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Solar Saver(s): A case study of place-based financial intermediation for just transitions to sustainable housing in Australia

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ABSTRACT

Significant investment in residential energy efficiency, electrification, and renewable energy is needed to meet climate targets and address the social impacts of poor quality and unaffordable housing. Upfront costs and household financial capabilities remain a critical barrier to home retrofits, while government subsidies can reproduce inequalities in access. Situated in the literature on place-based intermediation of housing retrofit, this paper examines debt financing as a contested mechanism for addressing these challenges, and the role local government can play in advancing socially equitable outcomes. The paper presents an in-depth case study of a municipal solar finance program established in Melbourne, Australia in 2013 which saw over AUD$4.8 million invested by local government in interest-free loans for low-income homeowners to install solar PV and other appliances up to the closure of the program in 2025. Through qualitative analysis of council meeting documents and interviews with practitioners and households, this paper conceptualises retrofit financing as an intermediation function that assembles private product provider offerings, government subsidies, and energy prices through cost-benefit calculations, capital transfers, and risk management. As a public lender and trusted service provider, local government adapts incumbent financing logics and practices (interest, loan term, and credit worthiness) to improve access to credit and enable housing retrofits for typically excluded households. Nevertheless, the transformative potential of municipal home retrofit finance is circumscribed by tenure, the calculability of the retrofit, and municipal governance capacity. This case thus demonstrates both the opportunities and challenges in reconfiguring debt relations for just transitions to sustainable housing.

1. Introduction

Retrofitting existing housing to promote energy efficiency, electrification, and renewable energy consumption is an urgent climate change mitigation and adaptation imperative. Globally, annual building sector investment remains less than half of what is needed to 2030 for a net zero scenario, and building energy consumption is steadily increasing [1]. In Australia, residential buildings account for approximately 24% of national electricity use and over 10% of national carbon emissions, and, while over 30% of households have rooftop solar PV, 11 times more gas disconnections are needed each year to phase out gas by 2050 [2]. Housing affordability and cost of living pressures draw further attention to the poor energy performance of existing homes in the face of cold weather as well as heat [3]. With most Australian homes[1] built before the introduction of minimum energy efficiency requirements in 2003, there are considerable health and climate resilience benefits to be gained through retrofitting existing housing, particularly for those experiencing energy poverty and older people [5].

Recent empirical studies underscore the significance of (perceived) upfront cost and household financial capabilities as an impediment to scaling retrofit uptake [6,7]. Modelling suggests that Australian households could save between AUD$1690 and AUD$2002 on annual energy costs with thermal upgrades and electrification (excluding rooftop solar) [5]. However, these benefits come at an average cost of between AUD

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[1] The Australian housing stock is concentrated in metropolitan areas in the states of New South Wales (NSW), Victoria, and Queensland, made up of detached houses (70%), apartments (16%) and semi-detached homes (13%), and is owned outright (30%), mortgaged (33%), and privately rented (26%) (with 3.6% government or community housing) according to 2021 Census data [4].

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$12,038–$35,439 for thermal upgrades (including heating and cooling), AUD$1693 for full electrification of appliances, and AUD$4706–$5622 for rooftop solar [8]. Cost and cost-benefit concerns have been reported as the most common barrier to uptake of retrofits based on recent household surveys in the US [9,10], Ireland [11], and Norway [12]. Other modelling suggests that approximately half of homeowners in the Flemish region in Belgium could not finance energy performance renovations for a 2050 scenario, regardless of whether renovations occur at once or over a longer period of time [13]. Others qualify households' capacity to pay as a temporal condition relative to life stage, such as receiving an inheritance [14]. Altogether, these studies underscore the importance of cost for household decision-making on retrofit.

While government subsidies have sought to alleviate such upfront cost barriers, research highlights how government subsidies can reproduce inequalities. Studies of national rooftop solar PV and state energy efficiency retrofit schemes in Australia show that subsidies have benefited higher wealth households in the case of solar [15] and have lower uptake in areas with lower economic resources and more rental housing in the case of energy efficiency [16]. Government subsidies funded through universal levies on energy bills, as in the case of feed-in-tariffs (FiTs), have further regressive cross-subsidisation effects by disproportionately impacting those without and unable to purchase rooftop solar [17]. In the UK, government incentives for households able to pay upfront for renewable energy and heat generation were more often accessed by higher income households, whereas energy efficiency incentive schemes targeting low-income households *were* able to reach those households [18].

Meanwhile, debt financing is an increasingly debated mechanism for addressing upfront cost barriers for (disadvantaged) households, recognising the limits of direct public investment through grants and subsidies [19–22]. Policymakers and practitioners are calling for new financial solutions [6], including aspirations for "one-stop-shop" models to provide end-to-end home retrofit services that incorporate private finance options [23]. Alongside traditional loans and lease models, examples of debt instruments include energy performance contracts, green mortgages, and on-bill finance (see [20] for a detailed overview). Debt financing leverages future cash flows in the present to enable investment with immediate benefits to the housing stock and its occupants, and the climate. At the same time, debt financing generates obligations to lenders that risk social harms associated with the cost of capital, repayment burdens and risks, and access barriers [24–28].

In this context, a growing body of work is advancing a relational understanding of home energy retrofit which foregrounds trust and relationships as key determinants of uptake [29–32]. Intermediation is understood as a critical process for enabling sustainability transitions that involves convening actors and resources around strategic visions, demonstration projects, and niche markets; championing and advancing policy and institutional change, including development of new business models; and engaging with and supporting end users [33–35]. Local government is one such intermediary that can engage and support households by conducting home energy assessments, locating contractors, sharing information on available finance, and facilitating access to subsidies and rebates, including for vulnerable and disadvantaged households [36–40]. This intermediary role highlights the importance of place in tailoring services to local conditions and needs, and building and leveraging relationships and trust to achieve uptake [18].

In this paper, I examine municipal financing for housing retrofit as an intermediation function that shapes the potential for just transitions to sustainable housing, but which has received limited scholarly attention to date. This paper is guided by the following research question: *what role can local government play in home retrofit finance to advance socially equitable outcomes in sustainable housing transitions?* To answer this question, the paper presents an in-depth case study of a novel low-income residential solar finance scheme developed in Melbourne, Australia through which over AUD$10 million of local government funding and almost AUD$2 million in state subsidies has been invested over an approximately 10-year period, with over AUD$4.8 million in loans targeted low-income and disadvantaged households. The case illuminates how local government leverages its role in the community as a trusted service provider, and adapts financial calculation and property relations through an existing tax mechanism, to enable rooftop solar PV uptake among low-income households. However, the case reveals the challenges associated with applying the model to other energy efficiency products, rental properties, and in different jurisdictions. Through qualitative analysis of program documents and reports over a 10-year period, and interviews with local government practitioners and select households, the paper offers a new perspective to debates on the financialisation of municipal government and household experiences of debt in the context of climate change.

The paper proceeds as follows. The next section reviews existing literature on housing retrofit finance and outlines the analytical framework employed in the paper. Section 3 details the research methods and background on the case. Section 4 presents the results of the analysis, and Section 5 discusses the overarching research findings and contributions to the literature on place-based intermediation of housing retrofit finance. The paper concludes by reflecting on local government agency and the need for radical and systemic interventions to overcome ongoing limitations and exclusions in the transition to sustainable housing.

2. Place based intermediation of housing retrofit finance

Existing literature on housing retrofit finance illuminates four interconnected dimensions shaping the social outcomes of sustainable housing transitions. First, a fundamental dimension of retrofit finance is calculation. Calculation represents a value logic in household preferences, often in the form of energy bill neutrality or cash-flow positive retrofit finance [21]. Studies have identified calculative logics in household preferences where willingness to take out a retrofit loan is associated with future cost savings [41,42]. Regarding household capacities, homeowners with lower incomes and credit scores sought low interest rates and longer payback periods to manage monthly repayments [43]. Moreover, the balance of upfront cost, interest, and repayments over time in retrofit financing mechanisms influences the nature of home retrofit. European residential energy renovation financing instruments indicate that long loan terms can enable deeper renovations at higher capital cost, while on-bill financing (where repayments are made via utility bills) will likely favour lower cost and thus less substantial measures to ensure energy cost savings are not exceeded by repayments [20]. Galvin and März [6] explore the potential for a savings and loan scheme that could enable small private landlords to access commercial loans and bring forward energy performance renovations without affecting future cash flows (assuming landlords have modest saving practices for future upgrades). Others identify "surplus extraction" where loan providers in a French study were found to set higher interest rates for home renovation than car purchases, which the authors suggest may be associated with homeownership and willingness to pay [44].

A second key dimension of retrofit finance is risk. Property-linked finance, such as energy efficiency mortgages, leverages housing assets as security on loans and potentially reduces default risks for banks based on anticipated energy cost savings [41]. Similarly, utility-based finance attaches repayments to the energy meter rather than the household, which can accommodate household changes (including for rentals) to ensure continued debt repayments [27]. Government guarantees, such as loan loss reserves, can further de-risk private retrofit financing [20]. Conversely, debt financing of rooftop solar PV installations can expose households to financial stress. Research documents risks around inaccurate advertisements of solar PV output, and where solar companies are dissolved (affecting access to long term technical support and maintenance) [24]. In the housing-based PACE (Property Assessed Clean Energy) loan model in the US, early repayments have been forced by the

Federal Housing Finance Agency to enable properties to be re-mortgaged when sold, while broader concerns have been raised about mounting housing debt and cost burdens, default risks, contractor malpractice, lawsuits filed against lenders, and a lack of consumer protections [26]. Other studies of household preferences highlight that some households are debt-averse [45], including an estimated 22% of European homeowners that correlates with lower energy efficiency retrofit adoption regardless of access to capital [46].

Access is a third key dimension of retrofit finance which is closely associated with risk. How households qualify for retrofit loans largely depends on credit score or other measures of financial capability, which can be further influenced by racial discrimination, power, and uncertainty and knowledge gaps [27]. Research has identified an energy efficiency financing "coverage gap" of households who do not qualify for low-income programs, but lack access to finance due to their credit score, which is estimated to represent 12% of households in the US state of Michigan [25]. Others point to a "poverty penalty" where the total cost of commercial loans for solar home systems in a Bangladesh case was higher for constrained borrowers who made smaller down payments [28]. Exploring options for low-income households, on-bill financing with lower interest rates and longer loan terms is recommended as it can use bill payment history rather than credit score for eligibility to improve accessibility [27].

A fourth cross-cutting dimension of retrofit finance is governance, particularly in terms of actor roles, priorities, and relationships. As indicated above, commercial lenders tend to prioritise risk and profit measures in the provision of credit. Government can play a role in incentivising and underwriting private retrofit finance [20], and the judiciary can provide recourse for households impacted by speculative practices by holding the private product providers accountable [24]. Other potential retrofit financing models seek to leverage existing mechanisms and relationships with households, such as debt repayment via multi-unit residential management bodies [45] and utility bills [20,27]. Critically, improving access requires tailored interventions to accommodate the needs of diverse households [43]. Tailoring not only requires adapting measures of financial capacities (such as consistent utility bill payments) [27], but provision of support services for undertaking home retrofit. A notable example is a public financing model in Ghent (Belgium) which involved city government provision of €30,000 loans to owner-occupiers living in poor quality housing to fund renovations, enabled by technical and social support with an added cost to the city of about half of the renovation budget [13]. This role reflects broader studies of place-based intermediation of housing transitions in which local authorities have the capacity to actively engage and support (marginalised) households [31,37,40].

Altogether, these studies signal how the incumbent logics and processes of contemporary capitalism shape the feasibility of retrofit finance [47], as well as emerging alternatives that attempt to improve access to the benefits of energy efficient and sustainable housing through debt. Critical scholars have questioned the capacity of finance to internalise social and environmental values due to risks of reproducing predatory lending practices and uneven development, driven by a need for return on investment [48–50]. This work contributes to studies of financialisation, understood as the expansion of profit generation by the financial sector compared with other sectors in the economy, and the growing application of financial practices, logics, and markets in non-financial spheres of activity [51]. At the same time, diverse economies scholarship recognises that financialisation is not unidirectional and monolithic, encouraging investigation of heterogenous and alternative rationalities in financial relations that promote solidarity, care, and redistribution in response to climate change [52,53]. As policymakers seek solutions to upfront cost barriers of housing retrofit for households without ready access to capital, research is thus needed to understand the conditions through which progressive social outcomes are made possible. Situating this study in the literature on housing retrofit intermediation discussed in the Introduction, I examine whether and how a novel municipal home retrofit finance scheme advances socially equitable outcomes by adapting the parameters of the incumbent finance regime and thus creating alternative financial spaces for just transitions to sustainable housing [54–57]. The analysis is framed by the interconnected logics and processes of calculation, risk, access, and governance discussed above.

3. Research methods

This paper employs a relational epistemology [58] to examine how municipal government and housing assets mediate financial logics, capital flows, and home retrofits. The case study method enables a rich examination [59] of the complex interplay between municipal governance, housing, and financial systems. This paper takes an exploratory approach focused on a unique empirical case of a not-for-profit municipal solar finance model. This case study is particularly timely as the program has recently ended after over 10 years of implementation and, as such, offers a longitudinal empirical perspective.

3.1. Case study: Solar Saver(s)

The first Solar Saver program in Australia was established in 2013 and operationalised in 2014 by Darebin City Council, an inner-north municipality of Melbourne, Victoria. Solar Saver is a voluntary financing scheme primarily targeting (aged and disability) pensioner and other low-income homeowners to install rooftop solar PV systems as a climate change and equity program of local government. The scheme sought to address cost of living pressures and vulnerability to heatwaves among low-income populations by enabling households to save money on their electricity bills by generating and using solar power, and in turn feel more comfortable using cooling appliances like air-conditioning during heatwaves [60]. The financing model is structured such that Council purchases the solar PV systems from a private supplier selected through a council tender, and the cost is repaid by participating households via an additional property tax or Special Rates Charge as a type of loan attached to the property rather than the homeowner. In this way, the municipality acts as a capital lender. The approach repurposes a legislated local government mechanism which is usually allocated to properties in a specified area to fund capital upgrades. Darebin City Council led the implementation of this approach up until June 2025 when the program was closed. With a core focus on Darebin, the paper draws on insights from applications of the model in other councils through a state-wide pilot led by the Eastern Alliance for Greenhouse Action (EAGA) in Victoria in 2017–18 (supported by a Victorian Government grant of AUD760,000) known as Solar Savers. At the time of writing, no Australian municipality is offering new rates finance for home energy upgrades to the author's knowledge.

3.2. Data collection and analysis

This paper draws on two periods of data collection:

- 2017–18: Conduct of face-to-face semi-structured interviews with practitioners involved in the Darebin Solar Saver and broader Solar Savers programs from local government (n = 11), community/NFP (n = 6), energy businesses (n = 3), and banking (n = 1), and a sample of Darebin participant households including a tenant (n = 1) and homeowners (n = 10); and analysis of program inception documents.
- 2025: Analysis of Darebin Solar Saver program reporting in council meeting documents (n = 46) between 2016 and the conclusion of the program in 2025; and follow up virtual interviews with Darebin Solar Saver and Solar Savers program managers (n = 3).

Research participants involved in the programs at the core of this case study (Appendix A, summarised in Table 1) were selected through purposeful sampling [61]. Darebin City Council facilitated recruitment

Table 1
Interview participant groups and roles.

Stakeholder group	Participants (2017–18)	Participants (2025)
Public	8 local government officers[a]	1 local government officer
	3 municipal network officers	1 municipal network officer
		1 municipal network executive
Private	6 managers (NFP/community)	
	3 managers (energy)	
	1 manager (bank)	
Civil society	10 homeowners	
	1 cooperative housing tenant	
Total interviews	31	3

[a] One interview conducted with two project officers at Adelaide City Council in Adelaide, South Australia (SA), Australia where the Solar Saver model was trialled.

of participant households in the initial phase of data collection. It is important to note that there is a level of self-selection bias among the household participants as they were sufficiently engaged and interested in the research to agree to speak about the program (including previous experience in media appearances). The first phase of interviews asked practitioners to explain the origins and aims of the program, the financing arrangements, actor roles and relationships, the business case for investment, the social implications of the program (benefits, limits, and trade-offs), policy and other barriers and enablers, and prospects for wider uptake (through replication, expansion, or other means) (see Appendix B, part A). Interviews with households followed similar themes, focused on their personal experience of the program as a participant and the solar PV installation on their home (see Appendix B, part B). The follow-up round of practitioner interviews involved more targeted questioning based on prior knowledge of the program, focused on how the program changed over time, lessons learned through implementation, and the ongoing viability of the model. Interview participants provided informed consent to data collection and reporting of key findings and select quotes. The study was approved by the University of Melbourne Human Research Ethics Committee (approval number 1748736.1) and Monash University Human Research Ethics Committee (approval number 44225) prior to data collection.

Program reports and other relevant documents were sourced from public domain websites, or shared by interviewees. Council meeting agendas and minutes were a key secondary data source (see Appendix C). Because of the legislative requirements around special rates charges, council officers prepared reports for each batch of solar installations through the Solar Saver scheme for council approval. These submissions detail the number of contracts signed, investment and rebate amounts, state government feed-in tariff rates for rooftop solar electricity exported to the energy grid, associated solar PV capacity of planned installations, as well as summary reporting of program decisions, outcomes, and challenges. Actual, anticipated, and estimated figures (where available) are reported in this paper to support the qualitative analysis of how finance is mobilised by council in the model.

The primary and secondary data was used to map and trace the dimensions of the case, including constitutive actor roles and relations, the technical function of the solar PV systems in the home and within wider infrastructure networks, and the nature and flow of capital. Abductive, iterative thematic coding of interview transcripts (using NVivo software) and program documents examined themes in relation to broad categories of calculation, risk, access, and governance (as discussed in Section 2). Direct quotes are included in the results section to illustrate key findings in respondents' own words.

4. Results

4.1. Calculating the energy gap

Calculation of energy bill cost savings after installation of rooftop solar PV and other home energy upgrades is central to the function of the Solar Saver(s) special rates charge mechanism. The core premise of the model is that households will be financially better off from the first year of the loan. This threshold is intended to enable participation of low-income and disadvantaged homeowners who are unable to benefit from home energy upgrades due to upfront cost barriers. Identification of future cost savings aims to mitigate the financial burden of debt repayments for these households. Equally, expected cost savings represent an assurance of the household's ability to repay the debt to local government. The financial rationale thus involves capitalising on what can be termed the "energy gap" between business-as-usual household energy costs, and household energy costs after installation of solar and other home energy upgrades, to de-risk investment for the lender and debtor (EAGA interview 2018). This equation incorporates estimated solar electricity generation, daytime energy consumption, the export of excess solar electricity to the grid for credit, and quarterly special rates charges or debt repayments on the upfront cost of solar. The financial benefits for households are enhanced through the local government program, including a bulk product purchase discount, a 10% saving on GST (goods and services tax) due to a local government exemption, and 10-year product warranties covering the term of the loan. Residents perceive few risks in participating; either no risk at all—particularly given the debt is attached to the property and can be recovered at sale as well as the projected value of the solar system once the loan is repaid ("the rest is pure profit then" (Preston resident interview))—or a normal amount of risk for any investment in the house ("that it all goes pear-shaped and the thing doesn't work and you've got all these hassles chasing it up, but that's the same when you get anything done with the house" (Kingsbury resident interview)).

The "energy gap" is dependent on a number of thresholds and financial variables. In the early stages of the program and its piloting in other local government areas, higher daytime energy use, interest rates, and loan terms were identified as key determinants of cost savings. Business case modelling conducted prior to establishing the EAGA Solar Savers program compared the Darebin rates finance model with alternative financing conditions across different household profiles, reinforcing this rationale [60]. Modelling outcomes for Darebin Solar Saver (see Appendix D, Part A) established that "retirees" (i.e., pensioners) followed by a family with one parent staying at home[2] have higher daytime energy use. With higher overall energy use (10 kWh or more per day), these households were expected to benefit from over AUD$120 annual cost savings with 2 kW–5 kW solar PV systems. Comparing different financing conditions, cost savings for pensioners consuming 10 kWh/day of energy gradually decline with interest rates applied from 2.5 to 8% per annum and fall into negative at 8% for larger solar PV systems (4 kW and 5 kW) (Appendix D, Part B). With a 15% interest rate, only the smallest solar PV systems (2 kW), i.e., the lowest cost systems, break even. Short-term (3-year) loans at 6% interest result in net costs to pensioners of over AUD$500–$1500 per year, increasing with the solar PV system capacity/cost.

4.2. Access to home retrofit

A key implication of calculating the "energy gap" is that certain households are excluded or not recommended to participate. Aged and disability pensioner homeowners were identified as a target group for this scheme when it was first established because they are more likely to be at home during the day and therefore able to maximise electricity consumption while the rooftop solar PV system is generating electricity during daylight hours (in the absence of battery storage). In addition, despite being asset-rich, households receiving a government pension

[2] One can expect households with corporate workers regularly working from home (normalised since the COVID-19 pandemic) would fall into these categories of beneficiaries.

live on low incomes and thus are still likely to face cost barriers for home energy upgrades. Being owner-occupiers, these households are able to both upgrade the property and experience the benefit. Administratively, because these households receive low-income concessions on their rates, local government can more easily identify and contact these households via their rates database. At the same time, a council officer highlighted the need for "dynamic values [in relation to eligibility] that move with the market" each year, not only in relation to product costs but household income levels (Darebin City Council interview 2025). To improve uptake of the scheme, the 2021 combined income threshold of $90,000 was raised to a median income level of $160,000 [62]. Finally, there remain critical questions around the usefulness of this model for reaching the most vulnerable households in the community. Besides participation of community housing tenants in an early round of the scheme, there is no record of private landlord participation,[3] while a representative of the Eastern Alliance for Greenhouse Action argues that it is "the most vulnerable households who will never be able to afford any sort of additional repayment" (EAGA interview 2025).

A further implication of the need to calculate an "energy gap" is that certain home energy upgrades are not financeable without generating financial risks for households and Council. As solar PV has become mainstreamed, policy and industry attention has turned to housing electrification alongside continued calls for energy efficiency and thermal performance improvements. In this financing model, households need to be bearing energy costs in the future that can be measurably offset by a home energy upgrade to be able to benefit from upgrade financing. In a 2021 briefing [63], Darebin City Council officers stated that:

> "for program success, it is essential that the participating household achieves overall savings for every year that they repay the special charge to Council […] Modelling has shown that reverse cycle air conditioning (RCAC) is the only product – at this stage – that can meet this financial outcome […] We are not recommending considering insulation at any stage, due to difficulties in verifying energy savings back to households and significant auditing costs."

This uncertainty is explained by a council manager as a function of a lack of data on these products and appliances, and the role of behaviour in shaping appliance energy use (Darebin City Council interview 2025). Another financial risk identified is a potential mismatch between the (shorter) warranty or life of the product, and the (longer) loan term (10 years). Despite this financial uncertainty, a number of households signed contracts for solar PV systems plus hot water heat pumps and reverse cycle air conditioners in the 2023–24 and 2024–25 rounds.

Eligibility for the scheme has been adjusted over time. The program initially focused on aged and disability pensioner homeowners, and later expanded to all Darebin residents in 2018–19 as part of an updated council Climate Emergency plan (though still prioritising disadvantaged households), followed by a return to a targeted approach determined by income and other qualities. When the scheme was renewed in 2021, council sought to engage residents in the suburbs of Reservoir and Preston in particular, citing their particular vulnerability to urban heat [63]. The program thus operationalises vulnerability to weather extremes, electricity bill shock, and unaffordability through static measures, which social welfare practitioners recognise are not necessarily able to respond to dynamic circumstances influencing the precariousness of household finances for all citizens (Kildonan interview 2018). The limits of these assumptions are illustrated by decisions made by a regional Victorian council offering rates finance up until 2024:

> "[Hepburn Shire] didn't do [rates finance] last year […] people just don't have the money [and] they didn't want to have a loan. I think the cost of living really affected that cohort of people [pension card holders] and it just wasn't something they wanted to do"
>
> (EAGA interview 2025)

Conversely, one resident involved in an early iteration of the program negotiated with council to participate on "environmental grounds" (Thornbury resident interview) despite being advised that they did not use enough electricity to benefit from cost-savings.

Table 2 summarises the participation and investment mobilised through Darebin Solar Saver from program inception in 2013 to program end in 2025 based on council meeting documents. Almost 2000 household agreements were made for solar PV installations, 35 of which included reverse cycle air conditioners or heat pump hot water systems in the 2023–24 and 2024–25 rounds. Overall, the program invested over AUD$10.5 million of council funds, and leveraged approximately AUD $1.8 million of state government subsidies. At least 1192 of the household contracts, amounting to over AUD$4.8 million of upfront investment by Darebin City Council, involved targeted resident demographics as defined by the eligibility criteria, namely aged and disability pensioners, social housing residents, low-income households, culturally and linguistically diverse (CALD) households, and a broader category of people experiencing disadvantage and discrimination including Aboriginal and Torres Straight Islanders, refugees and asylum seekers, international students (detailed in Table 2). The program's expansion in 2018–19 resulted in approximately half of the total investment made through the scheme going to households not classified as low-income or disadvantaged. A breakdown of figures by household demographics is not available, however Table 2 details the eligibility parameters for each financial year of the program.

4.3. Mediating financial risk

The previous section indicates the complexity of costs and transfers involved in property-based finance for home energy retrofits. In the Solar Saver(s) rates finance model, local government is the credit provider and the key intermediary between the homeowner and the hardware provider, and in some cases the state government (for provision of rebates), illustrated in Fig. 1. Through the scheme, the property owner makes debt repayments to local government, and reduced energy bill payments to their energy utility. The housing asset mediates the debt obligations between the homeowner and the local government, as the debt liability is tied to the property title through the Special Rates Charge mechanism rather than the individual. Likewise, FiTs for exported solar electricity are tied to the property through its connection to the electricity grid. The solar PV provider claims renewable energy generation certificates via the Small-scale Technology Certificate (STC) market which are discounted from the product cost, and receives upfront payment from local government. State government pays rebates to local government or the property owner. If the property is sold before the debt is repaid, local government has the right to claim remaining payments (a lien). Secondary to the scheme, households may continue to make regular home mortgage and insurance payments.

In its role as a public lender, Darebin City Council mediates energy and solar market and regulatory conditions to mitigate financial risk for participating households. A key justification for council to play this intermediary role was a recognition of "market failure" where residents who would benefit from household solar for reducing energy costs—pensioners at home during the day—face fundamental financial barriers (the high upfront capital cost and limited incomes), as well as limited access to credit due to age and income [60]. Market and regulatory conditions have nevertheless influenced cost saving calculations as well as technology deployment over time. Illustrated in Fig. 2, while households were opting for larger systems in 2018–19 (over 5 kW on average compared with approximately 2 kW in previous years), the

[3] Darebin City Council offered to support tenants by writing a letter to their landlord about the scheme, but this was only taken up by a couple of tenants (Darebin City Council interview 2025).

Table 2
Summary of Darebin Solar Saver participation and investment from program inception (2013) to program end (2025). Figures are based on available reporting in public council meeting documents (see Appendix C).

Program year	Total signed contracts	Total special rates charge amount (AUD)	Estimated value of state government rebates (AUD)	Targeted residential contracts	Targeted residential net investment (AUD)	Targeted/eligible resident demographics
2013–14	292	$ 848,374.00		292 (100%)	$ 848,374.00	Pensioners
2015–17[a]	192	$ 742,000.00		183	$ 707,218.00	Pensioners (majority), social housing residents
2018–19[b]	978	$ 5,862,574.99	$ 1,114,725.00	263	$ 870,539.23	Low income, pensioners, renters, social housing tenants, culturally and linguistically diverse (CALD)
2020–21[c]	187	$ 1,089,202.38	$ 310,173.03	155	$ 779,029.35	Low-income households (majority), pensioners, those with specific communication needs
2022–23	73	$ 480,797.67	$ 102,200.00	73 (100%)	$ 378,597.67	People identified as experiencing disadvantage and discrimination[d]
2023–24[e]	130	$ 801,587.66	$ 167,254.03	130 (100%)	$ 634,333.63	People identified as experiencing disadvantage and discrimination[d]
2024–25[e]	96	$ 764,911.87	$ 139,168.73	96 (100%)	$ 625,743.14	People identified as experiencing disadvantage and discrimination[d]
Total	**1948**	**$ 10,589,448.57**	**$ 1,833,520.79**	**1192**	**$ 4,843,835.02**	

[a] Financial figures calculated based on total budget reported including administration costs. Nine community centres are included in the totals.
[b] Figures for targeted contracts and investment are estimated based on the total figures reported. Data on targeted uptake may be missing for two out of four rounds for this period due to differences in public reporting.
[c] Data on targeted uptake is missing for two out of seven rounds for this period due to differences in public reporting.
[d] Eligibility is detailed in the 22 November 2021 council meeting agenda as related to State government rebate program criteria for disadvantaged communities, households significantly impacted financially by COVID-19, renters (those eligible for state government rebates, meeting combined income threshold, and where landlord is not seeking repayments from the tenant), Aboriginal and Torres Straight Islanders, refugees and asylum seekers, international students, a person with a disability, older person receiving government support, owner-occupiers meeting the combined income threshold, and other owner-occupiers receiving social security or with a concession card [63]. The combined income threshold started at $90,000 and was increased to $160,000 in June 2024 [62].
[e] In the 2023–24 iteration, three households signed contracts for both reverse cycle air conditioners and solar PV systems. In 2024–25, in addition to solar PV systems, 20 households signed contracts for hot water heat pumps and 12 households installed reverse cycle air conditioners. Two out of three rounds in the 2024–25 iteration had a 5% processing fee applied.

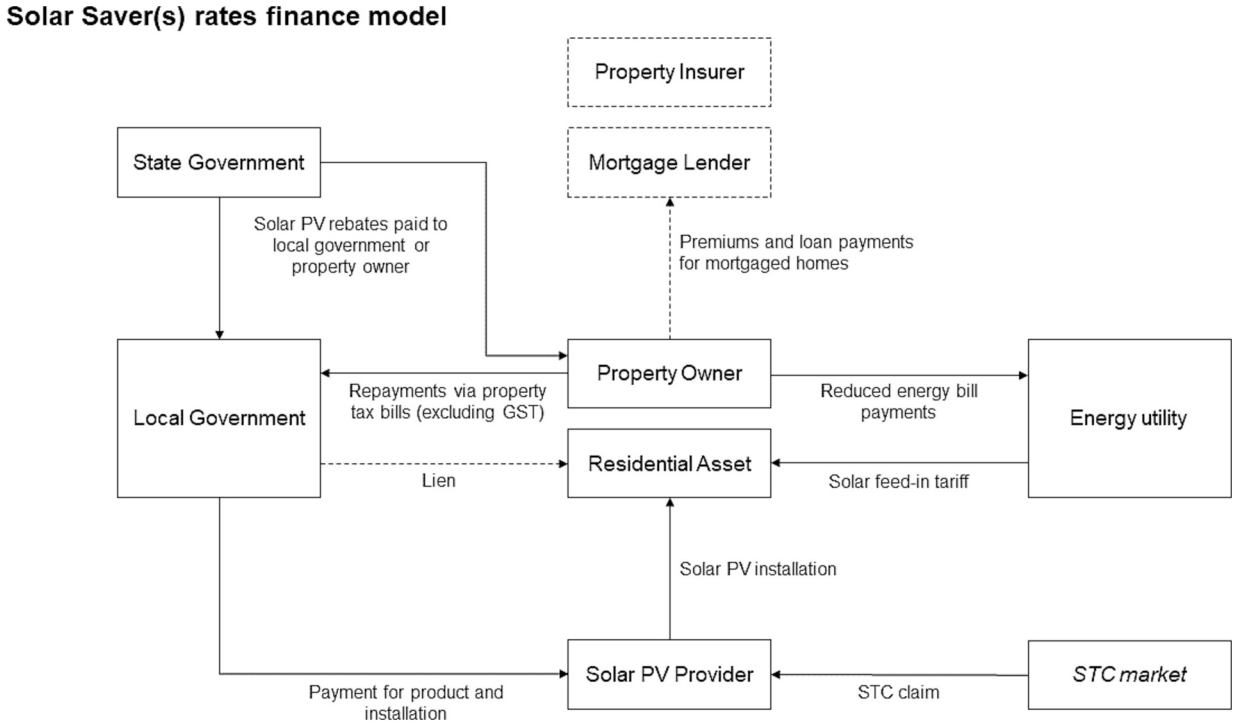


Fig. 1. Solar Saver(s) rates finance model. This figure illustrates the direction and nature of relationships between actors, following Taylor and Knuth's (2023) illustration of PACE finance.

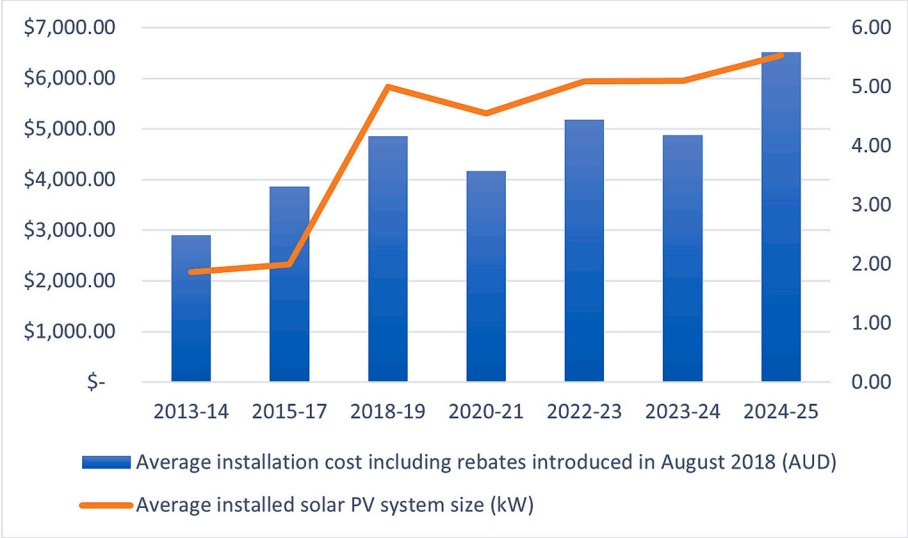


Fig. 2. Average installation cost (AUD) and solar PV system size (kW) of Darebin Solar Saver installations per household as reported in council meeting documents (Appendix C). Cost figures include estimated state government rebates introduced in August 2018 (applying to three out of four rounds in 2018–19). The 2015–17 figures exclude solar PV installations on nine community centres, and are estimated based on the total budget reported. The 2024–25 round includes 20 hot water heat pumps and 12 reverse cycle air conditioners installed with solar PV systems which accounts for some of the increase in average installation cost.

introduction of generous state government subsidies in August 2018 (available up to the final installations completed in 2025) mitigated a similar jump in cost. On average, estimated rebates since 2018 resulted in a 20% reduction in installation costs in Darebin (see Table 2).[4] However, council officers observed installation cost increases of AUD $300–500 per system linked to increased demand for rooftop solar PV generated by the introduction of the state government rebates in 2018 [64], and a further increase of less than 10% of initial quotes for installation attributed to the effects of the COVID-19 pandemic on Australian exchange rates and thus stock costs in 2020 [65].

Third, changes in state-level FiT for solar electricity exported to the grid affect how Darebin City Council estimates cost savings. In 2016, the reduced FiT of 5 cents/kWh is associated with a reduced estimate of net cost savings from AUD$100 to AUD$20–90 per year during the term of the loan (Fig. 3) and reduced uptake of the scheme (Table 2). In 2017, the increased FiT of 11.3 cents/kWh is associated with improved net cost savings of AUD$150–180 per year during the term of the loan. Victorian FiT rates have been in decline since 2020. Interestingly, around this time, Darebin City Council stopped specifying expected cost savings as a result of participating in the program, instead opting for a more general claim that households will "save more on their energy bills than they will be paying back to Council so that they are financially better off from the outset" [66] supported by solar PV provider estimates.

Local government's role as a financial intermediary not only hinges on calculation, but in its status as a non-commercial broker providing impartial advice to homeowners—a relationship that builds on and develops trust and esteem. A central logic of the program is to determine whether installing solar is a "good choice" for the household, where council takes on the role of "buyers' advocate," rather than focusing purely on sales (EAGA interview 2018). Council takes an intermediary role in sheltering participants from the complexity of solar technology and sales pressure from the market by engaging a solar provider on the household's behalf, identifying a quality product, and monitoring safety in the installation. Risks associated with the functioning of the solar panels over the period of the loan are mitigated by a 10-year warranty on the system components (the term of the loan) and a 25-year performance warranty (the expected life of the product) which council secured from solar suppliers at the procurement stage.

Households cited access to information and having confidence in council's due diligence in procuring quality solar panels/providers as sometimes more important than the upfront cost barrier as motivation to participate [67]. These assurances are juxtaposed with general cynicism and suspicion associated with (perceived) self-interested energy companies and solar panel salespeople. As one resident argued: "the council's not going to get involved with some shonky person who's going to come in and tell you: 'Terribly sorry, we've got to double the price because you've got a nail in the wrong place on your roof' or something" (Fairfield resident interview). The advisory relationship between council and residents was sometimes supplemented by residents' own social networks (neighbours, family, friends), particularly those with past experience installing solar panels (Fairfield, Northcote, Bundoora, Kingsbury [2] resident interviews).

Over the course of the program, local government has managed other market dynamics. The US parent company of SunEdison Australia (the solar PV provider for the Darebin scheme) filed for bankruptcy in 2016, requiring negotiation by council to ensure that the 10-year product warranties for installations in 2014 and 2016 would be honoured. Darebin City Council staged installations to manage installer capacity (such as sub-contractor availability and warehouse solar panel storage capacity (Solar provider interview 2018)), and accommodated COVID-19 lockdowns impacting the operations of solar providers through 2020 and 2021. The EAGA pilot program of the same model instituted strict OH&S documentation and auditing above industry standard to minimise risk of failure or error in installations, and associated reputational risk for councils (which unearthed some roof safety problems) (EAGA interview 2018). Finally, council alerted participating households to the grid connection process which, in earlier program iterations, was a recurring problem due to inconsistency and errors in paperwork transfers between solar installers, inspectors, energy retailers, and distribution companies, resulting in considerable delays (up to 1 year) in the solar system being turned on and generating feed-in tariffs (Darebin City Council interview 2018).

[4] In another Victorian local government application of the model, Hepburn Shire Council reduced the loan term to eight years following the introduction of state government subsidies for rooftop solar PV in 2018 based on improved cost savings and the benefit to Council of recouping the debt sooner.

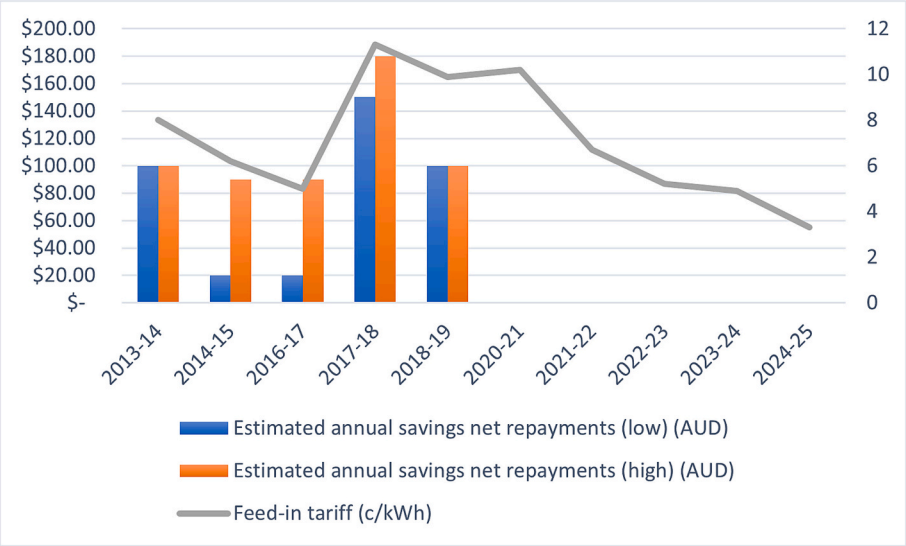


Fig. 3. Comparison of anticipated net cost savings per household for the term of the loan (AUD) and Victorian feed-in tariff rates (c/kWh) for Darebin Solar Saver as reported in council meeting documents (Appendix C).

4.4. Local governance capacity

The low-income solar rates finance model exemplifies the relational capacity of local government to inform, engage, and support households in undertaking home retrofits as part of their role in community services provision. Human resourcing and time are essential for attending to resident needs through communications and support, including responding to phone inquiries, explaining how the scheme/solar works, and minimising confusion:

> "Their level of energy literacy is not high […] The electricity market has changed […] They don't necessarily understand how solar works, the feed-in tariff […] We have to go through a fair amount of information to explain how solar works. We have to explain how the Solar Saver program works. Many [residents] struggle to actually understand or accept that you don't have to pay anything up front, at all. That takes often several times in a conversation and written material just to prove that that's the case."
>
> (Darebin City Council interview 2018)

An interim program evaluation was explicit about the need for project officers to have "a professional, patient and empathetic phone manner" [67] when managing often time-consuming inquiries and explaining the process. The importance of this resourcing and approach has positive reputational value (Knox City Council interview 2018) and is a source of satisfaction for council staff (Darebin City Council interview 2018). This aspect was reflected in what residents valued in the program; that council representatives were available and responsive as a source of information and expertise (Northcote resident), and that council had done the "legwork" of determining a quality product and engaging with the solar market (Kingsbury resident 1 and 2 interviews).

At the same time, realising this role comes with a significant resource burden. In the EAGA-led rollout of the mechanism from 2017, only five of the 23 participating councils trialled the special rates charge with small numbers of loans. The remainder opted for a private finance option in partnership with Bank Australia which charged a "low" fixed interest rate (4.75%) and was considered "easier" and less costly. The availability of capital to fund the loans was a significant barrier for many councils outside of Darebin in the early regional pilot, explained by a lack of cash reserves (which Darebin used to fund their program), expanded services requirements, state-level rate-capping legislation, general fiscal responsibility or "risk aversion," reluctance to procure debt (e.g., through the Municipal Association of Victoria according to a representative interview in 2018), as well as conservative narratives around the "core business" of local government.

In terms of human resources, in the latest iteration of Darebin Solar Saver, two full-time staff and a manager (approximately 25% of their role) handled household applications (including checking eligibility, requesting missing information, and ensuring the household is up to date on their rates payments); reviewed installer quotes and rectify issues; prepared and reviewed agreements between council and the resident; provided tailored support (e.g. if a permit is needed for the installation in a heritage area, or in managing body corporate); followed up with households throughout the process; and periodically consolidated and checked participant data. The council revenue team received information, raised special charges, set up and printed notifications, and updated the customer management system, while the communications team handled marketing (including flyer mailouts and other communications through media channels, networks, and newsletters). The latest reported council operational budget for a target of 150 installations in 2023–24 was AUD$200,000 [68]. A 5% administration fee was introduced in the 2024–25 iteration of the program to help cover the costs of managing the loans (the council represent remarked that "We didn't see much of a backlash on that […] people understand that there is a cost to council" (Darebin City Council interview 2025)). Engaging a single supplier is preferred, as dealing with multiple product suppliers increases the administrative burden as well as "the possibility of mistakes, the risk of having people not happy and to falling into the same thing where people just get too confused and they just don't want to go ahead" (Darebin City Council interview 2025). Moreover, changes to the program, including the introduction of an administration fee and program pauses, add to the cost of running a program long term (Darebin City Council interview 2025).

Institutional frictions have been highlighted as more fundamental challenges associated with the model. Establishing this kind of program necessitates internal advocacy to higher-level decision-makers, and buy-in from the rates and finance teams, which can be "a lot of work [for a single] sustainability officer" (EAGA interview 2025) in less-resourced councils. With that buy-in, providing loans through the special rates charge mechanism requires council approval and a 28-day public notice period. In October 2022, the Darebin City Council CEO was delegated authority to make an intention to declare and issue the public notice, which helped to streamline the process and allow more time for participants to sign up (cutting out time e.g., to prepare and distribute council meeting agendas in advance) (Darebin City Council interview

2025). Nevertheless, as an EAGA representative reflected:

> "There's just a big tension between the timing of those type of things and how these upgrades might actually happen in the real world. The real world doesn't work to council meeting dates. So, just logistically and mechanically, it's very hard […] I think there's up to five councils per year doing different iterations of [subsidy programs] now, and it's just easier for them to give the money away than it is trying to get it back"
>
> (EAGA interview 2025)

5. Discussion

This in-depth case study traces the design and implementation logics, processes, and outcomes of a novel municipal solar finance program targeting low-income households. This section synthesises three overarching findings from the analysis of stakeholder interviews and council documents over an approximately 10-year period, capturing program inception (2013) to closure (2025).

First, I conceptualise retrofit financing as an intermediation function that assembles private product provider offerings, government subsidies, and market prices through cost-benefit calculations, capital transfers, and risk management. Through this case, I argue that financial intermediation is a key process through which socially equitable transitions to sustainable housing can be realised [13,25,27]. Interest free credit with a long-term repayment period, coupled with assessment of the "energy gap" or cost savings over time and matching product warranties, minimises the financial risks and burdens of debt associated with home retrofit. Compared to incumbent financial logics and practices tied to profit generation and assessment of household credit worthiness, these adaptations make debt-financed solar PV investments viable for (aged and disability) pensioner homeowners with limited incomes and other marginalised homeowners. The model thus highlights how for-profit interest rate and loan term conditions have the potential to generate financial burdens and risks for households if added costs cannot be managed. While the aim for households to be financially better off from the outset (energy bill neutrality) was considered a limitation that contributed to the failure of the UK Green Deal [21], this case study recasts this requirement as an ethical principle for (public) lending to low-income households.

Second, this case builds on emerging literature on place-based intermediation [31,37,40] by reinforcing local government's role in advancing more socially equitable outcomes through innovative adaptation of financial standards and expectations to meet social and environmental objectives [53]. Supported by its climate change commitments, local government leverages its position as a public service provider to take an integrated role as a trusted product broker, capital lender, and retrofit facilitator. The case thus offers an alternative to framings of local government as an enabler of financialisation in the interest of accumulation and exploitation of households by private lenders [26]. However, this is not a role readily taken up by the sector and its future relevance is in doubt. The rates finance model is widely recognised as administratively burdensome, and Darebin City Council was able to draw on cash savings that other councils do not have to fund the program (totalling over AUD$10.5 million), as well as political capital where other councils do not see it as their role to intervene. There are ongoing debates about alternatives, including proposals for a national government-backed funding facility for councils to both subsidise and finance retrofits (EAGA pers. comm. March 2025) and mobilising private capital through property taxes (Environmental Upgrade Agreements) similar to PACE in the US [69]. The governance challenges affecting Solar Saver(s) mirror those identified in retrofit literature, including geographical variation in capacities [70]; reliance on external service providers for delivery [71]; organisational challenges such as difficulty working across silos, declining council budgets, and insufficient prioritisation of programs by council [71]; and a general need for better resourcing [40]. This case thus illustrates the limits of local government leadership and agency in the climate finance sphere in the face of institutional disempowerment.

Third, accessibility remains constrained by structural, material, and financial barriers [72] which limits the transformative potential of the financing model. The special rates charge mechanism relies on a relationship between council and the homeowner and is primarily accessed by owner-occupiers (despite being open to rental properties), demonstrating an entrenched retrofit barrier associated with housing tenure. The particularities of the built environment, such as the quality of the roof and switchboard, constitute material and financial barriers to uptake. In addition, in the absence of battery storage, higher levels of daytime energy consumption are generally required to enable substitution of grid energy consumption with solar and reduce energy bills. This condition potentially excludes more vulnerable households experiencing underconsumption of energy at home, who might not reduce their energy costs as a result of a retrofit and instead consume more to meet their needs [73]. There are further indications that cost of living pressures may influence low-income homeowners' willingness to take on debt [45,46]. Moreover, while calculation of estimated cost savings is relatively straightforward for rooftop solar, there is more uncertainty when it comes to cost savings associated thermal performance upgrades such as insulation, and smaller electric appliances with a lower capital outlay are not expected to warrant a 10-year loan and which are further complicated by the role of household energy use behaviours [7]. The difficulty of calculating cost-savings for certain energy efficiency measures highlights the role modelling tools will likely play in rendering hidden costs of energy inefficiency (such as a lack of insulation and draught proofing) visible and measurable for financial products, as well as potential risks associated with misleading or speculative estimates [24].

6. Conclusion

This paper asked *what role can local government play in home retrofit finance to advance socially equitable outcomes in sustainable housing transitions?* Situated in the literature on place-based intermediation of home retrofit, this paper conceptualises retrofit financing as an intermediation function that assembles private product provider offerings, government subsidies, and energy market prices through cost-benefit calculations, capital transfers, and risk management. Through an in-depth case study of a novel municipal solar finance model, the paper demonstrates local government's role in improving home retrofit uptake through access to credit. As a trusted and benevolent lender providing public credit without commercial terms, local government mediates relations between households and solar and energy markets and state policy and regulation. Socially equitable outcomes for debt-based housing retrofit require alternative financial logics that minimise the financial burdens of capital exchange (interest free credit attached to the property with a long-term repayment period and subsidised support) and enable (vulnerable) households to meet their energy needs. Nevertheless, the transformative potential of municipal home retrofit finance is circumscribed by tenure, the calculability of the retrofit, and municipal finance and administrative capacity.

The research findings thus underscore the ambivalence of local government agency in financing sustainable housing transitions. In this case, the municipality was sufficiently motivated and resourced to innovate and invest substantially in housing retrofit, but remains a sector outlier, in part due to the absence of national-scale funding and streamlined administration to support wider implementation. These structural limits suggest that more radical and systemic interventions are needed to enable retrofit investment in private rental and low-income housing, and to shift beyond resource generating assets (i.e., solar PV systems) such as much-needed thermal performance upgrades, for a just transition to sustainable housing. In the interim, the case demonstrates that local government can play an important role as a

financial intermediary where they have the authority to add charges to residential property taxes, in addition to providing direct subsidies for especially constrained households. Community climate action targets, understanding of resident profiles, willingness of council leaders to experiment, and support from municipal network organisations are key factors that could enable application of the Solar Saver(s) model in other municipal contexts.

CRediT authorship contribution statement

Paris Hadfield: Writing – review & editing, Writing – original draft, Visualization, Validation, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The author has no conflicts of interest to declare.

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Appendices A-D. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.erss.2026.104589.

Data availability

Interview data used in this research is confidential in accordance with the human research ethics protocols. Secondary data detailed and cited in the paper is available on request.

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