Information needs for electrification: a literature review

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1 Introduction

Transitioning household and small business heating, hot water and cooking from fossil fuel gas to electricity is necessary to achieve Australia's 2050 net zero emissions targets as recognised by industry, policy makers and households (Climate Change Authority 2024; Energy Consumers Australia 2023b, 2024b). Electrification also offers a pathway to empower consumers through both greater affordability and improved access to emerging consumer energy products and services (Energy Consumers Australia 2023a).

However, household and small business consumers face significant complexity in navigating the electrification process (Energy Consumers Australia 2024b). There is also much uncertainty around future energy prices and the implications of electrification for product and electricity tariff selection. Maximising the benefits of electrification for consumers often requires engagement beyond merely swapping fuel sources or appliances; behavioural change, technology retrofits, home renovation, and the adoption of new consumer energy resources (CER) are all typically relevant. This engagement is further complicated as individual choices form part of consumers' sometimes-piecemeal electrification journey, where each decision taken creates new opportunities for engagement.

We know that household and small business consumers are motivated to play their part in the energy transition (Energy Consumers Australia 2024). What is less known, however, is what types, formats, and timing of information consumers require in order to be better placed to take action on electrification.

1.1 Contextualising information provision

In examining the role of information provision in electrification, it is important to consider how the way consumers are framed shapes information provision approaches. Dominant consumer narratives frame consumers largely as economically rational actors, motivated by personal gain (Lutzenhiser 2014; Shove 2010). This framing lends itself to information provision aligned with so-called literacy approaches, which emphasise "factual knowledge, cognitive decision-making, ideal attitudes to energy and climate change, and ideal energy saving behaviours" (Burchell, Rettie, and Roberts 2015). It assumes that if people have the right information, they will take action. While

highly scalable, there is growing evidence suggesting that this approach has limited efficacy if not embedded in the broader life worlds of consumers. As an alternative, Brown et al. propose a 'relational' framing of households where people are understood to value "trusted relationships, personal referrals and peer networks when seeking out these services" (Brown et al. 2025, p.3). Interactions between relationality and energy is a growing area in energy studies (e.g. Ambrosio-Albala et al. 2020; Cain 2025; Middlemiss et al. 2019, 2024; Wilson, Crane, and Chryssochoidis 2015). This relational framing positions consumer experiences of energy retrofits (and electrification) within their broader contexts (e.g. cultural norms around energy retrofits, desirable appliances) and decisions (e.g. wider home renovation projects). Accordingly, information provision should better account for these contextual considerations and be embedded within a broader package of supports for household electrification.

It is also important to take note of the role of information within broader policy and market supports. This is evident is a recent survey of low-income Australian households (Chandrashekeran et al. 2023) which found 76% thought information provision to be a very or moderately important support measure to help households transition away from gas. However, greater importance was attached to other measures, including grants towards appliance costs (79%), energy cost subsidies (90%) and landlords upgrading appliances (90%) suggesting information provision is best understood as one element within a broader suite of supports.

1.2 This literature review

This report presents an overview of current understandings of the role of information provision in supporting households and small businesses to electrify their energy use. To this end, we have explored a broad range of both academic and industry literature relating to electrification. Rather than focus on the very large body of technical electrification literature, much of which has been developed by technical experts remote from everyday social realities (c.f. Kaviani et al. 2023), our review focuses on the social science literature, (encompassing multiple disciplines including human geography, behavioural economics, science and technology studies, and social marketing). Much of the academic literature is from Europe or elsewhere but, where possible, we have foregrounded findings from Australian industry and public reports, and from the growing body of Australian energy social science.

We have considered household electrification to include replacement of gas appliances with electric, adoption of electric vehicles and installation of rooftop solar and batteries. Electrification is a relatively recent concept, but has emerged from a broader field of energy consumer-side decarbonisation. We have therefore extended our scope to draw on relevant insights from related topics such as studies of home and business energy efficiency, home energy upgrades and retrofit programs, such as improved insulation and glazing, as well as deployment of consumer-owned energy resources and energy-efficient appliances. Where available, we have included material on small business electrification, but note that much of the literature on commercial electrification is focused on larger businesses, reflecting policy approaches in this area.

In seeking to understand the particular role of information provision, we have explored more broadly the decision-making process and the contexts in which it takes place. Section 2 describes the material context for electrification, including the prevailing infrastructure, the scale and timescale of retrofits and the particular role of key technologies. Section 3 describes the social context: life milestones, values and demographics that drive, inform or constrain decisions, and the role of relationality. Section 4 focuses on the knowledge context and different characteristics of knowledge provision, including its source, its specific purpose, nature and form. In the final Sections of the report, we make a tentative mapping of information needs to stages of electrification journeys as a basis for refining approaches for information provision.

2 Material context

2.1 Prevailing infrastructure

Electrification necessarily takes place within a broader material context. In Australia, this is evident in policy and advocacy focussed on incentivising electrification within existing residential and commercial buildings (e.g. ACT Government 2025) as well as increased regulatory focus on institutionalising electrification in new buildings (e.g. ACT Government n.d.; City of Paramatta 2025; City of Sydney 2025; Victorian Government 2025). Australia currently has approximately 10,879,349 dwellings with approximate quarterly net growth of 0.3 % for houses, 0.5 % for townhouse and 0.5 % for apartments (Australian Bureau of Statistics 2022). This material context both opens up and constrains the ease and attractiveness of electrification opportunities. As Dunlap et al. (2025) illustrate in their Los Angelese-based study, although electrification of household appliances leads to ongoing energy saving which subsequently lowers household bills, building type (detached house, townhouse or apartment) and size (number of bedrooms) will impact the size of these benefits. In their context, the largest benefits flow to single-family detached households. As Davis (2021) notes in another United States based study, these benefits also depend on energy prices and climate (and thus heating or cooling needs). Their assessment found that under 2021 energy pricing models, electrification would result in higher energy costs. It is important to consider how this dynamic may change under future energy pricing scenarios, such as rising gas prices and increasing availability of lower cost renewable energy generation, if electrification technologies are configured to make use of these technologies. It is important, therefore, for information provided to reflect the specific material context (as well as interactions with the technoeconomic arrangements) when exploring electrification options.

Material realities of existing energy supply arrangements also shape electrification opportunities. For example, despite lower energy consumption of many electric appliances, the capacity of the electricity connection to a household or business may not be sufficient to support the power needs of new electric appliances. In the United States, for example, Gul and Meier's (2025) nationwide review of detached house circuit boards indicates that 31 % of such homes would likely need to be upgraded to accommodate new electric appliances. The authors note a correlation between older buildings and lower connection capacities. This issue also features in Australia's

electrification discourse (e.g. Rewiring Australia 2025) where it is noted that changes to building supply arrangements may be required to facilitate electric appliances. Changes to switchboard capacity, metering infrastructure updates or replacement of old materials such as asbestos, or connection of three-phase power are often noted. These material arrangements may reflect earlier energy policy assumptions or programs, such as tailoring of metering infrastructure to state-based solar programs (e.g. Origin Energy 2017) or the uneven roll out of smart metering (c.f. Lovell 2017). The presence of gas networks is also a key factor shaping existing material context. For example, gas use in homes and small businesses is concentrated in Victoria, New South Wales and Australian Capital Territory for cooking, water heating and maintaining thermal comfort (Department of Industry Science and Resources 2024). In these geographies, gas use is largely although not exclusively enabled by the presence of gas distribution networks supplying household and business customers. (e.g. Australian Department of Industry Science and Resources 2024). A detached house may more easily be able to disconnect their gas supply whereas an apartment building or small business operating within a multi-tenanted building may face spatial and electrical capacity as well as other constraints, making this a more challenging option. Dahlgren, et al. (2023) note that, in the short-term, electrification may be more prevalent in new buildings. And there are growing efforts to improve planning and regulatory coherence between electricity and building sectors (e.g. ACT Government n.d.; Australian Energy Market Commission 2025; City of Paramatta 2025; City of Sydney 2025; Victorian Government 2025). Beyond the household, state and territory governments and network operators are also grappling with the work required to maintain safe and reliable network operation as consumers transition from gas to electricity (e.g. ACIL Allen and GHD 2022). This illustrates that building format, age, historic and contemporary planning schemes and existing services are likely key to influence the type of information required to support consumer electrification.

2.2 Home energy upgrade within the typology of home improvement

While it is common to see electrification policy focused on encouraging adoption of specific electric appliances within existing built infrastructure, through upgrades and retrofits, literature increasingly highlights that such actions need to be understood as situated within a broader context of home (or building) improvements. An Australian study (Comber and Soleiman 2025) exploring home energy upgrades found that the scale and purpose of the upgrade influences how households approach the renovation process. Participants in this research fell into three broad categories: major renovation (those undertaking major work that incorporates energy upgrades); home improvements (piecemeal upgrades over time); and emergency replacement (urgent replacement of broken appliances). Australian government support for homeowners interested in electrifying also notes the connection between electrification and key events like renovations, stating: “Consider prime times to go all-electric. These times include when you are renovating, building a new home or upgrading your appliances.” (Department of Climate Change, Energy and the Environment and Water n.d.). Examining these three categories offers important insights for areas of support. While this Section focuses on material context, it is also important to note interconnections between material aspects of renovation and the social context. The latter is covered in more detail in Section 3.1.

For major renovation, substantial opportunities for electrification exist. However, it is important to consider how electrification fits within the scale and complexity of such processes. Rumings et al. (2024) emphasise that, foremost, undertaking large-scale sustainable renovations can be a technical process involving installing solar panels, wires, batteries, control panels, switchboards, pipes, and pumps. As such, these renovation projects tend to be undertaken by professionals. Secondly, renovation cost and the availability of government programs, grants, and subsidies are key influences on large-scale renovation decisions. Thirdly, aesthetics, convenience and comfort are often primary or significant drivers of renovation but may not align with sustainability or electrification goals.

Similar findings are emerging in home improvement electrification. Mogensen and Gram-Hanssen (2023), in their Denmark-based study, found that energy renovations (e.g. installing heat pumps, solar PV, insulation, etc.) often only occur after amenity renovations, meaning those more closely associated with functionality or social life in the home (such as a kitchen upgrade). The authors also find that people gain experience and skills in home renovations (whether as DIY or through contracting professional tradespeople), which they bring to bear on successive home renovations. Thus, energy-related renovation "is usually not implemented in isolation, as a one-off renovation, but often follows or is guided by other renovations. They are also usually implemented by more experienced renovators, who have already implemented amenity renovations related to the social life at home." (Mogensen and Gram-Hanssen 2023 p.39). The role of renovation in prompting electrification (for example of stove tops) was also found elsewhere (Boddington 2025; Brown et al. 2025).

Finally, emergency replacement of appliances is a key opportunity to implement electrification. This introduces a major challenge as the loss of amenity and inconvenience may prevent planning and deliberation needed to pursue electrification resulting in a like-for-like or lowest cost replacement (c.f. JWS Research 2021). While limited academic literature exists, this concern is increasingly evident in household and small business focused grey literature, such as government websites, which all direct attention to this end-of-life replacement opportunities or encourage early planning (e.g. ACT Government n.d.). However, a key opportunity exists to ensure the right information is available to households and small businesses during emergency replacement decision making e.g. from installers, real estate agents or other involved at the point of time critical decision-making.

2.3 The role of appliances in shaping electrification pathways

While it is important to consider appliances within the broader material infrastructure, the literature also highlights that certain appliances, technologies, and services can influence electrification pathways. These technologies may be desirable in their own right. They can also act as catalysts for further electrification. They can also be "sticky", resisting change. These divergent pathways reflect the complexity of electrification within the broader material and social context.

In Australia, rooftop solar is hugely popular, with 40 % of detached houses now hosting rooftop solar making it the second largest source of renewable electricity

generation (Ashby et al. 2024; Clean Energy Council 2025). This high uptake reflects the technology's popularity and the substantial support that successive federal and state governments have provided to households as part of decarbonisation objectives, through rebates and feed-in tariffs for eligible new solar installs (e.g. Australian Greenhouse Office 2005; Department of Climate Change and Energy Efficiency 2012; NSW Government 2009). With the emergence of the electrification movement, rooftop solar increasingly features as a key technology in electrification processes, as households and businesses with rooftop solar look to make "proper use" of the output of their rooftop solar system through electrification (Boddington 2025). For some, this is driven by a sense of pride in making a contribution to wider collective effort to achieve environmental and social outcomes (e.g. Lucas-Healey et al. 2022). However, there is a growing narrative around financial imperatives (e.g. Boddington 20240 Chandrashekeran et al. 2024). Boddington (2025), for example, observed that installing rooftop solar could act as a prompt for stovetop electrification to realise cost savings available. Chandrashekeran and colleagues (2024) also observed this sentiment for lower-income Australian households: "solar installation encourages electrifying appliances to maximise the return on investment which creates a positive feedback effect and virtuous cycle driving further electrification." (pg. 12). A similar narrative is embedded in policy support to households and businesses to adopt small-scale battery systems (e.g. (Department of Climate Change, Energy and the Environment and Water 2025). Importantly, however, Chandrashekeran et al. (2024) reinforce that assets (such as owning one's own home with access to useable roof space) and resources alone are not sufficient to facilitate electrification; the presence of trusted intermediaries, and issues such as the impact of infrastructural politics (how energy systems are designed and controlled, by and for whom) and energy injustice, also importantly shape electrification among lower-income households (also noted in Section 3.3). The expiry and phase out of feed-in tariff incentives, introduction of household and business solar export limits and changes to electricity pricing which incentivise self-consumption and load shifting offer important context to this narrative (e.g. Essential Energy n.d.; Essential Services Commission 2025).

Similar to rooftop solar, EV adoption is increasingly entwined in the movement towards electrification. EVs are a new electrical load with significant power and energy demands previously supported by non-electric energy supply infrastructure (e.g. petrol, diesel and gas). Australian EV ownership arguably remains in the early adopter phase of roll out, with EV purchases dominated by those with higher incomes, living in detached houses and with environmental factors a key motivation (Mortimore, Ratnasiri, and Iftekhar 2024). However, Australian and international research suggests the increasing visibility of EVs, for example, through social and local peer networks and media, is also a key driver of interest in EVs and similar technologies and is expected to promote further uptake, along with other drivers including lower cost of ownership (Kale and Brown 2025; Mortimore et al. 2024). Industry research from Australia highlights the link between solar and electric vehicles, showing that electric vehicles can support the continued integration of solar into the grid by acting as a solar sponge during daytime solar generation peaks (Electric Vehicle Council 2024), key to the value proposition of EVs (c.f. Boddington 2025; Chandrashekeran et al. 2024). A Queensland-based study indicated a preference for charging at home, mostly from a combination of grid and rooftop solar

among early adopters (Mortimore, Ratnasiri, and Iftekhar 2024). Similarly, a study of electrification in the rural United States found that rooftop solar and electric vehicle adoption are highly correlated (Min and Mayfield 2023). Interest among households to charge EVs using their own rooftop solar may also drive household-level uptake of home batteries to facilitate charging from solar in the evening or overnight (e.g. Shen et al. 2023), particularly for those who use their EV as a business vehicle or to commute to their place of work. Alternatively, availability of EV charging infrastructure in publicly accessible locations or at workplaces or similar material infrastructure and consumer willingness, may be required to unluck solar sponge benefits. In rural areas of Australia there appears to be a preference to retain internal combustion engine vehicles as a backup for electric vehicle in case of emergencies; however, the presence of the backup vehicle was also connected with a greater willingness for automated EV charging (Dahlgren et al. 2023), a material infrastructure (as well as a practice) that may be required to enable electrification.

As shown above, the literature suggests climate concerns and sustainability issues remain key drivers for rooftop solar and EV adoption which may precipitate broader household and business electrification. However, some appliances appear more resistant to electrification. In the United States, a number of studies position heat pumps (for space heating) alongside rooftop solar and EVs as the three key technologies enabling electrification. However, some studies suggests motivations for heat pump adoptions do not necessarily align with other technology adoption pathways (Kale and Brown 2025). The enabling material infrastructure is important; for example, in the United States, air conditioning may be provided centrally (Huang et al. 2023) reducing the agency of individual households to drive electrification of this service. Similarly, an Ireland-based study of space heating upgrades indicated that location near existing gas supply networks made switching to electric heating less likely, and that knowledge of environmental impact had no discernible influence on heating practices even among those concerned about the environment (Curtis, McCoy, and Aravena 2018). Heat pumps may introduce new spatial and acoustic characteristics, e.g., the need to find space for additional components sometimes located outside (as for a split system) or the production of new sounds during operation, which must be navigated in the transition to new electrified water and space heating technologies (Fell 2022; de Wilde 2021).

Cooking electrification may also face challenges. As found repeatedly in studies of clean cooking interventions the global south (e.g. Akpalu, Dasmani, and Aglobitse 2011; Malakar 2018; Masera, Saatkamp, and Kammen 2000; Yasmin and Grundmann 2020), cooking technology selection is deeply rooted in social context, such as taste preferences, social practices around cooking, and the ability of cooking technologies to enable preferred cooking practices. Similar factors are observed in studies of cooking electrification in Australia and similar contexts. As Boddington (2025) found, some participants were unfamiliar with induction stove top and thus sceptical that it could be used to prepare culturally-specific dishes as effectively as their gas stove. As Chandrashekeran et al. (2024) points out, assets and resources alone are insufficient to support electrification, as issues of identity, cooking practices, and cultural norms also shape the appliances and energy sources people use.

An alternative incremental approach to electrification is to target appliances that are inefficient or require high gas consumption (also seen in Department of Climate Change, Energy and the Environment and Water 2025). In the Australian Capital Territory, for example, a recent study of electrification found that the chief energy efficiency and emissions reduction benefits come from replacing inefficient gas heaters with reverse cycle air conditioners (Hammerle and Burke 2022). The study also noted the positive impact of large reductions in gas consumption for more vulnerable households through water heating electrification. This strategy may be an effective way of demonstrating the benefits of electrification through the delivery of cost savings which, in turn, may inspire (and with cost savings, enable) further electrification.

2.4 Small Business

While less is known about small business energy upgrades, it is likely that there is much diversity within the material context. Some businesses operate from a household setting. where small business operations may interact with household renovation projects discussed above. As Strengers, et al. (2021) note, for those who are able to work from home, households where small businesses operate are likely have higher energy use (e.g. driven by need for space heating and cooling during business operating hours). This higher energy consumption may precipitate electrification efforts through appliance replacement or larger renovation projects, justified by need for amenity and through linkages to business operating costs. For small businesses operating from tenancies, the situation is more complicated as they often have less control over the material infrastructure, such as central or shared heating and cooling provided across multiple tenancies (Daly et al. 2023).

3 Social context

The social context describes how personal and relational considerations, including individual characteristics like gender, income, core values, and key life events, as well as social relationships, shape when and how people undertake electrification (including within renovations). As such, the social context is important to consider and offers insights into the types of information households and small businesses need. These social considerations should be understood as contextual and connected, rather than as isolated factors shaping electrification. For example, although an Australian study found that home ownership was central to electrification, financial considerations, like the installation costs for solar panels, were also key to whether people actually electrified (Chandrashekeran et al. 2024).

3.1 Life stage and key life milestones

The literature demonstrates that life course (meaning the phase of life one is in, rather than a particular age) and key life milestones are important because they can act as triggers that shape the timing of electrification and energy retrofit. In a Portuguese study (Abreu, de Oliveira, and Lopes 2020), the homeowner's phase of life was found to connect with their motivation for energy-related renovations, such as replacing windows and upgrading hot water and heating systems. Older homeowners (over 65) were more concerned with the functionality, safety, and comfort of the home, as well as the length

of payback periods. Middle-aged owners (50-65) were seen to be more interested in connecting energy-related renovations with aesthetic improvements or visible measures. Younger homeowners (under 50) tended to take a piecemeal approach to renovation due to a lack of capital. Meanwhile, key life events including the birth of a child, purchasing a home, undertaking a major renovation, children leaving home, and retirement have all been found to importantly shape home renovations, including those involving energy upgrades (Brown et al. 2025; Tapsuwan et al. 2018; Tjørring and Gausset 2019). An anthropological fieldwork study of Danish homeowners receiving energy advice similarly found that home renovation "reflected the situation of the homeowners' life cycle and were influenced by personal events." (Tjørring & Gausset 2018, p.401). Consequently, the study authors suggest that "energy advisors should be more sensitive to this issue both to target people in a specific situation and to adapt their message to these specific situations." (Tjørring & Gausset 2018, p.402).

3.2 Attitudes, motivations, and values

Dominant "rational actor" narratives seen in electrification policy often position people's attitudes, values, and motivation as primary drivers of electrification. While cautious to note that such drivers fit within broader lifeworlds, these considerations nonetheless shape how those decisions are made. Research consistently finds that financial, environmental, and health and safety considerations are key priorities, while comfort-related attitudes are also important. For example, a representative sample of Australian households conducted by the Australia Institute found that environmental reasons were the largest driver of positive attitudes to home electrification, followed by the potential for cheaper energy bills (Stolper, Diseris, and Di Benedetto 2023). Research from Energy Consumers Australia similarly found that environmentally conscious consumers and early adopters of technology were more interested in home electrification (Energy Consumers Australia 2024b). International studies echo these findings, showing that those who are more concerned about the environment and combating climate change are more likely to undertake energy retrofit and renovation; nonetheless, financial considerations, including installation costs and reducing energy bills are also priorities (Ameli and Brandt 2015; Broers et al. 2019; Ebrahimigharehbaghi et al. 2019). A nationally representative survey of American households found that the most common reason cited for choosing electric replacement appliances was safety, followed by environmental sustainability, energy efficiency, and reliability (Sussman and Eisen 2024). Comfort is also understood as an important influence on the adoption of heat pumps for space and water heating, although here the implications are less clear because of the subjective nature of comfort. For example, while a Danish study found that improving comfort was one of the key motivations for purchasing a heat pump (Gram-Hanssen, Christensen, and Petersen 2012), a German study found that a higher prioritisation of comfort meant households were more likely to retain fossil fuelled heating systems (Michelsen and Madlener 2016). Understanding underlying attitudes, values, and motivations offers opportunities to identify and target different audiences with tailored information.

3.3 Demographics: Home ownership, income, and gender

Demographics, including home ownership status, income level and gender, also influence electrification and home energy retrofit. Australian research shows that home

ownership (along with roof space, and financial means) are key influences on electrification (Chandrashekeran, et al. 2024). Another study of solar PV adoption in Australia similarly found that cost, along with issues surrounding tenure (e.g. rental or payback periods exceeding anticipated residency), can act as barriers to uptake (McCarthy 2025). Much literature understandably focuses on the housing occupants, revealing important insights into homeowners, as well as renters who are often an excluded demographic in home energy retrofit programs. A recent Australian-based study of landlords suggests that many of the policy mechanisms to encourage landlords to undertake home energy retrofits do not address the structural barriers that prevent them acting (Hammerle, White, and Sturmberg 2023). These findings are reflected in international literature, which likewise shows that homeowners and higher-income households are more likely to invest in clean and energy efficient technologies (Ameli and Brandt 2015). Energy Consumers Australia research (2024) similarly indicates that income may be a barrier for electrification, with low-income households less likely to consider replacing gas due to the upfront installation costs.

Much scholarship has illustrated the role that gender plays in household energy programs. Gender has been observed to influence energy consumption via gendered practices around housework and care (Gram-Hanssen et al. 2017; Johnson 2020). Gender roles are also seen to be reproduced or reinforced through the uptake of solar PV systems and use of energy management and monitoring systems (Mechlenborg and Gram-Hanssen 2022). Likewise, consumers' home renovation and electrification journeys appear to be shaped by gender in a number of ways. As illustrated by Bolton, et al. (2023), norms around gender can produce distinct meanings and motivations for home renovation: women, commonly positioned as carers, may prioritise upgrades as expressions of care, while men, traditionally framed as financial managers, may see renovation in economic terms. These authors also explored how gender influences interactions between homeowners and tradespeople. Some women reported feeling taken advantage of in the absence of a male presence in the household, while others expressed a reluctance to engage with certain tradespeople. Relatedly, Crawley, Wade and de Wilde (2023) explore the differently gendered impacts and key differences between existing heating systems and heat pumps. They find there are indications that heat pumps could be beneficial for women's thermal comfort and wellbeing needs due to their more stable temperatures. Yet, home energy upgrades like installing a heat pump are often the domain of men, and engaging with heat pump controls is gendered, with some women less likely to adjust settings. On this basis, the authors suggest that further work is needed to better consider and involve women in the heating transition, including in relation to technology design, accounting for gendered heating practices, and in the interactions of installers with customers.

In related research, de Wilde (2020) explores heat pump adoption through a feminist-inspired STS (science and technology studies) perspective to understand the relational dynamics between users, technology, and technicians. She argues that heat pump adoption goes beyond installation to also include maintenance, repair, and care – practices which are typically gendered, and in which technicians often engage women post-installation, invoking their perceived responsibilities for care work and domestic duties. Consequently, although support for post-installation training on care and

maintenance of heat pumps is important, this must be done in a more equitable way that shares responsibilities. In terms of electrification, this research suggests a general need to better account for the ways in which technologies like heat pumps are used and maintained post-installation, as well as deeper reflection on how laudable policy goals like promoting energy efficiency or home retrofits or may unintentionally reflect or further entrench normative gender roles in the home.

While much of the literature on gender and home energy renovations reveals energy retrofit installers assumptions that men lead energy retrofits, this may not accurately reflect the Australian experience. Membership of the popular community electrification information-sharing forum, My Efficient Electric Home has evolved from 80% male in 2015 to 56% female in 2021, demonstrating increased interest in electrification amongst women. However, 90% of the most active posters are men (Temby and Ransan-Cooper 2021), suggesting a continuing gender imbalance amongst existing technology *users*, or perhaps that men have greater confidence in their own technical expertise.

Such insights are not intended to be prescriptive in terms of their reflections of gendered practices in the home; rather, they illustrate how gender norms can significantly shape the way different people engage with the process of home renovation and energy upgrades, as well as the ongoing use of and care for these technologies. Information that accounts for a diversity of people, needs, and contexts – including in the context of gender – is vital to ensuring that energy efficiency and electrification programs are successful and reach as many households as possible.

3.4 Relationality

Taking account of broader, related issues – including thinking about the energy system and engaging with the energy transition – we can understand in general terms the role that social networks play in energy decisions. The idea of relationality also helps draw attention to the role social relationships play in supporting electrification. De Wilde and Spaargaren (2019) describe three types of low carbon retrofit customer journey, each involving different trust relations with intermediaries: *private*, where the household relies on the expertise of a local intermediary such as a sustainability consultant; *civic*, where information is shared through an engaged community of households[1]; and *public,*– where information and support tools provided through a digital platform seek to expand householders' expertise and decision-making competencies.

As mentioned in Section 1.1, there is a growing need to bring nuance to dominant understandings of energy consumers as rational actors in the energy system. Research challenging or adding nuance to the view households as *purely* rational consumers is not new (e.g. Shove 1998). According to Brown et al. (2025), part of the underperformance of energy retrofit policies can be attributed to the framing of households as 'rational actors' whose chief interest is having choice in a competitive market that drives lowest cost options. At the same time low uptake of energy efficiency measures is understood as the result of lacking information, time, and financial capital – barriers which once removed "allow households to undertake what are assumed to be cost optimal improvements"

[1] The Facebook group My Efficient Electric Home is a prime example

(Brown, et al. 2025 p.2). Though influential, Brown et al. argue that this rational actor framing of households is limited and ignores social and cultural dimensions of home life that importantly shape energy use and retrofit. In place of the rational actor, Brown et al. (amongst others, such as Hargreaves and Middlemiss 2020, Steg et al 2005, and Wilson et al 2015) propose a 'relational' framing of households where people are understood to value "trusted relationships, personal referrals and peer networks when seeking out these services" (Brown, et al. 2025 p.3). A key argument of this work is that energy retrofits occur within broader contexts (e.g. cultural norms around energy retrofits, desirable appliances) and decisions (e.g. wider home renovation projects). Accordingly, information provision should better account for these contextual considerations and be embedded within a broader package of supports for household electrification.

As outlined in Sections 2.2 and 3.1, rather than seeing retrofit as a standalone project, households frame energy efficiency retrofits within broader contexts, including wider home renovations, moving to a new home, changing family circumstances, and replacing faulty services and appliances). Social relations beyond those with formal expertise, including the relationships one has with family, friends, neighbours, and others, also importantly shape how home energy retrofits occur (Bolton, et al. 2023). For example, exchanging positive experiences with neighbours and friends can increase solar PV uptake (Fox, 2018). Along with broader work exploring connected themes like care for consumer energy resources (Lucas-Healey 2022) and the role of social relations on who applies for energy subsidies (Owen et al. 2023), these findings collectively suggest that the way electrification occurs is influenced by those around us and our personal relationships.

Intermediaries, such as retrofit advisers, salespeople and installers, are important sources of information about domestic energy technologies and electrification more broadly (Owen, Mitchell, and Gouldson 2014; Wade, Hitchings, and Shipworth 2016). They are the people who engage directly with consumers to identify suitable technologies, outline costs, discuss installation options, and oversee the installation itself. Energy consumers are often dependent on advice and decision-making support from these intermediaries as the energy retrofits are singular goods (Karpik (2010) in de Wilde (2020)), that is, they involve multiple elements, vary in quality and are difficult to compare, particularly for a non-expert. As de Wilde (2021) demonstrates, consumers may simply have to trust in the advice provided by intermediaries when making energy upgrade decisions, particularly within the messiness of everyday life. This point is similarly noted by Lucas-Healey et al. (2022) who observe that household decision-making is often facilitated by social connections developed with suppliers; knowledge and skills (particularly technical) as well as time and energy to self-educate, and material resources and infrastructure are also important. Despite the important role that intermediaries play in facilitating energy upgrades, these actors are under-considered in low carbon retrofit policies (Horne and Dalton 2014). Owen et al. 2014, in theorising 'relational' retrofits, suggest that the *source* of information, rather than only the information itself, is at least an equal priority for people electrifying their homes.

In terms of how small businesses like tradespeople interface with electrifying households, insights from Electrify 2515 suggest that issues like familiarity with

electrification and electric appliances, and subcontracting relationships between electrical generalists and relevant specialists (e.g. for specific appliances and/or services), are vital for supporting household electrification (Harvey-Scholes 2024). Businesses such as Goodbye Gas (Goodbye Gas n.d.), which offers a one-stop shop for household electrification and coordinates trades on behalf of residential customers, further attest to the significance of managing social relationships in home electrification, aligning with ECA's finding that "Australia needs One-Stop-Shops to provide trusted advice to households, to help guide them through the process, and ensure they can make optimal decisions that suit their circumstances at the right times." (Energy Consumers Australia 2024, p.3)

3.5 Small Businesses

There is some overlap between the priorities, capacities, and everyday needs of households and small businesses. However, small businesses likely conform more to the economically rational view of consumers imagined by the sector, as they tend to prioritise financial considerations (upfront costs, the impact of installation on revenues, long-term profitability), while requiring that electrified services can perform the same core functions as their fossil fuel counterparts (i.e., no loss of service). However, they also have multiple demands on available capital, and electrification investments may need returns that compete with those of core business activities. The social context of small businesses may also constrain electrification. As noted above, small businesses operating from tenancies may have limited control or influence over energy appliances once they have signed the tenancy agreement. Similarly, a facilities manager in charge of appliance operations may be me more concerned with service level (to avoid complaints) rather than how the service is delivered (Daly et al. 2023).

Daly, et al. (2023) also highlight the importance of regulators in setting minimum standards; while building managers value lower operating costs (which may be achieved through the efficiency of electrical appliances), installers and technicians often seek to secure work by offering products with lower upfront cost. In addition to regulating minimum standards, the authors suggest building owners should be obliged to disclose relevant and plain English energy information (in their study of Heating, Cooling and Ventilation, they suggest maintenance records) to prospective tenants to address information asymmetries. In this vein, there may also be a role for voluntary sustainability certification programs, such as Climate Active (Climate Active 2019) and B Corp (B Lab n.d.) to assist small businesses to engage with electrification in a structured way.

Research from Energy Consumers Australia illustrates how small businesses source advice from wide networks, including from peers, customers, staff, industry associations, and advisors (Energy Consumers Australia 2023a). This research also underscores the need for advice tailored to the varied contexts and needs of Australian small businesses.

4 Knowledge context – role of information

Where is the wisdom we have lost in knowledge?
Where is the knowledge we have lost in information?
Eliot, T. S. "Choruses from *The Rock* "

Research suggests that knowledge or its absence plays an important role in electrification decision making. For example, "knowledge and confidence drive upgrade decisions" (BETA 2025) and lack of knowledge about heat pump technology and cost is a barrier to heat pump adoption (Rao, Siam, and Bond 2025). According to the Data-Information-Knowledge-Wisdom (DIKW) hierarchy (possibly based on Elliot's quote above, (Lucky 1989)) knowledge is created from information, but is not equal to information. People create, acquire and apply knowledge by processing relevant information within social and material contexts (as described in Sections 2 and 3). There is also evidence that people navigating electrification are faced with *too much* (rather than too little) information about energy efficiency programs, appliance upgrades and the like and that its volume and complexity can reduce their understanding and confidence to make good decisions (BETA 2025), overwhelm them, and ultimately become an impediment to household engagement and action (The Insight Centre 2023).

It is therefore important that the right type of information is provided to households and businesses when they need it, that it is relevant to the decisions they are making, and is in an appropriate form and from the right source; it is equally important that irrelevant, incomprehensible or poorly timed or delivered information is avoided.

4.1 Purpose of information

Information about electrification can serve a range of purposes. The appropriate content, form and source for providing the information depends on this intended purpose and on the needs of the recipient. The concept of the 'customer journey' is an increasingly central element of commercial service design (Lemon and Verhoef 2016) and public policy (Ludwiczak 2021); this also appears to be the case in energy, where terminology around electrification journeys, electrification pathways, and the customer journey feature across the home retrofit and electrification literature, as well as in policy and business arenas (Brown, et al. 2025). In essence, electrification journeys refer to a step-by-step process through which fossil-fuelled appliances are replaced with electric alternatives. As Brown et al. (2025) note: "at each stage there are opportunities and pitfalls to ensuring a smooth and positive customer experience."

In de Wilde and Spaargaren's (2019) customer journeys described above, six touch points are identified (Sensitize-Advice-Tender-Install-Evaluate-Inspire), which present opportunities for an intermediary or service provider to engage with the customer, including by providing information to inform decision-making. The purpose of the information provided at each touch point is dependent on the stage of the journey.

Sensitising information aims to alert households to the benefits (financial, environmental, comfort, etc.) of retrofits. *Advice* includes information tailored to individual preferences, dwelling characteristics and energy needs to inform decisions

about the type of retrofit or appliance. At the next stage, households navigating the *tender* process and seeking to understand contractor's claims and quotations benefit from transparency, which the authors suggest can take the form of recommendations for contractors, but might also be afforded by helping people compare options presented to them, using appropriate metrics. Information provision during *installation* is focussed on operation, maintenance, etc. of appliances and is largely the domain of contractors and suppliers. Post-installation, there is an opportunity to provide information to assist households to *evaluate* their retrofit – comparing predicted costs and benefits with actual outcomes – and to use their experiences to *inspire* others to retrofit.

4.2 Information content

4.2.1 Tailored information

Good decisions require relevant information and, importantly, the removal of irrelevant information (Ackoff 1989). A number of studies identify that tailored information can help households and small businesses navigate their electrification opportunities, but lack detail about the type of tailored information that is needed.

Many consumer information campaigns aimed at energy behaviour change focus on sensitising information, calling households to specific actions rather than helping them to identify the best or most appropriate action for their specific circumstances (The Insight Centre 2023). The ECA Consumer Sentiment Survey (Energy Consumers Australia 2024b) found that households and businesses want general information about products and ways to reduce costs (40% and 35%, respectively) more than more tailored *'recommendations for products to narrow my choices and suggest actions based on my household details'* (22% and 24% respectively). However, participants in the Australian Facebook group My Efficient Electric Home (MEEH), a community forum for sharing information on household electrification, are often looking for personalised and context-specific information, based on their budget, house characteristics, location, climate zone, energy usage, driving patterns, personal preferences and future plans (Temby and Ransan-Cooper 2021).

Interestingly, in the low-income household survey described above, although only 78% of respondents thought information provision to be important, 82% thought energy assessments and advice (i.e., tailored information with a particular form and source) to be important (Chandrashekeran et al. 2023). More specifically, the same report identified that low-income households, in particular, need more information about the affordability of electric appliances and the potential bill savings (as well as other benefits) they can deliver, as well as advice "tailored to their circumstances of energy hardship, vulnerability or financial stress." Renters in particular, for whom the options to electrify are more constrained, have different information needs from homeowners (BETA 2025).

This suggests that highly personalised information, relevant to "both the property and the householder aspirations" (Simpson, Cockbill, and Childs 2022), may be useful to a subset of households and businesses, while others are looking for information targeted more broadly at their demographic. "Tailored information" is a very broad category and further research is needed to explore to what extent the appetite for tailored information

depends on its purpose, content and delivery form and varies across demographics and circumstances.

4.2.2 Financial metrics

As discussed at length above, to view households – or even small businesses – as *purely* rational actors in their approach to electrification is to neglect the considerable influence of material and social contexts on decision-making. Nevertheless, the cost of buying and installing a new technology or appliance, and the consequent reduction in running costs, as well as environmental benefits, are key factors influencing take-up of new technologies. (BETA 2025; Chandrashekeran, et al. 2023). A survey of Australian households (BETA 2024) found cost and savings calculators to be the second most popular type of information (42% of participants). However, these factors can inform the decision-making process in different ways, and can be presented using a range of metrics, relating to costs, benefits or a combination of both.

Assessing the cost of electric appliances requires an understanding of the appliance specifications, which in turn depend on household characteristics and behaviour and other factors like building construction, climate zone, etc., as discussed in Section 2. However, the full cost of electric appliances can also be hard to identify with any accuracy, as installation may require upgrades to switchboards and wiring that are only identified when the contractor visits the property (also see Section 2.1). Understanding this total cost of installation is important; a number of academic studies explore "willingness to pay" for heat pumps, for example, focusing only on capital cost (Rao, Siam, and Bond 2025) as high – or unknown – up-front costs can be a hard barrier to installation. This is particularly true for low-income households, for whom subsidies and grants are extremely important (Chandrashekeran, et al. 2023). The significance of the up-front cost for a particular household or business also depends on the availability of cash or cost of borrowing and their personal opportunity cost for the technology investment.

Reduced energy bills can be an important benefit of electrification, as of energy efficiency, and a key driver in decision making. This can be hard to quantify without an understanding of existing and future behaviour and energy use as well as a number of external factors. For example, cost savings from rooftop solar and batteries depend on the amount and timing of electricity use, as well as roof orientation and slope, climate and electricity tariffs (e.g. Ashby et al. 2023). For example, cost savings from replacing heat pumps in place of gas for water heating depends on tank size, electricity tariff, climate, household size and hot water usage patterns (Yildiz et al. 2025), as well as whether it is installed in conjunction with rooftop solar and/or a battery (Liu and Yildiz 2025).

The balance between costs and benefits can be understood in different ways. Commonly used metrics for evaluating consumer investment decisions, from a purely economic rationalist viewpoint, are net present value (NPV), return on investment (ROI) and payback period. ROI and NPV are useful metrics for comparing the financial return on different investment opportunities but are only well understood by people used to investing capital for a return. Payback period is more widely understood and is often used

in consumer-facing comparisons of the financial impacts of energy efficient appliances. The savings from some technologies (for example, rooftop solar) pay back their investment cost in a few years in most circumstances. However, for others (such as batteries or hot water heat pumps), the variability of cost savings means that some households or businesses will be unable to recover the investment cost within the technology lifetime.

Other financial considerations may also be relevant to an individual consumer's circumstances. Availability and perceived cost of capital can be important. From an economic perspective, discounted payback period provides a more "accurate" measure of the value of an investment than simple payback period, but the appropriate discount rate to apply depends on individual circumstances as well as future economic forecasts. Simple payback is a more intuitive concept and, although it does not account for individual circumstances or the time value of money, enables a straightforward way to *compare* different technology options under "standard" use case scenarios. Consumers need to assess costs and benefits relative to their own values framework, e.g., the perceived value of future bill savings to an individual, as well as their appetite and capacity for risk. Many people, particularly those without easy access to capital, consider present costs more highly than future benefits (BETA 2025). However, others may be more willing to spend money now to minimise future bills (in retirement, for example) or to hedge against possible future energy price increases.

As with other consumer-facing environmental programs, consumers may seek to make use of (often technology- or appliance-focused) subsidies and rebates. Indeed, for those planning home energy upgrades information about available government rebates and subsidies (48%) emerged as the most popular response, followed by cost and savings calculators (42%), in a national survey (BETA 2024).

4.2.3 Emissions

67% of Australians are very or quite interested in reducing their household carbon footprint but only 43% clearly understand how to do so (Energy Consumers Australia 2024b). For many households, emissions reductions is a driver for electrification, particularly when bundled with co-benefits such as bill savings and comfort (BETA 2025) (also see Section 3.2). For example, ECA research shows that emissions reduction was a major reason for 27% of existing solar installations and a minor reason for 40% and, of those considering solar, 33% consider emissions reductions a major reason and 47% a minor reason. However, more people associate rooftop solar and electric vehicles with emissions reductions than other retrofits like heat pumps, insulation or double glazing (BETA 2025), suggesting a need for sensitizing information about the environmental benefits across all retrofit and electrification options, as well as more granular advice on the comparative emissions impacts of different technologies.

4.2.4 Process

Other uncertainties that householders have about retrofits include lacking information about suppliers, installers, specific appliances and the process of preparation and installation (Simpson, Cockbill, and Childs 2022). In the government survey described earlier (BETA 2024), 30% of surveyed Australians were interested in information about 'choosing the right upgrade'. Many of the posts in the My Efficient

Electric Home group are about process, including questions about how to correctly size solar or batteries, what type of system to specify when asking for quotes, how to compare quotes from installers, how to prepare the home for EVs, how to maximise the benefits of solar and batteries, post-installation (Temby and Ransan-Cooper, 202). As well as needing to understand their options, households are looking for confidence in "what to do and in what order" (Simpson, Cockbill, and Childs 2022).

4.3 Trusted sources

In the discussion of social relationships supporting electrification (Section 3.4 above), the role of trusted private, public and civic intermediaries, is identified. More broadly, the level of trust, mistrust ("stemming from doubt or fear (Lehtonen and De Carlo 2019) and distrust ("the absence of trust", ibid.) in the source affects how people process information.

A report by the Insight Centre (2023) underscored a general lack of trust in energy market institutions, energy providers, and government. This conclusion is echoed across academic, government, and industry sources (e.g., Temby and Ransan-Cooper 2021), although there is heterogeneity across different types of organisations. In Australia, Temby and Ransan-Cooper (2021) found that information from different levels of government is seen differently, with local councils generally well trusted and some households and industry experts having less trust in the then federal government, specifically, due to their climate and energy policies (Temby and Ransan-Cooper 2021). Meanwhile, ECA's 2024 Consumer Sentiment Survey found that trust in Australian electricity and gas companies is lower than in banks and supermarkets (Energy Consumers Australia 2024b).

Other reports noted that low trust in the energy sector as a whole was the result of increasing energy bills, inadequate consultation on the construction of transmission infrastructure, engagement with for-profit organisations and tradespeople, a lack of long-term planning, and the privatisation of an essential service (Temby and Ransan-Cooper 2021). Trust is dynamic, requiring long term effort to establish and maintain (de Wilde 2020). As explored elsewhere (e.g. De Wilde and Spaargaren 2018), many of these trust issues can be at least partially addressed by considering the intermediaries households engage with (e.g. social welfare organisations, family/ friends), providing one-stop shops, and training tradespeople/ appliance retailers/ energy retailers to build trust (Chandrashekeran et al. 2023).

A survey of low-income households (Chandrashekeran et al. 2023) found high levels of trust in information from social welfare organisations; government bodies, especially councils; and social and cultural networks, particularly for people who speak a language other than English at home. There is evidence that information provided by community groups can have a positive impact because they are more trusted and, more broadly, households trust groups they perceive to be free of commercial or political bias (Temby and Ransan-Cooper 2021).

The Insight Centre report noted that top search engine results were often from corporate entities, of whom consumers are less trusting. Marketing information

(brochures and websites) from technology suppliers can be useful for understanding specific technical aspects but may be perceived as 'spin' and distrusted or ignored, particularly if accompanied by unsolicited sales tactics or 'easy pay' finance options (Temby and Ransan-Cooper 2021). An important source of information is tradespeople and appliance or energy retailers, but they may be seen as less trustworthy (Chandrashekeran et al. 2023) or as "too bullish" (Simpson, Cockbill, and Childs 2022).

4.4 Form

"...where information is provided, it needs to be delivered in the right way, in the right format, at the right time, to the right person." (Temby and Ransan-Cooper 2021 p.38).

The most appropriate and effective form of information depends on its purpose and content. For example, the Insight Centre report, focused on sensitising information aimed at reducing consumers' bills, recommends singular, stand-alone messaging with a simple, low-effort call to action (The Insight Centre 2023), and advises specifically against communications that require people to visit a website. However, at the advice stage, the best course of action is dependent on multiple factors. This requires more complex information and some way for people to interact with the information source rather than simple one-way messaging. This could include allowing people to choose particular pieces of information from options presented on a fact sheet or website, online tools that use a series of questions to guide users to tailored information, through to talking to a consultant.

4.4.1 Solar and batteries

As the Australian household and small business market for rooftop solar is mature and, with the recent implementation of the federal government's cheaper home batteries program, the market for batteries is rapidly expanding, it is unsurprising that there is more consumer information available for solar and batteries than for electrification more broadly.

The federal government's Solar Consumer Guide (SCG) and Solar Victoria's Solar Hub are the leading civic information sources. Both provide high level explanations of solar and battery technologies, guidance for navigating the process of installing solar and batteries, including selecting suppliers, installers and products, generalised information on costs and (financial and emissions) benefits, and tips for maximising the benefits post-installation. Both sites also link to the APVI's SunSPOT tool for more tailored advice, contextualised within broader, high-level information.

Commercial options include Solar Choice and Solar Quotes. Like the SCG and Solar Hub, they provide "101" level overviews of as well as information aimed at helping consumers navigate the process. They also offer tools to assist consumers to tailor general information provided to make more relevant for the consumers' specific circumstances, such as area-based calculations to estimate potential energy yield from the consumer's roof, or rebates or subsidies that may be available (linked to location). Commercial options typically operate as lead generators for solar and battery installers; that is, they are paid by installers for referring customers (both entities make this disclosure on their websites). Installers they refer typically have passed a quality assurance process and provide services to the location of the customer, acting to

establish trust between the customer and the installer which reducing the amount of information the customer has to navigate.

4.4.2 Websites, factsheets and case studies

With increased interest in electrification, there is a corresponding rise in information aimed at supporting consumers as they navigate their electrification journey. An initial sector scan suggests these are grouped into one-way information, providing both an entry point for those new to electrification and information to refer back to throughout the journey, and into interactive tools that support consumer decision-making as they move through the process of electrifying. Some forms of information cover both these elements.

Fact sheets and web resources are provided by advocacy organisations, such as Electrify Everything, councils, governments and similar agencies. They typically provide an appliance- or upgrade-specific focus, presenting information about cost and emissions savings as well as availability of rebates, lifetime, whether upgrades are required to facilitate installation and who can install the appliance. A key limitation of this approach is that assumptions about how the appliance is used are made. For example, the NSW government presents examples from a 2-bedroom apartment in Western Sydney and a 4-bedroom house in Dubbo. While this makes the information simple to present and for the reader to digest, it may be difficult for householders or small businesses to translate this information to their own circumstances.

Similarly, some resources provide generalised steps to take action, e.g. ,Orange Council's steps to electrify your home and Action Plan, or Electrify Everything's eight upgrades. These may provide a suggested order of electrification upgrades or a qualitative assessment of impact (e.g. Upfront cost vs running cost). However, because they are based on exemplar appliances and use cases, the information may not readily translate to a particular consumer's experience. At times, there is no discrimination between options; i.e., all upgrades are presented as equal. At other times, they may draw on knowledge that has not yet been developed; e.g., suggestions to start with the least efficient appliance, which may not be known by the user. A strength of these resources is the focus on communication style and rigorous research. There is evidently a lot of thought given to structuring these resources in easy to digest ways. For example, the Energy section of the "Your Home" website provides short description of key points but allows users to click through to more detailed information. Overall, these do appear to align with the so-called literacy model of information provision (discussed in Section 1.1). However, they may fit into a wider information provision ecosystem to support consumers at various stages of their journey.

These resources are often accompanied by more emotive or translatable content, aligning with the Wilde and Spaargaren's (2019) *inspire* phase of retrofit consumer journeys. For example, Orange Council provide short videos of local residents reflecting on their electrification journey, showcasing the technologies, the process of installing these, and their impact on the residents' experience, energy and environmental contribution. Similarly, Bank Australia provides an Electric Home Stories section on their website, which includes a video about Meg and Pat's electric home journey, as

well as examples of purpose-built green homes, renter experiences, tips from MEEH and examples of people making use of government support programs, including the Cheaper Home Batteries Program. This sits alongside information about Bank Australia's Clean Energy Home Loan, Renovate and New Build products, which they offer with the support of Australia's Clean Energy Finance Corporation's Household Energy Upgrades Fund.

Reflecting the connection between electrification and solar and battery roll outs, there is also a trend to add information about electrification to existing information resources focused on these technologies (as described above in Section 4.4.1). This is evident, for example, through Solar Victoria's Solar Hub, leveraging the role of solar in driving electrification to provide electrification information to solar households and businesses.

4.4.3 Interactive planning tools

Interactive planning tools offer avenues for factual or exemplar information to be contextualised to support a consumer's electrification journey. As BETA's (2024) survey found, "...online decision support tool increased homeowner's confidence in their upgrade decisions..." (p.4). There are a variety of such planning tools developed by civic and commercial organisations, with varying levels of detail, customisation and complexity linked to different objectives, reflected in the examples below.

As mentioned in Section 4.4.1, Solar Quotes and Solar Choice are examples of commercial tools available that provide options for consumers to contextualise information. Rather than a single tool, these businesses offer a number of tools specific to policy, location and products. Unlike other tools listed below, both Solar Quotes and Solar Choice offer tools for businesses as well as households. The tools appear, in the main, to use an excel back end to perform calculations or look-ups to calculate annual energy yield from a solar installation, or savings on energy bills based on a user-defined electricity tariff, or to find product and policy specific information. These tools do not necessarily drive lead-generation explicitly. Rather, they establish credibility and trust, as well as opening up consumer understandings of different parts of their future journey (rebates, potential savings, etc.) and may be referred back to as a consumer moves through stages of this journey.

Boom! Power is another commercial tool which is explicitly focused on electrification. And designed to be licensed to customer-facing businesses in banking, energy retail and housing. Users input email address and home address, then select from predefined categories (spend on electricity and/or gas, number of people in the household, appliances (labelled photos) – cooktops, oven, hot water, source of heating and/or cooling, and whether have solar panels—if yes, size 1-15kW). The tool then recommends electrification upgrades, presenting breakdown and total of energy bill savings, emissions reductions and upgrade cost. Information is provided about rebates/incentives (presumably using the user's home address to filter for relevant jurisdictional information). The focus of this tool appears to be simplicity and speed which prevents overwhelm and rapidly provides cost and emissions savings. Organisations using the Boom! Power tool, provide a wrap-around experience. For

example, SEC Victoria, offer users further support via a hotline number and link back to their electrification information. Conversely, Bank Australia's version produces estimated costs and savings, links to "trusted" installers as well as information about relevant finance products they offer.

While Boom! Power markets their planning tool to energy companies, it appears that the larger retailers are interested in using their own tools, offering degrees of customisation. For example, the AGL Electrify Now Tool. The user starts by selecting the appliances they are interested in (rather than existing appliances). Bill and emission savings are then calculated, along with a link to approved/recommended installers. Alternatively, users can log in to their AGL account to use their existing data or give personal details to access CDR data. Origin also offer a planning tool but require personal information upfront. In other parts of their website, they refer customers to Solar Quotes (for a commission).

While SEC Victoria uses Boom Power, other government entities have also developed their own tools, such as the ACT Government's Make Your Next Choice electric planning tool. In addition to household and appliance information, they also request ACT specific information, such as a pick list of suburbs and concession cards. The tool also asks for the year that a building was constructed, as a proxy for the building's minimum energy efficiency performance, and when each appliance was installed, and generates a replacement plan based on expected end-of-life for the appliance. For each appliance, the tool produces a recommendation for when to replace, cost of install and appliance, and yearly saving. The tool also provides independent product recommendations consumer advocacy organisation, Choice.

5 The customer journey: material, social and knowledge

The material, social and knowledge contexts explored above offer important insights into what it means to provide information "*the right way, in the right format, at the right time, to the right person.*" (Temby and Ransan-Cooper 2021 p.38). In this section, we draw on the concept of the electrification journey to synthesise these findings. This is, first, because the concept of electrification journeys reflects terminology and thinking already commonplace in the energy sector, including in consumer-facing contexts and, second, because the focus on the *process* of electrification enables us to situate literature findings from relevant material, social, and knowledge contexts within this journey, thereby highlighting how people need different kinds of electrification information in different circumstances, using de Wilde and Spaargaren's (2019) framework for customer journeys described above.

In the *sensitise* phase, information plays the role of consciousness raising among energy consumers about the opportunities and benefits of electrification, aiming to inspire and empower consumers to take steps along their electrification journey. As discussed above, there may be multiple entry points or triggers (c.f. Brown, et al. 2025) to this journey, which may be an iterative process nested within broader material and social processes and relationships. Information about electrification is available from a

wide range of government, commercial and civic organisations, much of it focused on environmental and cost benefits, including information about financial incentives.

Information linked to environmental motivations or values may sensitise consumers to engage with electrification and is often used in government websites, etc., along with information about rebates and subsidies. This perhaps reflects the policy origins of electrification within the decarbonisations space which has historically used rebates and other upfront subsidies to remove barriers to uptake. However, it is clear that this may only be part of electrification decision making and electrification may be sensitized by other values, such the desire to remove gas from the home to improve health and safety (e.g. Stolper, Diseris, and Di Benedetto 2023). or to achieve comfort, function, aesthetics or other objectives as explored in the earlier discussion on home upgrades (Section 2.2). As discussed in Section 3 these various objectives are typically linked to life stages or events such as growth of family or moving home and may also relate to decisions about the physical materials within a building structure. While less prevalent, some resources not explicitly focused on electrification, such as renovation and home building website home.gov.au, also include information about electrification and energy upgrades. Similarly, the efforts of banks, electricity retailers and local councils to provide electrification information illustrates consciousness raising efforts to reach a broader audience beyond those already engaged in energy efficiency and environmental action, such as consumers with rooftop solar and batteries. Similarly, some electrification websites include information that appeals to a range of different life stages, motivations and material conditions (e.g. Department of Climate Change, Energy and the Environment and Water n.d.). Reflecting the interconnection between home energy upgrades, past appliance installations and further electrification, information about electrification may be helpfully embedded in retrofit- or appliance-specific communications.

Reflecting the relational reframing of energy upgrades, peer networks are also an important sensitizer to electrification. For example, Boddington (2025) noted participants discussing their induction stove tops with visitors (who may be sceptical). Community scale efforts (e.g., the Electrify 2515 or Electrify Canberra projects) may also make electrification pathway information available to the local community. It is likely that community-scale action is also occurring less formally, as illustrated by Owen, et al. (2023) who theorises the importance of relational or peer networks in sharing information about energy retrofit funding among geographically and culturally situated peer groups. An appeal to relationality is also evident in personal stories and profiles offered by some websites seeking to provide relatable and accessible information about electrification. There may be opportunities to broaden avenues to sensitizing electrification by providing information in spaces known to be relevant. For example, real estate agents could play a greater role as a source of information to landlords or tenants, or strata companies could provide information to apartments or similar complexes.

In the *advice* phase, information may be tailored to a consumer's particular values, motivations, life stage, energy supply arrangements, existing housing materials and appliances, tenure and energy use. Typical mechanisms for advice include energy audits and/or physical inspection of a house or small business site. Installers or specialist

energy consultants may provide this service, and offer rich and tailored advice, but an installer may be unwilling to invest upfront time to support without compensation or consumers may perceive a conflict of interest, while energy audit consultants come at a cost and have a speckled history (e.g. Department of Climate Change and Energy Efficiency 2011).

Some information provision combines sensitization and advice, by identifying or recommending electrification options and or offering guidance on prioritisation based, for example, on cost or emissions benefits. For example, the Australian Government's Electrification website recommends consumers consider focusing on inefficient (expensive) gas (polluting) appliances first (Department of Climate Change, Energy and the Environment and Water n.d.), while many electrification-focused websites provide high-level information about upfront cost, financial savings, emissions reductions, rebates and subsidies (e.g. ACT Government 2025; Department of Climate Change, Energy and the Environment and Water n.d.; SEC Victoria n.d.), enabling consumers to compare outcomes, albeit based on generalisations rather than tailored to specific needs.

The interactive planning tools described in Section 4.4.3 are a key emerging mechanism provided by a range of actors seeking to provide tailored advice. These typically seek to drive consumer actions by narrowing technology options, identifying 'better' options based on assumed goals/benefits (such as financial benefits and emissions savings), or opening up pathways for next steps through eligibility for financial incentives or installer recommendations.

Peer networks are also an important source of advice, as illustrated by the membership and user activity of the MEEH Facebook group - an institutionalised peer network where users can seek advice. Electrify community groups similarly offer advice through a peer network. Community organisations are also seen as trustworthy and reliable (Chandrashekeran et al. 2023) and may be willing to support their clients with advice. However, they may not necessarily have sufficient expertise to engage in detailed and tailored advice, and may more appropriately provide a referral to existing tools, e.g., Boom! Power licencing their tool in the housing sector or councils arranging SunSPOT presentations for local community groups.

In the *tender* process, energy consumers seek offers for a particular product or upgrade. They may define the scope of work or rely on installers to set these parameters. A difficulty here is that consumers may not be able to adequately assess suitability of tenders or service providers. While a number of tools link consumers with pre-approved or recommended service providers, as Maby and Owen (2015) highlight, installers have their own set of values, motivations, beliefs and experiences about what solution is appropriate that will influence the solution they propose, a point also illustrated by Daly et al (2023) in commercial contexts. Many installers are focused on a specific technology or product and may not provide advice relevant to the consumer's specific circumstances or their broader aims, for example, if the upgrade or appliance selection is part of a renovation. Public information resources in other sectors have addressed this issue by providing standard templates that can be customised. Tools such as SunSPOT

can contribute by suggesting a scope for consumers to take to service providers and/or acting as a source of truth for comparison with quotes.

Once a consumer accepts a tender offer, the *install* phase follows in which the work is delivered. This phase is highly dependent on the installer/contractor for information provision about specific installation/equipment. The consumer can, of course, draw on sensitising resources and planning tools through this process, although the this may depend on the degree of customisability available through the tool or the ability of the consumer to apply this information when engaging with the installer. While much information is focused on the process of procurement, there may be unmet information needs about ongoing operation beyond that provided by the installer. As de Wilde (2021) noted, the installer may reinforce their own understandings of how an appliance should be integrated into homelife and what information is relevant and for whom. Or, as Lucas-Healey, et al. (2022) and Cain (2024) have found, there may be limited interest from installers in providing this support in the Australian context. As for other stages, information needs to support this phase need to be relevant to the specifics of house format, tariff arrangements, desired function, etc.

The *evaluation* phase involves an assessment of whether installation has been completed correctly and whether the appliance or upgrade is functioning as expected and delivering on desired outcomes. This can be challenging for consumers but is not a strong focus for existing Australian policy mechanisms, research or information provision. For example, many rebates and upfront certificate payments provided to enable access to technologies or upgrades assume or deem particular energy savings or operational performance (e.g. NSW Government 2025). However, it is up to consumers to assess whether these have been achieved in practice, for example, by monitoring financial savings from energy bills, or adequacy of service level (e.g, comfort or hot water availability).

Opportunities may exist (e.g., through access to granular electricity meter data through the Consumer data Right) to validate outcomes against modelled or quoted predictions, at least in relation to electricity use and bills. This may be a realisable addition for tools like SunSPOT or tools provided by energy retailers, but a different approach may be needed for other technologies where account must be taken of other metrics (comfort, hot water availability, EV state of charge, etc.)

Finally, in the *inspire* phase, information collected from successful electrification may be relevant to others interested in electrification. This approach is already evident in bank and council websites featuring videos of retrofitters and in studies of relation explanations of retrofit e.g. Owens, et al. (2024) Boddington (2025). There are also examples from pilot projects where technical and experimental information has been shared through knowledge sharing reports (e.g. Harvey-Scholes 2024), often focused on simple quantitative metrics.

6 Conclusion

Information provision is a necessary tool for helping electrifying energy use in households and businesses but is most usefully deployed as part of a suite of other measures including subsidies and grants, regulations, industry training, supply train support, etc. Electrification decisions are made within intersecting social and material contexts which affect the most appropriate content, form of delivery and source for effective information provision.

The specific purpose of the information and the stage of the consumer journey also inform what is useful and how it is best delivered. Broad sensitising information can motivate electrification as well as contextualise more specifically advice to inform consumer decisions. There is a need to tailor this advice to individual consumer circumstances and to broader demographic needs, but the literature is unclear on the details of the information needed and the appropriate level of specificity. Follow-up information, supporting consumers through the tender and installation process and providing benchmarks for evaluating their decisions, is important and often overlooked.

This review provides a basis for further exploration, through surveys and in-depth interviews, to increase understanding of consumer information needs and its most effective delivery.

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