structure and timing of this funding was raised by many panel participants. It was noted that such government programs were central for retrofit and upgrades to their housing stock, but that this funding was often 'themed', so that retrofit activity in the sector is largely driven by the themes of funding available (rather than, for example, tenant requirements, the specific needs of a housing provider's dwelling stock or CE considerations). In addition, tied, themed funding may be designed to have impacts beyond the housing system, and may have a 'rapid spend' requirement. This limits the types of retrofit that can be achieved to 'quick won' interventions that may not be maximally beneficial to tenants.
- Retrofit program objectives are rarely explicit, and vary greatly between stakeholders. Social housing providers may be largely motivated to help their tenants avoid energy poverty, industry groups seem principally focussed on sustainability outcomes, and many tenants' main motivation is improving the liveability of their home. These different, and often competing, objectives obviously limit successful outcomes. However, industry advice designed around sustainability could form the basis of a government funded program where cost effectiveness is prioritised. Social housing providers could use this funding to reduce the energy costs of their tenants, and the tenants would value the program because of their improved living environment.

This research project aimed to capture the preferences and retrofit trade-offs of tenants, and present them to key stakeholders, to explore retrofit practice and implementation and make explicit the role of (and contribution to) CE practices. Reflecting on the findings of this project, the research has also revealed the complex, conflicted, and largely invisible underlying structure of retrofit policy and action.

Discussion of retrofit policy assumes that stakeholder groups have shared goals, but that is not the reality. Retrofit, at least in the social housing sector, is a relatively haphazard process, guided by good, but often conflicting, intentions. In addition there is a role for governments in coordinating large scale retrofit action (with or without CE aims) that is yet to be realised.

Policy development options

Considering the policy implications, it is noteworthy that, for the majority of panel participants (representing policy makers, social housing providers and industry), tenant preferences were both surprising, and largely unknown. This indicates that a systematic tenant voice (and tenant preferences) has, to date, rarely been included in existing retrofit activities. The inclusion of at least some acknowledgement of tenant preferences in the development of any social housing retrofit interventions would shift the focus of assistance (and the desired outcomes) towards basic liveability.

One of the main insights provided by the panel discussions was the (largely invisible) mismatch of retrofit ambitions between different stakeholders—social housing providers, industry, government agencies, and tenants. Acknowledgement of this mismatch and a more explicit statement of aims by all stakeholders is a valuable outcome of this research. While the policy implications of an alignment of retrofit ambitions are unclear, it would provide coordinated guidance to outcomes.

Related to an alignment of stakeholder retrofit ambitions, the current structure of retrofit funding is also uncoordinated, reactive and detached from long term systematic CE framing. A longer term funding pathway for social housing retrofit and quality upgrades would give social housing providers a clearer direction and allow for more considered and nuanced responses.

The study

This project is undertaken as part of a broader Inquiry into housing and the circular economy.

There is growing awareness in the policy community of overlapping public health concerns, variable housing quality and conditions in both new build and existing stock, climate change, and increasing cost of living pressures. To address these concerns, recent work has been undertaken to progress minimum standards, as well as the sustainability and performance of Australian housing. While much of the focus of this work has occurred in the privately owned and rented parts of the housing market, social housing presents some intrinsic challenges that have not yet been well considered.

This study provides a basis for our understanding of retrofit in the social housing sector. It intentionally looks beyond the relatively narrow consideration of energy efficiency, to respond to the broader requirements of the social housing sector—to incorporate and balance tenant needs with provider mandates, budgetary limitations, and wider social policy.

Conducted between 2021 and 2022, the project initially undertook a guiding review of existing standards and policy considerations driving social housing retrofit from a sustainability and minimum quality perspective. The focus was primarily on Australia but also included leading international examples identified in the wider literature. Building upon this knowledge, the project then explored how state housing authorities and community housing providers balance CE goals with decisions about retrofit, scale, minimum standards and tenant need.

In the third phase of the project a housing survey and choice modelling (DCE) experiment was used to understand households' preferences and prioritisation of different retrofit options by importance and potential impact. This survey captured essential information on tenant experience and the retrofit priorities of likely program recipients. The final phase of the project brought together expert social housing retrofit stakeholders from government, social housing providers, peak bodies, and industry associations to reflect on findings from the DCE, and the implications for social housing retrofit.

1. Introduction

- **The existing social housing stock in Australia has variable quality, condition and sustainability performance.**
- **Poor quality and performance of housing has a range of negative impacts on occupant liveability, health, wellbeing, and cost of living.**
- **Retrofit is typically proposed as a strategy to improve dwelling performance, but is often not linked to considerations of minimum quality and dwelling condition.**
- **Some states have started to introduce requirements for minimum standards for rental housing stock in Australia.**
- **There is limited understanding of what tenant households prioritise for quality, condition and performance.**

1.1 Why this research was conducted

There is an increasing global focus on transitioning towards a circular economy (CE). To date, CE within the built environment has focused on reducing the environmental impact of buildings through the design, construction and end-of-life phases of the building, closing the loop between extraction and use of resources, and their disposal or reuse (Marchesi and Tweed 2021; Iyer-Raniga and Huovila 2021). Proponents of CE have identified significant opportunities within the existing housing sector to improve outcomes during the life of the dwelling as well as at end-of-life. Retrofit has been seen as a key strategy to improve the performance and life of a dwelling. However, there are concerns that retrofit programs in countries like Australia have largely been focused on technological solutions, and higher socio-economic households, who could typically afford to undertake sustainable retrofit. Low-income renting households have been overlooked, especially those in the social housing sector.

Australia's social housing sector provides shelter and a place to live for around 300,000 households (Productivity Commission 2020) and approximately 785,000 individuals across 419,000 dwellings (AIHW 2019). The social housing stock presents a number of critical challenges—it represents some of the poorest-quality and unhealthiest housing in Australia, which has a range of negative implications for social housing tenants, policy makers and the wider community (Baker et al. 2016; Daniel et al. 2020; Sullivan 2016).

The quality and condition of social housing is extremely variable, and poor energy efficiency and relative 'un-healthiness' are well-documented (Andersen et al. 2018; Baker et al. 2019; Kenley et al. 2010; Moore et al. 2017). Low-income households are more likely to rely on inefficient appliances to heat and cool their homes (or lack the appliances altogether); have gaps around windows and doors that reduce the efficacy of building envelopes; and be living in uninsulated homes (ACOSS 2013). The Australian Institute of Health and Welfare's Social Housing Survey found widespread tenant concerns around heating, energy efficiency, security and safety (AIHW 2019). There are also problems with the provision of 'minimum' elements within low-income housing such as the provision of blinds or curtains for windows. Compounding these issues, social housing tenants often do not have the legal right or financial means to modify their homes to resolve these issues (Daniel et al. 2020).

Retrofitting, or upgrading, existing social housing stock has been proposed as a cost-efficient solution to concerns around energy efficiency, thermal performance, and quality issues. Retrofitting may enable social housing providers to meet their responsibility to provide 'affordable, safe and sustainable' housing to tenants (Commonwealth of Australia 2015) through the reduction of vulnerability to energy poverty (Daniel et al. 2020). Retrofitting may also be able to address other tenant priorities such as increased physical security (AIHW 2019), as well as managing the costs and supporting (or improving) the health and economic productivity of tenants.

The social housing sector, due to its size and importance, provides an opportunity to drive improved housing outcomes—not just for social housing tenants, but also as a demonstration pilot for retrofit and CE transition across the housing system. There is currently no systematic roadmap to guide a large-scale retrofit of the social housing sector—this report provides that roadmap.

The research was informed by four key research questions (RQ), designed to deliver knowledge and practical guidance to policy stakeholders, social housing providers, and the retrofit sector:

- **RQ1:** What acceptable standards and minimums frame retrofit decisions for the social housing sector?
- **RQ2:** What are retrofit priorities, options and limitations for social housing providers?
- **RQ3:** What are the retrofit priorities and trade-offs for tenants?
- **RQ4:** Which retrofit interventions should be prioritised, and how can they be operationalised, effectively bundled, and delivered 'on-the-ground' at scale? and what are the opportunities for broader translation to the private rented and owned stock?

1.2 Policy context

Motivated by awareness of public health concerns, building quality problems in both new build and existing stock, climate change, and increasing cost of living pressures, there has been a gradual policy shift in Australia towards acknowledging the quality, condition and energy efficiency of new and existing dwellings. This policy discourse has focussed on two key areas in existing housing: the setting of minimum standards, and retrofitting to improve sustainability and performance, to deliver suitable housing for a low carbon future. A similar policy shift has occurred internationally.

The minimum legal requirements for Australian housing are set within the National Construction Code (NCC) with governance split across national and state government jurisdictions. The introduction of the Nationwide House Energy Rating Scheme (NatHERS) in the early 2000s provided a framework to establish minimum performance requirements in new housing. While different states began to introduce their own minimum performance requirements, this was standardised across Australia in the 2010 NCC revision with the introduction of a 6 star standard—based on a model of predicted thermal energy a house requires to maintain thermal comfort—and performance is rated on a scale of 0 (worst) to 10 star (best) (Law 2021; Moore et al. 2019).

In 2022 the NCC was revised so that from mid-2023 all new housing was required to meet a 7 star minimum. This minimum requirement exists alongside older requirements for suitable insulation, sealing of the building, air movement, air-conditioning and ventilation, glazing, and access to a heated water supply (Williamson 2000).

The thermal comfort and energy efficiency requirements of the NCC are supplemented by varied residential tenancies legislation in each of the Australian states and territories (as detailed in Appendix 1). Currently, this legislation prescribes the minimum standards required for Australian residential properties, including rental properties, in each state. Notably:

- Only four states (NSW, South Australia, Tasmania, and Victoria) mandate minimum standards for rental properties that include thermal comfort and/or energy efficiency measures.
- Each state requires adequate ventilation in all residential properties (including social housing).
- Both the Victorian and Tasmanian *Residential Tenancies Acts* require properties to have functional heating, though there are minimal energy efficiency standards attached to these.
- NSW requires water efficiency measures in private rental properties, but social housing tenants are excluded from these requirements.
- Both South Australia and Victoria require residential properties to be free from mould and damp, with South Australia also requiring properties to be draft proof and weatherproof.
- The ACT, Northern Territory, Queensland, and Western Australia do not currently have set minimum standards for the condition of residential housing, beyond it being safe and in a reasonable state of repair and cleanliness.

As an international comparison, the New Zealand Residential Tenancies Act has stricter requirements—for example, all rental properties must have a minimum level of ceiling and underfloor heating (as required by the Building Code), a fixed heating device capable of achieving a minimum temperature of 18°C in the living room, draft proofing, and adequate ventilation.

Despite inconsistencies between states and territories, the residential tenancies legislation, along with the NCC, specify the minimum standards expected in residential housing. Where pre-existing housing stock does not meet these requirements, retrofitting may be undertaken to upgrade building elements to meet minimum conditions, however there is rarely a mandated requirement to do so.

In the past two decades, a number of policies and interventions have been introduced to improve the quality of Australia's privately owned stock through retrofitting. The Energy Efficient Homes Package: Housing Insulation Program was the largest of these programs, providing ceiling insulation to 1.2 million Australian homes between 2009 and 2010 (Hanger 2014). Although no national program on such a scale has been reattempted, smaller, state-based interventions have continued over the past decade, although a change of Australian Government in May 2022 may see a change in approach.

Many of these programs provide financial rebates, grants or loans to encourage energy-efficient retrofits (the Tasmanian Energy Efficiency Loan Scheme, the Victorian Energy Efficiency Target, the South Australian Residential Energy Efficiency Scheme, and the Northern Territory Home Improvement Scheme). These schemes focus on small upgrades such as updating lighting, air-conditioning or heating, replacing showerheads and hot water systems, or sealing and refurbishing windows and doorways—often in line with requirements of the Residential Tenancies Acts and current NCC.

To a significant extent, the focus of the retrofit activity encouraged by these programs has been driven by the sustainability goals of the CE. As well as improving the thermal comfort and condition of the housing stock, government-supported retrofit policies typically prioritise environmental sustainability in process and outcome, reduce carbon emissions and waste, and encourage the reuse of materials where practical.

Currently, the construction industry is responsible for one-third of global CO_2 emissions and produces 35 per cent of the global economy's waste (IPCC 2014; Maqsood et al. 2020). CE proponents in the housing and construction sectors aim to transition from a traditional linear economy model (make – use – dispose) to a closed, circular model that promotes recycling, reuse, and refurbishing to reduce waste and maximise the value of material resources (Marchesi and Tweed 2021; Clarion Housing 2018).

The implementation of a CE has traditionally focused on technological solutions, though there has been an increased focus in recent years on changes in user behaviour and social practices (Ceschin and Gaziulusoy 2016). This is evidenced in Australian policies relating to housing retrofit and energy-efficiency improvement—most prioritise technological and material improvements, but some also include strategies to educate households about energy efficiency and sustainability.

When applied to social housing, CE housing retrofit and energy efficiency policies have two key challenges.

1. CE thinking has, to a large extent, overlooked the fact that many living in social housing (and some in the private sector) lack access to even a basic quality of housing; for example, a place that is safe and warm, that doesn't leak when it rains and that supports the daily functions of cooking and cleaning (Daniel et al. 2019). Instead, these policies tend to prioritise energy-efficient upgrades (LED lighting, improving hot water systems), which although important in improving energy efficiency of homes, do not address key concerns about social housing quality.

   The NSW Home Energy Action Program, for example, provided discounts to eligible low-income households to purchase energy efficient whitegoods or assist Community Housing Providers (CHPs) to provide energy efficiency upgrades to properties. As many social housing dwellings in Australia are older (built pre-2010 standardisation of NCC Energy Efficiency requirements), problems with draft proofing and weatherproofing, insulation and window glazing, and functional temperature control systems may be more severe and more expensive to fix, and less likely to be mitigated by schemes targeting energy efficiency alone.
2. Sustainability focused retrofit activity has, to date, largely been piecemeal and focused on individual dwellings, and also, government policies have overlooked or not considered the needs of the social housing sector.

In some cases (such as the second stage of the NT Smart Cooling in the Tropics program), social housing tenants were actively excluded from interventions aimed at improving energy efficiency, despite recognised need and interest from the sector. The initial stage of the SA Beat the Heat! program (part of the Low Income Energy Efficiency Program 2013–2016) excluded community housing, but later included community renters due to the lack of initial participants (Uniting Communities 2016).

In other cases, social housing is included in policies targeting low-income households generally (including those in the private rental market), such as the Energy Efficiency Improvement Scheme (ACT) or the Victorian Home Energy Efficiency Upgrade Program (HEEUP) (2014–2016). Only 22 per cent of participating households in the HEEUP—intended to help low-income households to purchase a more efficient hot water system by providing independent information, a subsidy, and a low interest loan—were from community housing, compared to 71 per cent of upgrades occurring in low-income owner-occupier households (Halldorsson et al. 2020; Sullivan 2016).

The majority of policies specifically focused on the social housing sector target the construction of new dwellings, though some of these also extend to retrofitting older housing stock (such as the Clean Energy Finance Corporation Community Housing Program).

These challenges to retrofitting and energy efficiency policies reflect the lack of an overarching strategy for retrofitting and CE in the social housing sector. With rapidly increasing cost of living pressures, there is an urgent policy need to address housing quality, not just in social housing, but throughout the housing sector.

1.3 Existing research

While the introduction of the minimum NCC requirements has helped lift the quality and performance of new housing, they still fall short of what is required for a low carbon future, and there are significant issues across the industry in ensuring that the minimum quality and performance are even delivered.

For example, CSIRO analysed the condition of recently constructed dwellings by evaluating airtightness and insulation quality for a sample of 125 existing houses (up to 10 years old) assumed to have been built to a 5 or 6 star minimum. The results demonstrated more than half the houses tested fell short of target airtightness levels and some demonstrated outcomes expected of older dwellings constructed before any regulations were introduced. Additionally, the research found that elements such as insulation were not correctly installed in a significant percentage of dwellings—evidencing compromised quality and performance of the housing stock.

As well, before the early 2000s there were limited quality and performance requirements for building new housing, so the scale of the issue is vast. Research by Sustainability Victoria (2019) estimates that housing built between 1990–2005 in Victoria averages around 3 stars, and housing built before 1990 averages around 1.5 stars, highlighting the problem of the quality and energy efficiency performance of existing Australian housing. Their research of various retrofit activities found that there are multiple opportunities to significantly improve the quality and performance of existing housing with payback periods of less than 20 years.

The existing research on retrofit has typically focussed on the energy performance of the dwelling and overlooked the household or social impacts. The public health concern around morbidity and quality of life associated with poor housing conditions also needs consideration. The link between housing and individual physical and mental health and wellbeing is well established (Howden-Chapman and Wilson 2000; Phibbs and Thompson 2011; Beer et al. 2011; Dockery et al. 2013; Baker et al. 2016).

Poor housing conditions have been shown to negatively impact occupants' respiratory health (Free et al. 2010), along with cardiovascular disease (Clinch and Healy 2000), children's health (Gifford and Lacombe 2006), and general physical and mental health (Howden-Chapman and Wilson 2000; Pevalin et al. 2017).

Despite our mild climate, more Australians die each year from exposure to cold than exposure to heat (Daniel et al. 2019). Older housing stock in Australia provides limited protection against the cold due to poor thermal building standards (Moore et al. 2019), while messaging around temperature in homes tends to focus on protection from the risks of extreme heat, rather than cold (Daniel et al. 2019).

Many of these pre-existing issues and housing inequalities have been exacerbated by the economic and social impacts of COVID-19 (Horne et al. 2020; Baker et al. 2020). The growing awareness of housing quality as a health issue, as well as a social and economic issue, has led to an increased policy focus on improving the condition of Australia's housing stock, particularly with regard to thermal comfort and energy efficiency.

As well as often being poor quality and unhealthy, social housing dwellings are often significant carbon emitters due to their inefficient heating and cooling systems, and inadequate insulation. Retrofitting projects, using a CE approach, reduce carbon emissions and improve energy efficiency, while improving building quality, occupant satisfaction and physical and mental health.

Recent CE programs in the social housing sector have primarily focused on optimising building longevity, maximising material reclamation, and developing adaptable technological assets to improve housing stock quality (Marchesi and Tweed 2021).

Clarion Housing and KHL Sustainability worked together to implement CE principles in the Merton Regeneration project, which provided 2,800 new homes in Wimbledon, London and involved the demolition of 1,000 homes and repurposing of their materials. This project created new, quality social housing to regenerate a social housing neighbourhood, while reducing waste, carbon emissions, and project costs through a CE approach (Clarion Housing 2018). Similarly, Danish architectural company GXN collaborated with 60 Danish companies on the Circle House Project (2020), using a CE focus to build 60 housing units in Lisbjerg, Denmark. The project sought to ensure that 90 per cent of all building materials could be reused, integrating the principles of design for disassembly and circularity into the design.

Importantly, both projects adopted a CE approach throughout the building process, rather than focussing on creating energy efficient and high quality homes to benefit occupants (although this was also an outcome).

1.4 Research methods

Aligned with the four research questions, this project was undertaken in four interlinked work packages: synthesis of current policies and literature (RQ1); semi-structured policy stakeholder interviews (RQ2); a discrete choice experiment (DCE) survey (RQ3); and an expert policy maker and industry panel and focused interviews (RQ3; RQ4).

1.4.1 Review of existing research and policy

A desktop review of existing standards and policy considerations driving social housing retrofit from a sustainability and minimum quality perspective was undertaken. The focus was primarily on various Australian jurisdictions, but also included leading international examples identified in the wider literature. Key policy documents were identified by an online search of the peak policy department and key social housing bodies in each jurisdiction. This was augmented with a wider search of the academic literature using key search engines such as ProQuest, ScienceDirect, Scope and SpringerLink and then cross checked with a Google Scholar search to identify any additional relevant literature. Key search terms included 'social housing', 'minimum quality', 'minimum standards' and 'retrofit'. This resulted in an initial synthesis report which mapped the current context for existing research and policy for social housing retrofit and quality in Australia. The review also identified a number of retrofit and upgrade opportunities as an initial starting list for work package 3.

A series of brief interviews with research experts was undertaken to reflect on the findings of the initial policy and research review. The findings from the initial synthesis review and subsequent supporting interviews informed the other work packages and was the basis for the discussion paper developed for work package 2. The review of the literature and existing policy documents led to the synthesis presented in Section 1.2 and 1.3 above and in Appendix 1.

1.4.2 Semi-structured interviews

Addressing research question 2, this component focused on the 'on-the-ground' operationalisation of social housing retrofit programs. The discussion paper developed in work package 1 was provided to key social housing stakeholders for comment and feedback.

These interviews explored how state housing authorities and community housing providers balance CE goals with decisions about retrofit, scale, minimum standards and tenant needs. A specific focus was allocated to understand how decisions are made about extending the useful life of social housing dwelling stock and limiting waste, and how these concerns are balanced with minimum standards. A discussion around retrofit and upgrade opportunities ranging from low to high cost and short to longer term delivery was undertaken to understand similarities and differences compared to the potential list of retrofit and upgrade options identified in work package 1. The discussions held during these interviews were used to refine the DCE, and are reported in Section 2.2.

1.4.3 DCE data analysis

In order to answer research question 3, a housing survey and choice modelling experiment was used to understand households' preferences and prioritisation of different retrofit options by importance and potential impact. This survey captured essential information on tenant experience and the retrofit priorities of people actually living in the dwellings.

The survey combined typical questions on households' demographic, housing and financial characteristics with a set of forced-choice exercises (DCE). The attributes, and attribute levels, for the hypothetical scenarios presented as part of the forced-choice exercise were informed by the synthesis conducted in response to RQ1 and refined by findings from the interviews in response to RQ2. This led to three primary areas of focus in the DCE: quality and condition, energy affordability and energy efficiency. Each area then contained three specific activities which ranged from low to high cost to implement (see Chapter 2 for further details).

The survey was administered in April–May 2022 to a national sample of 1,064 low-income households via the Online Research Unit's representative survey panel. Participants were provided with a series of choices between different retrofit and upgrade options, with each scenario containing one element from each of the three areas. Participants were told that they should assume that any costs associated with the activities would be covered by the housing provider or other third party, and so they were to select the option that best suited their needs. Cost factors were purposefully excluded from the design of the experiment to elicit 'willingness-to-accept' rather than 'willingness-to-pay' preferences, reflecting the scenario of government-provided retrofit assistance.

The findings of this survey are presented and discussed in Chapter 2.

1.4.4 Expert panels

Two expert panel meetings were held in June 2022. Panels were comprised of key social housing retrofit stakeholders from across government, social housing providers, peak bodies, and the industry associations. In these panels, expert participants were asked to reflect on findings from the DCE. Key themes and outcomes are presented in Chapter 3.

2. Household preferences

- **Household preferences for difference retrofit options were derived from a discrete choice experiment (DCE) including more than 1,000 low-income experimental 'consumer households'.**
- **Solar panels, deep clean of the home, paint and carpet replacement, and ceiling insulation were the most highly preferred options.**
- **Consumer households surveyed were least likely to prioritise appliance servicing, tradesperson time, and draft sealing.**
- **Preferences for retrofit options did not vary significantly when the experimental sample was stratified by typical socio-demographic characteristics.**
- **When given the choice, households' retrofit priorities differ to those typically prioritised in retrofit funding schemes and often relate to improving minimum quality and function of their dwelling.**

2.1 Existing research

Recent developments in DCE methods allow researchers to better understand consumer preferences. For about a decade, DCE methodologies have increasingly been used to understand demand in the development and design of new products and services. A DCE essentially seeks to systematically assess stated and non-stated preferences for one product or service over another via a series of hypothetical choice tasks (Hensher et al. 2007). This approach has most commonly been applied in health care settings, for example, testing people's preferences for home-based support services in older age (McCaffrey et al. 2015), infectious disease control (Johnson et al. 2019), and end-of-life care (Finkelstein et al. 2015). As much as possible, the DCE aims to replicate a 'real-world' decision making scenario.

Applying DCE methods to housing retrofit issues potentially provides a way to capture the views and preferences of households for policy design by revealing unstated preferences. In the field of domestic energy consumption, choice modelling has been used to develop better understandings of consumer preferences, especially with regard to renewable energy alternatives. Price factors have a strong influence, with studies finding that people's preferences

for energy services are price sensitive (Sagebiel and Rommel 2014; Murakami et al. 2015). The findings are mixed however—for instance, Scarpa and Willis (2010) found that, while renewable energy sources were valued among a UK consumer sample, the value was not sufficiently large to cover the increased costs associated with renewable energy generation.

Other work focussing on willingness to pay for renewable energy from Greece (Ntanos et al. 2018) and roof-top solar panel systems from Australia (Zander at al. 2019) found that people's willingness to pay was positively associated with education, availability of subsidies or state support, and overall awareness of environmental issues and policy.

While the application of DCEs in housing research is not well developed, existing studies have revealed the importance of non-price factors in determining individuals' housing preferences. For example, work focussed on the preference for housing location highlights the importance of proximity to social and familial networks (Stokenberga 2017) and access to parks (Ardeshiri et al. 2018). A number of studies have also looked at the trade-offs that people are willing to make, and what this means for new housing developments. Rid and Profeta (2011), for example, used DCEs to understand people's preferences for sustainable versus traditional housing developments, while Earnhart (2022) examined the trade-offs (such as size, style, and age of dwelling) that households made in their home purchase decisions.

Studies of this nature help reveal the complexity of people's decision priorities, and allow researchers, and potentially policy makers, to test people's requirements and expectations in the development of better interventions.

2.2 Testing the DCE intervention options

Drawing upon the earlier literature and policy review of minimum quality and performance requirements for rental housing in Australia and internationally, and research into cost-effective retrofit activities and CE principles in the residential sector, a list of potential upgrade activities covering minimum quality and improved sustainability was created. The initial list contained 20 activities and was used as a starting point for consultation.

In order to sense check and refine the list down to a set of core choices for the DCE, a two-page discussion paper was developed for consultation with key social housing providers in Australia. The paper helped us understand how social housing providers currently make decisions about upgrading their existing housing stock, and where and how, if at all, minimum quality, sustainability and CE thinking is part of that process.

The paper included a background to social housing quality and performance in Australia and the opportunity available to be part of the transition to a lower carbon future. The current mandatory and voluntary policy interventions were also summarised. Social housing providers were asked:

- How do state housing authorities and community housing providers balance CE and sustainable development goals with decisions about retrofit, scale, minimum standards and tenant needs?
- How are decisions made about extending the useful life of the social housing dwelling stock and limiting material and utility waste?
- How are these decisions informed by, or related to, minimum standards?

Building on these questions, we identified a series of possible large-scale retrofit options for their housing stock across different costs (low–high) and time frames (next 12 months–10 years). So as not to influence the stakeholders, the initial list of upgrade activities compiled by the research team was not shared with the stakeholders, instead stakeholders were asked to nominate the kind of retrofit/intervention activities that were feasible within their portfolios. Separate meetings with three social housing providers (one public housing provider, one social housing provider and one co-operative housing provider) were then held to explore the discussion paper and collate their list of upgrade activities over the different criteria.

These meetings then helped refine the initial list of upgrade activities identified. To limit the number of different options available to meet DCE requirement, this list was grouped into three key categories: quality and condition, energy affordability and energy efficiency. Each area contained three choices covering low to higher-cost activities (Figure 1, see also Table A3 in Appendix 2).

Figure 1: Graphical summary of the final DCE attributes and levels

Source. Authors.

These individual options were then arranged into hypothetical retrofit packages that our experimental consumer households were asked to choose between. An example of the presentation of the choice sets is shown in Figure 2.

Figure 2: An example of the choice task presented to the experimental consumer households

HOUSING RETROFIT PACKAGES

The following exercise asks you to choose between hypothetical retrofit packages.
There's no right or wrong answer, just think about what would most suit your household.
Please assume that all costs will be met by your landlord or the service provider.

If presented with Option 1 or Option 2, which one would you chose?

Choice 1

Option 1	**Option 2**
Solar Panels	All major appliances serviced
New paint and carpet	Deep clean *(e.g., washing walls, carpet, surfaces in kitchen and bathroom)*
Add or upgrade ceiling insulation	Thermal block-out blinds or outdoor shading

Source. Authors.

2.3 Who we surveyed

To explore retrofit preferences, we surveyed 1,064 households across Australia. We targeted low to moderate income households irrespective of tenure. This enabled us to test whether preferences varied across the major tenures so that we could draw conclusions relevant to the potential for scaling retrofit programs to the private sector (both rented and owned).

Across the whole sample, whilst 14 per cent of respondents were social housing tenants, a further 40 per cent were renting from a private landlord, 27 per cent owned their home outright, and a further 16 per cent were paying off a mortgage (see Table A4 in Appendix 2 for summary statistics).

The proportion of participants in younger age groups were generally higher for private (42 per cent between 18–34 years old) and public renters (29 per cent between 18–34 years old), mortgage holders are more spread over middle-aged groups (63 per cent between 25–54 years old), while owners tend to higher proportions within older age groups (68 per cent between 55–84 years old).

The sample was relatively balanced between male (48 per cent) and female (51 per cent) respondents, with 1 per cent of respondents nominating another gender. Lone person households were the dominant household composition within both private and public rental (34 per cent). Most homes owned with a mortgage were lived in by families with two adults with child(ren), while those owned outright were mainly lone person (37 per cent) or couple (41 per cent) households.

Across the total sample, a relatively small proportion of respondents reported poor (5 per cent) or very poor (1 per cent) housing quality. Most nominated good housing quality (46 per cent). The proportions of private (20 per cent) and public (20 per cent) renters nominating excellent housing was slightly lower than those of owners with a mortgage (26 per cent) or outright owners (27 per cent). Conversely, owners with a mortgage (24 per cent) and outright owners (17 per cent) were less likely to nominate average housing conditions compared to private renters (32 per cent) or public renter (27 per cent).

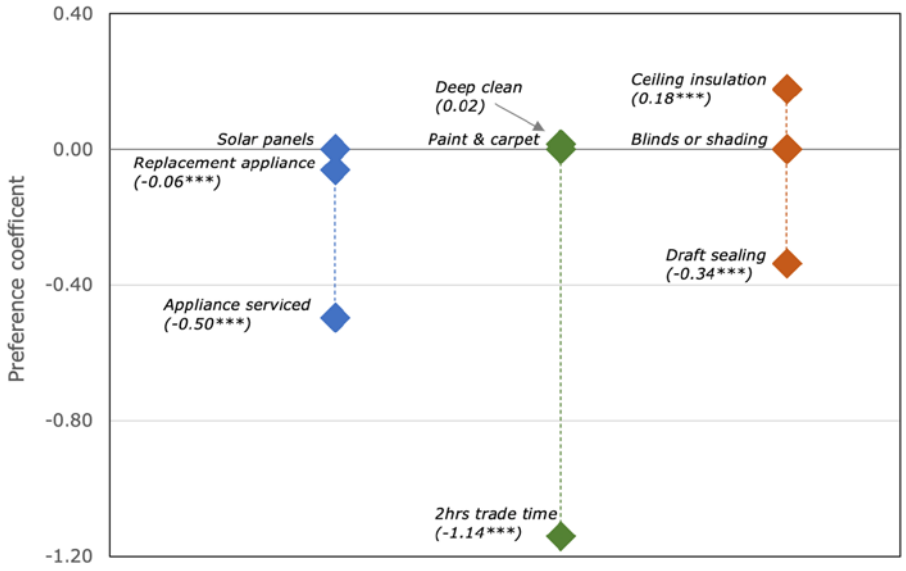
The majority of participants reported low to moderate annual household income (less than $60,000 per year pre-tax), from 70 per cent (mortgage holders) to 85 per cent (outright owners).

2.4 The DCE

Figure 3 presents the preference data for the individual intervention options. For each intervention category (energy affordability, quality and condition, and energy efficiency) the higher-cost option has been used as the reference case. The negative values can be interpreted as a less preferred option, compared to the reference case, while the positive values represent a more preferred option.

The results show that, on average, solar panels, new paint and carpet, and ceiling insulation are the most preferred intervention within their respective categories (see also Table A5 in Appendix 2). For the energy affordability category, both a replacement appliance and having all appliances serviced are significantly less preferred options in comparison to solar panels. Within the quality and condition category, trade time is the least preferred option (in comparison to new paint and carpet), while there is no statistical difference between the paint and carpet, and deep clean options. In comparison to blinds and shading, the reference option in the energy efficiency category, ceiling insulation is significantly more preferred, while draft sealing is least preferred.

Figure 3: Respondents' relative preference for individual intervention options within each category



Source: Authors.

Preferences for bundled packages

To provide an overall picture of people's preferences for retrofit intervention options as bundled packages, the top three most chosen hypothetical packages, across the entire sample, are shown in Figure 4. Replacement of an appliance, deep cleaning, and thermal block-out blinds or outdoor shading are all represented twice within the top three packages. Considering these results in conjunction with the statistical analysis presented in the section prior, we see again that certain options (service of appliances, trade time and draft sealing) are not prioritised, even when offered in packages with other intervention options.

Figure 4: The most chosen hypothetical retrofit intervention packages

Source: Authors.

Preferences by select socio-demographic variables

We stratified the preference data by select socio-demographic variables to gain a deeper insight into the factors that may be driving respondents' preferences (see Table A6 and Table A7 in Appendix 2).

Stratifying the preference data by income (those earning up to $40,000 annually compared to those earning above $40,000 annually), we can start to see some differences in respondents' preferred options. For example, people earning over $40,000 annually are less likely to prioritise having appliances serviced or trade time. The statistical difference between preference for solar panels or a new appliance observable in the overall results, however, is not present for the higher income cohort, meaning that those two options are equally prioritised. In contrast, the lower income cohort are less likely to value the deep clean option, which was equally valued as new paint and carpet by the sample overall.

Across the four main tenures—private rental, public rental, mortgage holders and outright owners—there was little meaningful difference in preferences. The only (weakly) significant difference was that of private renters' preferences for solar panels and replacement appliance, however the magnitude of the coefficient remained within the range of the coefficients of the other tenures.

There were no major differences in intervention option preferences by age, self-assessed health, gender, self-assessed dwelling condition, presence or absence of major building problems, ability to keep warm in winter or cool in summer inside the home, and household composition (not shown).

2.5 Policy development implications

- The DCE found that households' preferences for housing retrofit and upgrade options did not necessarily align with evidence of optimal retrofit priorities and do not align with the typical activities which receive funding (except for solar panels).
- The activities that often have the highest cost–benefit outcomes, such as draft sealing and ensuring appliances are operating efficiently, were not highly desired. Often these options are less 'visible' and the benefits occurring may not be immediately evident or well communicated to householders.
- Consumer households' preferences differ from typical activities associated with CE objectives, for instance, the low-cost, high impact activities aimed at improving the life-span and performance of the existing dwelling and appliances.
- Bespoke choice modelling experiments during the development of future retrofit policies and programs offer a targeted and cost-effective way to understand the specific needs of intended recipient or 'consumer' cohorts. Tailored surveys, for example, could investigate the influence national and local events (e.g. COVID-19 pandemic, flood or fire), and different tenure conditions (e.g. length of residency, affordability, utility expenditure) on households' preference.

3. Policy and industry reflection

- **Retrofit preferences of households are little known and quite different from the priorities of existing practice.**
- **Social housing tenants prioritise liveability and affordability over energy efficiency and CE considerations, as do home buyers.**
- **Social housing providers are challenged to balance their business obligations with their social obligation to assist their residents.**
- **The objectives underlying retrofit programs are rarely explicit, and vary greatly between stakeholders.**
- **Minimum standards (though currently piecemeal across states) were seen as a promising means to improve quality and guide retrofit activity in the social rental sector.**

3.1 Policy panel

Two expert panel meetings were held in June 2022 to guide the interpretation and potential application of the findings of this research. Comprised of social housing retrofit stakeholders from government, social housing providers, peak bodies, and industry associations, the panels were asked to reflect on retrofit preferences and trade-offs made by tenants in the DCE. The panel discussion was aimed at understanding the prioritisation of different interventions, how retrofit might be better delivered, and how it could be scaled up within the wider concept of the CE.

Social housing retrofit was revealed in these panel discussions to be far from a simple consideration of housing improvement or increased energy efficiency. Overall, the discussions showed significant concern for the needs of tenants across the stakeholder groups, a keen awareness of the intrinsic constraints of the social housing sector, and uncertainty around the attribution of costs of any retrofit activity.

The framing of these panel discussions around the choices and preferences of (current and potential) social housing tenants provided a fresh perspective to many panel members. Many of the priorities and retrofit trade-offs selected by tenants in the DCE were not expected by the panel members. For example, commonly provided retrofit measures (such as draft sealing) were not widely valued by the survey cohort. Further, less common interventions that were less focussed on energy efficiency (such as a deep clean) were highly regarded by the experimental consumer households.

Discussion of the retrofit trade-offs made by housing consumers in the experiment provided significant insight into the processes and ambitions guiding retrofit in the social housing sector. Three insights are particularly important in understanding the retrofit environment that social housing providers operate within:

1. Social housing providers are challenged to balance their competing obligations as a business, with their social obligation to assist their residents. They must maintain what is often poor-quality dwelling stock, improve it, build more—and remain solvent as a business. These competing obligations are central to their business, and although there is ambition to embrace environmental sustainability and CE, these are secondary considerations. One panel participant provided an example that neatly illustrates this point. In a recent new build development, they had 'hoped we would have enough surplus to build 6 star, but with a smaller surplus [due to the recent rise in construction costs] we just do the best we can'.
2. Social housing providers also rely on access to tied government funding to maintain or improve the quality of their stock over time. The structure and timing of this funding was raised by many panel participants. It was noted that such government administered programs were a central means for retrofit and upgrades to their dwelling stock, but that this funding was almost always 'themed', so the retrofit activity that occurs in the sector is largely driven by the themes of funding available (rather than, for example, tenant requirements, the specific needs of a housing provider's dwelling stock or CE considerations). In addition, tied, themed funding may be designed to have impacts beyond the housing system, so it may have a rapid spend requirement. This limits the types of retrofit that can be achieved to 'quick won' interventions that may not be maximally beneficial to tenants.
3. Finally, and perhaps most importantly, the objectives underlying retrofit programs are rarely explicit, and vary greatly between stakeholders. Social housing providers may be largely motivated to assist their tenants to avoid energy poverty, industry groups seem principally focussed on sustainability outcomes, and many tenants' main motivation is improving the liveability of their home. These different, and often competing, objectives obviously limit successful outcomes. However, industry advice designed around sustainability could form the basis of a government funded program where cost effectiveness is prioritised. Social housing providers could use this funding to reduce the energy costs of their tenants, and the tenants would value the program because of their improved living environment.

Panel members were asked to consider the DCE findings in the light of their experience and knowledge of retrofit, and respond to three guiding questions. The question of retrofit priorities was discussed at length during both panels—notably, there was no consensus on which retrofit interventions should be prioritised.

Current and potential consumers preferences for retrofit activity identified in the survey were noted as different to current retrofit activities prioritised. As discussed above, there is a clear disconnect between the focus of many retrofit programs (usually on sustainability), and the often more basic preferences of tenants (usually focussed on liveability).

Reflecting on the retrofit prioritisation discussions, social housing providers can be seen to be 'between a rock and a hard place'. Our DCE survey shows that tenants clearly want houses that are more liveable, efficient, clean and warm. Social housing providers often have poor quality stock, an ambition to improve it for tenants, but no dedicated funding source to do more than meet basic requirements for housing and safety. Social housing providers are further constrained by regulation to meet their budgets. This means that they generally try to make the quality of the properties as good as possible, with limited funding.

The *hard place* we refer to is created by the social housing funding model. Social housing providers rely almost solely on the rents that they collect, and may subsidise their limited rental income with 'bundles of money' in the form of tied grants for housing improvements and retrofit. This is an important point of disconnect. As highlighted during the panel discussion, tied funding opportunities were often politically initiated, highly targeted to specific outcomes, and importantly, rarely coordinated. Tied grants are rarely focussed on improving liveability for tenants, instead they are much more likely to reflect sustainability goals of the environmental sectors of government and peak bodies. Effectively, social housing providers are reliant on funding aimed at improving energy efficiency and sustainability, and face the challenge of capturing that funding, and using it to the best of their abilities to meet the basic living needs of their tenants.

The panels also highlighted issues of scale, minimum standards, and mandatory requirement processes.

It was recognised by many panel participants that retrofit activity should be better targeted. Each social housing dwelling, and resident, has distinct retrofit needs and may prioritise some interventions over others. This means that large scale programs may provide blunt assistance. More individualised packages of assistance have their own challenges, and panel participants noted the high potential administrative cost of targeted packages.

The problems of delivery of retrofit interventions at scale were discussed at length. There was widespread agreement for the suggestion that dedicated retrofit officers, capable of pulling together and installing individualised packages of retrofit improvements would be highly regarded in the sector—and potentially cost effective overall.

There was substantial discussion of the importance of minimum standards as a means to drive and guide retrofit responses. Minimum standards were seen as important in framing an ambition, they '*set a benchmark that we want to achieve, and then we just have to work out how to get there*'. Currently, minimum standards are piecemeal across states, but increasingly becoming a means to improve quality in the social rental sector. It was also noted that any change to minimum standards would need both 'carrots' of assistance and 'sticks' of regulation. If minimum standards were applied and upgraded, many social housing providers would likely be unable, without additional assistance (subsidies) to meet them.

It was widely agreed that mandatory requirements for minimum standards would have to be externally enforced. This caution over the design of mandatory requirements acknowledges the frequently uneven power relationship between tenants and landlord. In the social housing sector, and perhaps even more in the wider private rental sector, '*it cannot be up to the tenant to report or request an inspection*' as they may face fear of eviction.

There was also a slight caution raised, that any retrofit activity that occurred should benefit, rather than financially disadvantage, tenants. The example given was the installation of reverse cycle air-conditioning, which in some cases enabled tenant households to make their homes warm, but in many cases the poor construction quality of the home meant that the power costs of running the air-conditioner forced these households directly into energy poverty.

Finally, the panels highlighted the direct implications of any retrofit-style improvements in the social rental sector, for the broader rented and owned housing stock in Australia. For example, any goal setting for minimum standards in the social housing sector, would impact on standards in the broader rental market.

The suggestion from a building industry panel member, that, while the focus of much retrofit activity in the social housing sector was energy efficiency and sustainability, '95% of clients [in Australia's new build sector] are not interested in energy efficiency' was particularly interesting. This is not as surprising as it first seems however—reflecting on the findings of our consumer survey, it is likely that most households, not just social housing tenants, who are prioritising liveability and affordability over energy efficiency and considerations of the CE.

3.2 Policy implications

- In considering the policy implications, it is noteworthy that, for the majority of panel participants (policy makers, social housing providers and industry), tenant preferences were both surprising, and largely unknown. This indicates that a systematic tenant voice (and tenant preferences) has, to date, rarely been included in existing retrofit activities. The inclusion of at least some acknowledgement of tenant preferences in the development of any social housing retrofit interventions would shift the focus of assistance (and the desired outcomes) towards basic liveability.
- One of the main insights provided by the panel discussions was the (largely invisible) mismatch of retrofit ambitions between different stakeholders—social housing providers, industry, government agencies, and tenants. Acknowledgement of this mismatch and a more explicit statement of aims by all stakeholders is a valuable outcome of this research. While the policy implications of an alignment of retrofit ambitions are unclear, it would provide coordinated guidance to outcomes.
- Related to an alignment of stakeholder retrofit aims, the current structure of retrofit funding is also uncoordinated, reactive and detached from long term systematic CE framing. A longer term funding pathway for social housing retrofit and quality upgrades would give social housing providers a clearer direction and allow for more considered and nuanced responses.

4. Recommendations for sustainable social housing retrofit

The research finds that international best practice includes the setting of minimum standards for housing, including social housing stock. These minimum standards include a range of different housing elements such as window coverings, heating and cooling systems and other basic functions. In some jurisdictions, for example New Zealand, these minimum standards are linked, not only to improving the quality of a dwelling, but the wider social benefits (e.g. improved health) delivered.

In Australia, some states have introduced, or are considering introducing, limited minimum standard requirements for rental housing. For example, NSW, South Australia, Tasmania, and Victoria mandate minimum standards for rental properties that include thermal comfort and/or energy efficiency measures. The establishment of acceptable minimum standards for social housing could look to New Zealand, where the *Residential Tenancies Act* requires all rental properties to have a minimum level of ceiling and underfloor heating (as required by the Building Code), a fixed heating device capable of achieving a minimum temperature of 18°C in the living room, draughtproofing, and adequate ventilation.

These standards, while more comprehensive than what is currently required in Australia, don't incorporate some of the preferences identified in the DCE from this study. Therefore, any development or revision of acceptable and minimum standards should not just be about the technical performance of the dwelling but also include a requirement for basic quality and liveability inclusions.

Social housing providers sit somewhat uncomfortably in the retrofit landscape. They are simultaneously financially constrained, and obliged to provide the best possible living conditions to their tenants. Basic upkeep and maintenance are therefore prioritised over sustainability-focussed retrofit activities, which are largely funded by (often piecemeal) retrofit assistance outside of normal revenue streams. In this highly constrained funding environment, engagement with tenants about their housing quality, preferences for retrofit options, current maintenance needs, and practical considerations including timing and carrying out of retrofit work is largely absent. This results in a top-down and sporadic approach to any retrofit activity.

Our findings suggest that social housing providers require greater overall funding, more certainty around specific sustainability-focussed funding programs, and a clearer mandate to address sustainability within their housing stock to meet CE objectives.

Tenants were far more concerned with basic issues of cleanliness and function rather than improving environmental sustainability of their homes. These priorities are likely the result of:

- the concentration of poor-quality housing stock within the social housing sector and legacy of subpar maintenance programs
- a lack of understanding about the potential benefits of retrofit options by the householders, perhaps due inadequate communication
- finally, and most importantly, a broader failure of CE proponents to understand and acknowledge what is important to households, where, in fact, environmental sustainability (even with the potential co-benefits for improved living conditions) is likely to be low on their hierarchy of perceived needs.

4.1 Final reflections—trading off the circular economy?

This research project aimed to capture the preferences and retrofit trade-offs of tenants, and present them to key stakeholders, to explore retrofit practice and implementation and make explicit the role of (and contribution to) CE practices. Reflecting on the findings of this project, the research has also revealed the complex, conflicted, and largely invisible underlying structure of retrofit policy and action.

Within a CE context, retrofit has been put forward as a key strategy to address significant environmental issues within the existing built environment—both through improving the quality and performance of dwellings (e.g. reducing through-life impacts such as energy consumption) and by extending the life of the existing dwelling (e.g. reducing the need for knock-down rebuild and use of additional raw materials). The (rare) addition of the tenant voice to the consideration of retrofit has made more visible the intentions and aspirations (as well as conflicts) of retrofit stakeholders.

Discussion of retrofit policy assumes that the stakeholder groups have shared goals, but that is not the reality. Retrofit, at least in the social housing sector, is a relatively haphazard process, guided by good, but often conflicting, intentions. In addition there is a role for governments in coordinating large scale retrofit action (with or without CE aims) that is yet to be realised.

In general, social tenants are largely concerned with achieving good, comfortable and affordable to run homes —often within significant financial and health constraints. Social housing providers have social and welfare goals, but are constrained by funding models and their business requirements. Both social tenants and their housing providers acknowledge the value of CE considerations, but such considerations are perhaps a luxury in the social housing sector.

This highlights the complexities of CE within housing retrofit because there are different outcomes from, and for, the social housing provider and tenants. On one hand it could be better from a CE perspective to repair a heater, for example, and therefore reduce the need for a replacement, but on the other hand, replacement or upgrade could improve energy efficiency and reduce other CE considerations. Extending the life of a feature already in the dwelling reduces the need for additional resources, but does not necessarily improve dwelling quality and performance for the tenant, compared to what a retrofit could provide.

The data shows that retrofit and quality improvements are undertaken with short term focus, based on whatever funding or opportunities are available at that point in time. This funding model constrains all stakeholders from longer term planning or strategic coordination, but also reduces the opportunity to use CE principles in retrofit activities.

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Appendix 1: Summary of state, territory and national minimum quality standards

Table A1: Specific focus on social/public/community housing

Name	Aim	Target	Type of mechanism	Notes
Australia wide				
Clean Energy Finance Corporation	Improve energy efficiency	Community housing	Loans to community housing providers	The program aims to build 500 new 7-star NatHERS dwellings in Sydney and to provide 200 dwellings with energy efficiency upgrades. The upgrades include measures such as hot water heat pumps, LED lighting, ceiling, wall and underfloor insulation, double glazing windows, draughtproofing, smart meters, and solar panels.
Low Income Energy Efficiency Program (2011–2016)	Improve energy efficiency of low-income households	Low-income households and community housing	Grants	Up to 20 grants for small scale retrofit projects. Programs needed to target low-income householders. Some programs which were funded included social housing tenants (see state programs Home Energy Efficiency Upgrade Program (Victoria) – Brotherhood of St. Laurence, and Beat the Heat! – Uniting Communities of South Australia).
ACT – Canberra				
Energy Efficiency Improvement Scheme (2012–2030)	Stimulate energy efficient measures	Targets priority households (including low-income, public and community housing)	Company obligation/ incentive	Covers energy retrofit activities including reverse cycle air conditioners, LED lighting, standby controllers, draughtproofing, efficient appliances (dryer, freezer, fridge, pool pump, TV), insulation, windows, and efficient water heating.
Growing and Renewing Public Housing Program (2015– 2024)	Improve public housing dwellings	Public housing	Program	Covers energy retrofit activities including reverse cycle air conditioners, hot water systems, stoves, kitchens, bathrooms, and laundries. So far the program has provided retrofits to more than 1,250 homes in public housing, with another 1,000 homes to be retrofitted.
NSW				
Good Design for Social Housing Policy	Inform design quality of construction of new social housing	Architects, program managers and developers (new social housing builds)	Policy/ benchmarking tool	The policy outlines four key goals for social housing new builds: tenant well-being, sense of belonging, collaboration with partners, long term value for NSW government.

Name	Aim	Target	Type of mechanism	Notes
LAHC (Land and Housing Corporation) dwelling requirements	Inform design quality of construction of new social housing	Architects, program manages and developers (new social housing builds)	Benchmarking tool / optional	This tool aims to inform stakeholders involved in the design of new social housing in the following aspects: interior finishes, water ratings, joinery, doors and windows, utilities, and minimum floor area.
Home Energy Action Program (HEAP) (2014-2017)	Improve energy efficiency	Community housing providers and low-income households	Discounts and financial assistance	Multi-faceted program that targeted social housing providers who were provided 50% of financial cost of upgrades for dwellings. Partnerships highlighted as a driver for success.
Social Housing Upgrade Program	Energy efficiency	Public, community, and Aboriginal housing		Covers energy retrofit activities including insulation, lighting, cooling, natural ventilation, and hot water systems.
Queensland				
Sunny Savers	Enable access to solar in public housing	Public housing	Program	867 public houses acquired solar panels in regional Queensland. The program consisted of partnerships with government, Queensland Council Of Social Service and renewable energy companies.
Social Housing Design framework	Provide guidance in the development of new houses	Designers and architects involved in the development of new social housing units	Guidance tool	The tool assists designers in the following technical categories: Be comfortable, pleasant, and safe, designed to meet residents' needs, efficient use of space and land, attractive look, respect neighbours' privacy, overlook any adjacent street or parkland opposite to provide better 'neighbourhood watch', be well designed for the local climate and not rely substantially upon mechanical cooling or heating systems, and respond sensitively and creatively to the characteristics of its site.
South Australia				
Virtual power plant	Reduce energy usage	Public housing units	Financial	Provides solar panels and batteries to public housing. The program is subsidised through electricity generated by the panels. Managed and designed by Tesla.
Beat the Heat Trial (LIEEP) 2013–2016	Energy efficiency (during hot weather)	Low-income private renters and low-income community housing renters	Program	The program provided 200 houses (private tenants and community housing) with energy efficiency interventions. The program included community housing due to lack of participants from private rentals. Program focused on reducing energy usage during summer.
Better Places Stronger Communities program	Dwelling management transfer (from public to community housing)	Community housing (public prior to transition)	Government program	The program offered energy upgrades for dwellings as part of the transition plan. The program involved tenants in the decision making. $805,000 of cost-saving improvements to homes.
Renewing our streets and Suburbs	Continuation of Better Places Stronger Communities program	Community housing (public prior transition)	Government program	736 homes transferred and maintained when passed to Anglicare.

Appendix 1: Summary of state, territory and national minimum quality standards

Name	Aim	Target	Type of mechanism	Notes
Victoria				
Home Energy Efficiency Upgrade (part of LIEEP)	Provide access to more efficient water systems	Low-income households (71%) and community housing (22%)	Program	The program attended 550 low-income households and 176 community housing households. The community housing stream involved direct engagement with property managers, with a focus on logistics rather than detailed energy efficiency advice. The program report noted that the success of community housing provider engagement was overwhelmingly due to the trust that existed between the community housing provider and tenants.
Energy Smart	Energy efficiency	Public housing dwellings	Program	The program funded energy efficiency upgrades in 1,100 public housing dwellings. The measures included water and heating systems, and thermal upgrades (insulation and draft proofing). The upgrades were limited to one per dwelling. The delivery engaged with Australian Energy Foundation.
Western Australia				
Social Housing Economic Recovery Plan (starts in 2021)	Improve social housing dwellings and boost the economy	Public and community housing	Grants	Community housing providers can apply for a $20,000 grant that can be used to replace gutters, service ovens, service hot water systems, fixing fences, improving damaged cabinets and flooring. The program aims to provide maintenance to 1,500 public and private dwellings.
United Kingdom				
Decent Homes Standard	Provide minimum quality standards	Social housing	Minimum standards	The Decent House Standard is a mandatory standard that targets social housing through the dwelling's compliance of four criteria: 1. it should meet the Housing Health and Safety Rating System (tool below) 2. reasonable state of repair 3. reasonably modern facilities and services 4. reasonable degree of thermal comfort. In England, the percentage of non-decent homes reduced to 17% in 2019 from 34% in 2006, when the Decent Homes Standard was introduced. The main issue for failing were not achieving the Housing Health and Safety Rating System assessment, followed by not providing adequate levels of thermal comfort.
Housing Health and Safety Rating System	Evaluation of hazard and safety in a dwelling	Used by Local authorities to assess rentals (social housing)	Assessing tool made legislation	The assessment is based on the inspector judgement in evaluation 29 hazards arranged in four main groups according to health requirements: Physiological requirements, protection against incidents and infection. The assessment aligns to criteria 1 of the Decent Housing Standard. Currently legislated in England and Wales.

Name	Aim	Target	Type of mechanism	Notes
Community Energy Saving Program	Reduce energy poverty and improve energy efficiency	Low-income households (priority for social housing) in specific geographic areas.	Program (free upgrades)	Measures included wall insulation, loft insulation, the replacement of central heating boilers, installation of heating controls, draughtproofing and double glazing. The program was delivered using partnerships with local authorities, housing associations, community organisations and energy companies. 293,922 measures were installed in 154,364 dwellings with an average of two measures delivered per dwelling. Majority of carbon savings were from insulation measures (59%) and Heating measure controls (37%).

Table A2: Social/public/community housing explicitly included but not a specific focus

Name	Aim	Target	Type of mechanism	Notes
ACT - Canberra				
Residential Act	Regulate	Public and private renting (public and community housing)	Legislation/ Mandatory	No minimum standards yet established.
ActSmart Low-income Energy Efficiency Program	Energy efficiency	Low-income households	Program (free rebates)	Draughtproofing.
NSW				
Residential Tenancies Act 2010	Regulate all residential rentals (social housing included)	Public and private renting (public and community housing included)	Legislation	Working fire alarm, shower heads (social housing excepted), dual flushing toilet 3 (WELS) stars. Social housing excepted from water efficiency retrofit, social housing tenants are excepted from Section 39 (right not to pay water bills if premises do not contain water efficiency measures) – instead regulated by Part 7 section 3 (water efficient measures are not mentioned).
Home Power Savings Program (2008–2014)	Energy efficiency	Low-income households (approx. 20% social housing, 84% pensioners)	Free energy audits and energy kits	Around 20% were households in social housing (not specified if social or public). Total of over 220,000 households engaged in the program. The program provided free energy audits and if legible: shower heads, power savings kit, compact fluorescent lights.
Northern Territory				
Residential Tenancies Act 1999	Regulate all residential tenancies	All rentals	Legislation	The act establishes that rental need to be habitable, safe, clean and meet all healthy requirements (no specification of what constitutes this). Community housing tenants are not allowed to install air conditioners in their houses without permission; costs must be covered by the tenant and they must return the property to its original condition at end of lease.

Appendix 1: Summary of state, territory and national minimum quality standards

Name	Aim	Target	Type of mechanism	Notes
Smart Cooling in the Tropics (2014–2016)	Reduce energy consumptions, improve thermal comfort, increase energy literacy	Low-income households. Aboriginal Community housing tenants included in first stage of recruiting but not second.	Free upgrades	Program included different products categorised under structural modification, behaviour change, and appliances. Community housing tenants excluded from second stage of recruiting despite recognition that including social housing tenants would have made recruitment easier (more interest from social housing tenants).
Manymak Energy Efficiency Project (2013–2016)	Energy efficiency and water conservation	Aboriginal housing in East Arnhem Land	Free upgrades	Program that aimed to deliver best solution within specific budget. Provided upgrades in hot water units, stove timers, LED lighting, standby switches, air conditioning and insulation (just to units with air conditioning).
South Australia				
Housing Improvement Act 2016	Regulate rental properties	All rental properties (including social housing)	Legislative	Lockable doors and windows, rubbish bins, kitchen sink, shower, bath, mould free (insulation or dehumidifiers).
Tasmania				
Residential Tenancy Act	Set minimum standards in all rentals	All rentals (social housing included)	Legislative	Curtains and blinds, electric heater OR gas heater OR heat pump OR fireplace (no efficiency required).
Victoria				
Residential Tenancies Act	Set minimum standards in all rentals	Private and social housing rentals. Caravans and rooming houses excluded from some standards.	Legislative framework	The act provides minimum standards in the following categories: Locks, bins, bathrooms, laundry, structural soundness, mould and damp, electrical safety, windows, lighting, ventilation, heating. It is considered a criminal offence if providers fail to address the standards.
Victorian Healthy Homes Programs	Energy efficiency	Vulnerable households in Western Melbourne (public and community housing included but not focus)	Program	The program targeted vulnerable households experiencing health issues in Western Melbourne. Public and community households were eligible. The program provided an energy assessment and the installation of draughtproofing, insulation, and efficient heating/cooling system.
Western Australia				
Residential tenancies act and regulations	Regulate	All rentals	Legislative	No minimum standards are prescribed in the Act, nor is 'reasonable state' is defined.
New Zealand				
Healthy Homes Standards (National Residential Act)	Align rental housing to the requirements in the building code	Existing rental housing (including social housing)	Regulate	Private rentals need to comply form July 2021, social housing providers must comply by July 2023. The Healthy Homes Standards require all rental properties nationwide to have minimum insulation, heating, ventilation, drainage, and draughtproofing standards.

Appendix 2: Discrete choice experiment results

Table A3: Summary of the final DCE attributes and levels

Category (attributes)	Lower cost	Mid-range cost	Higher cost
Quality and condition	2 hours of trade time for maintenance	Deep clean	New paint and carpet
Energy affordability	All major appliances serviced	Replacement of one major appliance with an energy efficient one	Solar panels
Energy efficiency	Draft sealing	Thermal blockout blinds or outdoor shading	Add or upgrade ceiling insulation

Table A4: Socio-demographic and housing characteristics of the sample by tenure

	Private rental % (count)	Public rental % (count)	Mortgage % (count)	Owner % (count)	Other % (count)
Age					
18–24	16 (65)	15 (22)	10 (17)	6 (17)	10 (4)
25–34	26 (108)	24 (35)	20 (35)	7 (22)	20 (8)
35–44	19 (78)	20 (29)	22 (38)	6 (18)	15 (6)
45–54	18 (74)	17 (25)	21 (36)	9 (28)	13 (5)
55–64	10 (40)	14 (21)	15 (26)	24 (72)	10 (4)
65–74	7 (28)	5 (8)	8 (14)	26 (78)	13 (5)
75–84	3 (14)	5 (7)	3 (5)	18 (54)	15 (6)
85+	0 (2)	1 (1)	1 (1)	2 (5)	5 (2)
Prefer not to state	0 (0)	0 (0)	0 (0)	0 (1)	0 (0)
	100 (409)	100 (148)	100 (172)	100 (295)	100 (40)
Gender					
Male	46 (187)	52 (77)	48 (82)	50 (147)	50 (20)
Female	53 (216)	47 (70)	51 (88)	50 (147)	50 (20)
Other	1 (6)	1 (1)	1 (1)	0 (0)	0 (0)
Prefer not to state	0 (0)	0 (0)	1 (1)	0 (1)	0 (0)
	100 (409)	100 (148)	100 (172)	100 (295)	100 (40)

	Private rental % (count)	Public rental % (count)	Mortgage % (count)	Owner % (count)	Other % (count)
Household composition					
Lone person	34 (138)	34 (50)	22 (37)	37 (108)	28 (11)
Couple only	19 (78)	22 (32)	22 (38)	41 (120)	10 (4)
Family, two adults and child(ren)	21 (84)	15 (22)	41 (70)	9 (28)	8 (3)
Family, lone adult and child(ren)	12 (49)	17 (25)	10 (18)	5 (15)	5 (2)
Sharehouse	13 (55)	11 (16)	5 (9)	6 (18)	40 (16)
Other	1 (5)	2 (3)	0 (0)	2 (6)	10 (4)
	100 (409)	100 (148)	100 (172)	100 (295)	100 (40)
Dwelling quality					
Excellent	20 (81)	20 (30)	26 (44)	27 (79)	23 (9)
Good	42 (170)	45 (67)	48 (82)	53 (155)	43 (17)
Average	32 (129)	27 (40)	24 (41)	17 (50)	23 (9)
Poor	6 (24)	7 (10)	2 (4)	3 (9)	10 (4)
Very poor	1 (5)	1 (1)	1 (1)	1 (2)	3 (1)
	100 (409)	100 (148)	100 (172)	100 (295)	100 (40)
Household annual income					
Up to $12,000	6 (25)	13 (19)	5 (8)	4 (13)	20 (8)
$12,001–$20,000	15 (61)	15 (22)	10 (18)	10 (30)	18 (7)
$20,001–$40,000	38 (157)	40 (59)	27 (46)	49 (146)	23 (9)
$40,001–$60,000	24 (100)	13 (19)	28 (49)	21 (63)	15 (6)
$60,001–$80,000	5 (22)	3 (4)	12 (21)	5 (14)	10 (4)
$80,001–$100,000	5 (21)	4 (6)	3 (6)	2 (5)	5 (2)
$100,001–$150,000	2 (7)	3 (5)	6 (11)	1 (3)	3 (1)
$150,001–$200,000	1 (4)	3 (4)	2 (3)	0 (0)	0 (0)
More than $200,000	0 (0)	2 (3)	1 (1)	1 (3)	0 (0)
Prefer not to state	3 (12)	5 (7)	5 (9)	6 (18)	8 (3)
	100 (409)	100 (148)	100 (172)	100 (295)	100 (40)

Table A5: Bivariate analysis of the DCE attribute levels

Attribute	Coefficient (n=1,064 & obs.=9,576)
Energy affordability (*Ref: solar*)	
All major appliances serviced	-0.497*** (0.022)
Replacement of one major appliance	-0.061*** (0.022)
Quality and condition (*Ref: new paint and carpet*)	
Two hours of trade time for maintenance	-1.140*** (0.018)
Deep clean	0.015 (0.018)
Energy efficiency (*Ref: thermal block-out blinds or outdoor shading*)	
Draft sealing	-0.336*** (0.017)
Add or upgrade ceiling insulation	0.177*** (0.018)

*Notes: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.10.*

Table A6: Bivariate analysis of preference data by income group

	Income	
Attribute	Up to $40,000 (n=628)	>$40k (n=387)
Energy affordability *(Ref: solar)*		
All major appliances serviced	-0.493 (0.028) ***	-1.140 (0.024) ***
Replacement of one major appliance	-0.047 (0.029) ***	0.018 (0.026)
Quality and condition (*Ref: new paint and carpet*)		
Two hours of trade time for maintenance	-0.224 (0.024) ***	-1.140 (0.030) ***
Deep clean	-0.559 (0.029) ***	0.006 (0.030)
Energy efficiency (*Ref: thermal block-out blinds or outdoor shading*)		
Draft sealing	-0.337 (0.022) ***	-0.325 (0.027) ***
Add or upgrade ceiling insulation	0.184 (0.023) ***	0.158 (0.029) ***

*Notes: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.*

Table A7: Bivariate analysis of preference data by tenure

	Tenure			
Attribute	Private renter (n=409)	Public renter (n=148)	Mortgage (n=172)	Owner (n=295)
Energy affordability *(Ref: solar)*				
All major appliances serviced	-0.506 (0.034) ***	-0.483 (0.059) ***	-0.507 (0.053) ***	-0.477 (0.042) ***
Replacement of one major appliance	-0.068 (0.035) *	-0.040 (0.060)	-0.087 (0.054)	-0.044 (0.042)
Quality and condition (*Ref: new paint and carpet*)				
Two hours of trade time for maintenance	-1.137 (0.029) ***	-1.137 (0.049) ***	-1.135 (0.045) ***	-1.151 (0.034) ****
Deep clean	0.022 (0.030)	0.022 (0.048)	0.001 (0.045)	0.009 (0.034)
Energy efficiency (*Ref: thermal block-out blinds or outdoor shading*)				
Draft sealing	-0.328 (0.027) ***	-0.345 (0.044) ***	-0.299 (0.042) ***	-0.370 (0.031) ***
Add or upgrade ceiling insulation	0.185 (0.028) ***	0.20 (0.047) ***	0.147 (0.044) ***	0.168 (0.034) ***

*Notes: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.*

Australian Housing and Urban Research Institute
Level 12, 460 Bourke Street
Melbourne VIC 3000
Australia
+61 3 9660 2300
information@ahuri.edu.au
ahuri.edu.au
twitter.com/AHURI_Research
facebook.com/AHURI.AUS
Australian Housing and Urban Research Institute