ACIL ALLEN

20 June 2022

Report to Energy Security Board

Barriers and enablers for rewarding consumers for access to flexible DER and energy use

Rapid evidence review

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Key messages for policy-makers

Insight – key barriers and enablers

Consumers are diverse – they differ in terms of their motivation, ability and opportunity.

The barriers and enablers for flexible distributed energy resources (DER) and energy use are also diverse – they vary by consumer and by the particular type of product or service with which that consumer engages. Importantly, while perceived costs and financial benefits are key considerations, non-financial benefits (such as environmental benefits, community benefits and independence/autonomy) are also important for many consumers.

The barriers and enablers will reflect the characteristics of the particular type of product or service being considered, noting that the products and services vary in terms of their nature, maturity and complexity. For example, while control of hot water loads is a relatively simple mature product, Virtual Power Plants (VPPs) are novel and complex.

Barriers and enablers exist at every step in the customer journey – from engagement and acquisition, to installation, operation and maintenance, and retention. These barriers and enablers may impact the consumer experience, the benefits realised and whether expectations are met.

Notwithstanding the multifaceted nature of the barriers and enablers, there are a small number of barriers and enablers that are key to consumers accessing the benefits of flexible DER and energy use (trust, motivation, communication, complexity, ability and opportunity, and perceived costs and value). For example, the ability and opportunity to access the benefits of flexible DER and energy use is very closely linked to housing/building tenure and access to finance.

There are a range of forms of flexible DER and energy use that have been researched and trialled. These can be broadly categorised into indirect (default), behavioural, self-managed and enabled (automated). Importantly:

— There are limits to behavioural flexible energy use. Consumers may not have the scope to adjust energy use, or may do so for a period, but then revert to their previous energy use over time.

— Automated flexible energy use may help consumers manage the complexity associated with flexible DER and energy use, but it requires expensive technology and high levels of trust – in the energy sector more broadly, as well as the provider, and the product or service.

'Flexibility' is a new concept that is not well understood by consumers at either a product/service level, or how it fits into the broader changes underway in the energy system. Approaches which bundle benefits at the point of sale, where the benefits take the form of a discount on a product, may be more easily understood than benefits which are embedded in bills or rewards over time. However, trust around benefits sharing and in relation to delegating/retaining control is an

important barrier/enabler. Where rewards are embedded in bills or received over time, transparency around how the benefits are being shared is important.

The trials have revealed that consumers often require higher levels of support from their service provider to install, manage and engage with flexibility products and services, and to realise the promised benefits, than was anticipated. The product or service may require settings to be adjusted or may not always work as expected (for example, technical glitches or lost internet connection due to a storm or password change). The more complex and novel the product or service, the greater the level of support that is required by consumers.

The engagement at the point of sale and installation, including the provision of information and advice, is particularly important in shaping the consumer's experience with the flexibility product or service.

Policy implications

To enable consumers to be rewarded for access to flexible DER and energy use, policy makers, and program and product/service designers should undertake customer journey analysis as a routine part of their process. Frameworks and tools will help policy-makers explore the issues that might arise for different consumers along these journeys.

A range of consumer segmentation approaches, which are context specific, have been developed and applied. ACIL Allen developed a consumer segmentation approach with Energy Consumers Australia (ECA) that is built around a consumer's motivation, ability and opportunity, with the intent that it be applied by policy-makers based on the choices that are made by consumers.

The segmentation framework has been applied to the choices consumers make to manage their energy bills (for the ECA) and to participate in a more mature two sided market (for the Australian Energy Market Commission). The Energy Security Board and the Australian Energy Regulator are currently exploring how to apply the segmentation framework to the Retailer Authorisation Review to inform a risk assessment of new products and services for a range of different consumers. This rapid evidence review provides an important 'insights' sourcebook or guide to undertake these kinds of exercises.

However, the experience to date with applying these types of frameworks in policy processes indicates that it can be challenging to apply even these simplified models, and more work needs to be done to develop practical frameworks/tools that can help policy-makers stand in the shoes of customers.

Policy-makers, and program and product/service designers need to consider how they can effectively communicate with, and engage, consumers in a way that is relevant to their context. While there is no one-size-fits-all approach, some general rules should be borne in mind such as:

— using consumer-centric language, free from ambiguous or confusing language, and taking into account a high proportion of English as a second language households
— providing the right information at the right time
— providing targeted and personalised messages
— providing consistent, ongoing communication campaigns over time.

At a strategic policy level, policy-makers, program and service designers will need to grapple with how consumers will engage with an energy system that is becoming increasingly complex, given the preference for simplicity that comes through the research.

A related strategic challenge is how to ensure that the significant number of consumers who may continue to engage with the energy system in the traditional way via a simple retail offer, and may

not be able to or want to participate in flexible DER and energy use (at least in the short to medium term) are not left behind.

Insights gaps

The literature reviewed is largely around the experiences of early adopters during the initial stages of the customer journey, and less about the experiences of other consumers, and (for all groups) the experiences of living or working with flexible DER and energy use over an extended period of time.

Some trials have struggled to recruit participants, and particularly struggled to recruit a diverse range of participants. At the very least, this suggests there needs to more effort to better understand who is 'not' participating and develop recruitment/engagement strategies to reach these groups.

Additionally, there is also not a great diversity in the concepts that are tested as part of the trials – they tend to be reasonably similar, albeit across different locations and providers.

Trials which tested different approaches side-by-side were particularly insightful and should be encouraged (for example, a 2016 Ausgrid trial compared behavioural and automated strategies).

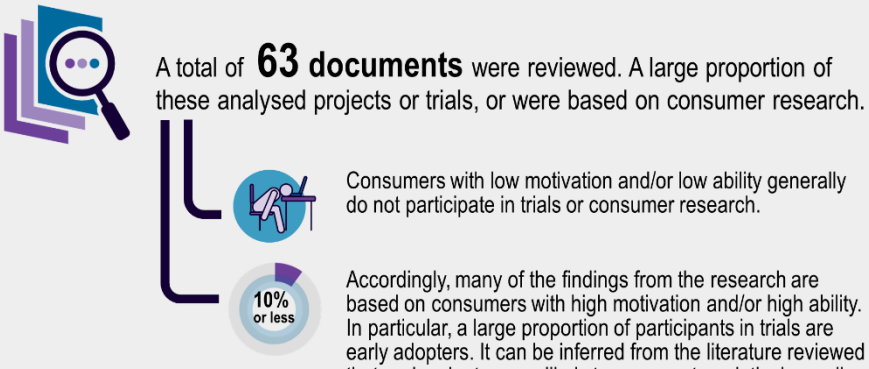
Policy-implications

Policy-makers and program and product/service designers need to take care in the conclusions they draw from trials of new products and services. The engagement by early adopters may not be a reliable guide to how other groups of consumers will engage.

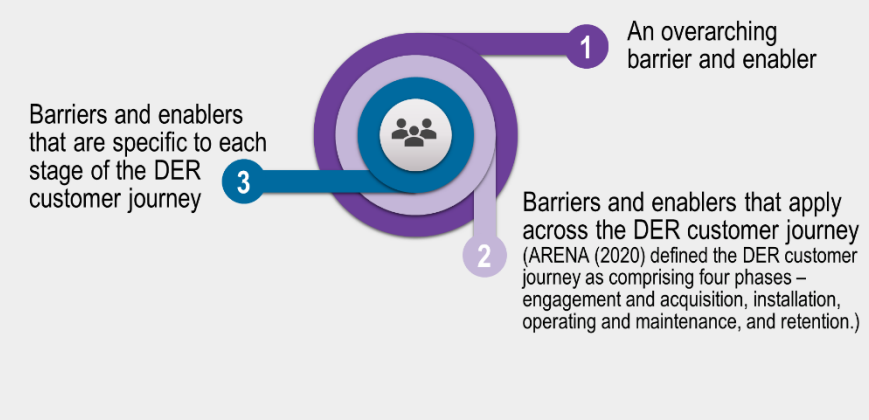
Policy-makers and program and product/service designers also need to consider how to fill the insights gaps through research and trial design, as well as policies and regulatory frameworks that support innovation, prototyping etc. that can shed light on the diversity and practicality challenges identified through the trials undertaken to date.

Key messages from the literature review

ACIL Allen was engaged by the Energy Security Board (ESB) to undertake a rapid evidence review of recent research, including information submitted by stakeholders in response to a call for evidence, on the barriers and enablers for consumers to be rewarded for access to their flexible Distributed Energy Resources (DER) and energy use. Importantly, a comprehensive literature search was not conducted.



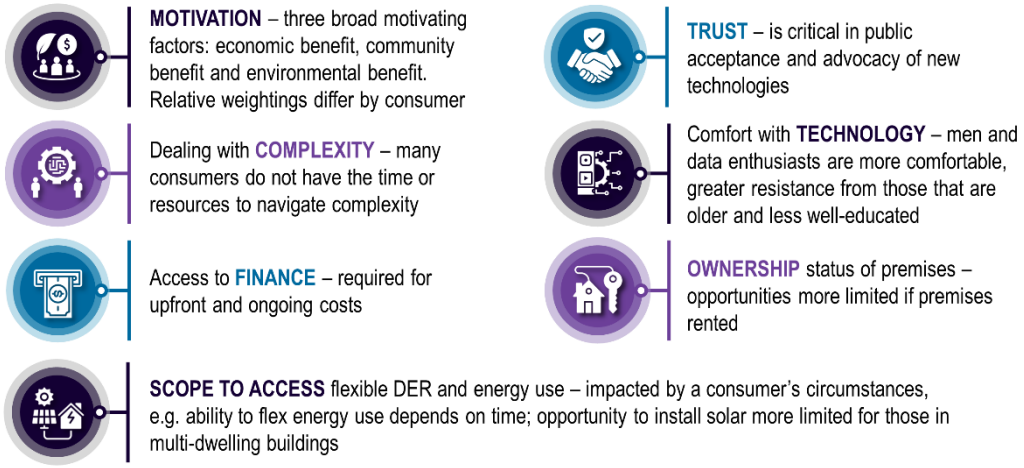
The review identified three "layers of barriers and enablers to rewarding consumers for access to their flexible DER and energy use:



Overarching barrier and enabler

Consumers are diverse. The diversity of consumers is not a barrier to consumers being rewarded for access to their flexible DER and energy use, in and of itself. However, based on the literature reviewed, ACIL Allen is of the view that, not understanding and recognising the diversity of consumers during the design and implementation of the policies, regulations and programs to support consumers being rewarded for flexible DER and energy use, may be a key overarching barrier. Understanding and recognising the diversity of consumers facilitates the development of an inclusive approach that recognises the different needs, wants and expectations of consumers, in terms of products, services and engagement, while recognising the role that each type of DER technology may play in meeting these requirements, based on the nature, maturity and complexity of each technology.

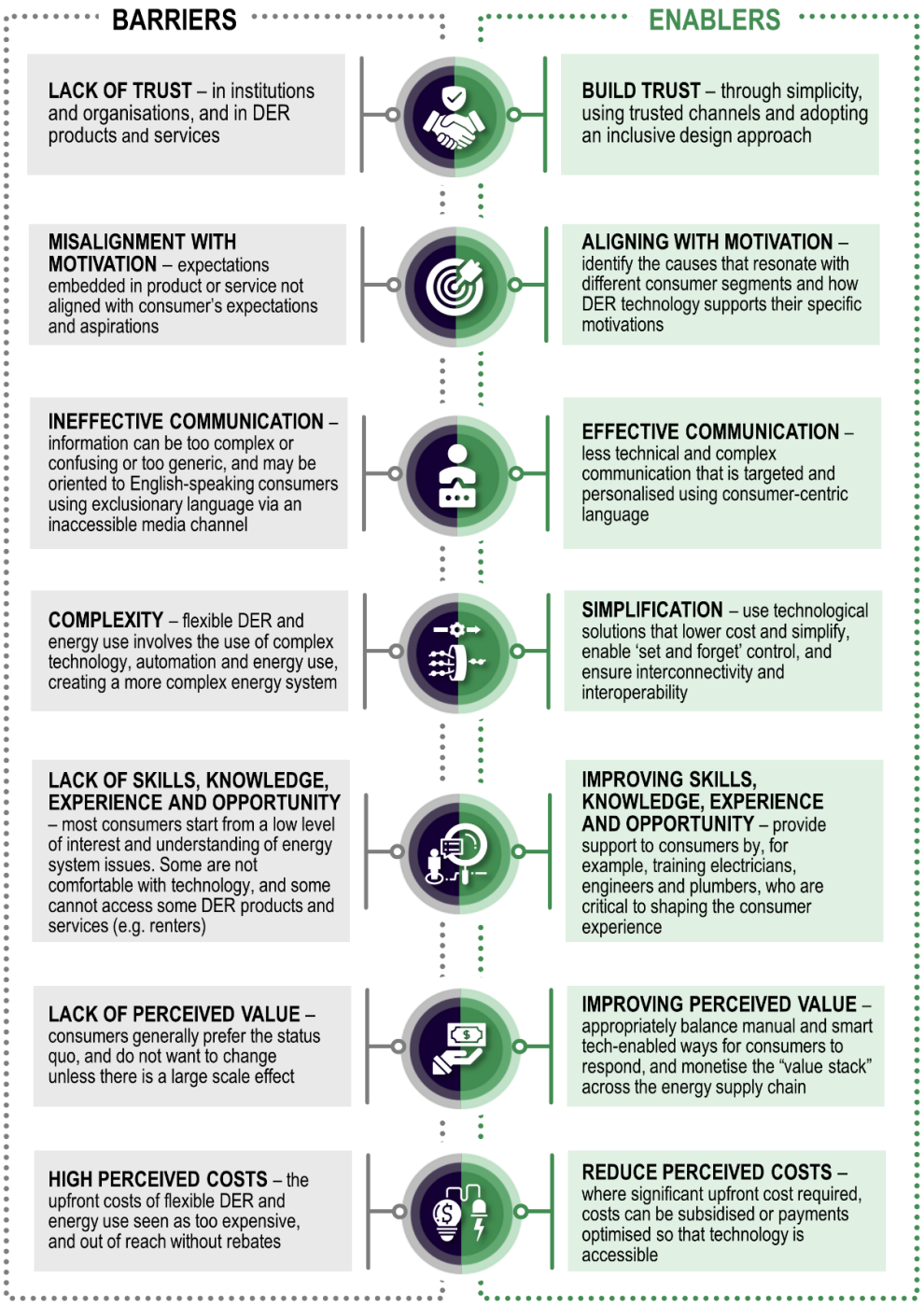
Seven key aspects of consumer diversity identified in the literature review



Based on the literature reviewed, and given the diversity of consumers, ACIL Allen is of the view that a key overarching enabler to rewarding consumers for access to their flexible DER and energy use is to develop a tailored approach. The Australian Renewable Energy Agency (ARENA) identified that one of the keys to a happy DER customer is a tailored customer proposition and engagement.

The extent to which the approach is tailored, and the way in which the approach is tailored, will depend on the specific DER technology and the objective for tailoring the approach. The tailored approach could be based on a consumer's motivation, opportunity and ability. It could comprise the tailored design of programs, marketing and communications strategies, personalised advice and support.

Barriers and enablers that apply across the DER customer journey



Barriers and enablers specific to each stage of DER customer journey

The barriers and enablers that are apply at each stage of the DER customer journey are similar to those that apply across the DER customer journey. However, they are more specific and more detailed. For example, lack of trust at the engagement and acquisition phase may be due to:

— irregular or impersonal contact during the engagement and acquisition phase

— the customer being subject to unsolicited sales tactics, or inappropriate or unaffordable finance

— concern about the end of life arrangements, and human rights and environmental concerns about the supply chain.

Executive summary

Over the last decade innovative new technologies for generating, storing and managing electricity have emerged which change when and how consumers use electricity. Distributed energy resources (DER) are integral aspects of the transition to an efficient, low emissions electricity system. Flexible DER and energy use services include a range of technologies, some of which are relatively simple while others are complex. DER technologies include solar panels, battery storage, electric vehicles, home energy management systems, controlled loads[1] and demand response.

In October 2021, National Cabinet endorsed the Energy Security Board's (ESB's) Post 2025 DER Implementation Plan. The Post 2025 DER Implementation Plan outlines reform activities to be conducted over a three-year horizon aimed at rewarding customers for their flexible demand; integrating flexible DER and flexible demand into the market at all levels, safely and effectively; supporting a phased implementation of reforms where possible; and developing reforms using a customer centric approach.[2]

ACIL Allen was engaged by the ESB to undertake a rapid evidence review of recent research, including information submitted by stakeholders in response to the call for evidence, on the barriers and enablers for consumers to be rewarded for access to their flexible DER and energy use. The objective of the review was to consider the barriers and enablers across the DER customer journey, as described by ARENA (2020a) – from engagement and acquisition, through installation, and operations and maintenance, to retention (refer Figure ES 1).

The literature that has been considered for this review is summarised in Table 1.1. The review identified three "layers" of barriers and enablers to rewarding consumers for access to their flexible DER and energy use:

1. an overarching barrier and enabler
2. barriers and enablers that apply across the DER customer journey (as defined by ARENA (2020a))
3. barriers and enablers that are specific to each stage of the DER customer journey.

[1] Including control of loads such as water heating, pool pumps and under floor heating and, in more recent years, air conditioning.

[2] Energy Security Board, *Scope of Work and Forward Project Plan, Delivering the DER Implementation Plan – Horizon One*, page 1, available at https://www.energy.gov.au/sites/default/files/2021-12/Scope%20of%20works%20document%20-%20Integrating%20DER%20and%20Flexible%20Demand%20-%20December%202021.pdf, accessed 22 December 2021

Understanding and recognising the diversity of consumers

Consumers are diverse. The diversity of consumers is not a barrier to consumers being rewarded for access to their flexible DER and energy use, in and of itself. However, based on the literature reviewed, ACIL Allen is of the view that, not understanding and recognising the diversity of consumers during the design and implementation of the policies, regulations and programs to support consumers being rewarded for flexible DER and energy use, may be a key overarching barrier. Understanding and recognising the diversity of consumers facilitates the development of an inclusive approach that recognises the different needs, wants and expectations of consumers, in terms of products, services and engagement, while recognising the role that each type of DER technology may play in meeting these requirements, based on the nature, maturity and complexity of each technology.

Understanding and recognising the diversity of consumers is complex – some factors that influence the diversity are easily identifiable (for example, different climate zones), while others are not (for example, different levels of trust and motivations).

A range of consumer segmentation frameworks have been developed to illustrate the diversity of consumers. However, many of the segmentation approaches identified in the evidence for this review are based on trials or consumer research and therefore do not include those that do not participate in trials or consumer research – those with low motivation and/or low ability – or they identify segments that are not homogenous and can include consumers that have diverse motivations and abilities.

Notwithstanding, the segmentation approaches identified in the literature reviewed for this report are useful because they generally quantify the proportion of consumers in each segment, albeit based on a trial or consumer research. The relative sizes of different consumer segments can be inferred from this evidence. Most importantly, it can be inferred that the early adopters of flexible DER and energy use are likely to represent a relatively small proportion of all consumers (in the order of 10 per cent or less).

Importantly for this review, Watson et al (2019) identified that the early experiences with early adopters may not translate well to other types of consumers. Different strategies will need to be developed over time to attract different segments that will be less engaged and harder to reach than the early adopters (CSBA 2021).

A segmentation approach was developed as part of Energy Consumers Australia's (ECA's) Power Shift program of work, based on an extensive literature review. The segmentation framework, referred to as the Supporting Households Framework, was specifically designed to include all types of households and identified nine segments (see Figure 2.5) based on three factors – motivation, ability and opportunity.

The framework was subsequently extended to include small-medium sized businesses (ACIL Allen 2021). The factors that influence the motivation, ability and opportunity for a household and small-medium-sized business are summarised in Table ES 1. In the case of a business, the factors apply to the person in the business making energy-related decisions rather than to the business *per se*.

Table ES 1 Summary of factors that influence the motivation, ability and opportunity of a household and small-medium sized business

Motivation	Ability	Opportunity
– Attitude towards the behaviour, for example, the perceived costs and benefits, the importance of energy, and cultural considerations – Alignment with choices made within the household's or business's circle of influence – Likelihood of success – Unwillingness to create disharmony/conflict – For a business, maintaining competitiveness	– Literacy, numeracy, problem solving and research skills – Language barriers – Ability to self-advocate, negotiate – Belief in the ability to succeed – Trust in others – Ability to influence behaviour of all relevant people within the household or business – General interest in, and capability using, technology	– Type of housing or premises – Ownership status of the home or premise – Scope to make energy-related decisions – Access to liquid funds – For a business, the way in which the business operates

Source: Based on ECA (2020) and ACIL Allen (2021)

Of these factors, motivation and trust were the two that were most commonly referred to in the evidence reviewed.

Motivation to be rewarded for access to flexible DER and energy use

Watson et al (2019) notes that householder participation in flexible DER or energy use is not certain; it cannot be assumed that householders are willing (or motivated) to participate. Where consumers are willing to participate in flexible DER or energy use, a number of the studies have examined the different factors that motivate them to participate.

Roberts et al (2020) and CSBA (2021) identified three broad types of motivating factors that influence participation in a Virtual Power Plant (VPP) trial:

— economic benefit, that is, a financial benefit for the participant as bill savings or income

— community benefit, that is, contributing to the community through supporting management of the network

— environmental benefit, that is, generating clean energy.

Participants in the VPP trials differed in the relative weightings of the three broad types of motivating factors, in particular, the importance they ascribed to personal, financial benefits compared to the wider, social benefits (Roberts et al 2020). AGL (2019), CSIRO (2021) and Ausgrid (2016b) also found different weightings of the motivating factors for demand response.

CSBA (2021) found that the desires and hopes of participants in VPP trials tended to be polarised towards their own interests or the interests of others. Those with an individual focus considered the financial benefits of being a member of a VPP or their enthusiasm for owning their new technology and being a pioneer in the VPP. Those with a community focus have a strong desire to use more green energy and reduce harm to the planet caused by greenhouse gas emissions and/or a desire to help stabilise the energy grid ensuring a reliable supply of electricity for others in the area.

For the most part, energy is seen by businesses as a dollar value to reduce to maximise profitability. Energy is only one external factor among many others which impacts the business on a daily basis, and is generally not high on the priority list (Foresight 2019b).

The importance of energy to a business generally depends on the size of the business and the energy intensity of the business (see Figure 2.8), with a higher priority placed on energy by larger and more energy intensive businesses. Smaller businesses are generally too busy trying to survive

in the market, with some believing their contributions are not substantial enough to make a difference (Foresight 2019b). They fall into a 'set and forget' mindset (Hall & Partners 2021).

Ability to be rewarded for access to flexible DER and energy use

The review identified a number of strong themes relating to the ability of consumers to be rewarded for access to their flexible DER and energy use. These include:

— trust
— dealing with complexity
— comfort with technology.

Trust

ARENA (2020a and 2020b), Nicholls et al (2021) and Cannizzaro et al (2020) identified that trust is critical in public acceptance and advocacy of new technologies, including flexible DER and energy use. ARENA (2020b) suggested the "Trust Equation" as a means of building trust, with the Trust Equation comprising four variables – credibility, reliability, intimacy and self-orientation. Cannizzaro et al (2020) similarly identified competence, benevolence and integrity as the elements of trust.

Nicholls et al (2021) found that, until consumers determine whether a program or device can be trusted, they want a level of personal control.

Dealing with complexity

ARENA (2020a) noted the complexity associated with flexible DER and energy use – at all stages of the customer journey with a DER technology.[3]

In the context of retail energy pricing, COSBOA (2018) notes that it is confusing and time consuming for small businesses to navigate all the information about energy costs and savings. Most small businesses do not possess either the time or the level of expertise required to negotiate the plethora of competing and confusing offers in the current energy market.

Comfort with technology

Nicholls et al (2021) found that some households prefer to minimise the introduction of new digital technologies or cannot install them due to financial, space, occupancy, language, internet or skill constraints. Technology-led initiatives appeal more to men, while women are more interested in adapting and modifying routines (Nicholls et al 2021).

In the context of demand response, Nicholls et al (2021) found that typical households that are not energy or data enthusiasts have limited interest in data, particularly if it is not clearly translated into meaningful outcomes or imperatives for households. Cannizzaro et al (2020) found greater resistance to new technology from older respondents and less well-educated respondents.

Opportunity to be rewarded for access to flexible DER and energy use

The review identified a number of the factors that influence the opportunity for consumers to be rewarded for access to their flexible DER and energy use. These include:

— access to finance
— ownership status of premises
— scope to access flexible DER and energy use.

[3] The DER customer journey is discussed further in Chapter 4.

Access to finance

Nicholls et al (2017) (as summarised in ECA (2020)) noted that, for smart control to work successfully, all household members need a smart phone and internet to access the app. However this is not possible or is unaffordable for some vulnerable customers.

COSBOA (2018) notes that many businesses cannot afford the up-front capital expenditure required for energy efficiency upgrades.

Ownership status of premises

Renting a home or business premises adversely impacts the opportunity for households and businesses to be rewarded for access to their flexible DER and energy use. Renters feel the decision to install a smart meter is out of their hands (Newgate 2021). They have little or no information on the energy performance of buildings and are unable to easily make changes to the fabric of a house or change major appliances (ECA 2020, EWOV 2020a). Installing rooftop solar panels and/or a battery system is off limits unless the landlord agrees and this can be accommodated effectively in the terms of the lease.

Over 50 per cent of small businesses rent their premises (COSBOA 2018). COSBOA (2018) notes that it is complex and burdensome for a business to negotiate a 'green lease' with a landlord.

Scope to access flexible DER and energy use

The scope for consumers to access flexible DER and energy use may be positively or adversely impacted by the circumstances of the consumer, for example:

- the opportunity for households to shift energy use in time and space varies (Adams et al 2021)
- the opportunity for demand response may be restricted by emergency situations such as bushfires – by a requirement to operate in an emergency response mode or by air quality issues due to the smoke from bushfires (ARENA 2021)
- industries with high levels of regulatory and environmental requirements, such as telecommunications, water utilities and wastewater services, may face difficulties providing demand response during periods of drought, bushfire or other emergencies (ARENA 2021)
- the opportunity for shopping centres to access flexible demand may be limited due to a requirement to remain open for late trading hours (ARENA 2021)
- consumers in multi-dwelling buildings (such as apartments) may not be able to install a smart meter (Newgate 2021) or solar panels (EWOV 2020a)
- regional businesses in regional areas may have more space onsite to take advantage of solar panels (Forethought 2019b).

Adopting a tailored approach

Based on the literature reviewed, and given the diversity of consumers, ACIL Allen is of the view that a key overarching enabler to rewarding consumers for access to their flexible DER and energy use is to develop a tailored approach. The extent to which the approach is tailored, and the way in which the approach is tailored, will depend on the specific DER technology and the objective for tailoring the approach. Many of the tailored approaches in the literature are based on the consumer segmentation frameworks discussed in chapter 2.

Basis for tailoring the approach

The need for a tailored consumer-centric approach, rather than mass market initiatives, was identified by ECA (2020) in the context of supporting households to manage their energy bills, by

Nicholls et al (2021) in the context of demand response, and by ARENA (2020a) in the context of flexible DER and energy use more broadly. ARENA (2020a) identified that one of the key ingredients to a happy DER customer is to:

> *Know who your customers are and the values that drive them – through customer segmentation, customer research, and customer feedback. Tailor customer proposition and engagement accordingly.*

The Supporting Households Framework indicates that a tailored approach needs to take into consideration a consumer's motivation, ability and opportunity.

> *Power Shift has demonstrated that measures to empower consumers to manage their energy use and take control over their costs are more effective when they are designed using evidence of the diversity of consumers in their motivation, ability and opportunity when making decisions.*
>
> *ECA 2020*

ARENA (2020b) notes that it is difficult to understand customer values at a glance, so strategies that maximise customer motivation without isolating potential target groups can be useful. It suggests that, from a psychology perspective, it is perceived to be safest to move up Maslow's hierarchy of needs from Settlers to Pioneers (see Table 2.3).

In the context of businesses managing their energy bills, COSBOA (2018) also suggests a tailored approach, with an interactive toolkit to tailor suggestions to suit business owners' needs and location, taking into account their industry, whether they rent or own their premises, and what factors they identify as the biggest contributors to their current energy usage.

How to tailor the approach

The literature identified the use of a tailored approach in relation to:

- the design of programs, including providing for manual, programmed and automated strategies (Nicholls et al 2021) and different compensation mechanisms (upfront payment versus ongoing payments) (Roberts et al 2020)
- marketing and communication strategies (ARENA 2020b, ECA 2020, CSBA 2021)
- personalised advice, including energy feedback and practice insights to consumers (Nicholls et al 2021)
- support for consumers, in the form of hands-on, face-to-face support for digital technologies (Nicholls et al 2021), noting that this can yield strong uptake but comes at a high resource cost (ARENA 2020b).

However, care needs to be taken with providing personalised advice as CPRC (2021b) found that the majority (76 per cent) of consumers find the common practice of companies using their personal information to make predictions about them to be unfair.

Identifying the appropriate tailored approach

The objective of developing a tailored approach is to remove the barriers to a consumer being rewarded for access to their flexible DER and energy use. ACIL Allen (2021) identifies that the objective is to increase the motivation of, or increase the opportunity for, consumers to make a choice (in this case to be rewarded for access to their flexible DER and energy use).

While some consumers may already have a high level of motivation, opportunity and ability to choose to be rewarded for access to their flexible DER and energy use, others may have a high level of motivation and opportunity to choose to be rewarded for access to their flexible DER and

energy use, but a low level of ability to do so. An approach tailored to the latter consumers would therefore target the removal of ability-related barriers.

However, prior to developing any tailored approach, the objective for doing so needs to be clarified. For example, is the objective to ensure that:

— all consumers have the necessary level of motivation, opportunity and ability to be rewarded for access to their flexible DER and energy use, or

— specific consumer segments have the necessary level of motivation, opportunity and ability to be rewarded for access to their flexible DER and energy use and, if so, which ones?

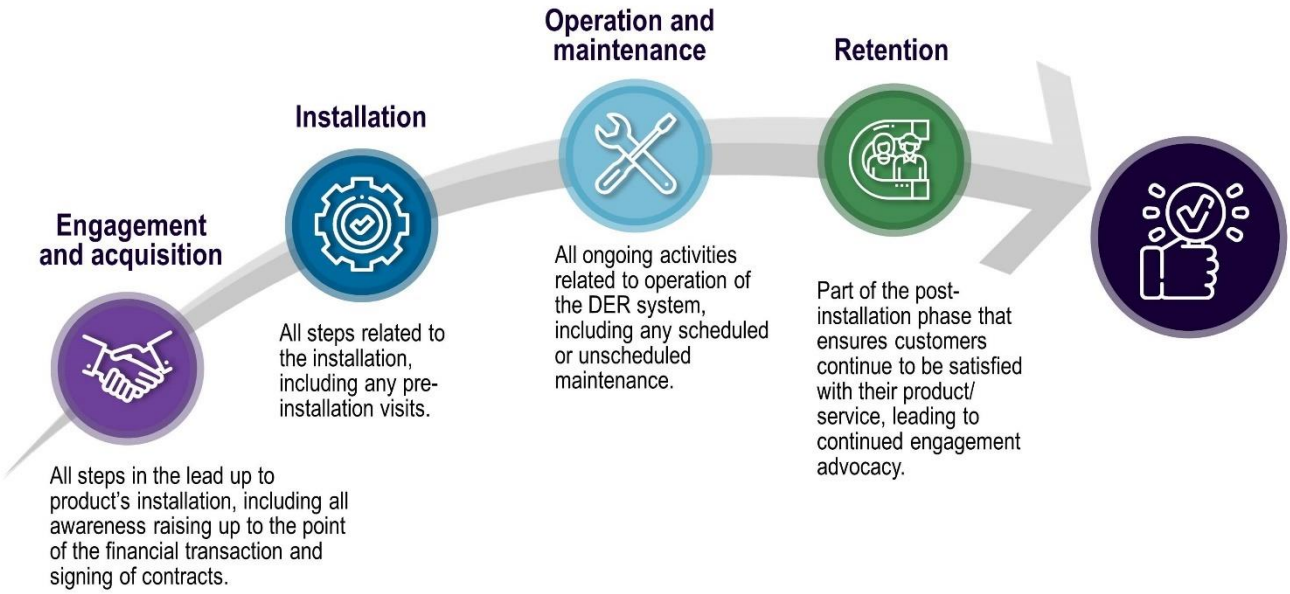
Barriers and enablers across the DER customer journey

As indicated above, the objective of this review was to identify the barriers and enablers for consumers to be rewarded for access to their flexible DER and energy use across the DER customer journey, as described by ARENA (2020a) (refer Figure ES 1). However, the review revealed that:

— many of the barriers and enablers are common across the DER customer journey

— there is currently more evidence about the barriers and enablers that are specific to the early stages of the customer journey than to the later stages of the customer journey as many of the trials are focused on the earlier stages of the customer journey.

Figure ES 1 The customer journey to engage with a DER technology



Source: ARENA 2020a

We therefore first considered the barriers and enablers that are common across the DER customer journey, and then considered the barriers and enablers that are specific to each phase of the DER customer journey. These barriers and enablers are secondary to the key overarching barrier of not understanding and recognising the diversity of consumers, and the key overarching enabler of using a tailored approach.

The barriers and enablers that apply across the DER customer journey are summarised in Table ES 2.

Table ES 2 Barriers and enablers that apply across the DER customer journey

	Barrier	Enabler
Trust	**Lack of trust** – there is a lack of trust in government and the energy sector (ECA 2020, Hall et al 2021, EWOV 2020a), compounded by: – digital, financial and energy inequities (Nicholls et al 2021) – the complexity of VPPs and their potential business models (Roberts et al 2020) – in many cases, the absence of an affordable dispute resolution process for flexible DER and energy use services (CALC 2019) – links by agents to the coal industry (Roberts et al 2020). There is also a lack of trust in flexible DER and energy use services, including privacy and security concerns, and that products will operate reliably.	**Building trust** – there are a range of approaches to build and deepen trust in the relevant agents and issues including: – embedding trust through simplicity (Forethought 2020) – using trusted channels (COSBOA 2018, ECA 2020, Nicholls et al 2021) – offering rewards rather than penalties (Nicholls et al 2021, Rheem 2022, Essential 2021) – adopting an inclusive design approach to the development of policies, regulations, programs and communications (CPRC 2021a) – adopting a staged approach (Nicholls et al 2021) – obtaining a 'social licence' through identifying: – who is included and who is excluded – who wins and who loses – whose lives and livelihoods will be put at risk (Adams et al 2021).
Motivation	**Misalignment with motivations** – there may be misalignment with motivations where: – consumers are primed based on financial benefits rather than community or environmental benefits (CSBA 2021) – those motivated by energy independence and security lose autonomy and control (Roberts et al 2020) – consumers are not willing to cede control of their end-use equipment (ARENA 2021, EnergyAustralia 2018, Ausgrid 2016b).	**Aligning with motivations** – motivations can be aligned by identifying the causes that resonate with different consumer segments and how the DER technology supports their specific motivations (CSBA 2021).
Communication	**Ineffective communication** – information on new energy products and services, and the energy sector more broadly, can be: – complex and confusing (Temby et al 2021), which can overwhelm consumers (Forethought 2019a), or – generic, which is unrelatable or inaccurate (Nicholls et al 2021). Communication is oriented towards the English-speaking population (CPRC 2021a), using exclusionary language (Temby et al 2021) and words or terms that do not resonate with consumers (Temby et al 2021, Roberts et al 2020, Nicholls et al 2021, CPRC 2021a). Some information sources (e.g. government and industry) may not be trusted (Temby et al 2021). Additionally, consumers do not have equal access to media channels, such as online information, or in-person information for those in rural and regional areas.	**Effective communication** – less technical and complex communication is needed (Nicholls et al 2021, Forethought 2019a) and is best developed through a co-design approach (ECA 2020). Messages should be targeted and personalised to households (ECA 2020, D'Oca et al 2014). Receiving the right information at the right time helps households make informed decisions (Forethought 2019a). The language should be more consumer-centric (Nicholls et al 2021), free from ambiguous or confusing language (BIT 2022), and account for a high proportion of English as a second language households from CALD communities (Nicholls et al 2021, CPRC 2021a, Forethought 2020). Consistent, ongoing communication campaigns are required to grow familiarity and understanding over time (Nicholls et al 2021).

	Barrier	Enabler
Complexity	**Complexity** – flexible DER and energy use involves the use of complex technology, automation and energy use (Roberts et al 2020, CALC 2019), creating a more complex energy system (EWOV 2020a). A lack of standardisation of household appliances and infrastructure makes it difficult to create standardised products and services (ECA 2020, Rheem 2022). The ability to calibrate complex, sometimes opaque and occasionally missing or misleading information reflects a position of relative socio-economic privilege (Temby et al 2021), thereby excluding vulnerable groups (Adams et al 2021).	**Simplifying flexible DER and energy use** – flexible DER and energy use could be simplified by, for example: – helping customers navigate the complexity of the new energy landscape (Woolcott 2021) – industry understanding households' habits and routines as they design smart home technologies, so they make sense and fit in with everyday lives (ECA 2020, Nicholls et al 2021) – technological solutions that lower cost and simplify (ESC 2022) – ensuring interconnectivity and interoperability across devices (ECA 2020, Forethought 2020, SAPN 2022) – enabling "set and forget" control – ensuring control is on a "whole of home basis" (Rheem 2022).
Skills, knowledge, experience and opportunity	**Lack of skills, knowledge, experience and opportunity** – most households start from a low level of interest and understanding of energy system issues (Nicholls et al 2021). They have a sense of inexperience or lack of comfort with new ideas and technologies, and do not know how to engage (ECA 2020). Additionally, rented premises are restrictive to making changes that facilitate flexible DER and energy use (Forethought 2019b).	**Improving skills, knowledge, experience and opportunity** – support is required by households and businesses so they have the skills, knowledge and understanding to engage with flexible DER and energy use services, such as: – providing consulting support to businesses (Forethought 2019b) – training electricians, engineers and plumbers, who are critical to shaping the consumer's experience (ECA 2020).
Value	**Lack of perceived value** – consumers generally prefer the status quo (Hall et at 2021, Rheem 2022, Newgate 2021), particularly as the complexity increases (Frederiks et al 2015). Households do not think it is worth changing their energy behaviour unless there would be a large scale effect; they don't see a direct benefit to their busy, everyday lives from changing their energy behaviour (Forethought 2019a). There is also a temporal dimension with consumers perceiving things of less value or significant if further away in time (Frederiks et al 2015). Businesses are of the view that current renewable technologies are unable to meet the demands of their businesses (Forethought 2019b). Smart meters, smart devices and retail tariffs that reflect price signals are required to realise the value of flexible demand, but the uptake of smart meters outside Victoria is low, the penetration of smart devices is low and many consumers are on flat retail tariffs (SAPN 2022)	**Improving perceived value** – the perceived value of flexible DER and energy use can be improved by appropriately balancing manual and smart tech-enabled ways for households to respond (Nicholls et al 2021). Retail tariffs that align with market and network needs are a simple and accessible method for rewarding consumers for moving flexible loads (SAPN 2022). Additionally, the value of flexible DER and energy use could be improved by monetising the "value stack" across the energy supply chain (Rheem 2022), including their contribution to reliability (Forethought 2020).

	Barrier	Enabler
Costs	**High perceived costs** – the upfront costs of flexible DER and energy use services are seen as too expensive (Forethought 2019a, ARENA 2020b, SAPN 2022, Simply Energy 2020, Rheem 2022, Ausgrid 2016b) and out of reach if consumers are unable to access rebates (Temby et al 2021), particularly low income households (ANU 2018). Businesses may not have the upfront capital to invest in flexible DER and energy use (Forethought 2019b).	**Reducing the perceived costs** – some forms of flexible DER and energy use do not require a significant capital outlay, such as behavioural demand response (ARENA 2021). Where flexible DER and energy use requires significant upfront costs, subsidies could be used to reduce that cost (CSBA 2021, Forethought 2019a) or payments optimised so that the technology is accessible (Forethought 2019a).

Source: ACIL Allen based on sources referenced in the table

Barriers and enablers specific to each phase of the DER customer journey

The barriers and enablers that are specific to each phase of the DER customer journey are summarised in Table ES 3.

Table ES 3 Barriers and enablers that are specific to each phase of the DER customer journey

Barrier	Enabler
Engagement and acquisition phase	

– Lack of **trust**
  – irregular or impersonal contact during the engagement and acquisition process (ARENA 2020a)
  – consumer may be subject to:
  – unsolicited sales tactics
  – inappropriate or unaffordable finance (Temby et al 2021, CALC 2019, CALC 2017)
  – no ability to opt-out
  – lack of transparency (Roberts et al 2020, CSBA 2021)
  – concern about the end of life arrangements, and human rights and environmental concerns about the supply chain (Temby et al 2021).
– **Burden** on consumer
  – engagement and acquisition process may be slow and/or cumbersome (ARENA 2020a)
  – consumers need to invest significant time, effort and funds to research, choose and configure technology (Temby et al 2021)
  – significant upfront costs.
– Lack of perceived **value**
  – consumers may not have access to smart meter data or real time data to assess the value of flexible DER and energy use (ECA 2020)
  – consumers may not have access to benefits that accrue in the full value stack of energy services (ECA 2020, Rheem 2022).
	– Building **trust**, including by:
	  – involving user in the design phase
	  – providing a trial period and/or opt-out mechanism
	  – providing transparency.
	– Aligning with consumer's **motivations** by, for example:
	  – making time to understand consumer's contexts and objectives
	  – providing a clear value proposition.
	– Effective **communication** by:
	  – thoroughly planning all communication and engagement
	  – tailoring communication to consumer.
	– Reduce **complexity** by:
	  – focusing on a simple message and avoiding jargon
	  – helping navigate complex technological choices.
	– Reduce **burden** on consumers by:
	  – minimising the number of steps in the process
	  – timely and effective follow-up of leads
	  – early determination of customer eligibility
	  – reducing the upfront cost.
	– Identifying **value** to the consumer by providing detailed information on the benefits, including the broad range of co-benefits.
	– **Regulating** to protect the interest of consumers and to ensure safety of equipment

Barrier	Enabler
	(AGL 2022, ARENA 2020a, ARENA 2020b, ARENA 2021, CALC 2021, COSBOA 2018, CSBA 2021, ECA 2020, EnergyAustralia 2018, Energy Queensland 2022, Nicholls et al 2021, Roberts et al 2020, Temby et al 2021 and ZEN 2019).
Installation phase	

– Lack of **trust**, due to:
  – a lack of appropriately skilled/ motivated installers, with installations delayed as a result of installer's cashflow, overstretched supply chains or installers covering large areas (ARENA 2020a, CSBA 2021)
  – quality issues, including solar panels not fitting, poor aesthetics, incorrect or faulty wiring, damage to the roof and incorrect orientation of solar panels (CALC 2019, ARENA 2020a, Temby et al 2021, EWOV 2022)
  – missing or inadequate documentation and paperwork (CALC 2019, EWOV 2022).
– Ineffective **communication** – installers can vary greatly in terms of the level of education and support they provide consumers (Watson et al 2019).
– **Complexity** – installation requires adjustment to each individually designed, built and positioned home (Watson et al 2019).
– **Burden** on consumers – the installation process is not necessarily a discrete one-off process; it may involve multiple actors and organisations (Watson et al 2019).
	– Building **trust** through inclusion of installers in the design phase, conducting an in-person site assessment, recruiting more installers and comprehensively training them, and providing timely effective response to issues.
	– Effective **communication** with the installers showing the consumer how the equipment works.
	– **Simplifying** the processes of installation, rebate application and grid connection by devoting resources (people, time, expertise, money), providing firm pricing options, and planning for internet connectivity issues.
	– Reducing **burden** on consumers by undertaking a quick effective installation with a single site visit with installers arriving at an agreed time (ARENA 2020a, Temby et al 2021, Watson et al 2019, EWOV 2022).

Operating and maintenance phase	
– **Complexity** of overall system – there is a need to combine and synthesise information from different components of the system, with little support across the entire system (Watson et al 2019, Temby et al 2021, ECA 2020). – **Technology** issues – difficulties experienced include challenges understanding the technical support and app interface, information gaps, and technical glitches (Watson et al 2019, AGL 2019, Intelligent Automation 2022, EWOV 2022). – Inconsistent warranties provided, and parties going out of business so warranties cannot be relied on (EWOV 2022). – 'Smart' technologies not fitting into everyday lives (Temby et al 2021).	– Handover process – helping consumers to understand how to operate product and how to access help (Temby et al 2021). – After sales support – providing access to up-to-date information, effective fast follow-ups to customer issues and a clear complaints process (CSBA 2021, ARENA 2020a). – Customer support staff – providing comprehensive technical and customer engagement training (ARENA 2020a). – Providing access to an app – for those that want to monitor their system (CSBA 2021).

Barrier	Enabler
Retention phase	

– Lack of **trust** – level of trust eroded over time due to issues with the quality of the technology and providers (Temby et al 2021).
– Benefits:
  – difficulty accessing benefits due to complexity of pricing structures and value propositions (ARENA 2020a)
  – difficulty assessing community and environmental benefits (CSBA 2021).
– Misalignment – operational experience not aligning with expectations (CSBA 2021) and expected value not realised e.g. differences between app and energy bill or exports constrained (EWOV 2022).
– Lack of engagement – level of engagement by consumers varied over time with some disengaging (CSBA 2021, Watson et al 2019).
– Legacy issues – with people moving house (owners and renters), and batteries depleting over time.
	Customer retention is driven by customer service and experience (McKinsey 2018), including:
	– Benefits:
	  – providing ongoing certainty of financial benefits, e.g. through guarantees, and lower fixed rewards rather than higher variable rewards (CSBA 20201, AREA 2020a)
	  – for those motivated by control and independence, providing advanced notice of operation and/or override function, and ensuring power can be provided by the battery during an outage (Roberts et al 2020, CSBA 2021, ARENA 2020a)
	  – using apps to reinforce benefits (CSBA 2021).
	– Engagement – providing ongoing and planned engagement (ARENA 2020a).
	– Ongoing support – providing advice on how best to operate and care for the product and assistance on dealing with issues (Temby et al 2021).
	– Understanding different types of customers – for example differentiating the ongoing validation required by 'optimisers' versus 'set and forgetters' (CSBA 2021, ARENA 2020a).

Source: ACIL Allen based on sources referenced in the table

1 Background and introduction

Over the last decade innovative new technologies for generating, storing and managing electricity have emerged which change when and how consumers use electricity. Distributed energy resources (DER) are integral aspects of the transition to an efficient, low emissions electricity system. Flexible DER and energy use services include a range of technologies, some of which are relatively simple while others are complex. DER technologies include solar panels, battery storage, electric vehicles, home energy management systems, controlled loads[4] and demand response.

Solar panels allow consumers to generate their own power, while home batteries and electric vehicles allow the power to be stored for later use. Virtual power plants (VPPs) coordinate the output from these 'behind the meter' solar panels and battery storage.

Smarter, more efficient appliances provide better information about how and when they are drawing power, while allowing consumers or other third parties a host of pre-programmed and dynamic smart controls. Demand management (or demand response) programs reward consumers for reducing their demand at peak times.

1.1 The Post 2025 DER Implementation Plan

In October 2021, National Cabinet endorsed the Energy Security Board's (ESB's) Post 2025 DER Implementation Plan. The Post 2025 DER Implementation Plan outlines reform activities to be conducted over a three-year horizon aimed at:

- ***rewarding customers for their flexible demand**, enabling access to products and services that innovation offers, and managing risks to customers through the right protections, no matter how customers choose to use or receive energy, or their level of engagement*
- ***integrating flexible DER and flexible demand** into the market at all levels, safely and effectively*
- ***supporting a phased implementation of reforms** where possible, to enable parties to transition earlier to new arrangements where standards are in place, and where barriers to enter the market can be safely removed*
- ***development of reforms using a customer centric approach**. A collaborative approach will be used to consider and co-design solutions to key customer challenges, with insights informing activities and reforms across each horizon of the DER Implementation Plan pathway.[5]*

[4] Including control of loads such as water heating, pool pumps and under floor heating and, in more recent years, air conditioning.

[5] Energy Security Board, *Scope of Work and Forward Project Plan, Delivering the DER Implementation Plan – Horizon One*, page 1, available at https://www.energy.gov.au/sites/default/files/2021-12/Scope%20of%20works%20document%20-

1.2 The Customer Insights Collaboration

The ESB has indicated that it will keep consumer issues and outcomes at the heart of the reform process. To facilitate this, the ESB will facilitate a Customer Insights Collaboration – a collaborative forum to work with customer groups and industry stakeholders on key cross cutting consumer issues that have implications for DER reform development and implementation. The ESB will use this forum to share and undertake research and analysis (independently and in partnership with other organisations) on current consumer needs and issues to inform work with stakeholders and the delivery of reforms across the DER Implementation Plan.[6]

The Collaboration will be organised around six-month blocks of work on key consumer issues relevant to DER Implementation Plan reform activities. At the end of each release, a knowledge sharing report will be published to detail the insights and possible solutions emerging from the work.[7]

The topic for the first release of the Collaboration is to consider barriers and enablers to consumers being rewarded for their flexible DER and flexible demand.[8] The objective is to gather insights about:

- how to grow access to the benefits of DER and flexibility services
- how to make it easy for customers to make choices, as well as simple and safe to switch between service providers
- the level of risk customers are prepared and able to take (e.g., safe default settings on devices)
- customer needs and expectations around rewards for the flexibility that they may choose to provide to the system (in ways they wish to be rewarded)
- how to design arrangements that work for all customers (not just those with DER assets).[9]

The ESB issued a call for evidence to gather relevant research on barriers and enablers to consumers being rewarded for DER and flexibility.

ACIL Allen was engaged by the ESB to undertake a rapid evidence review of recent research, including information submitted by stakeholders in response to the call for evidence, on the barriers and enablers for consumers to be rewarded for access to their DER assets and flexible demand.

1.3 Purpose and structure of this report

The purpose of this report is to document the outcomes of the rapid evidence review the barriers and enablers for consumers to be rewarded for access to their flexible DER and energy use. The objective of the review was to consider the barriers and enablers across the DER customer journey, as described by ARENA (2020a) – from engagement and acquisition, through installation,

%20Integrating%20DER%20and%20Flexible%20Demand%20-%20December%202021.pdf, accessed 22 December 2021

[6] ibid, page 3

[7] Energy Security Board, *Scope of Work and Forward Project Plan, Delivering the DER Implementation Plan – Horizon One, Attachment B – Customer Insights Collaboration*, page 1, available at https://www.energy.gov.au/sites/default/files/2021-12/Attachment%20B%20-%20Customer%20Insights%20Collaboration%20and%20call%20for%20evidence%20-%20December%202021.pdf, accessed 22 December 2021

[8] ibid, page 2

[9] ibid, page 3

and operations and maintenance, to retention.[10] The literature that has been considered for this review is summarised in Table 1.1.

The review was undertaken in two phases. The first phase was undertaken prior to receipt of additional information from stakeholders in response to the call for evidence, referred to above. The ESB identified 27 papers that were reviewed as the basis for a draft report. The draft report informed discussions by the Stakeholder Steering Group (SSG) that was convened to support the first release of the Collaboration. The SSG identified four themes to enable customers to realise the value of their flexible demand and DER.

During the second phase, a further 36 documents were reviewed, including information submitted by stakeholders in response to a call for evidence and additional information sought by the SSG on the four themes identified by them.

Importantly, a comprehensive literature search was not undertaken as part of this rapid evidence review.

The review identified three "layers" of barriers and enablers to rewarding consumers for access to their flexible DER and energy use:

1. an overarching barrier and enabler
2. barriers and enablers that apply across the DER customer journey (as defined by ARENA (2020a))
3. barriers and enablers that are specific to each stage of the DER customer journey.

The rest of the report is structured as follows:

- The first layer of barriers and enablers are discussed in chapters 2 and 3:
  - Chapter 2 discusses the diversity of consumers, which is a key overarching barrier if it is not recognised and understood. An overview is provided of a number of consumer segmentation frameworks that have been identified in the literature.
  - Given the diversity of consumers, a key overarching enabler is to develop a tailored approach, which is discussed in chapter 3.
- The second and third layers of barriers and enablers are discussed in chapters 4 and 5, with the barriers and enablers that are common across the DER customer journey discussed in chapter 4, and the barriers and enablers that are specific to each phase of the DER customer journey discussed in chapter 5. The impact of the barriers will vary depending on the nature, maturity and complexity of the specific DER technology. Chapters 4 and 5 include ACIL Allen's indicative view as to how the impact or significance of the barriers may vary by DER technology, based on the literature reviewed.
- Gaps that were identified in the research are discussed in chapter 6.

[10] Refer to chapter 4 for further discussion on the DER customer journey.

Table 1.1 Literature reviewed

Author	Report title	Date	Nature of study	Type of consumers	Sample size	Nature of technology
Accenture Strategy (Accenture 2014)	The Balance of Power: Why Australian Utilities Need to Defend, Delight and Disrupt	2014	Consumer research	Households	13,720 in 26 countries	Not applicable
ACIL Allen (ACIL Allen 2021)	Consumer archetypes for a two-sided market, Final report, Report to Australian Energy Market Commission	1 April 2021	Literature review	Households and small businesses	Not applicable	Two-sided energy market
Sophie Adams, Declan Kuch, Lisa Diamond, Peter Fröhlich, Ida Marie Henriksen, Cecilia Katzeff, Marianne Ryghaug, Selin Yilmaz (Adams et al 2021)	Social Licence to Automate: A Critical Review of Emerging Approaches to Electricity Demand Management	Journal of Energy Research & Social Science, Volume 80, October 2021, 102210	Academic research	Households	Not applicable	Demand management
AGL (AGL 2019)	NSW Demand Response, ARENA Knowledge Sharing Report	October 2019	Programs and trials, including surveys	1. Households 2. Households 3. Commercial and industrial	1. 3,500 2. 45 (air conditioners), 14 (EV charging) 3. 34	1. Behavioural demand response 2. Controlled load 3. Demand response
AGL (AGL 2021)	AGL NSW Demand Response, Final ARENA Knowledge Sharing Report	May 2021	Programs and trials, including customer research	1. Households 2. Households 3. Commercial and industrial	1. 8,000 2. 43 (air conditioners), 14 (EV charging) 3. 37	1. Behavioural demand response 2. Controlled load 3. Demand response
AGL (AGL 2022)	Response to Customer Insights Collaboration – Release One – Q1 2022: Call for evidence	24 January 2022	Programs and trials	Households and businesses	Not applicable	Not applicable
Australian Council of Social Services, Brotherhood of St Laurence and ANU, Centre for Social Research & Methods (ANU 2018)	Energy Stressed in Australia Funded by Energy Consumers Australia	October 2018	Analysis of ABS data	Households	Not applicable	Expenditure on electricity and gas

Author	Report title	Date	Nature of study	Type of consumers	Sample size	Nature of technology
Australian Renewable Energy Agency (ARENA 2020a)	DER Customer Insights: The Customer Journey	July 2020	Analysis of 20 DER projects	Households and businesses	More than 1,346	Solar panels, battery storage (on premise and community scale), battery storage control modules, microgrids, demand response and energy management
Australian Renewable Energy Agency (ARENA 2020b)	DER Customer Insights: Values & Motivations	July 2020	Analysis of 20 DER projects	Households and businesses	More than 1,346	Solar panels, battery storage (on premise and community scale), battery storage control modules, microgrids, demand response and energy management
Australian Renewable Energy Agency (ARENA 2021)	Demand Response Short Notice RERT Trial, Year 3 Report	October 2021	Analysis of 10 demand response projects	Households and businesses	One program alone had more than 8,000 participants	Behavioural demand response and controlled load
Ausgrid (Ausgrid 2016a)	Ausgrid *Cool*Saver Survey Highlights	April 2016	Survey of trial participants	Households	83	Controlled load (air conditioners)
Ausgrid (Ausgrid 2016b)	Ausgrid Demand Management, Hot water load control trials	August 2016	Trial	Households	1. 44 2. 104 3. 28 zone substations	1. Controlled load (hot water) 2. Subsidised controlled load connection 3. Optimising controlled load
The Behavioural Insights Team (BIT 2022)	Testing the better offer notice on energy bills, Final Report from the Behavioural Insights Team	2022	Literature review and consumer research	Households	15 interviews 1,716 surveys	Energy bills
Sara Cannizzaro, Rob Procter, Sinong Ma, Carsten Maple (Cannizzaro et al 2020)	Trust in the smart home: Findings from a nationally representative survey in the UK	29 May 2020	Consumer research	Households	2,033	Smart home devices

Author	Report title	Date	Nature of study	Type of consumers	Sample size	Nature of technology
Consumer Action Law Centre (CALC 2019)	Sunny Side Up: Strengthening the Consumer Protection Regime for Solar Panels in Victoria	April 2019	Based on casework	Households	Not applicable	Solar panels
Consumer Action Law Centre (CALC 2021)	The New Energy Tech, Consumer Code, Representing the Interests of Consumers at the Australian Competition Tribunal	March 2021	Based on participation in a Tribunal hearing	Households	Not applicable	Not applicable
Consumer Action Law Centre, Loddon Campaspe Community Legal Centre, WestJustice (CALC 2017)	Knock it off! Door-to-door sales and consumer harm in Victoria	November 2017	Based on casework	Households	19 case studies	Not applicable
Centre for Sustainable Energy (CES 2020)	Smart and fair? Exploring social justice in the future energy system, Phase One report and recommendations Funded by Scottish & Southern Electricity Networks and Western Power Distribution	December 2020	Desktop research	Households	Not applicable	Not applicable
Council of Small Business Organisations Australia (COSBOA 2018)	COSBOA Energy Bill Shock: Future Proofing Small Business	Undated (assume 2018)	Consumer research and literature review	Small businesses	More than 200 surveys and nine case studies	Energy costs
Consumer Policy Research Centre, Roy Morgan (CPRC 2021a)	COVID-19 and Consumers: key insights series – CALD consumers	March 2021	Consumer research	Households	1,113 surveys in November 2020 and 1,180 surveys in December 2020	Not applicable
Consumer Policy Research Centre (CPRC 2021b)	The Digital Checkout	December 2021	Research based on public data and previous consumer research	Households	Not applicable	Not applicable
Customer Service Benchmarking Australia on behalf of the Australian Energy Market Operator (CSBA 2021)	Virtual Power Plant Demonstrations Consumer Insights Report Funded by ARENA	September 2021	Consumer research	Households	Baseline survey of 993 consumers, longitudinal qualitative survey with 50 consumers and post-demonstration survey of 1,451 consumers	VPPs

Author	Report title	Date	Nature of study	Type of consumers	Sample size	Nature of technology
CSIRO (CSIRO 2021)	Consumer perspectives on demand response and community energy, A national survey of Australian residential energy consumers	May 2021	Consumer research	Households	2,968	Demand response and community energy
D'Oca, S., Cornati, S. P., and Buso, T. (D'Oca et al 2014)	Smart meters and energy savings in Italy: Determining the effectiveness of persuasive communication in dwellings	Journal of Energy Research & Social Science, vol. 3, August 2014	Trial	Households	31	Smart meters
Energy Consumers Australia (ECA 2021a)	Energy Consumer Behaviour Survey, Household Topline Results	October 2021	Consumer research	Households	2,277	Consumer behaviour in relation to energy use
Energy Consumers Australia (ECA 2021b)	Energy Consumer Behaviour Survey, Small Business Topline Results	October 2021	Consumer research	Small businesses	255	Consumer behaviour in relation to energy use
Energy Consumers Australia (ECA 2021c)	Energy Consumer Sentiment Survey, Household Topline Results	December 2021	Consumer research	Households	2,200	Perceptions of the electricity and gas system
Energy Consumers Australia (ECA 2021d)	Energy Consumer Sentiment Survey, Business Topline Results	December 2021	Consumer research	Businesses	550	Perceptions of the electricity and gas system
Energy Consumers Australia (ECA 2020)	Power Shift, Final Report	February 2020	3-year research program	Households	Not applicable	Building the evidence for better-targeted and more effective and innovative energy management services and programs
Energeia, Prepared for Renew (Energeia 2021)	Renew DER Optimisation (Stage II): Final Report	September 2021	Desktop research	Households and businesses	Not applicable	Regulatory incentives
EnergyAustralia (EnergyAustralia 2018)	Do It For Me Demand Response, Insights and Knowledge Book	August 2018	Desktop research, interviews and online testing	Households	5 interviews	Controlled load (air conditioners and pool pumps)
Ergon Energy Network, Energex (Energy Queensland 2022)	DMIA Project, Market-Delivered Demand Response Pilot (MDDR), Final Report	January 2022	Pilot	Households	28	Home Energy Management System
Essential Services Commission (ESC 2022)	Victorian Energy Market Report	March 2022	Desktop research	Households and small businesses	Not applicable	Retail energy tariffs

Author	Report title	Date	Nature of study	Type of consumers	Sample size	Nature of technology
Essential Energy (Essential 2021)	Essential Energy's Tariff Trial Project, Summary of the 'Trial Design' phase	26 April 2021	Consumer research	Households, small businesses and stakeholders	Workshops (6 with small customers and one with stakeholders), in-depth interviews (8), one-on-one stakeholder meetings (17), surveys (779)	Network tariffs
Energy and Water Ombudsman Victoria (EWOV 2020a)	Charging Ahead, New Energy Technology and the Future of Energy Complaints in Victoria	March 2020	Desktop research	Households	Not applicable	Solar panels, battery storage, microgrids, electric vehicles, VPPs, Peer to Peer trading and Home Energy Management Systems
Energy and Water Ombudsman Victoria (EWOV 2020b)	Charging Ahead, Hypothetical Case Studies, Five Hypothetical Case Studies Highlighting Probable Energy Consumer Issues in the Near Future	June 2020	Desktop research	Households	Not applicable	Solar panels, battery storage, microgrids, electric vehicles, VPPs, Peer to Peer trading and Home Energy Management Systems
Energy and Water Ombudsman Victoria (EWOV 2022)	EWOV Solar Customer Journey Map	April 2022	Casework	Households and businesses	Not applicable	Solar panels
Forethought (Forethought 2019a)	A Future Energy Vision, Consumer Expectations Research, Energy Consumers Australia, Household Findings	2019	Consumer research	Households	187 – in-depth interviews (80) and focus groups (14)	Understanding the consumer life journey and the role of energy in life
Forethought (Forethought 2019b)	A Future Energy Vision, Consumer Expectations Research, Energy Consumers Australia, Small-Medium Business Findings	2019	Consumer research	Small-medium businesses	28 in-depth interviews	Understanding the role of energy in different types of businesses
Forethought (Forethought 2020)	Foresighting Forum 2020, Solving for a Better Energy Future, Prepared for Energy Consumers Australia	2020	Ideation workshop	Households and small-medium businesses	Not applicable	Ideating for a better energy future – affordable, simple, clean, easy to manage, inclusive and reliable

Author	Report title	Date	Nature of study	Type of consumers	Sample size	Nature of technology
Frederiks, E., Stenner, K. and Hobman, E. (Frederiks et al 2015)	Household energy use: Applying behavioural economics to understand consumer decision-making and behaviour	Journal of Renewable and Sustainable Energy Review, vol. 41, January 2015	Academic research	Households	Not applicable	Not applicable
Frontier Economics (Frontier 2009)	Impact of TOU pricing on EnergyAustralia customers – Final report, Prepared for EnergyAustralia	December 2009	Analysis of metering data	Households and small-medium businesses	Thousands (varies by season, by year)	TOU tariffs
Hall & Partners (Hall & Partners 2021)	Australian Energy Regulator, Small to Medium Business Owners, Better Bills Guideline Research Report	December 2021	Consumer research	Small-medium businesses	4 focus groups with 12 participants plus 2 interviews	Energy bills
Stephen Hall, Jillian Anable, Jeffrey Hardy, Mark Workman, Christoph Mazur, Yvonne Matthews (Hall et al 2021)	Innovative energy business models appeal to specific consumer groups but may exacerbate existing inequalities for the disengaged	Journal of Nature Energy, Vol 6, April 2021, pp 337-338	Consumer research	Households (in the UK)	2,024	New retail energy contracts
Intelligent Automation (Intelligent Automation 2022)	Customer Insights Collaboration	Undated	Pilot	Households	28	Home Energy Management System (26 had solar, 22 had pool pumps, 23 had electric hot water, 26 had an air conditioner and 2 had an EV)
Langevin, J. Gurian, P. and Wen, J. (Langevin et al 2013)	Reducing energy consumption in low income public housing: Interviewing residents about energy behaviours	Journal of Applied Energy, vol, 102, January 2013	Consumer research	Households	50 interviews	Demand management
Lorenc, A., Pedro, L., Badesha, B., Dize, C., Fernow, I., Dias, L. (Lorenc et al 2013)	Tackling fuel poverty through facilitating energy tariff switching: a participatory action research study in vulnerable groups	Journal of Health Policy, vol. 127(10), 2013	Consumer research	Households	151 interviews	Switching energy tariffs
McKinsey & Company (McKinsey 2018)	Commercial excellence: Powering success in today's evolving energy retail utility markets	May 2018	Desktop research	Not applicable	Not applicable	Not applicable

Author	Report title	Date	Nature of study	Type of consumers	Sample size	Nature of technology
Newgate Research (Newgate 2021)	AEMC Metering Review, An assessment of consumer experiences relating to smart electricity meters and their competitive roll out within the National Electricity Market, Full research report	September 2021	Consumer research	Household and small business	Focus groups (14 groups with 101 participants) Survey (1,948)	Smart meters
Larissa Nicholls, Yolande Strengers, Sergio Tirado (Nicholls et al 2017)	Smart home control: exploring the potential for off-the-shelf enabling technologies in energy vulnerable and other households. Centre for Urban Research, RMIT University Funded by Energy Consumers Australia	August 2017	Trial	Vulnerable or disadvantaged households	40	Smart switch and two smart light bulbs
Larissa Nicholls, Karl Dahlgren, Sarah Pink, Rex Martin (Nicholls et al 2021)	Digital Energy Futures, Demand Management Opportunities. Emerging Technologies Research Lab (Monash University) A partnership between Monash University, Ausgrid, AusNet Services, and Energy Consumers Australia, funded through the Australian Research Council's Linkage Projects Funding Scheme	December 2021	Based on ethnographic research	Households	72	Demand management
Paul Ramsay Foundation and dandolopartners (Ramsay 2022)	Understanding Linkers	February 2022	Desktop research, interviews with Linkers and workshop	Vulnerable households	6 linkers	Not applicable
Rheem Australia (Rheem 2022)	Response to Customer Insights Collaboration, Release One call for evidence	10 February 2022	Various programs and trials	Households	Thousands	Solar PV, batteries, smart water heaters, air conditioning, pool pumps, EV chargers

Author	Report title	Date	Nature of study	Type of consumers	Sample size	Nature of technology
Mike Roberts, Sophie Adams, Declan Kuch (Roberts et al 2020)	VPP User Research, Final Report – FINAL The research was carried out by the Collaboration on Energy and Environmental Markets at UNSW Sydney in collaboration with the Social Licence to Automate Annex of the International Energy Agency's User-Centred Energy Systems Technology Collaboration Program – Users TCP, as part of the Consumer-led Distributed Energy Study (VPP) project led by Solar Analytics (SolA) and funded by the NSW Department of Planning and Environment	November 2020	Consumer research	Households	Stage 1 – 10 semi-structured interviews, 15 users participated in 2 focus groups Stage 2 – four focus groups with up to 6 participants each	VPPs
Russell-Bennett, R., Mulcahy, R., McAndrew, R., Letheren, K., Swinton, T., Ossington, R., & Horrocks, N. (Russell-Bennett et al 2017)	Taking advantage of electricity pricing signals in the digital age: Householders have their say: A summary report The research was carried out by Queensland University of Technology and CitySmart, funded by Energy Consumers Australia with funding provided by Energy Queensland, TasNetworks, Ausgrid, Western Power, Essential Energy and Endeavour Energy	July 2017	Consumer research	Households	45 interviews (118 people), 1,345 surveys	Electricity pricing
SA Power Networks (SAPN 2022)	Submission to the ESB in response to the call for evidence	24 January 2022	Programs and trials	Households and businesses	Not applicable	Tariffs, VPPs, solar PV, smart hot water, smart load devices
Simply Energy (Simply Energy 2020)	Simply Energy – Lesson Learnt Report	October 2020	Analysis of sales and survey	Households	1,188	VPPs
Cass R. Sunstein (Sunstein 2014)	Nudging: a very short guide	Journal of Consumer Policy, 2014, vol. 37, issue 4	Academic research	Households and businesses	Not applicable	Not applicable

Author	Report title	Date	Nature of study	Type of consumers	Sample size	Nature of technology
Hugo Temby, Hedda Ransan-Cooper (Temby et al 2021)	'We want it to work': understanding household experiences with new energy technology in Australia, Final report of the VOICES project (Victorian Energy and Water Ombudsman's Investigation of Consumer Experience) Funded by the Energy and Water Ombudsman (Victoria) and Victorian Department of Environment, Land, Water and Planning	March 2021	Consumer research	Households, energy industry and consumer experts	92 – interviews (45), focus groups (3), an internet forum content analysis and a re-analysis of primary data	New technologies – rooftop solar (41), home battery (11), electric vehicle (19), home energy management system (8), Virtual Power Plant (4), microgrid (4), peer-to-peer trading (24)
The University of Sydney (Uni of Sydney 2019)	What will energy consumers expect of an energy and water ombudsman scheme in 2020, 2025, and 2030?	15 October 2019	Academic research	Households and businesses	24 surveys and over 70 interviews with stakeholders and staff of Ombudsman Schemes	Not applicable
Kelly Burns and Bruce Mountain, Victorian Energy Policy Centre (VEPC 2020)	Do households respond to Time-of-Use tariffs? Evidence from Australia	June 2020	Data analysis	Households	6,957	TOU tariffs
Phillipa Watson, Heather Lovell, Hedda Ransan-Cooper, Veryan Hann, Andrew Harwood (Watson et al 2019)	Consort Bruny Island Battery Trial, Project Final Report A collaboration between the Australian National University, The University of Sydney, University of Tasmania, Reposit Power and TasNetworks, with funding through ARENA	April 2019	Trial	Households	100 interviews, 33 house observations, 2 focus groups, 33 energy diaries	Battery, battery controller and solar photovoltaics
Woolcott Research & Engagement (Woolcott 2021)	Customer and Stakeholder Engagement for the 24-29 Regulatory Proposal – Phase 1, Research report prepared for Essential Energy	December 2021	Consumer research	Households and businesses	7 visioning forums, 5 group discussions, 24 in-depth interviews, virtual drop-in website	Network tariffs
Zen Ecosystems (ZEN 2019)	ARENA / AEMO DR Trial, Project Performance and Knowledge Sharing Report, Summer 2019	19 August 2019	Trial	Households and businesses	16 residential and 7 commercial	Controlled load – residential heat pumps and commercial HVAC

Source: ACIL Allen

2 Consumers are diverse

Consumers are diverse. The diversity of consumers is not a barrier to consumers being rewarded for access to their flexible DER and energy use, in and of itself. However, based on the literature reviewed, ACIL Allen is of the view that, not understanding and recognising the diversity of consumers during the design and implementation of the policies, regulations and programs to support consumers being rewarded for flexible DER and energy use, may be a key overarching barrier, particularly if a "cookie cutter approach" (ECA 2020) is inappropriately applied. Understanding and recognising the diversity of consumers facilitates the development of an inclusive approach that recognises the different needs, wants and expectations of consumers, in terms of products, services and engagement, while recognising the role that each type of DER technology may play in meeting these requirements, based on the nature, maturity and complexity of each technology.

Understanding and recognising the diversity of consumers is complex – some factors that influence the diversity are easily identifiable (for example, different climate zones), while others are not (for example, different motivations), as discussed in section 2.1. A range of consumer segmentation frameworks have been developed to illustrate the diversity of consumers. Those identified in the literature for this review are discussed in section 2.2.

2.1 The diversity of consumers

Consumers are diverse – Australia has multiple climate zones, there are wide differences in degrees of urbanisation from inner city remote, households range from the wealthy to those highly vulnerable to cost-of-living pressures, and there are varying levels of competition between energy suppliers across states and territories (ECA 2020). The use of energy by small businesses varies significantly by location and by industry, as well as the capacity for energy savings (COSBOA 2018).

Seemingly homogeneous groups, such as the culturally and linguistically diverse (CALD) community, are diverse. The CALD community includes international students, highly skilled migrants, recently arrived refugees as well as older refugee and migrant communities from a variety of different countries – at all different stages of life (CPRC 2021a).

Householder responses to flexible DER and energy use are diverse. For example, nine of 30 households in the Bruny Island Battery Trial were responsive to price signals, while others were much less so. Of the nine households that were responsive to price signals:

— five did not change immediately, but did so a year later

— four reported a change after installation of the battery, but not a year later.

Four of the 30 households did not change behaviour at all. Some had no flexibility to change behaviour and some were already very low energy users.

Furthermore, two-thirds of trial households used an app regularly, while a few didn't even download the app (Watson et al 2019).

Watson et al (2019) found that a greater awareness and appreciation of the context in which households make decisions about energy is crucial to understanding their receptiveness to DER and their DER preferences.

Different consumer segments have different needs (Forethought 2020). For example, Roberts et al (2020) found that the participation in a VPP by households who purchased batteries for largely non-financial reasons was contingent on 'home energy needs' being met first. But what these 'needs' are, and how they are met by a battery is unclear and complex – and vary according to the size of the solar panel and battery, the household's energy consumption, as well as lifestyles and perceptions.

However, households do not make consumption decisions and experience technology based on their own motivations; decisions are made and technology is experienced in specific social, political and environmental contexts. Temby et al (2021) was of the view that it is important to understand these contexts – the organisations householders come into contact with, the conversations they have with others, their everyday routines and expectations of technology, previous experience and future hopes/desires.

A key finding from ECA's Power Shift program was the need to design energy management services and programs for diversity (ECA 2020). Understanding the different consumer segments can help ensure continued growth and participation in DER (CSBA 2021). In the context of demand response, Nicholls et al (2021) found that diverse strategies are needed to engage people who are enthused about using new technologies as well as those without new energy technologies or particular interest in the energy system.

Much of the literature reviewed is based on trials with the participants being Early Adopters, who may be attracted to more complex initiatives such as technology solutions, VPPs and time of use (TOU) pricing structures (Nicholls et al 2021). CSBA (2021) identified that Early Adopters of VPPs:

- live in free-standing homes (93 per cent)
- rely on energy hungry appliances such as air-conditioning (67 per cent) and electric ovens
- generally intend to remain in their home for the foreseeable future (at least the next ten years)
- have a high level of education with 51 per cent having tertiary education and an interest in understanding energy
- generally read widely and conduct web searches on topics of interest.

Watson et al (2019) identified that the early experiences with Early Adopters may not translate well to other types of households. Different strategies will need to be developed over time to attract different segments that will be less engaged and harder to reach than the Early Adopters (CSBA 2021). In the context of demand response, less technical and complex approaches are needed to build trust, engagement and demand response in the wider household population (Nicholls et al 2021).

2.2 Consumer segmentation frameworks

A variety of segmentation approaches have been identified to understand the diversity of consumers, and the factors that influence that diversity. This section first describes a number of segmentation approaches that were identified in the literature reviewed for this report, namely:

- a segmentation based on life stages, which identifies the changing priorities for consumers and the changing role of energy through the life stages (section 2.2.1)
- the role of organisational culture, which identifies how different types of households make decisions, gather information and use technology (section 2.2.2)
- attitudes towards innovation in the energy sector by reference to the technology adoption curve (section 2.2.3)
- adoption of innovative energy business models based on motivation, ability and opportunity (section 2.2.4)
- segmentation of VPP participants based on motivation and engagement (section 2.2.5)
- segmentation of customers in the UK based on ability and opportunity (section 2.2.6).

However, many of these segmentation approaches are based on trials or consumer research and therefore do not include those that do not participate in trials or consumer research – those with low motivation and/or low ability – or they identify segments that are not homogenous and can include consumers that have diverse motivations and abilities.

A segmentation approach developed as part of ECA's Power Shift program of work is described in section 2.2.7. This segmentation framework was based on an extensive literature review – it includes all households and identifies segments that are relatively homogeneous – but does not quantify the proportion of consumers in each segment.

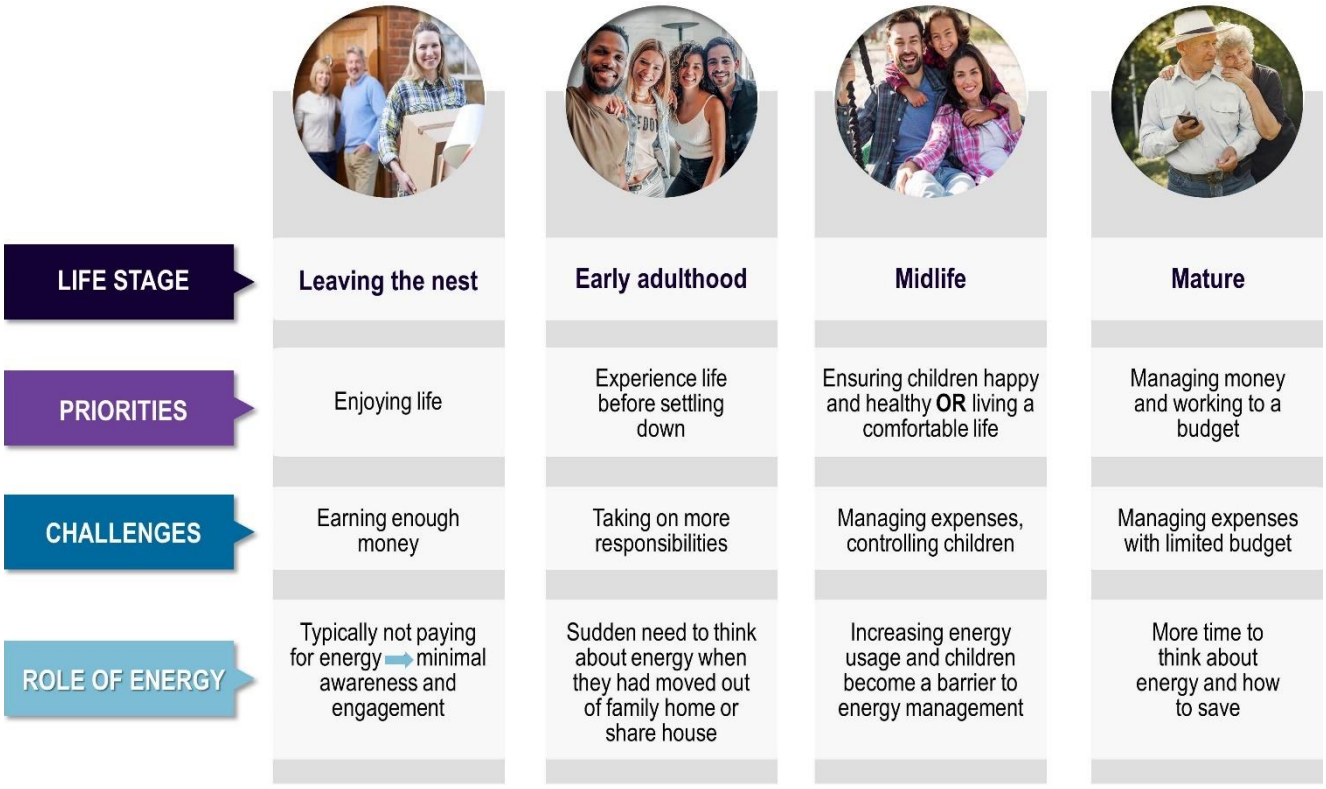
The segmentation approaches identified in the literature reviewed for this report are useful because they generally quantify the proportion of consumers in each segment, albeit based on a trial or consumer research. The relative sizes of different consumer segments can be inferred from this literature. Most importantly, it can inferred that the early adopters of flexible DER and energy use are likely to represent a relatively small proportion of all households (in the order of up to 10 per cent). If policies, regulations and programs to support consumers being rewarded for flexible DER and energy use are driven by the wants, needs and expectations of early adopters, then a large proportion of consumers will be excluded.

2.2.1 Segmentation based on life stages

Forethought (2019a) identified the priorities, challenges and role of energy for four life stages – leaving the nest, early adulthood, midlife and mature – an abridged version of which is provided as Figure 2.1. The role of energy changes as households move through the life stages – from minimal awareness and engagement on energy-related issues during the Leaving the Nest stage to having the time to think about energy and how to save during the Mature stage.

Foresight (2019a) also noted that life events, such as illness or divorce, can change the course through these life stages.

Figure 2.1 Changing role of energy through the life stages



Source: Based on Foresight 2019a

2.2.2 Role of organisational culture

Russell-Bennet et al (2017) identified how different households make decisions, gather information and use technology. The types of households identified were (as summarised in ECA (2020)):

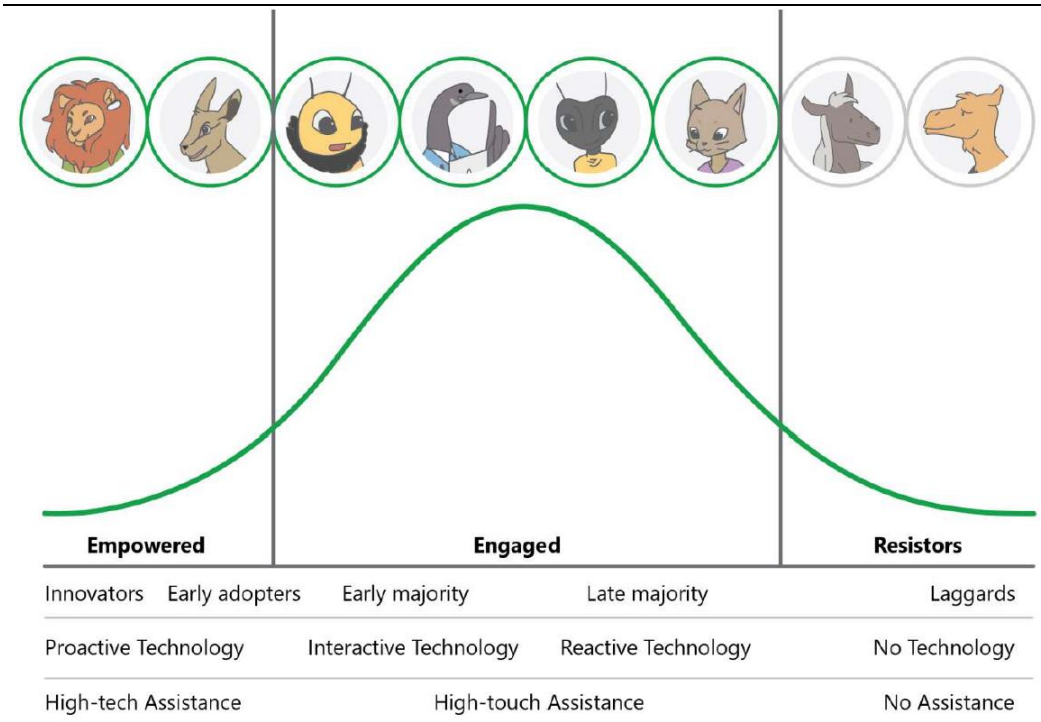
- Ant colony – a single person makes the decisions but the household works together (13 per cent of sample).
- Beehive – the household works together, with everyone bringing expertise (18 per cent of sample).
- Flock of geese – an adaptable household, where leadership may rotate (19 per cent of sample).
- Wallaby household – a household that resists rules and shares decision-making (16 per cent of sample).
- Domestic cat families – households that value comfort and independence, and are all engaged in the decision (17 per cent of sample).
- Lions – households that like to figure things out by themselves – unlike cats, they will seek out information (17 per cent of sample).

The scope of the research included how technology could be used to help consumers understand and manage price signals. Accordingly, households that were likely to resist the use of technology (camels and brumbies) were excluded from the research.

Russell-Bennet et al (2017) applied the diffusion of innovations model to these segments (see Figure 2.2) and identified that:

- lions were generally innovators
- wallabies were generally early adopters of technology
- beehives and flocks of geese were generally in the early majority of technology users
- ant colonies and domestic cats were generally in the late majority of technology users
- brumbies and camels were generally technology laggards.

Figure 2.2 Applying the diffusion of Innovations Model for Technology to the organisational culture segments



Source: Russell-Bennet et al 2017

2.2.3 Attitudes towards innovation in the energy sector

Newgate (2021) quantified the proportion of respondents in a smart metering survey along the technology adoption curve. The proportions varied by households and small businesses, and by those who did and did not have a smart meter, as summarised in Table 2.1. Most residential consumers adopt a 'wait and see' mindset around innovation in the energy market. Small businesses tend to be early adopters and innovators, especially those with a smart meter.

Table 2.1 Attitudes towards innovation in the energy sector

	Total	Households		Businesses	
		With smart meter	No smart meter	With smart meter	No smart meter
Innovators	11%	6%	6%	30%	19%
Early adopters	20%	18%	12%	43%	30%
Early majority	37%	42%	37%	20%	40%
Late majority	19%	21%	25%	5%	8%
Laggards	13%	13%	20%	1%	4%

Source: Newgate 2021

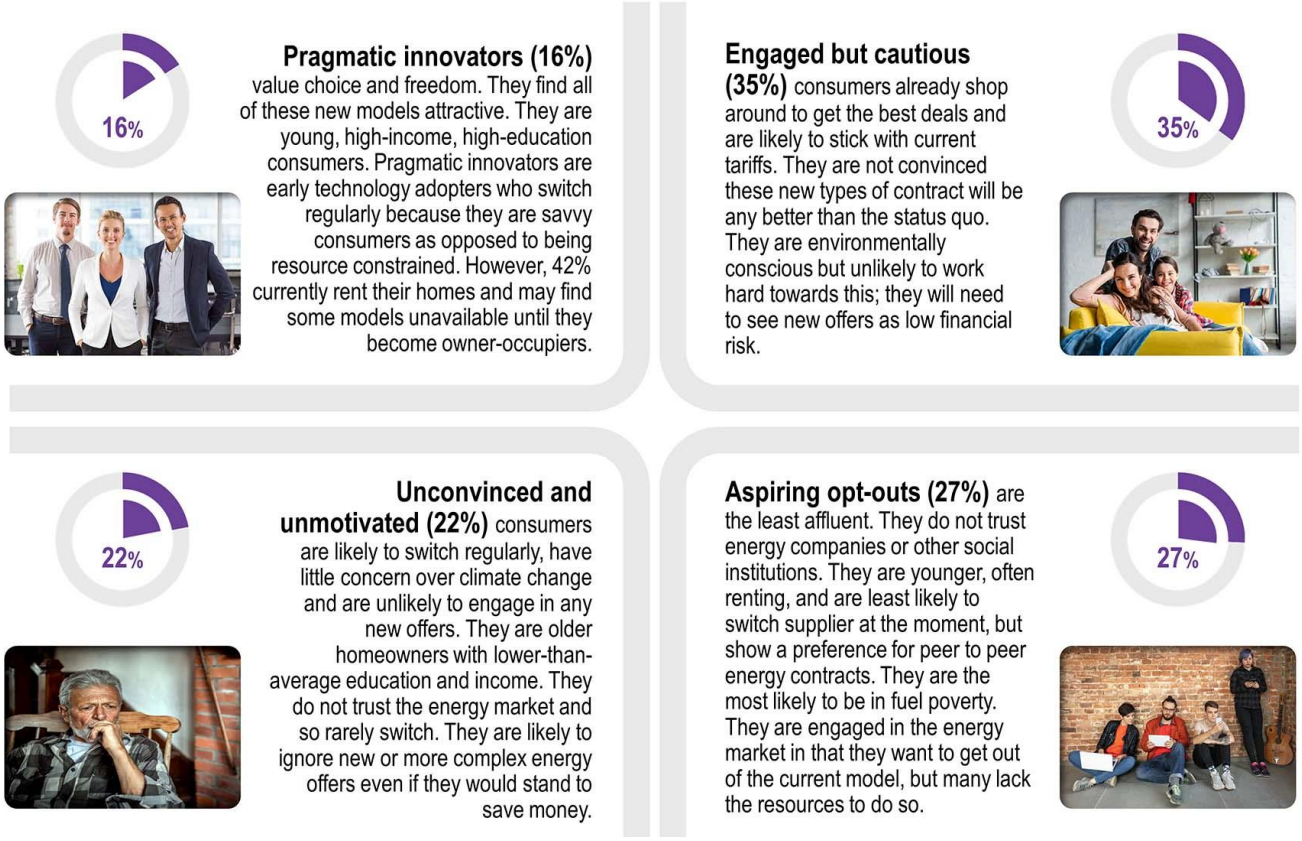
2.2.4 Adoption of innovative energy business models

Hall et al (2021) identified four consumer segments to identify which consumers would adopt innovative energy business models, such as peer-to-peer trading or energy as a service, refer Figure 2.3.

They identified the proportion of consumers in each segment based on a survey of 2,024 households in the UK. Approximately 16 per cent were categorised as early adopters (Pragmatic Innovators). Of these, 42 per cent rent their homes and therefore some business models would not be accessible to them. Accordingly, only 9 per cent of households surveyed would be motivated and able to adopt innovative energy business models.

The proportion of the broader population that is motivated and able to adopt innovative energy business models is likely to be lower than 9 per cent as those that are unmotivated are less likely to participate in a survey.

Figure 2.3 Segmentation for adoption of innovative energy business models

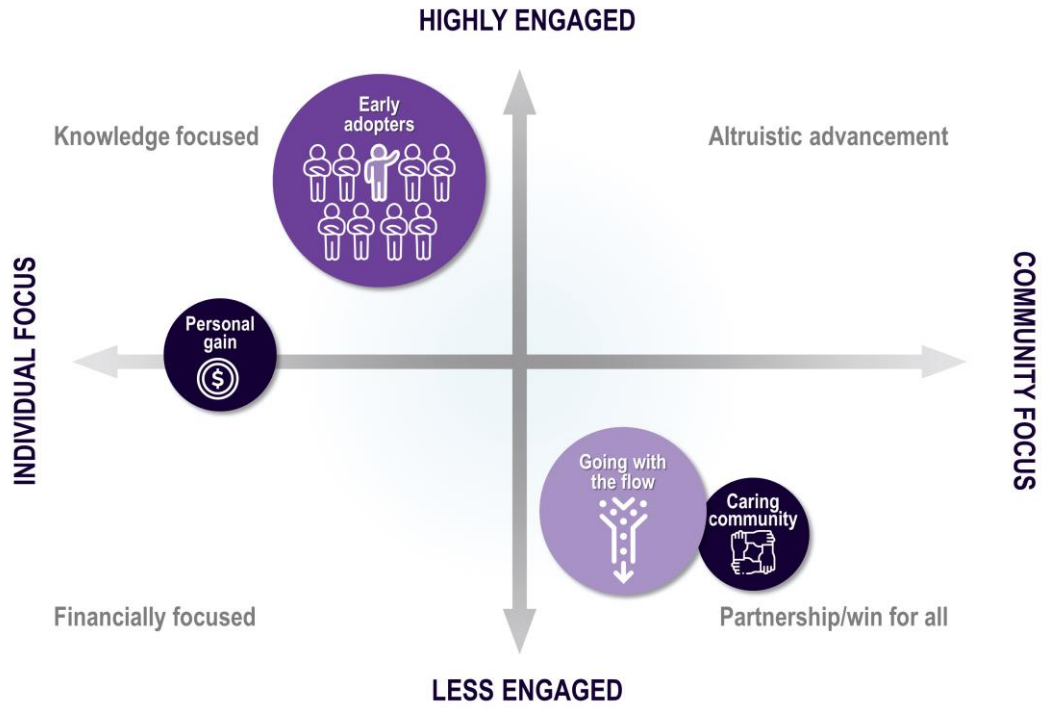


Source: Hall et al 2021

2.2.5 Segmentation of VPP participants

Based on a survey, CSBA (2021) identified four segments of consumers that participated in a VPP trial (see Figure 2.4). The segmentation is useful as it provides the proportion of consumers in each segment but it only includes those motivated to participate in a VPP trial and respond to a survey. Accordingly, the segmentation represents a relatively small proportion of the population.

Figure 2.4 Segmentation of VPP participants



Source: CSBA 2021

The four segments of VPP participants are:

1. Early Adopters (42 per cent of respondents) – driven by a desire to be pioneers in new energy solutions and were highly motivated and engaged in a VPP demonstration.
2. Go with the Flow (30 per cent of respondents) – pleased to be a part of the VPP because they could see the benefits for the environment, wider community and themselves, but there was a lack of engagement with the VPP.
3. Caring Community (16 per cent of respondents) – drawn to the VPP by the expectation of being able to use more green power and therefore help the environment, and also to share their excess solar energy with others in the community or not for profit organisations.
4. Personal Gain (12 per cent of respondents) – primarily driven by the opportunity to make money from their asset, significant subsidies on batteries, and the expectation of being able to use more free solar power during the day or evening.

2.2.6 Segmentation of energy consumer groups in the UK

CES (2020) identified five clusters of capabilities that influence whether a household is capable of being rewarded for flexible DER and energy use, namely:

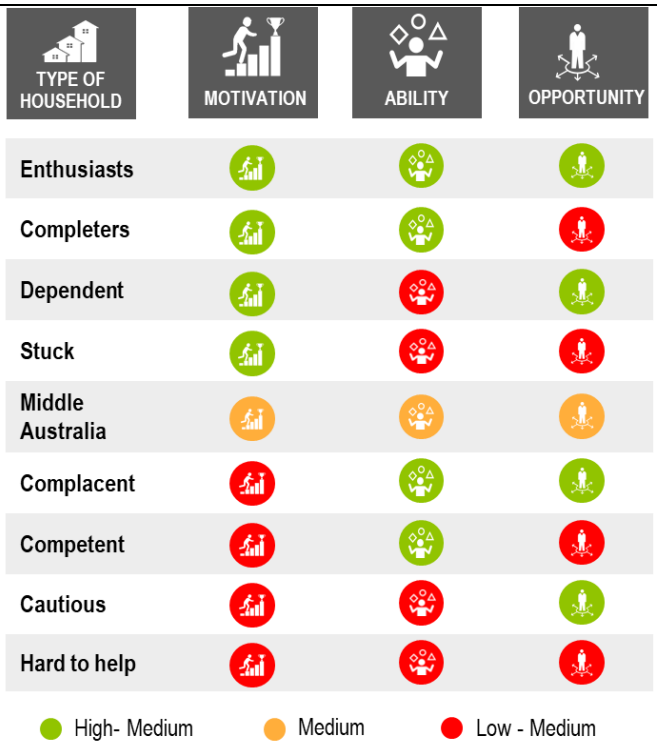
— household – from socio-demographic characteristics, skills, knowledge and attitudes
— dwelling – and its potential to accommodate change
— available technology
— energy usage profile, which is a product of the household and dwelling
— locality, which may influence opportunities available.

It identified that flexible DER and energy use are more accessible to less vulnerable and better off households in more urban areas.

2.2.7 Supporting Households Framework

As part of the ECA's Power Shift program, a consumer segmentation framework was developed for targeting energy services and programs through an extensive literature review and stakeholder consultation. The segmentation framework, referred to as the Supporting Households Framework, was specifically designed to include all types of households and identified nine segments (see Figure 2.5) based on three factors – motivation, ability and opportunity.

Figure 2.5 Different types of consumers



Source: Based on ECA (2020)

The framework was subsequently extended to include small-medium sized businesses (ACIL Allen 2021). The factors that influence the motivation, ability and opportunity for a household and small-medium-sized business are summarised in Table 2.2. In the case of a business, the factors apply to the person in the business making energy-related decisions rather than to the business *per se*.

The factors that influence the motivation, ability and opportunity for consumers to be rewarded for access to their flexible DER and energy use are discussed further in the following sections.

Table 2.2 Summary of factors that influence the motivation, ability and opportunity of a household and small-medium sized business

Motivation	Ability	Opportunity
– Attitude towards the behaviour, for example, the perceived costs and benefits, the importance of energy, and cultural considerations – Alignment with choices made within the household's or business's circle of influence – Likelihood of success – Unwillingness to create disharmony/conflict – For a business, maintaining competitiveness	– Literacy, numeracy, problem solving and research skills – Language barriers – Ability to self-advocate, negotiate – Belief in the ability to succeed – Trust in others – Ability to influence behaviour of all relevant people within the household or business – General interest in, and capability using, technology	– Type of housing or premises – Ownership status of the home or premise – Scope to make energy-related decisions – Access to liquid funds – For a business, the way in which the business operates

Source: Based on ECA (2020) and ACIL Allen (2021)

2.2.8 Motivation to be rewarded for access to flexible DER and energy use

Watson et al (2019) notes that householder participation in DER is not certain; it cannot be assumed that householders are willing (or motivated) to participate. Where consumers are willing to participate in flexible DER and energy use, a number of the studies have examined the different factors that motivate them to participate.

Motivating households

Roberts et al (2020) and CSBA (2021) identified three broad types of motivating factors that influence participation in a VPP trial:

— economic benefit, that is, a financial benefit for the participant as bill savings or income

— community benefit, that is, contributing to the community through supporting management of the network

— environmental benefit, that is, generating clean energy.

Participants in the VPP trials differed in the relative weightings of the three broad types of motivating factors, in particular, the importance they ascribed to personal, financial benefits compared to the wider, social benefits (Roberts et al 2020).

CSBA (2021) found that the desires and hopes of participants in VPP trials tended to be polarised towards their own interests or the interests of others. Those with an individual focus considered the financial benefits of being a member of a VPP or their enthusiasm for owning their new technology and being a pioneer in the VPP. Those with a community focus have a strong desire to use more green energy and reduce harm to the planet caused by greenhouse gas emissions and/or a desire to help stabilise the energy grid ensuring a reliable supply of electricity for others in the area.

Roberts et al (2020) provided examples of the diversity of consumers' views on motivation. While some participants saw it as empowering to play a different and important role in the energy system, one participant perceived it to be the responsibility of governments rather than individuals to manage transitions in the energy grid.

A number of studies quantified the proportion of consumers by motivating factor:

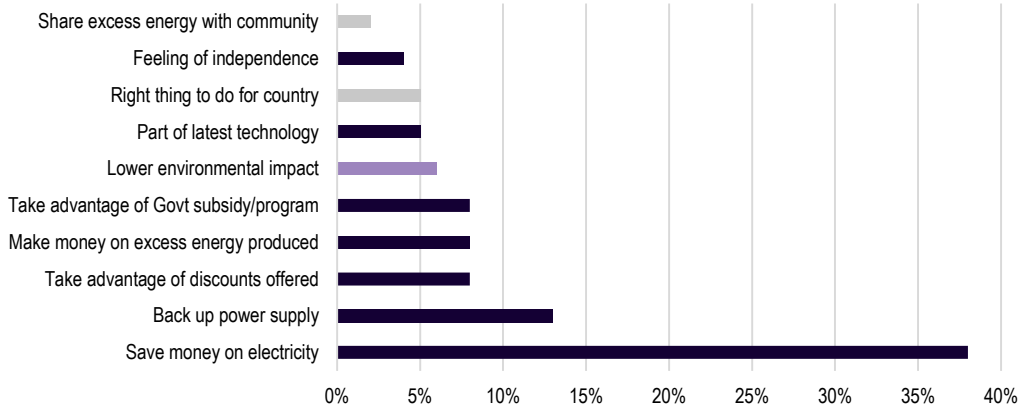
— Ausgrid (2016a) found that more than half the participants in a demand response trial participated because of financial incentives, a quarter participated to help reduce overall network charges, with the remainder interested in new technology

— AGL (2019) found that 42 per cent of participants in a demand response trial were motivated by financial incentives with the remainder interested in helping the grid, or just wanting to be involved in something new or novel

— CSIRO (2021) found that between 25 and 26 per cent of participants in a survey were willing to participate in demand response and community energy for economic or financial benefit

— the diverse range of motivators for joining a VPP program are illustrated in Figure 2.6.

Figure 2.6 Main reason for joining a VPP program



Note: Dark purple bars – personal, financial benefit; Grey bar – community benefit; Light purple bar – environmental benefit
Source: Based on CSBA (2021)

Values modes

ARENA (2020b) analysed the values of customers with flexible DER and energy use and their motivations. It notes that:

> *values are stable psychological structures that motivate behaviour, cutting across demographics.*

ARENA (2020b) identified three types of values modes for customers flexible DER and energy use – settlers, prospectors and pioneers. Table 2.3 describes each of these value modes and summarises the motivators for each, and illustrates the different weighting of economic, community and environmental benefits for each different mode.

Table 2.3 Description of, and motivating factors, for different values modes

	Settlers	Prospectors	Pioneers
Description	Sustenance-driven, needing safety, security and belonging	Success driven, including esteem of themselves and others	Focused on new ideas and self-actualisation
Motivators	– Financial / security benefits – cost savings – Security of supply – Maintaining status quo – Community benefit – Trust	– Financial / security benefits – smart investment – Security of supply – New technology – Aesthetics / status symbol – Energy independence – Trust	– Financial / security benefits – good value for money (fairness) – Energy independence – Environmental benefit – Community benefit – Trust

Source: ARENA 2020b

Financial / security benefits were generally described by ARENA (2020b) as the strongest motivator, with the nature of the financial / security benefits differing for each of the values modes –

cost savings for settlers, smart investment for prospectors and good value for money for pioneers. That said, ARENA noted that participants may have been primed to nominate financial / security benefits as a motivator due to the cost of the projects.

Although financial considerations are important, there are a range of other issues and motivations that are also important. Temby et al (2021) found that almost all households are motivated to some degree by pro-environmental attitudes, particularly the need for climate action. Another significant factor is the knowledge of, and motivation to support, the energy transition. Other motivating factors identified include:

— desire for greater self-sufficiency and reliance
— community-mindedness
— enthusiasm for technology
— comfort
— convenience
— entertainment.

Woolcott (2021) noted that a topic of importance to customers and stakeholders is to cater for individual needs while focusing on the collective good (equity).

Non-financial motivating factors

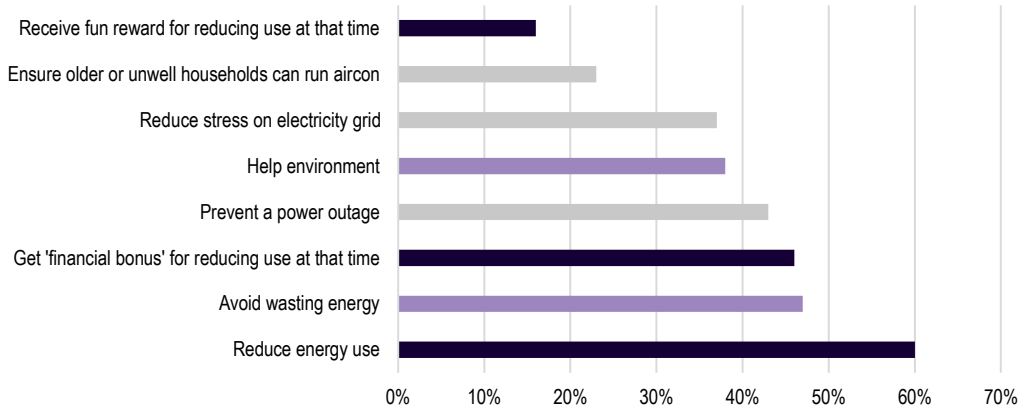
The desire for greater self-sufficiency and reliance varies by location, with the desire stronger in regional and rural areas. The use of flexible DER and energy use was seen as a way of reducing national and local risks such as catastrophic bushfires and heightened tensions with China.

Some participants are motivated by control and independence (ARENA 2020a) to install solar panels and battery storage, particularly for those who experience frequent blackouts. However this desire for control and independence can be undermined by participation in a VPP (Roberts et al 2020). The extent to which a consumer has a desire for control and independence influences whether they 'set and forget' or optimise their energy use in a VPP (ARENA 2020a). It also influences their engagement with aligning EV charging with the demands of the network (Nicholls et al 2021).

As with the self-sufficiency and reliance motivator, the comfort motivator is also stronger with particular cohorts, particularly renters with very poor thermal comfort, and households with disability and illness that are more sensitive to heat and cold (Temby et al 2021).

Nicholls et al (2021) found that there has been a resurgence in interest in environmental sustainability. Many people would like to reduce their impact on the environment, including households without solar panels, and households with solar panels often desire more sustainability options. There are a range of reasons for households to join demand management programs, with some joining primarily for environmental reasons, as illustrated by the light purple bars in Figure 2.7. Similarly, Energy Queensland (2022) found that participants in its demand response trial were driven less by bill savings than by being more sustainable, using more of their renewable generation on site, and having more control of their energy use.

Figure 2.7 Reasons for households to reduce energy use during periods of high demand



Note: Dark purple bars – personal, financial benefit; Grey bar – community benefit; Light purple bar – environmental benefit
Source: Based on Nicholls et al (2021)

Nicholls et al (2021) also found that community benefits can be more attractive than small financial benefits.

Watson et al (2019) found that the cost of bills and saving money were an important motivator for 31 of 36 participants in the Bruny Island Battery Trial, and only six were motivated only by financial considerations. Another four were also motivated by issues such as interest in new technology and being opportunistic. Battery back-up at times of grid outages was seen as particularly valuable, and community and environmental values were important.

Similarly, Roberts et al (2020) found non-financial motivations for purchasing a battery including energy independence, increased self-consumption of solar and security of power supply. The security of supply (black out protection) was considered to be particularly important in remote areas, for facilities for vulnerable groups (for example, childcare centres and community facilities), and for small/home businesses.

While financial factors were less frequently offered as a reason to purchase a battery, most interviewees gave financial reasons for not buying a battery, expressed as high cost, long payback period and lack of access to capital.

Motivating businesses

For the most part, energy is seen by businesses as a dollar value to reduce to maximise profitability. Energy is only one external factor among many others which impacts the business on a daily basis, and is generally not high on the priority list (Foresight 2019b). Other issues such as staffing, legal issues, rent and leasing agreements are prioritised over energy bills (Hall & Partners 2021).

The importance of energy to a business generally depends on the size of the business and the energy intensity of the business (see Figure 2.8), with a higher priority placed on energy by larger and more energy intensive businesses. Smaller businesses are generally too busy trying to survive in the market, with some believing their contributions are not substantial enough to make a difference (Foresight 2019b). They fall into a ‘set and forget’ mindset (Hall & Partners 2021).

Figure 2.8 Segmentation of businesses

Source: Foresight 2019b

However, ARENA (2021) noted in its review of the demand response short notice Reliability and Emergency Reserve Trader (RERT) trial that:

> *… while the financial incentive has always been and continues to be the main motivation for [commercial and industrial] C&I customers to participate in [demand response] DR, the availability of these technologies and the social benefit of assisting to maintain reliability of supply also played a role in motivating the participation of customers.*

Similarly, in an annual survey of small businesses, ECA (2021b) found that, while a third of survey respondents would be willing to reduce peak energy usage if offered a financial incentive, a further one half would do so even if no financial incentive was offered.

2.2.9 Ability to be rewarded for access to flexible DER and energy use

The review identified a number of strong themes relating to the ability of consumers to be rewarded for access to their flexible DER and energy use. These include:

— trust
— dealing with complexity
— comfort with technology.

In addition, BIT (2022) considered whether consumers would be more likely to act in response to messages in relation to energy bills based on differing levels of financial literacy, financial hardship or CALD backgrounds. It found that the only differential effects related to financial literacy. Those with higher levels of financial literacy were more likely to respond to messages.

Trust

ARENA (2020a and 2020b) and Nicholls et al (2021) identified that trust is critical in public acceptance and advocacy of new technologies, including flexible DER and energy use. Similarly, Cannizzaro et al (2020) noted that trust is fundamental to consumer technology where transmission of personal and sensitive information is involved. A technology must be trustworthy for it to be desirable or acceptable.

ARENA (2020b) suggested the "Trust Equation" as a means of building trust, with the Trust Equation comprising four variables – credibility, reliability, intimacy and self-orientation. A description of each of these variables is provided in Box 2.1.

Box 2.1 Variables to measure trustworthiness

1. **Credibility** is about expertise and feeling that the people you are engaging with know their subject.
2. **Reliability** is about track record. If customers have had bad experiences, then this will be low.
3. **Intimacy** is about safety and security. Consumers are more likely to feel safe and secure with people that share their values.
4. **Self-orientation** is about whether a customer feels like the organisation has their interests at heart or is being self-serving. Self-orientation will be reduced (and trust increased) if the provider expresses intrinsic values that are 'bigger than self' rather than self-focused extrinsic values.

Source: Based on ARENA (2020b)

Cannizzaro et al (2020) identified that trust can be broken down into:

— competence – for example, belief in the capability to protect clients' personal and sensitive data

— benevolence – belief that clients' interests will be respected

— integrity – belief that the entity is honest and will fulfil its promises to the client.

Nicholls et al 2021 found that, until consumers determine whether a program or device can be trusted, they want a level of personal control.

Dealing with complexity

While ARENA (2020a) noted the complexity associated with flexible DER and energy use – at all stages of the DER customer journey[11] – ECA found that 67 per cent of households and businesses surveyed in December 2021 were confident in their ability to make choices about energy products and services (ECA 2021c, ECA 2021d). A slightly lower percentage of households (61 per cent) and businesses (63 per cent) were confident there is enough easily understood information to make decisions about energy products and services. These percentages may be higher than those for the broader population, and also may be responses to simpler concepts than those considered in the DER projects reviewed by ARENA (2020a).

In the context of retail energy pricing, COSBOA (2018) notes that it is confusing and time consuming for small businesses to navigate all the information about energy costs and savings. Most small businesses do not possess either the time or the level of expertise required to negotiate the plethora of competing and confusing offers in the current energy market. Accordingly, small businesses often feel hamstrung and disempowered to do anything about their energy bills.

Comfort with technology

Nicholls et al (2021) found that some households prefer to minimise the introduction of new digital technologies or cannot install them due to financial, space, occupancy, language, internet or skill constraints. A trial by Nicholls et al (2017) (summarised in ECA 2020) revealed the difficulties that many households face dealing with new technology. 40 households in Victoria and South Australia were provided with a smart switch and two smart light bulbs to install. Of those households:

— 24 per cent tried, but couldn't

— 24 per cent installed them but didn't use them

— 26 per cent didn't take them out of the box

— only 10 actively used the devices on an ongoing basis.

[11] The customer journey is discussed further in Chapter 4.

In addition, six Victorian households were given a smart plug to install and test while being observed. All encountered difficulties and only half completed the installation process.

Nicholls et al (2017) found that technology enthusiasts, men and vulnerable households were more likely to successfully install and use the devices. Most over 55 years old did not use the device. As a result, technology-led initiatives appeal more to men, while women are more interested in adapting and modifying routines (Nicholls et al 2021).

In the context of demand response, Nicholls et al (2021) found that typical households that are not energy or data enthusiasts have limited interest in data, particularly if it is not clearly translated into meaningful outcomes or imperatives for households. It is therefore instructive to note that the majority of consumers in VPP trials were technologically savvy Early Adopters (CSBA 2021).

In a survey of UK consumers, Cannizzaro et al (2020) found that they have fairly low levels of trust in technology, particularly regarding the likelihood of incidents resulting in physical risk. There is greater resistance to technology from older respondents and less well-educated respondents.

ECA found that 59 per cent of households and 62 per cent of businesses surveyed in December 2021 were confident that they have the tools and assistance (for example, electricity meters, smart phone devices, apps) to manage their energy use and costs (ECA 2021c, ECA 2021d). However, an earlier survey by ECA (2021a) found that only 13 per cent of households would definitely use smart devices to control energy use in the future, 29 per cent say they probably would and 31 per cent sat on the fence. A similar survey of businesses found that only 23 per cent of home / mobile businesses would definitely use smart appliances to reduce energy usage (ECA 2021b).

By way of contrast, Newgate (2021) found that small business customers demonstrate higher levels of technology adoption than residential customers, who are more inclined to adopt a 'wait and see' mindset around technological adoption in the energy space.

2.2.10 Opportunity to be rewarded for access to flexible DER and energy use

The review identified a number of the factors that influence the opportunity for consumers to be rewarded for access to their flexible DER and energy use. These include:

— access to finance
— ownership status of premises
— scope to access DER assets and flexible demand.

Access to finance

Nicholls et al (2017) (as summarised in ECA (2020)) noted that, for smart control to work successfully, all household members need a smart phone and internet to access the app. However this is not possible or is unaffordable for some vulnerable customers. For example, CPRC (2021a) identified that CALD Australians are likely to be overrepresented in insecure employment opportunities, with 73 per cent being "somewhat" concerned about their financial wellbeing compared to 56 per cent of the broader population.

COSBOA (2018) notes that many businesses cannot afford the up-front capital expenditure required for energy efficiency upgrades.

Ownership status of premises

Renting a home or business premises adversely impacts the opportunity for households and businesses to be rewarded for access to their flexible DER and energy use. Renters feel the decision to install a smart meter is out of their hands (Newgate 2021). They also have little or no information on the energy performance of buildings and are unable to easily make changes to the fabric of a house or change major appliances (ECA 2020, EWOV 2020a). Installing rooftop solar

panels and/or a battery system is off limits unless the landlord agrees and this can be accommodated effectively in the terms of the lease.

Over 50 per cent of small businesses rent their premises (COSBOA 2018). COSBOA (2018) notes that it is complex and burdensome for a business to negotiate a 'green lease' with a landlord.

Scope to access flexible DER and energy use

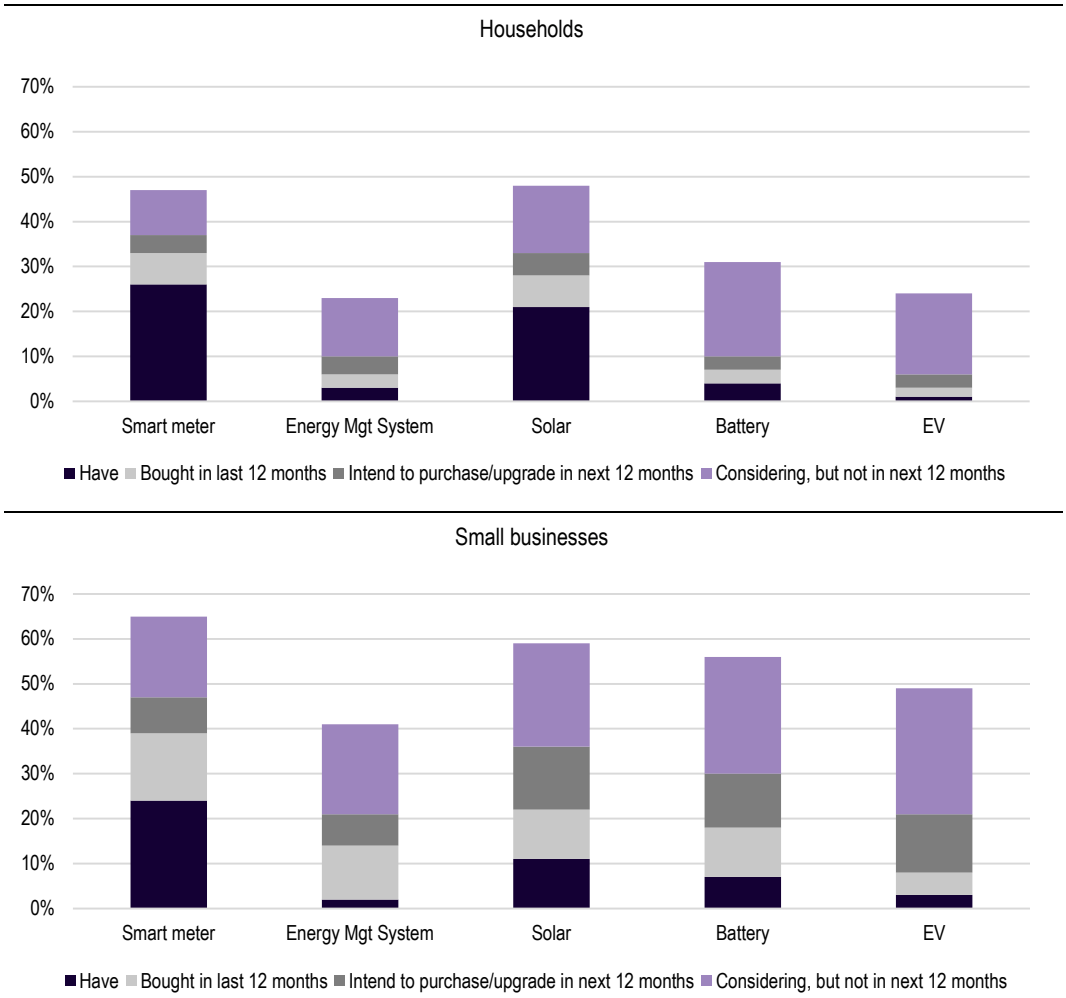
The scope for consumers to access flexible DER and energy use may be positively or adversely impacted by the circumstances of the consumer, for example:

- the opportunity for households to shift energy use in time and space varies (Adams et al 2021)
- the opportunity for demand response may be restricted by emergency situations such as bushfires – by a requirement to operate in an emergency response mode or by air quality issues due to the smoke from bushfires (ARENA 2021)
- industries with high levels of regulatory and environmental requirements, such as telecommunications, water utilities and wastewater services, may face difficulties providing demand response during periods of drought, bushfire or other emergencies (ARENA 2021)
- the opportunity for shopping centres to access flexible demand may be limited due to a requirement to remain open for late trading hours (ARENA 2021)
- consumers in multi-dwelling buildings (such as apartments) may not be able to install a smart meter (Newgate 2021) or solar panels (EWOV 2020a)
- regional businesses in regional areas may have more space onsite to take advantage of solar panels (Forethought 2019b).

Surveys have revealed that only 34 per cent of households who charge appliances during peak times say it would be very easy to switch to off peak (ECA 2021a) while the majority of small businesses using appliances during peak times say it would be easy to switch to off-peak (ECA 2021b).

A relatively small proportion of consumers have taken up new energy technologies, particularly energy management systems, batteries and EVs (ECA 2021a, ECA 2021b). This means that a relatively large proportion of consumers have the scope to take up new energy technologies in the future, as illustrated in Figure 2.9. While the intention to purchase a new energy technology is relatively high, the time until purchase is generally over a longer period than 12 months.

Figure 2.9 Intention to purchase new energy technologies



Source: ECA 2021a (households), ECA 2021b (businesses)

3 Tailoring approaches to consumers

Based on the literature reviewed, and given the diversity of consumers, ACIL Allen is of the view that a key overarching enabler to rewarding consumers for access to their flexible DER and energy use is to develop a tailored approach. The extent to which the approach is tailored, and the way in which the approach is tailored, will depend on the specific DER technology and the objective for tailoring the approach. Many of the tailored approaches in the literature are based on the consumer segmentation frameworks discussed in chapter 2.

3.1 Basis for tailoring the approach

The need for a tailored consumer-centric approach, rather than mass market initiatives, was identified by ECA (2020) in the context of supporting households to manage their energy bills, by Nicholls et al (2021) in the context of demand response and by ARENA (2020a) in the context of DER more broadly. ARENA (2020a) identified that one of the key ingredients to a happy DER customer is to:

> *Know who your customers are and the values that drive them – through customer segmentation, customer research, and customer feedback. Tailor customer proposition and engagement accordingly.*

The Supporting Households Framework indicates that a tailored approach needs to take into consideration a consumer's motivation, ability and opportunity.

> *Power Shift has demonstrated that measures to empower consumers to manage their energy use and take control over their costs are more effective when they are designed using evidence of the diversity of consumers in their motivation, ability and opportunity when making decisions.*
>
> *ECA 2020*

As discussed in section 2.2.8, motivations can be broadly categorised into personal, environmental and community considerations. ARENA (2020b) notes that it is difficult to understand customer values at a glance, so strategies that maximise customer motivation without isolating potential target groups can be useful. It suggests that, from a psychology perspective, it is perceived to be safest to move up Maslow's hierarchy of needs from Settlers to Pioneers (see Table 2.3).

Nicholls et al (2021) identified that approaches could be tailored based on a range of factors that relate to motivation, ability and opportunity, namely:

- particular household experiences, for example, heatwaves
- life stages, for example, parenthood
- practices, for example cooking and charging
- interests, for example pet care, health and sustainability
- work circumstances, for example, stay-at-home parents with young children, work-from-homers, people not currently working (including retirees)
- personal circumstances, such as:
  - housing characteristics, for example, renters and apartment dwellers
  - cultural interests and concerns
  - internet accessibility
  - security and privacy concerns
  - occupancy restrictions
  - eyesight and hearing capabilities
  - digital skills
  - financial constraints.

ECA (2020) similarly suggests that information, tools and assistance should be developed for consumers that suits their circumstances and lifestyle, giving them relevant options for how to manage their energy use. As part of the Power Shift project, ECA developed resources specifically targeted for low income consumers, low income renters, older people with low digital literacy skills and/or not engaged with energy, and Indigenous Australians in regional and remote communities. The resources were tailored in content, design, format and distribution channels (ECA 2020).

Ramsay (2022) identifies the use of Linkers by not-for-profit organisations as an emerging strategy to support individuals to navigate complex and hard to access service systems. They build trust and connection, and develop a tailored plan. Linkers:

> *… provide a way to operationalise the relational, client-centred, flexible support which evidence shows is more effective.*
>
> *(Ramsay 2022)*

However, more research is needed to build the evidence base about the effectiveness of Linker programs.

Adams et al (2021) discusses the concept of a 'social licence' to create acceptance in DER, by drawing on the concept originally developed in the mining sector. The concept of a social licence implies a tailored approach to addressing concerns that takes into consideration, among other things, a consumer's sense of control and agency and their trust in energy providers.

In the context of businesses managing their energy bills, COSBOA (2018) also suggests a tailored approach, with an interactive toolkit to tailor suggestions to suit business owners' needs and location, taking into account:

- their industry
- whether they rent or own their premises
- what factors they identify as the biggest contributors to their current energy usage.

3.2 How to tailor the approach

The literature identified the use of a tailored approach to tailoring:

- the design of programs, including:
  - providing for manual, programmed and automated strategies (Nicholls et al 2021)
  - different compensation mechanisms (upfront payment versus ongoing payments) (Roberts et al 2020)
- marketing and communication strategies (ARENA 2020b, ECA 2020, CSBA 2021)
- personalised advice, including energy feedback and practice insights to consumers (Nicholls et al 2021)
- support for consumers, in the form of hands-on, face-to-face support for digital technologies (Nicholls et al 2021), noting that this can yield strong uptake but comes at a high resource cost (ARENA 2020b).

However, care needs to be taken with providing personalised advice as CPRC (2021b) found that the majority (76 per cent) of consumers find the common practice of companies using their personal information to make predictions about them to be unfair.

3.3 Applying a tailored approach to VPP participation

As discussed in section 2.2.5, CSBA (2021) segmented VPP participants into four groups:

1. Early Adopters (42 per cent of respondents)
2. Go with the Flow (30 per cent of respondents)
3. Caring Community (16 per cent of respondents)
4. Personal Gain (12 per cent of respondents).

CSBA (2021) identified that Early Adopters may drive the early uptake of VPP initiatives, but as the industry matures, strategies will be required to attract other segments over time. As the uptake of VPPs increases, less engaged consumers will be harder to reach and will continue to need validation. The tailored approach proposed by CSBA (2021) is provided in Box 3.1.

Box 3.1 Tailoring an approach for different groups of potential VPP participants

The interest and engagement of Going with the Flow consumers could be improved by providing explanations to enable them to understand the information in their apps, the specific benefits of being a part of the VPP and how to optimise their membership.

As VPP deployments continue, the information the different consumer segments desire should be defined and provided to them, such as providing in-app help and updates targeted to consumers' information needs.

Attracting more Caring Community consumers requires a strategy tailored to their interest in the environment and sharing benefits for their community, as well as addressing their relative unfamiliarity with VPP technology and processes compared with other consumer segments.

Once the VPP industry becomes more established, it is likely that Personal Gain consumers may be on the lookout for the best deals. Retaining these consumers will depend on ensuring the offering is competitive. Attracting more Personal Gain consumers will depend on explaining the financial benefits and the return on investment of participation.

Source: CSBA 2021

CSBA (2021) also identifies that the marketing strategy and onboarding process for VPP participants needs to be tailored based on the consumer's pathway to participation in a VPP – whether the consumer has transitioned directly from grid-connected electricity to a VPP, from solar

panels only to a VPP, or from solar panels and battery storage to a VPP – as their expectations will be different. Those with a pathway from solar panels to a VPP may be accustomed to high ongoing financial earnings from solar panels and existing discounts. Those with a pathway from solar panels and battery storage need to transition from having complete control over the charging and discharging of their batteries to ceding control to another party.

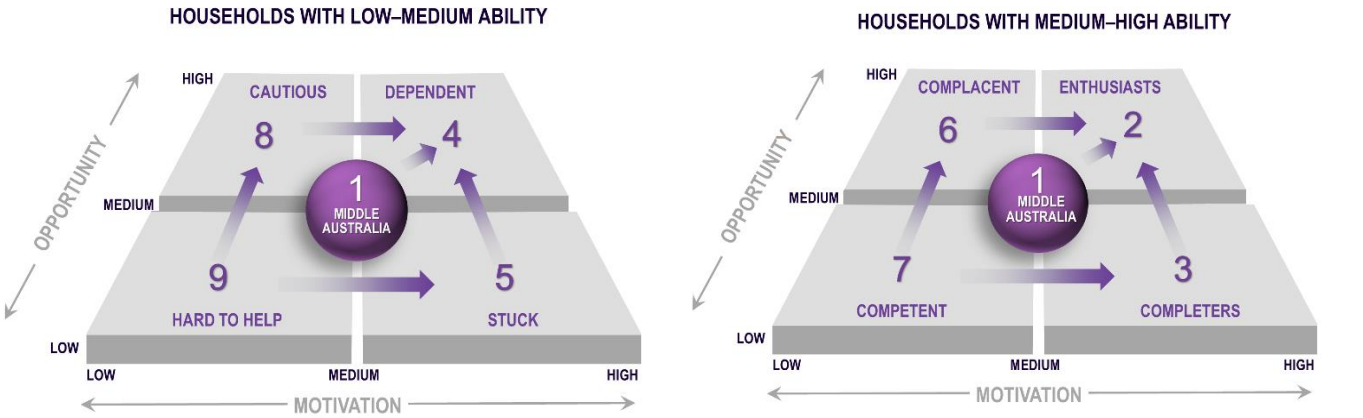
3.4 Identifying an appropriate tailored approach

The objective of developing a tailored approach is to remove the barriers to a consumer being rewarded for access to their flexible DER and energy use. ACIL Allen (2021) identifies that the objective is to increase the motivation of, or increase the opportunity for, consumers to make a choice (in this case to be rewarded for access to their flexible DER and energy use), as illustrated in Figure 3.1.

Consumers in the Enthusiasts segment[12] already have a high level of motivation, opportunity and ability to choose to be rewarded for access to their flexible DER and energy use. Consumers in the Dependent segment also already have a high level of motivation and opportunity to choose to be rewarded for access to their flexible DER and energy use, but a low level of ability to do so. An approach tailored to consumers in the Dependent segment would therefore target the removal of ability-related barriers.

Consumers in the Middle Australia segment, who have a medium level of motivation, opportunity and ability, may only require lighter forms of support than consumers in other segments as the incremental increase in motivation and opportunity required for them to choose to be rewarded for access to their flexible DER and energy use is less.

Figure 3.1 Desired impact of recommended complementary measures



Source: ACIL Allen 2021

However, prior to developing any tailored approach, the objective for doing so needs to be clarified. For example, is the objective to ensure that:

- all consumers have the necessary level of motivation, opportunity and ability to be rewarded for access to their flexible DER and energy use, or
- specific consumer segments have the necessary level of motivation, opportunity and ability to be rewarded for access to their flexible DER and energy use and, if so, which ones – for example, the "low hanging fruit" or those with the greater ability-related barriers?

[12] Refer section 2.2.6 for more detail on the different consumer segments referenced in this section.

Barriers and enablers across the DER customer journey

4

This chapter considers the barriers and enablers for consumers to be rewarded for access to their flexible DER and energy use across the DER customer journey.

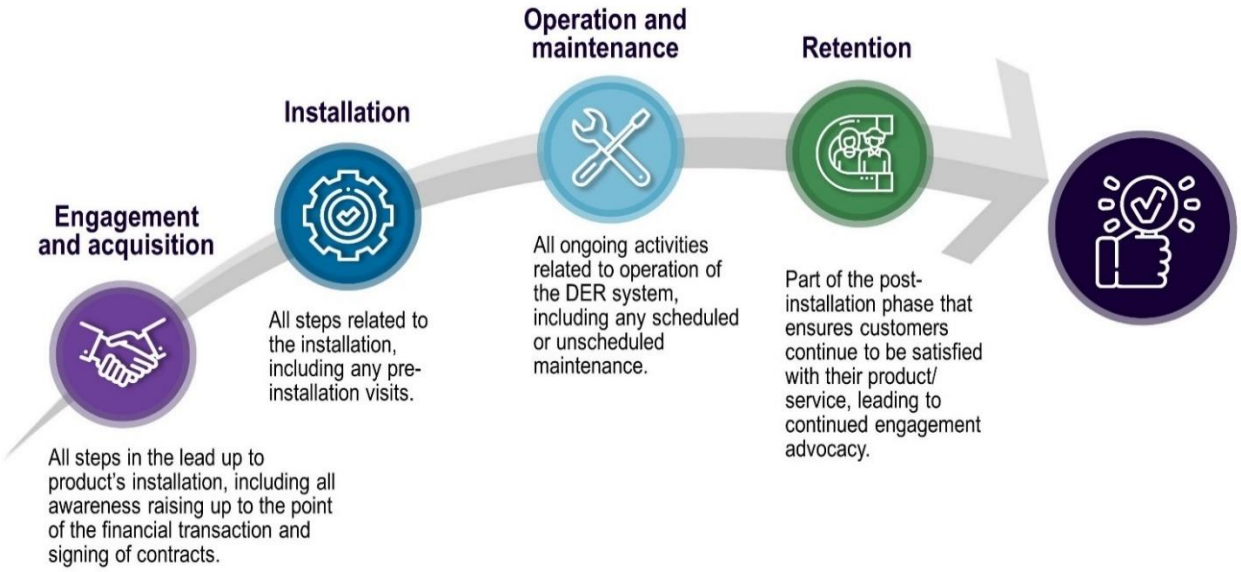
The objective of this review was to identify the barriers and enablers for consumers to be rewarded for access to their flexible DER and energy use across the DER customer journey, as described by ARENA (2020a) (refer Figure 4.1). However, the review revealed that:

— many of the barriers and enablers are common across the DER customer journey

— there is currently more information on the barriers and enablers that are specific to the early stages of the customer journey than to the later stages of the customer journey as many of the trials are focused on the earlier stages of the customer journey.

This chapter therefore consider the barriers and enablers that are common across the DER customer journey, while chapter 5 considers the barriers and enablers that are specific to each phase of the DER customer journey. The barriers and enablers discussed in this chapter are secondary to the key overarching barrier of not understanding and recognising the diversity of consumers (discussed in chapter 2) and the key overarching enabler of using a tailored approach (discussed in chapter 3).

Figure 4.1 The customer journey to engage with a DER technology



Source: ARENA 2020a

4.1 Barriers across the DER customer journey

Temby et al (2021) found that negative emotions include confusion, frustration, anxiety and disappointment. These emotions are an indicator of a barrier being experienced by a consumer Negative emotions are usually a result of complexity, technology failures and lack of support; they can shape, and are shaped by, experiences (Temby et al 2021).

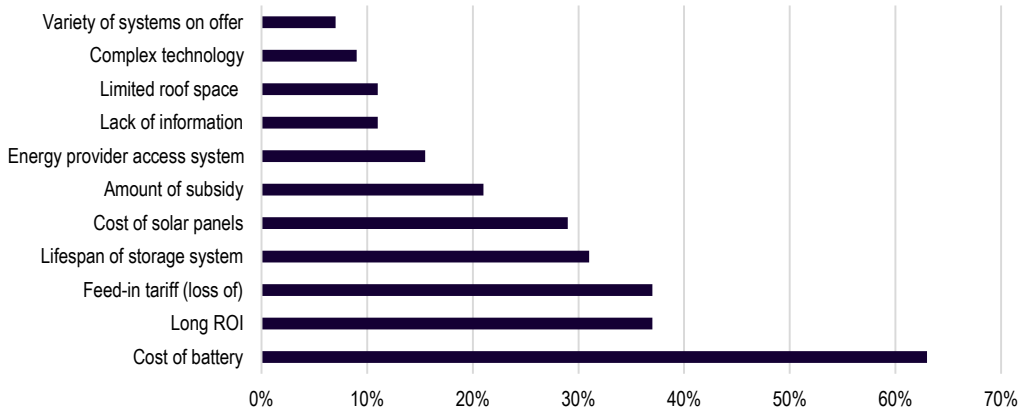
This section discusses the barriers to consumers being rewarded for access to their flexible DER and energy use. The types of barriers discussed are generally factors that influence a consumer's motivation, ability or opportunity, such as:

— lack of trust
— misalignment with motivations
— complexity
— lack of skills, knowledge, experience and opportunity
— lack of perceived value
— high perceived costs.

This section also considers communication barriers as communication is one of the tools and services that can support consumers in their DER journey.

To provide some context for these barriers, Figure 4.2 illustrates how participants in a survey rated the barriers to purchasing an energy storage system. Five of the six highest rated barriers related to cost, although the survey participants are likely to be early adopters ad not representative of the broader population, and the survey was in relation to a relatively high cost DER technology.

Figure 4.2 Barriers to purchasing an energy storage system



Source: Simply Energy (2020)

The impact of the barriers affecting a consumer's motivation, ability or opportunity will vary by DER technology. Section 4.1.8 provides ACIL Allen's indicative view as to how the barriers may vary by DER technology, based on the literature review.

4.1.1 Lack of trust

Lack of trust in institutions and organisations

One of the key barriers identified to consumers being rewarded for access to their flexible DER and energy use is a lack of trust in government and the energy sector (ECA 2020, Hall et al 2021, EWOV 2020a). The government was considered by consumers to have a short term focus and industry was seen to be purely revenue driven and not acting in the interests of consumers. In particular, energy retailers were seen as having a lot of power to enact change, but were considered to be unlikely to act (ECA 2020).

There has been an ongoing distrust and frustration towards the energy sector due to the rapid increases in electricity bills over the last decade (Nicholls et al 2021), lack of long term planning, and privatisation of an essential service (Temby et al 2021). This is particularly the case for energy retailers and generators with links to the coal industry (Roberts et al 2020). COSBOA (2018) noted that the level of dissatisfaction by small-medium sized businesses with electricity retailers has been increasing year on year, with 45 per cent of businesses not satisfied with their electricity provider at the time of the survey.[13]

That said, in a recent survey, CSIRO (2021) found that electricity providers, particularly electricity distributors, were the preferred providers of direct load control and community energy (27-39 per cent of the sample, depending on the program), more so than:

— local government (15-24 per cent)
— state or federal government (17-18 per cent)
— not-for-profit organisations (7-12 per cent)
— community groups or social enterprises (4-11 per cent)
— other energy industry providers (5-10 per cent)
— other third parties.

[13] This compares with 64 per cent being satisfied with their gas provider, which has remained constant.

In a survey on smart meters, Newgate (2021) found the most trusted sources of information on smart meters were electricians (36 per cent), energy retailers (31 per cent), an independent regulatory organisation (31 per cent) and electricity network companies (28 per cent). Households are more likely to trust electricians than businesses. The most trusted source also varied depending on whether a smart meter had been installed, whether one is likely to be installed in the next 12 months, age, and home ownership.

An earlier study by Accenture (2014) identified the level of trust and distrust in various institutions and organisations as set in Table 4.1.

Table 4.1 Level of trust in institutions / organisations

Institution / organisation	Level of trust (%)	Level of distrust (%)
Academics / schools / scientific associations	49	8
Consumer associations	46	7
Environmental associations	43	13
Government / governmental organisations	37	19
Utilities / energy providers	35	22
Online service providers (e.g. Google, Microsoft	29	14
Retailers / equipment manufacturers	26	18
Home service providers (e.g. cable television, telecommunication, home security)	25	23

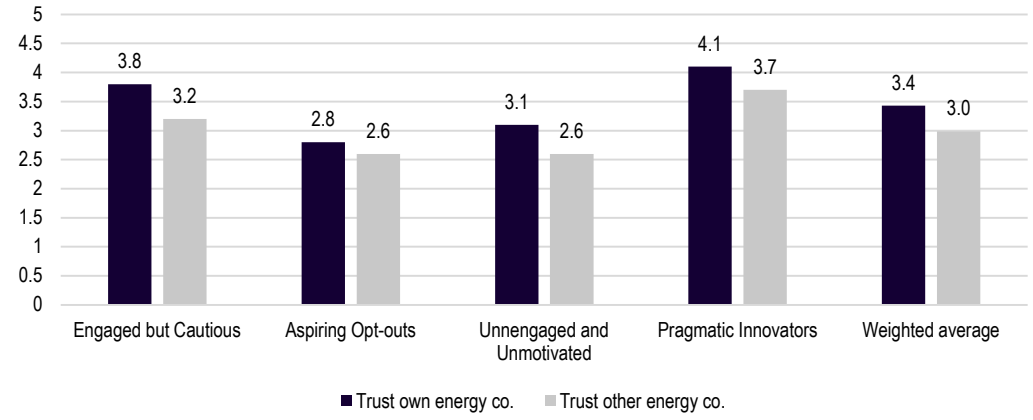
Source: Accenture (2014)

The trust that is required by consumers to implement flexible DER or energy use may be undermined by digital, financial and energy inequities (Nicholls et al 2021).

In the context of VPPs, this distrust, combined with the complexity of VPPs and their potential business models (discussed in section 4.1.3), generates concerns that VPPs are another way for the industry to take advantage of energy users (Roberts et al 2020).

Hall et al (2021) found that the level of trust in energy companies by consumers in the UK varied by consumer segment, as illustrated in Figure 4.3. Pragmatic Innovators (who are the early adopters) have a higher level of trust in energy companies than the other consumer segments. For each of the consumer segments, the level of trust in the consumer's own energy company is higher than for other energy companies.

Figure 4.3 Level of trust in energy companies by UK consumers



Source: Hall et al 2021

The lack of trust is compounded by the absence of an affordable dispute resolution process for DER technologies such as solar panels, as disputes related to solar installations are outside the jurisdiction of the energy ombudsman (CALC 2019, EWOV 2020a). Alternative avenues of redress may not have the power to conciliate individual cases, lack a detailed knowledge and understanding of the energy sector, be more time-consuming and/or expensive, and may require legal representation to provide individualised assistance (Uni of Sydney 2019).

Lack of trust in products and services

Cannizzaro et al (2020) surveyed households in the UK to measure the level of trust in smart home devices. The components of trust that were surveyed were:

— competence – trust the devices would perform automated functions reliably

— benevolence – trust that their interests would be protected

— integrity – trust that the data produced by smart home devices would not be used for any purpose without explicit consent

— privacy – likelihood of privacy-related incidents

— security – likelihood of compromised security in smart home devices.

Survey participants were neutral in their belief that smart home devices are likely to result in privacy-related incidents or compromised security, neutral to fairly low in the competency component of trust, and fairly low in the benevolence and integrity components of trust. There was some differences across gender, age and education but these were relatively immaterial other than for the integrity element of trust, with those aged 65 or over more distrustful than the younger cohorts.

4.1.2 Misalignment with motivations

As discussed in section 2.2.8, there are a range of factors that motivate households and businesses on a DER customer journey – not just a financial motivation, but also community and environmental motivations. CSBA (2021) found that if consumers are primed based on a financial motivation rather than other motivations, there may be missed opportunities:

— consumers may be prepared to pay more (or ask for less) if they align with more altruistic values

— consumers that are strongly motivated by conflicting values (such as benevolence) may be turned away, and may be turned off by products promoting cost benefits.

Similarly, Adams et al (2021) identified that (mis)alignments can occur when the expectations embedded within models of automation in DSM are at odds with users' expectations and aspirations. These misalignments include:

> *(1) the requirement to change energy practices to facilitate load flexibility without consideration of the differential capacity held by households;*
>
> *(2) the agency and sense of control on the part of the user participating in these programs; and*
>
> *(3) the extent to which users not only perceive DSM to be aligned with their interests but are also substantively involved in sharing its benefits.*

There is a misalignment of motivations for those who have invested in solar panels and batteries, and participation in a VPP. There is a 180 degree pivot from a consumer managing their energy use with solar panels and/or batteries to operation of those solar panels and batteries as part of a VPP by an external organisation. Consumers motivated by energy independence and security to invest in solar panels and batteries, particularly by those experiencing frequent blackouts, lose autonomy and control over the battery when participating in a VPP (Roberts et al 2020).

Additionally, participation in a VPP may undermine a consumer's environmental motivation if they have to purchase electricity because they are not able to access energy stored in their battery. Furthermore, there may be no financial benefit for that consumer, or they may be financially disadvantaged.

Concerns regarding a loss of control with flexible DER or energy use was a consistent theme through the review. Adams et al (2021) found that:

> *… a sense of control is highly important, and users' requirements for a sense of control may not simply be satisfied or offset by financial compensation or other measures.*

ARENA (2021), EnergyAustralia (2018) and Ausgrid (2016b) found that residential customers were not willing to cede control of their end-use equipment, particularly air conditioning, and CSBA (2021) found that inadequate compensation was a key factor for dissatisfaction by consumers with losing control of their asset in a VPP. In a survey by CSIRO (2021), 22 per cent of the participants indicated an unwillingness to participate in load control due to limited control, freedom and autonomy.

4.1.3 Complexity

Flexible DER and energy use involves the use of complex technology, automation and energy use, creating a more complex energy system that engages more parties in more complex ways (EWOV 2020a). For example, Roberts et al (2020) noted the conceptual complexity of VPPs and its potential business models, CALC (2019) noted the complexity of solar panels, ESC (2022) noted the complexity in retail energy tariffs, and BIT (2022) notes the difficulty in switching retailers. This complexity potentially adds to the cost of installing, commissioning and maintaining the DER technology (Rheem 2022).

Temby et al (2021) identified that many householders invest significant time, effort and funds into researching, choosing and configuring their technology. This requires careful calibration of complex, sometimes opaque and occasionally missing or misleading information. That many householders were able to make this effort often reflected a position of relative socio-economic privilege, particularly in terms of income, age and education.

Many households are not in a position to make a similar investment given competing family, caring and work responsibilities, varying income and education levels, or vulnerabilities (Temby et al 2021). As a result, the level of complexity may act to exclude vulnerable groups (Adams et al 2021). For example, prioritising digitally-enabled demand response can exclude households with

less digital access and interest, such as CALD households[14], the elderly and renters. Nicholls et al (2021) found that technology-focused and led demand response initiatives appeal more to men, while women are more interested in adapting and modifying routines. Only 5 per cent of participants in ZEN's demand response trial were women (ZEN 2019).

Additionally, there is a lack of standardisation of household appliances and infrastructure which can make it difficult to create standardised products and services (for energy efficiency and demand response), limiting customer reach (ECA 2020, SAPN 2022).

4.1.4 Lack of skills, knowledge, experience and opportunity

One of the barriers to energy efficiency identified by ECA (2020) was a lack of knowledge. A similar barrier applies to flexible DER and energy use. For example, Roberts et al (2020) found that the understanding of a VPP is generally low and CSIRO (2021) found that there is a relatively limited knowledge and awareness of demand response and community energy with, for example, only 23 per cent of survey participants having heard of 'demand response'. Rates of participation in demand response (both past and present) ranged from just 3 per cent to 10 per cent across the survey sample.

Most households start from a low level of interest and understanding of energy system issues (Nicholls et al 2021). Households are of the view that there is a lack of clarity, lack of certainty and lack of agreement over the future of the industry, and no clear leadership. Furthermore, households have a sense of inexperience or lack of comfort with new ideas and technologies, and do not know how to engage (ECA 2020).

The energy sector focuses on the 'bill-payer' as the economic agent. This ignores that the use of energy in the home is the result of a series of lifestyle choices made by adults and children in a household. In the absence of any meaningful or useful information the household is unable to link these decisions to energy costs (ECA 2020). While there is a benefit to them educating themselves, time and the current difficulty understanding the market act as barriers (Forethought 2019a), and households cannot access affordable or free energy advice for their home and circumstances (Nicholls et al 2021).

While community organisations may be trusted by consumers to support them on their DER customer journey, Roberts et al (2020) found that they may lack the required expertise or decision-making abilities.

Rented premises

The ownership status of a household's home or a business's premise is a key factor influencing the opportunity for consumers to be rewarded for access to their flexible DER and energy use.

Rented premises are restrictive to making changes that facilitate flexible DER and energy use (Forethought 2019b) – renters have less choice and less control in the reduction of energy bills (ANU 2018). The tenant may be unable to readily install infrastructure such as solar panels (ARENA 2020b, ANU 2018) or it is simply not their responsibility (Forethought 2019b). Living in a rental property was cited by Roberts et al (2020) and EWOV (2020a) as a reason for not buying a battery.

Hall et al (2021) found a disconnect between those consumer segments interested in innovative energy business models and those that are able to sign up to them.[15] The two consumer segments with above average owner occupation status (Engaged but Cautious, and Unconvinced and Unmotivated) were least likely to choose an innovative energy business model that requires

[14] While noting the diversity of CALD households, as discussed in section 2.1.

[15] Refer to section 2.2.3 for a discussion of these consumer segments.

alterations to the building fabric. Those most likely to choose an innovative energy business model (Pragmatic Innovators and Aspiring Opt-outs) are more likely to be in rented tenure.

4.1.5 Lack of perceived value

Forethought (2019a) found that households did not think it was worth changing their energy use behaviour unless there would be a large scale effect; they didn't see a direct benefit to their busy, everyday lives from changing their energy use. Frederiks et al (2015) also identified a temporal dimension – consumers perceive things as less valuable or significant if further away in time.

For example, a 2009 Frontier report for EnergyAustralia identified a 4 per cent reduction in coincident maximum demand by residential consumers in response to a TOU tariff and no statistically significant positive effect by business customers (Frontier 2009). Similarly, VEPC (2020) found that "Victorian households respond weakly to time varying tariffs and households in the lowest socio-economic areas do not respond at all". Over half (58 per cent) of the respondents in CSBA's survey (2021) lack awareness of the value generated by a VPP-connected battery or do not see it generating more value.

VPP participation is constrained for some consumers by restricted flexibility capital (including lifestyle, economic resources etc.), reliability concerns, concerns about being taken advantage etc. (Roberts et al 2020). Examples of lifestyle considerations include:

— children – concerns about impacts on health and education, device usage and temperature, especially for babies and young children in hot weather

— pets, which are increasingly treated as family members – have needs including heating, cooling and digital energy technologies (for example, petcams, digital toys or feeders) (Nicholls et al 2021).

From a business perspective, Forethought (2019b) found that businesses were of the view that current renewable technologies are unable to meet the demands of their businesses, as they are using more energy than could be reliably produced by solar panels on their premises. Businesses in energy demanding industries are often operating beyond standard business hours – and some are operating on a 24/7 basis. Additionally, an absolute focus by businesses on reducing cost deters them from energy optimisation (Forethought 2019b).

ZEN (2019) found that commercial businesses are more likely to participate in demand response than residential consumers. While residential consumers will readily opt out from demand response if they have a negative user experience, individuals within a commercial business may not be able to opt out if they have a negative user experience – the decision to opt out is generally made by one person within the business. That said, AGL (2019, 2021) identified a number of barriers to businesses participating in remote controlled demand response including operational complexity of the site / process, risk management (including cybersecurity risks), customer service, safety and the desire to override the demand response for commercial reasons.

SAPN (2022) noted that the value to consumers from flexible DER and energy use has changed over time. The value for its network now is addressing 'reverse peaks' from daytime solar rather than peak demand constraints on the network. That said, Energy Queensland (2022) found a higher participation rate by consumers for addressing 'reverse peaks' than peak demand, including by non-solar customers increasing load.

The perceived value of flexible DER and energy use may also change over time due to changing government policies and initiatives (EWOV 2020a).

Inertia

Inertia may act as a barrier to consumers being rewarded for access to their flexible DER and energy use – consumers generally prefer the status quo (Rheem 2022), especially as the amount or complexity of information increases (Frederiks et al 2015). Newgate (2021) also found a desire to stay with the status quo with respect to the installation of a smart meter – this was due to inertia as well as cognitive and informational barriers, and loss aversion – and D'Oca et al (2014) found that households' behaviour is ruled by habits and routines which are hard to break.

Hall et al (2021) found that the most popular innovative energy business model is one which represents only an incremental change from the status quo, with a weighted average of 43 per cent. The incremental change was the most popular option for all consumer segments with the intention varying from 27 per cent for the Unengaged and Unmotivated consumer segment to 56 per cent for the Engaged but Cautious consumer segment (Hall et al 2021).

Technical constraints

Technical constraints may also be a barrier to consumers being rewarded for access to their flexible DER and energy use, as they reduce the perceived value. SAPN (2022) identified that smart meters, smart devices and retail tariffs that better reflect network and market price signals (e.g. TOU tariffs) are required to realise the value of flexible demand. However, the take up of smart meters outside of Victoria is low[16], the penetration of smart devices is low, and a large proportion of consumers are on flat retail tariffs.

Newgate (2021) found that only 8 per cent of residential customers without a smart meter were very or extremely likely to request one within the next 12 months, with 61 per cent not at all or not very likely to do so. The likelihood of a small business customer requesting a smart meter was found to be higher (27 per cent extremely or very likely to request installation). The likelihood of people requesting a smart meter to be installed increased after they were given more information.

While some consumers already have smart meters installed, they are likely to be measuring net energy flows (import and export power flows combined) rather than gross energy flows (import and export flows separately). Gross metering is required to appropriately reward demand response (AGL 2021).

Nicholls et al (2021) identified a barrier with the entrenched arrangements around the control of load during, what has been traditionally, the overnight off-peak period, rather than when the greatest value may be realised – during periods of 'reverse peaks'.

Two of the reasons identified by Roberts et al (2020) for consumers not buying a battery were technical, namely:

— a lack of excess generation, due to a small solar system or high daytime energy consumption
— the requirement for a three phase grid connection.

EWOV (2020a) and Woolcott (2021) also identified the potential for restrictions on exports from DER systems to reduce the reduce their perceived value.

Loss aversion

Frederiks et al (2015) noted that consumers will weigh losses more heavily than equal-sized gains. Rheem (2022) similarly noted that consumers will forego the prospect of larger gains to avoid even small losses. Newgate (2021) found consumers reluctant to install a smart meter to benefit from flexible demand and TOU tariffs unless there was certainty they would be no worse off.

[16] Similarly, AGL (2019, 2021) noted the low take up of smart meters in New South Wales.

Regulatory barriers

One of the barriers to consumers being rewarded for flexible DER and energy use is that they do not have access to the benefits that may accrue in the full value stack of energy services in Australia with the disaggregation of the energy supply chain. For example, retailers do not have an incentive to help the networks manage their costs (ECA 2020, Rheem 2022).

Compounding this barrier, Energeia (2021) identified that there is a regulatory barrier to electricity distributors rewarding consumers for delivering value to the network through flexible DER and energy use. Analysis by Energeia (2021) indicates that the electricity distributors earn greater returns from investing in assets than through the incentive schemes for non-network solutions (it estimated at least 200 per cent better).

4.1.6 High perceived costs

The upfront costs of some DER technologies were seen as too expensive (Forethought 2019a, ARENA 2020b, SAPN 2022) and out of reach if consumers are unable to access rebates (Temby et al 2021).

Simply Energy (2020) found price (cost) to be the main factor influencing consumer take-up of residential home battery systems and participation in VPP programs, with a spike in take up preceding a reduction in rebates or subsidies. Roberts et al (2020) similarly noted that the reasons for not installing a battery include high costs, long payback period and lack of access to capital. Low-income households (other than older people on low incomes who own homes), in particular, cannot afford or access solar panels to reduce energy bills (ANU 2018).[17]

Rheem (2022) found that cost was a barrier even for relatively low cost household appliance-based DER technologies. Consumers may be unwilling to make a short term capital investment to make long term gains. Similarly, Ausgrid (2016b) found that the (relatively low) upfront costs for installing new controlled load and metering equipment, and the associated electrical works, to facilitate demand response can be significant and impact take up.

Businesses may not have the capital upfront to invest in better energy solutions and it is perceived to take too long to capitalise on the benefits (Forethought 2019b).

4.1.7 Ineffective communication

Communication (information, advice and non-financial support) is one of the tools and services that can support consumers in their DER journey (ECA 2020). However, the communication may be ineffective, in which case it may be a barrier for consumers to be rewarded for access to their flexible DER and energy use, or effective, in which case it may be an enabler. The effectiveness of communication is influenced by the source of the information, media used, the content of that communication and the language that is used.

Regardless of the form of communication, it can be ineffective where the customer is disengaged about energy (Nicholls et al 2021), which can be exacerbated where the communications has not been co-designed with the target consumer group (COSBOA 2018).

Information sources

There are a range of different information sources including through family, friends, community groups, governments or industry. As discussed in section 4.1.1, there is a lack of trust in

[17] There is a relatively even distribution of solar ownership by household income as solar panels are owned by older people on low incomes who own homes.

government and the energy sector, and therefore these may not be the most effective sources of information (Temby et al 2021).

Digital communications, and regular and automated bill payments, decrease the visibility of electricity bills, and many households do not read communications from their energy retailer (Nicholls et al 2021). Information from governments may be discounted by some that are sceptical about the government's bona fides on energy and climate change policy (Temby et al 2021).

Media channel

There is a wide range of media channels through which content can be disseminated, including oral communication, events, social media and print media. However, consumers do not have equal access to these media channels. For example, access to information provided in person depends on that person's distance from an urban or regional centre, and access to online information depends on internet speeds (Temby et al 2021), and ARENA (2021) noted poor engagement by residential customers with an in-event portal as part of the RERT trial.

The online environment may not be an effective medium as it can feel overwhelming to consumers. The proliferation of choice, while ostensibly a positive for consumers, has led to an increase in frustration and confusion. Choice becomes meaningless and even detrimental if it is not structured clearly or easily for consumers to navigate and act in accordance with their preferences (CPRC 2021b).

COSBOA (2018) notes that the high level of friction in the user interface for government websites creates significant barriers for small businesses accessing information as they are time poor. The high level of friction is created by users having to navigate through multiple webpages to find any information that could be relevant to them.

Content

A number of reports commented on the generic or complex nature of the information provided.

COSBOA (2018) referred to poor and generic information that doesn't speak to its audience and specifically noted that the information typically doesn't contain much industry or sector specific information, nor cater for the specific needs or circumstances of businesses. Nicholls et al (2021) noted that generic advice can be unrelatable or inaccurate, and is limited in its ability to engage households and promote change.

Temby et al (2021) commented that information on new energy products and services, and the energy sector more broadly, was complex and confusing. Forethought (2019a) noted that the complex nature of the information provided can overwhelm consumers. Further, Temby et al (2021) was of the view that vulnerable users were particularly exposed, sometimes deliberately by unethical providers, to information asymmetries.

Language

Communications, engagement and information remain oriented towards the English-speaking population (CPRC 2021a). Access by non-English speakers is impacted by their ability to search and find information, and through the use of exclusionary language (Temby et al 2021).

There are certain words or terms that do not resonate with consumers, for example:

— use of the term "virtual" in VPP as it is a term that is intangible and cannot be understood or relied upon (Roberts et al 2020)

— use of the term "controlled load" as it prompts concerns as to who has control of their home appliances and whether they trust that organisation (Nicholls et al 2021)

— references to “state” as this is associated with the communist regime for the Vietnamese community (CPRC 2021a)
— there are key limitations translating “concession” in Arabic (CPRC 2021a)
— there are multiple interpretations for “energy plan” in Arabic (CPRC 2021a).

COSBOA (2018) noted that information can include highly technical language. Forethought (2019a) noted that convoluted language and detail can overwhelm consumers.

4.1.8 Indicative impact of barriers by DER technology

The impact of the barriers affecting a consumer’s motivation, ability or opportunity will vary by DER technology. Table 4.2 provides ACIL Allen’s indicative view as to how the barriers may vary by DER technology, based on the literature review.

As illustrated in Table 4.2**:**

— Trust – trust has been earned for existing forms of load control but a high level of trust is required to cede control by consumers of appliances, such as air-conditioning, or of solar panels and battery storage through a VPP.
— Motivation – the potential for a misalignment of motivations varies similarly across all DER technologies.
— Complexity – some products, such as existing forms of load control, are relatively simple, while others, such as VPPs, are highly complex.
— Skills, knowledge, experience and opportunity – a low level of skills is required for existing forms of load control, but opportunities for renters are limited for a number of DER technologies including solar panels, battery storage and VPPs.
— Perceived value – the perceived value is generally high for solar panels, but this may limited by technical constraints, and is low for behavioural demand response and new forms of load control for which the benefits are outweighed by the effort.
— Perceived cost – the costs range from low for behavioural demand response and load control to very high for electric vehicles.

Table 4.2 Indicative impact of barriers by DER technology

DER technology	Trust	Motivation	Complexity	Skills, knowledge, experience and opportunity	Perceived value	Perceived cost
Behavioural demand response	Requires trust that demand response is required	Consumers may be motivated by: – economic benefits – community benefits – environmental benefits. The potential impact of the barrier is similar across all DER technologies	Relatively simple	Requires an ability to influence others and an understanding of the actions to be taken	For many, perceived value is low – benefits low relative to effort	Low cost
Controlled load – existing (e.g. off peak hot water and pool pumps)	Trust has been earned over a long period of time (but could be undermined if times of operation change)		Relatively simple	Low level of skills and knowledge required	Economic benefit has been demonstrated over a long period of time	Low cost
Controlled load – new (e.g. air conditioning)	High level of trust required to cede control to others		Relatively simple	Low level of awareness and experience currently Opportunities limited for renters	For many, perceived value is low – benefits low relative to effort	Low cost
Solar panels	Requires trust that solar panels will work as required		Medium level of complexity	Need to be comfortable with the technology Opportunities limited for renters	Perceived value generally high, but may be limited by technical constraints	Medium cost
Battery storage	Requires trust that battery storage will work as required		Medium level of complexity	Need to be comfortable with the technology Opportunities limited for renters	Perceived value high to those that value independence and reliability of supply	Medium – high cost
Electric vehicles	Requires trust that electric vehicle will work as required		Medium level of complexity	Need to be comfortable with the technology	Perceived value depends on motivating factors and comfort with new technology	Very high cost
VPPs	High level of trust required to cede control to others	Misalignment of motivations if consumer motivated to be independent	Highly complex integration of products and services	Need to be comfortable with the technology Opportunities limited for renters	For many, perceived incremental value relative to solar panels and battery storage is low	Cost depends on pathway to VPP

Note: Red – Impact of barrier for DER technology is significant; Orange – Barrier will have some impact for DER technology; Green – Barrier will have less impact for the DER technology.

Source: ACIL Allen based on literature reviewed

4.2 Enablers across the DER customer journey

Temby et al (2021) found that positive emotions include happiness, satisfaction, enthusiasm and playfulness. These can be an indicator that a consumer is experiencing enablers to its DER journey. As with negative emotions, positive emotions can shape, and are shaped by, experiences (Temby et al 2021).

This section discusses the following enablers for consumers to be rewarded for access to their flexible DER and energy use:

- building trust
- aligning with motivations
- simplifying flexible DER and energy use
- improving skills, knowledge and understanding
- improving perceived value
- reducing the perceived costs
- effective communication.

Many of the enablers that are discussed in this section are consistent with the ten most important nudges that have been identified in the behavioural economics literature, and which are summarised in Box 5.1.

Box 4.1 Ten important nudges

The ten most important nudges for the purposes of policy:

1. **Default rules** – default rules may be the most effective nudges. In many contexts, default rules are indispensable because it is too burdensome and time-consuming to require people to choose.
2. **Simplification** – many programs fail or succeed less than they might because of undue complexity. As a general rule, programs should be easily navigable, even intuitive.
3. **Uses of social norms** – one of the most effective nudges is to inform people that most others are engaged in certain behaviour. Such information is often most powerful when it is as local and specific as possible.
4. **Increases in ease and convenience** – resistance to change is often a product not of disagreement or of scepticism, but of perceived difficulty – or of ambiguity. If the goal is to encourage certain behaviour, reducing various barriers (including the time that it takes to understand what to do) is often helpful.
5. **Disclosure** – disclosure policies can be highly effective, at least if the information is both comprehensible and accessible.
6. **Warnings, graphic or other** – if serious risks are involved, the best nudge might be a private or public warning. Large fonts, bold letters and bright colours can be effective in triggering people's attention.
7. **Precommitment strategies** – committing to a specific action at a precise future moment in time better motivates action and reduces procrastination.
8. **Reminders** – a reminder can have a significant impact in overcoming some combination of inertia, procrastination, completing obligations, and simple forgetfulness. Timing greatly matters; making sur that people can act immediately on information is critical.
9. **Eliciting implementation intentions** – people are more likely to engage in activity if someone elicits their implementation intentions.
10. **Informing people of the nature and consequences of their own past choices** – private and public institutions often have a great deal of information about people's own past choices, that individuals often lack. If people obtain that information, their behaviour can shift.

Source: Sunstein (2014)

4.2.1 Building trust

As discussed in section 4.1.1, one of the key barriers to consumers being rewarded for access to their flexible DER and energy use is a lack of trust. A key enabler is to build and deepen trust (ECA 2020), which must be earned (ARENA 2020a). In the context of demand response, improved trust in energy and emerging technologies sectors is needed to improve uptake and response to demand management. To build trust, it is critical that consumers trust:

— that electricity retailers, distributors or other system participants and governments are acting in the best interests of electricity consumers

— that household demand response is needed, and will benefit consumers and the electricity system

— that demand issues could not effectively and efficiently be addressed in other ways

— that the proposed technologies and approaches will work as intended, and be reliable and secure

— in other industries and agencies that provide complementary or competing advice

— that the electricity sector genuinely supports the transition to renewable energy (Nicholls et al, 2021).

A number of approaches are suggested in the literature for building and deepening this trust, including:

- embedding trust through simplicity (Forethought 2020)
- treating consumers as partners (Temby et al 2021) and engaging with them on the permissions and trust that they require (ECA 2020)
- using a staged approach (Nicholls et al 2021)
- adopting an inclusive design approach to the development of policies, regulations, programs and communications to ensure greater focus is placed on a collaborative approach to outreach and engagement with consumers from diverse communities (CPRC 2021a)
- providing those consumers that have the time with the opportunity to contribute to energy discussions through platforms and forums (Forethought 2019a)
- establishing consistent, reliable communication channels (CPRC 2021a)
- using trusted channels (COSBOA 2018, ECA 2020, Nicholls et al 2021)
- using references to existing customers with a positive experience of flexible DER or energy use (EnergyAustralia 2018, Frederiks et al 2015)
- offering rewards rather than penalties to position flexible DER and energy use as positive rather than punitive (Nicholls et al 2021, Rheem 2022, Essential 2021), with bill discounts, cash rebates and cash bonuses preferred to free gifts, free energy monitoring devices, subsidised appliances, prize draws or charity donations (CSIRO 2021)
- offering free energy periods to increase appeal of smart technologies (Nicholls et al 2021)
- setting standards (Forethought 2020)
- certifying / validating new technology by an authoritative source (Forethought 2019b)
- providing an affordable dispute resolution process (CALC 2019, Uni of Sydney 2019).

Trusted channels

Many households do not read communications from their energy retailer. Consumers are more willing to accept information, advice and tools through a trusted source such as community organisations, businesses from other sectors, and through initiatives with a presence in the local area (Nicholls et al 2021, ECA 2020, Roberts et al 2020). A common theme across all pilots conducted under the Commonwealth Government's Low Income Energy Efficiency program was that:

> *… households responded best when information or offers of assistance were delivered through an organisation or individual that was considered a trusted – and typically – independent – voice.*
>
> *ECA 2020*

While the literature consistently refers to the need to use trusted channels, there are a range of views as to which are the most appropriate trusted organisations. As discussed in section 4.1.1, ECA (2020) and Hall et al (2021) found there is a lack of trust in government and the energy sector. Community organisations may be more trusted but, as discussed in section 4.1.6, may lack the required expertise or decision-making ability.

In a survey administered by COSBOA (2018), small businesses overwhelmingly indicated they wanted third party 'trusted' advice to make cost effective decisions. COSBOA (2018) noted that a trusted channel for business is one that understands business, such as industry associations, rather than someone from the general energy or business sector.

Some participants in the Solar Analytics VPP trial indicated that their willingness to participate was dependent on a VPP being run by a trusted party. They identified that the parties that would be trusted to run a VPP are Australian companies or ones with Australian data centres (due to data security concerns), organisations with technical expertise, or organisations with evidenced good

customer support. Public, not-for-profit or environmental organisations were preferred (Roberts et al 2020).

Notwithstanding the comments above, ECA (2020) identifies the broad categories of industry and community organisations that should work together, and Nicholls et al (2021) identifies governments, health authorities, advocacy bodies, and public and private sector organisations, especially those with an interest in sustainability, health and financial wellbeing of residential customers. Nicholls et al (2021) also identifies a couple of specific targeted partnerships:

— for households with children – health authorities, maternal/paternal care groups, and schools to reach parents

— for households with pets – veterinarians.

Interviews conducted by BIT (2022) in the context of energy bills found that consumers were less familiar with the regulator than the government, and recommended that referring to both might appeal to a larger range of consumers. Extending this concept, trust may be built with a larger cohort of consumers if multiple channels are used.

Building trust through a social licence

To obtain a 'social licence' for flexible DER and energy use, it is important to focus on those who may choose whether or not to grant a licence to different automation programs, and to those who may be unable to participate but may nevertheless be affected, by identifying:

— who is included and who is excluded

— who wins and who loses

— whose lives and livelihoods will be put at risk (Adams et al 2021).

Those who dominate participation and discourse can then be attended to, making room for the voices of affected actors. Such an approach facilitates engaging individuals more collectively, as energy citizens or energy communities, nurturing, maintaining or dispersing more collective routes to participation in flexible DER or energy use (Adams et al 2021)

4.2.2 Aligning with motivations

Recognising that consumers may have different motivations for pursuing the DER customer journey, aligning DER technologies and offering with a consumer's specific motivations is an enabler for rewarding them for access to their flexible DER and energy use.

Householders make consumption decisions and experience technology in specific social, political and environmental contexts. It is important to understand these contexts – conversations with others, everyday routines and expectations of technology, previous experience and future hopes and desires (Temby et al 2021). The causes that resonate with different segments need to be identified together with how flexible DER and energy use supports their specific motivations (CSBA 2021). For example, people without solar and battery are more open to VPPs as a purely financial proposition than those who have started a 'sustainable energy journey'. For others, an understanding of community, environmental and grid benefits can help motivate them to participate in a VPP (Roberts et al 2020).

Notwithstanding, as discussed in section 2.2.8, financial/security benefits were generally described by ARENA (2020b) as the strongest motivator, with the nature of the financial/security benefits differing by consumer. Consistent with this finding, in the context of the RERT trials, the ability to offer availability payments was a significant motivator of participation in the trial. Furthermore, those that were aware of the availability of a financial incentive had a notably more favourable view of the program than those who were not aware of the incentive (ARENA 2021).

For those consumers motivated by community benefits, there may be a preference for flexible DER or energy use projects to be undertaken at a local scale (Roberts et al 2020). The absence of a reward for participation does not necessarily lead to a negative perception for these consumers (ARENA 2021). Rewards that can be pooled for a community benefit may engage households who are not likely to respond to small financial incentives. Alternatively, opportunities could be provided to trade and share electricity, including:

— as a gift to other households that are less financially advantaged or cannot install solar panels
— to organisations that benefit the community (for example, community centres, social enterprises and services, and schools (Nicholls et al 2021).

A survey by CSIRO (2021) found that 39 per cent of the sample would prefer to trade excess solar power with their neighbours rather than engage in peer-to-peer trading, and 28 per cent would prefer to donate the excess to charity.

Consumers' preference to maintain control was discussed in section 4.1.2. To align with this motivating factor, an enabler is to ensure that consumers have the option to:

— retain complete control over their energy use and participation (ARENA 2021), including any automation of battery or EV charging (Nicholls et al 2021)
— access automated energy saving behaviour (Forethought 2019a).

In many cases, the use of DER technologies requires that data be shared. Roberts et al (2020) found that some are willing to share data if it is anonymised. Many are willing to share data for a legitimate purpose – where it is not driven by profit, and is in the interests of the community, environment or to support the grid.

4.2.3 Simplifying flexible DER and energy use

As discussed in section 4.1.3, flexible DER and energy use involves the use of complex technology, automation and energy use. DER technologies need to be simplified for consumers to enable them to be rewarded for access to their flexible DER and energy use. Consumer research undertaken by Essential (2021) identified that one of the principles for the design of network tariffs should be 'easy to understand'.

Flexible DER and energy use could be simplified by:

— helping customers to navigate the complexity of the new energy landscape (Woolcott 2021)
— industry understanding households' habits and routines as they design smart home technologies, so they make sense and fit in with everyday lives (ECA 2020, Nicholls et al 2021)
— technological solutions that lower the cost and simplify changing the timing of demand (ESC 2022)
— ensuring standardised interfaces, control devices and control modes for hot water systems (Ausgrid 2016b), and interconnectivity and interoperability across devices (ECA 2020, Forethought 2020, SAPN 2022)
— enabling "set and forget" control
— ensuring control on a "whole of home" basis (Rheem 2022).

There was overwhelming support from consumers, in research undertaken by Essential (2021), to test whether simple communication and education material results in sufficient behavioural changes without the need for significant changes to network tariffs.

The impact of simplification on consumer participation in demand management trials was exemplified in three hot water load control trials conducted by Ausgrid:

1. Control of continuous small hot water systems – of 1,400 customers invited to participate, 44 elected to participate.
2. Subsidised controlled load connections – of 14,800 customers contacted, 104 took up the offer.
3. Optimising the schedule for existing controlled load customers – resulted in a peak demand reduction of 4.0 MW (representing thousands of customers) (Ausgrid 2016b).

4.2.4 Improving skills, knowledge and understanding

Support is required by households and businesses so that they have the skills, knowledge and understanding to engage with flexible DER and energy use. This could be in the form of:

— providing consulting support to businesses (Forethought 2019b)

— training electricians, engineers and plumbers, who are critical to shaping the consumer's experience (ECA 2020).

4.2.5 Improving perceived value

Newgate (2021) found that the uptake of smart meters is dependent on people understanding exactly how a smart meter can help them better manage their energy use and ultimately save them money.

Easy to manage apps, real-time information[18] and smart homes would improve lives (Forethought 2019a). Newgate (2021) also notes the need for tools that help consumers to translate data into action and actually save money without too much effort.

To improve the perceived value of flexible DER and energy use, support is required for 'at home' preferences for manual (rather than automated) load shifts and demand response. Demand management programs need to appropriately balance manual and smart tech-enabled ways for householders to respond (Nicholls et al 2021).

SAPN (2022) identified that retail "tariffs are the simplest, most universal and most accessible method for customers to be rewarded for moving their flexible loads to better align with market and network needs". However, these tariffs rely on smart meters being installed. If the smart meters facilitate gross metering rather than net metering, changes in solar output can be measured and the demand response appropriately rewarded (AGL 2021).

Additionally, the value of flexible DER and energy use could be improved by monetising the "value stack" across the energy supply chain, particularly the network benefits (Rheem 2022), and including the contribution of flexible DER and energy use to reliability (Forethought 2020).

4.2.6 Reducing the perceived costs

While the upfront cost of some DER technologies can be a barrier, not all forms of flexible DER and energy use require a significant outlay by the consumer. Behavioural demand response is one example which does not require a significant outlay (ARENA 2021, AGL 2021) and household appliance-based flexible DER solutions are relatively low cost (Rheem 2022).

Where flexible DER and energy use requires a significant upfront cost, subsidies could be used to reduce that cost (CSBA 2021, Forethought 2019a). The payment could be optimised so that the technology is accessible to those considering a purchase (Forethought 2019a). Additionally, the costs could be reduced by:

[18] AGL (2021) also notes the need for real-time information.

1. providing access to data from a customer's revenue meter to be able to monitor the data in real-time rather than incur the cost of an additional meter for that purpose
2. overcoming the lack of adoption of open standards to support interoperability (Rheem 2022).

4.2.7 Effective communication

To enable consumers to be rewarded for access to their flexible DER and energy use effective communication is required.

Less technical and complex approaches are needed to build trust, engagement and demand response in the wider household population (Nicholls et al 2021, Forethought 2019a) and are best developed through a co-design approach (ECA 2020).

Roberts et al (2020) similarly notes that an inclusive design approach is required to develop policies, regulations, programs and communications to ensure greater focus is placed on a collaborative approach to outreach and engagement with consumers from diverse communities. A best-practice approach integrates co-design and partnerships that foster trusted relationships and establishes consistent, reliable communication channels.

Tailored communications

Messages and assistance that are targeted and personalised to households are far more likely to be effective (ECA 2020, D'Oca et al 2014). Receiving the right information at the right time helps households make informed decisions (Forethought 2019a).

Communication channels should be targeted to the right audiences and ongoing communications need to be tailored to the needs of consumers, with the information needs at different points of the consumer's journey defined (CSBA 2021). Targeted and personalised information could be provided through in-app help and updates targeted to the consumer's information needs (CSBA 2021). Nicholls et al (2021) notes that households should be able to opt into alerts and tailored advice.

Additionally, the solutions need to be described in terms that consumers value and to which they respond, noting that different consumers have different motivations (ECA 2020).

Information can be tailored to households' interests and concerns. A simple approach can be used for initiatives that target a wide range of households, with access enabled to meaningful data for those with a deeper interest or for initiatives that typically attract energy enthusiasts (such as VPPs) (Nicholls et al 2021).

A tailored approach also needs to be considered for households facing additional barriers, such as low-income households, those with English as a second language or an inability to modify the building envelope. For example, providers of flexible DER and energy use services could collect information on the consumer's preferred language to be able to appropriately tailor the information (ECA 2020).

Examples of a tailored approach include:

— elderly – approach through trusted networks, provide information in digestible chunks, and face-to-face where possible
— new migrants – provide information and education on how to engage in the market
— families with young children – communicate through digital channels so they can get help at a convenient time (ECA 2020).

Information sources

Consumers desire more information from their VPP provider, and it is important that it is made easily accessible. There is an opportunity to upskill customer service staff so they can address consumer questions about VPPs or channel access to knowledgeable experts for support to consumers (CSBA 2021). Nicholls et al (2021) similarly suggests using knowledgeable people that can build rapport and work over a sustained period to establish what type of help and interventions are appropriate and attractive.

Where possible, personalised face-to-face communication (Lorenc et al 2013) or a two-way conversation with households achieves results (ECA 2020).

Forethought (2019b and 2020) refers to the concept of networks. They indicate that some SMEs are willing to engage in conversations, to collaborate and find mutually beneficial outcomes, and identifies that:

— community energy hubs could address diverse language and culture

— a community online network can connect similar demographics.

Media

The literature reviewed largely referred to the use of different types of media that enabled the communications to be targeted to consumers, as discussed above. However, CPRC (2021b) noted that there has been an increase in customer engagement within digital channels triggered by COVID-19, including by those who wouldn't usually satisfy their demand by buying online, such as older people. It identified the following benefits of using digital channels:

— based on data, customers can be actively offered products and services more relevant to their circumstances[19]

— easier access to information when searching for and comparing products and services

— information can help consumers be confident in choosing products or services that are beyond the knowledge/experience of their immediate social network

— can access free services that automate the process of searching and comparing offers (for example, price comparison websites).[20]

Nicholls et al (2021) also suggested the use of remote home visits (via FaceTime or Zoom) to technologically enabled households, while ensuring that those who cannot or prefer not to engage digitally have equal access to personalised energy advice.

Content

To be most effective, the communications needs to:

— emphasise the convenience or lack of inconvenience, caused by the change, and the ease of the change itself (for example, outlining easy demand shift changes that could be made, such as automated settings for appliances to run at non-peak times) (Langevin et al 2013, D'Oca et al 2014)

— explain underpinning concepts (Nicholls et al 2021)

— be clear on the technology required, including clear information on how batteries in a VPP are managed (CSBA 2021)

[19] While noting that the majority (76 per cent) of consumers find the common practice of companies using their personal information to make predictions about them to be unfair (CPRC 2021b).

[20] To the extent that these exist

— educate consumers on the financial benefits to their household, the environmental benefits and the community benefits (CSBA 2021)

— provide positive reinforcement to consumers that they are helping the community/environment (CSBA 2021)

— engage via households' day-to-day concerns and interests beyond energy (Nicholls et al 2021)

— use positive feedback and stories about household responses (Nicholls et a 2021).

Communication strategies that focus only on technical information could limit the uptake of flexible DER and energy use (CSBA 2021).

Consistent, ongoing communication campaigns are required to grow public familiarity and understanding over time (Nicholls et al 2021).

Language

The language used to communicate flexible DER and energy use should be more consumer-centric than the language currently used by the industry to facilitate an understanding of complex concepts (Nicholls et al 2021). It should be free from ambiguous or confusing language (BIT 2022).

By doing so, the messaging will be available and comprehensible to the broader community, not just those with higher English and digital proficiency (CPRC 2021a). For example, EnergyAustralia (2018) found that consumers are not interested in technical descriptions or parameters such as kW or MW, and prefer language such as 'sending a signal to your air conditioner to switch to economy mode' rather than 'we will switch your air conditioner to half power or lower performance mode'.

The language used should account for a high proportion of English as a second language households from CALD communities (Nicholls et al 2021, CPRC 2021a, Forethought 2020). CPRC (2021a) was of the view that it is important to work directly with community leaders and educators from within target communities, fluent in language and dialect, to ensure messaging is comprehensible and genuinely meaningful.

The terminology used should be improved (ECA 2020) by agreeing on the terminology to be used nationally and then using it consistently to build consumer understanding over time (Nicholls et al 2021).

The tone of the communication is also important – it needs to be helpful and supportive rather than dictatorial (ECA 2020).

4.2.8 Clusters of enablers

CES (2020) identified three potential clusters of enablers which span across the enablers identified in this section:

1. Interventions to support consumers by providing or making up for key missing capabilities or attributes (refer section 2.2.6), for example:
   a) grants or loans for 'smart' technologies to make up for lack of access to capital
   b) under-writing of technology/offer performance to reduce perceived risk of participation
   c) access to advice to improve knowledge and support good choices.
2. Interventions to change the system (or an individual offer) so that some required capabilities and attributes are no longer essential, for example:
   a) improving trust and confidence in the market
   b) reducing minimum thresholds for participation in flexibility and demand-response services
   c) private and social landlord regulations to require improvements or allow tenant participation.

3. Interventions from 'outside' the energy system which increase the likelihood that required capabilities and attributes are more widely available and so no longer distinguish participants from non-participants, for example, high speed broadband and high quality 4G mobile signals.

CES (2020) identifies that some vulnerable consumers will genuinely be 'left behind' and beyond the reach of mitigating interventions. It suggests a protective 'non-participants' tariff for these consumers.

Barriers and enablers specific to each phase of the DER customer journey

5

This chapter considers the barriers and enablers for consumers to be rewarded for access to their flexible DER and energy use that are specific to each stage of a customer's DER journey (see Figure 4.1). These barriers and enablers are in addition to the barriers and enablers that apply across the customer journey, which were discussed in chapter 4, but the general themes (such as understanding and recognising the diversity of consumers, tailoring approaches, motivation, trust and complexity) are similar.

The barriers and enablers during the:

- engagement and acquisition phase are discussed in section 5.1
- installation phase are discussed in section 5.2
- operating and maintenance phase are discussed in section 5.3
- retention phase are discussed in section 5.4.

The significance of the barriers at each phase will vary by DER technology. Section 5.5 provides ACIL Allen's indicative view as to the significance of the barriers at each phase of the DER customer journey for each DER technology, based on the literature review.

5.1 Engagement and acquisition phase

ARENA (2020a) describes the engagement and acquisition phase as:

> *… involving all steps in the lead up to the product's installation, including all awareness raising up to the point of the financial transaction and signing of contracts.*

5.1.1 Barriers during the engagement and acquisition phase

Flexible DER and energy use is complex and consumers need to build trust that the acquisition of a flexible DER and energy use service will be in their best interests. Consumers need to invest significant time, effort and funds to research, choose and configure technology (Temby et al 2021), particularly as energy is generally not top of mind for households – they are focused on their busy everyday lives. These challenges are compounded when the messaging around flexible DER and energy use is complex, consumers may be provided with too many options, which they find daunting (ARENA 2020a), and there is less visibility of, for example, EV chargers compared with traditional petrol stations (Temby et al 2021). Not all Australians have the resources to spare to make the required investment in time, effort and funds (Temby et al 2021).

Consumers may find it difficult to assess the value of flexible DER and energy use as they do not have access to smart meter data or real time data to better understand their energy use and inform their decision. Additionally, they do not have access to the benefits that may accrue in the full value

stack of energy services in Australia with the disaggregation of the energy supply chain. For example, ECA (2020) and Rheem (2022) are of the view that retailers do not have an incentive to help the networks manage their costs.

Where consumers invest in the engagement and acquisition phase of the DER customer journey, the process may be slow and/or cumbersome, with irregular or impersonal contact (ARENA 2020a, Simply Energy 2020). Additionally, they may be subject to:

— unsolicited sales tactics which include bullying, harassment, deliberate obfuscation, and outright deceit
— inappropriate or unaffordable finance, including unregulated 'buy now, pay later' finance, which makes the purchase achievable.

These compound the risks, particularly for vulnerable consumers including elderly consumers, CALD and Indigenous consumers (Temby et al 2021, CALC 2019, CALC 2017). CALC (2017) found that vulnerable consumers are particularly susceptible to these techniques because they have depleted cognitive resources while high cognitive resources are required to resist unsolicited sales approaches, and they are least able to afford undesirable transactions.

Additionally, CALC (2017) found that unsolicited sales of retail solar panels cause significant consumer harm driven by a number of factors including consumer anxiety over rising energy costs and limited understanding of the product and appropriate cost.

Energy Queensland (2022) found that the barriers to engaging in a demand response trial included cost (36 per cent), technical nature of the solution (21 per cent) and third party access to personal data (14 per cent). EnergyAustralia (2018) also identified privacy concerns as a barrier to participating in a demand response program.

Roberts et al (2020) and CSBA (2021) identified the following barriers to engaging in a VPP:

— pressure to participate
— satisfying themselves on the credentials of the company making the offer
— significant upfront costs
— acquiring the correct assets for their needs without over-capitalising and being worse off
— lifetime of equipment and replacement value at end of life
— safety of system
— not owning the battery at the end of a trial
— uncertain earnings potential
— data insecurity
— not having the ability to opt out
— lack of transparency.

Additionally, some thought there would be an administrative barrier if a change of retailer was required to participate in a VPP (Roberts et al 2020). Some were concerned about the end of life arrangements for solar panels and (particularly) home batteries[21], and had human rights and environmental concerns about the supply chain for flexible DER and energy use products, including lithium and other rare earths (Temby et al 2021).

As discussed in section 4.2.1, consumers may engage through a community energy initiative. However, there are potential barriers associated with such an approach including securing

[21] Also noted in Woolcott (2021).

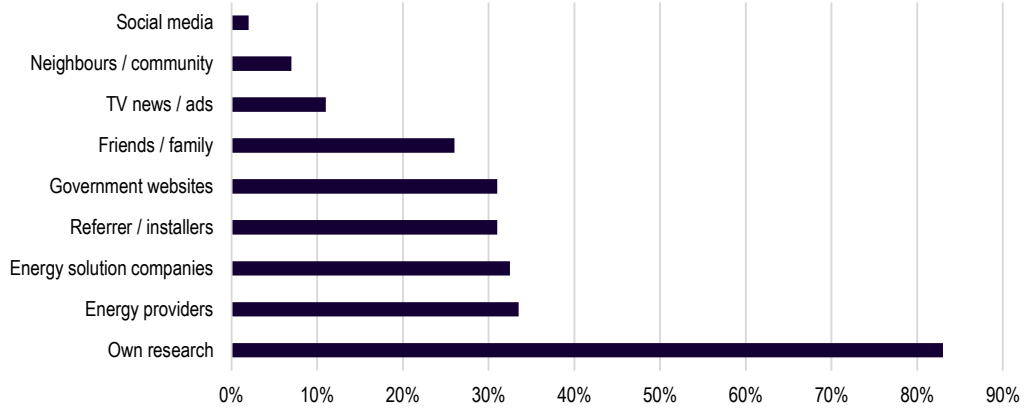
technical expertise, volunteer fatigue, ensuring inclusion in the design and governance, and ensuring a fair distribution of benefits (Temby et al 2021).

5.1.2 Enablers during the engagement and acquisition phase

To remove the barriers during the engagement and acquisition phase to consumers being rewarded for access to their flexible DER and energy use. AGL (2022), ARENA (2020a), ARENA (2020b), ARENA (2021), CALC (2021), COSBOA (2018), CSBA (2021), ECA (2020), EnergyAustralia (2018), Energy Queensland (2022), Nicholls et al (2021), Roberts et al (2020), Temby et al (2021), ZEN (2019), (EWOV 2022) and CES (2020) identified a range of enablers:

- building **trust** through:
  - being aware of customer concerns
  - working with local champions who are trusted
  - involving users in the design phase of the product offering
  - providing a trial period before committing to a longer term contract and/or providing an opt-out mechanism
  - providing transparency of the financial arrangements specific to the customer's circumstances
  - careful consideration of which partner's brand to use to ensure that the operator is trusted
  - using trusted platforms[22] – Figure 5.1 identifies the primary sources of information used by customers of Simply Energy when purchasing a home energy storage solution
  - providing assurances of data security including, what data is collected, how it is being used and who is using it, knowing that they are not being recorded and there are no hidden cameras, and use of Australian data centres and business ownership
  - providing transparency around end users and end uses of data

Figure 5.1 Sources of information when purchasing a home energy storage solution



Source: Simply Energy (2020)

[22] ARENA (2020a) suggested Government websites, but our review has identified that government is not necessarily a trusted partner. Temby et al (2021) referred to the My Energy Efficient Home forum which provides accessible information, personalised and context-specific; correcting or qualifying commercial claims; evidence of realised value; assisting with tech-support/trouble shooting problems; connecting peers with same values; and providing space to deliberate.

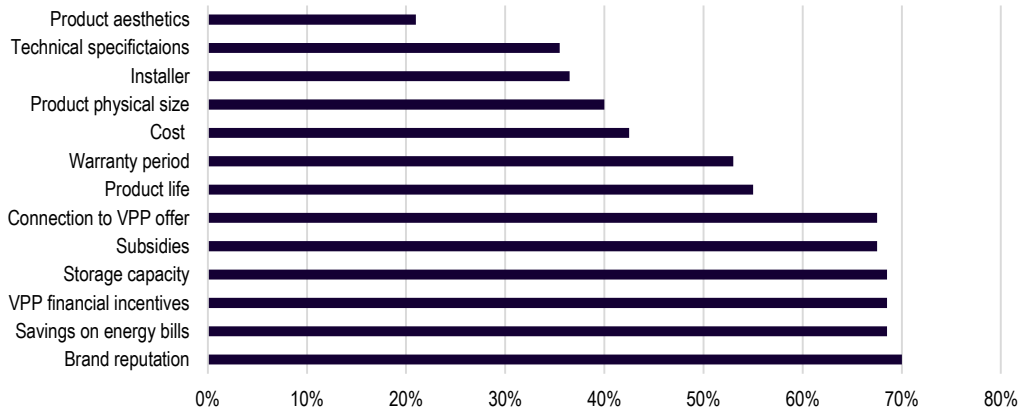
- aligning with consumer's **motivations** by:
  - making time to understand householders contexts and objectives
  - providing a clear value proposition that is simple and transparent, and appeals to the individual customer and their values – Figure 5.2 illustrates the factors that customers of Simply Energy considered when purchasing a home energy storage solution
  - tailoring the ownership models to the target customer group
  - managing trade-offs between risk, responsibilisation, equity and economic efficiency (for example, social enterprises, community energy, mid-scale generation, neighbourhood batteries)
  - for a VPP, providing offers with different degrees of control over the battery[23]
- effectively **communicating** the flexible DER and energy use service through:
  - thorough planning of all communication and engagement
  - understanding which communication channel works best for different types of customers[24]
  - tailoring the information to the circumstances
  - providing information consumers seek as well as reassurances through interactions
  - providing experiential information[25], including information from, and participation in, community groups
  - ensuring that all partners and key stakeholders have relevant and up-to-date information
  - updating information in response to developments and as part of a constant feedback loop
  - increasing publicity
- reducing the **complexity** by:
  - focusing on a simple message and avoiding jargon
  - helping navigate complex technological choices

[23] While noting that this potentially conflicts with the enabler to reduce complexity.

[24] For example, Ausgrid (2016b) found that a personally addressed customer letter with follow-up phone calls was more effective in generating interest in a demand response trial than a more expensive marketing brochure.

[25] Experiential information includes 'observability' and 'trialability', word of mouth, and background with technology, whether gained through education, employment, interest or previous experience.

Figure 5.2 Considerations when purchasing a home energy storage solution



Source: Simply Energy (2020)

- reducing the **burden** on consumers by:
  - minimising the number of customer steps to acquire a flexible DER and energy use service
  - timely and effective follow-up of leads
  - early determination of customer eligibility
  - reducing the upfront cost through rebates, loan schemes or reductions in the technology cost
  - implementing a stepped approach with future investment in extra solar panels or batteries planned
- identifying the **value** to the consumer of the flexible DER and energy use service by:
  - providing detailed information on the benefits, including transparent estimates of generation by solar panels
  - providing a compelling financial case with assurances the consumer will not be worse off
  - allowing consumers to set the price for use of a battery (in a VPP) to enable them to incorporate their own preferences by pricing other benefits (such as independence and reliability)
  - considering the broad range of co-benefits such as health and wellbeing, and social costs of poor health and social exclusion
- **regulating** to:
  - protect the interests of consumers, including effective offer comparison sites and good market information, 'switching' support for vulnerable customers including an assessment of the suitability of offers, solar Power Purchase Agreements (PPAs), VPP plans, prohibiting unsolicited selling or, at a minimum, introducing an opt-in model for unsolicited sales, and ensuring that finance offerings are regulated through the *National Consumer Credit Protection Act 2009*
  - ensure the safety of equipment.

5.2 Installation phase

ARENA (2020a) describes the installation phase as:

> *… involving all the steps directly related to the installation, including any pre-installation site visit.*

5.2.1 Barriers during the installation phase

The installation process is important – it has a strong impact on the consumer's ongoing experiences, including their satisfaction with the technology and pricing. Newgate (2021) found in a smart meter survey that 6 per cent of participants with a smart meter rated the installation process as very or somewhat difficult due to the process being complex and/or time consuming, and unexpected additional expenses.

The installer can enhance or thwart the installation process, thereby either creating frustration (Watson et al 2019) with key gaps between user experiences and what is provided (Temby et al 2021) or providing solutions (Watson et al 2019). CSBA (2021) found that, while the majority of consumers were satisfied or extremely satisfied with the onboarding process, 24 per cent were dissatisfied.

The installation process is not necessarily a discrete one-off event, but rather can be a diffuse process. Retrofitting (designing) technology into existing homes can be challenging, which requires active design and retrofit planning before installation to address safety concerns, integration into existing electricity network standards, and adjustment to each individually designed, built and positioned home (Watson et al 2019). It includes consideration of whether an electrical upgrade is required, the meter needs to be reconfigured, the nature of the grid connection, work safety protections are required, and bollards are required to be installed in the garage or carport (EWOV 2022). As a consequence, the time, complexity and cost in planning installation of new technology can be underestimated (ARENA 2020a) with adverse impacts on the installation process if these factors are not adequately considered (EWOV 2022).

For most households in the Bruny Island Battery Trial, installation took some time (in the order of months) and was not straight forward with multiple actors and organisations (for the smart meter, battery and solar panels) (Watson et al 2019, CSBA 2021), resulting in a diffusion of responsibility to the consumer through multiple parties (CALC 2019). Temby et al (2021) identified that there could be up to 12 actors in the installation process. Installation can be delayed as a result of the installer's cashflow or over-stretched supply chains, and installers covering large country areas can be slow to respond (ARENA 2020a, CSBA 2021).

The installation process also involves a large number of documents that are required to be completed, received and actioned by disparate parties. An overview of the documents required to install solar panels in Victoria is provided in Box 5.1. A failure to submit the necessary paperwork, or to complete the required B2B processes, may result in a consumer being unable to receive a feed-in tariff, which impacts on the financial benefits associated with the solar panels (CALC 2019. EWOV 2022).

Box 5.1 Documentation required to be submitted following the installation of solar panels in Victoria

- Clean Energy Regulator – various forms to process the financial incentives associated with the Commonwealth Government's Small-Scale Technology Certificates
- Solar Victoria – a Solar Provider Statement, proof of eligibility and a number of other documents, including the Certificate of Electrical Safety, to process the Victorian Government's Solar Home Rebate
- Electricity retailer – Electrical Work Request forms, a Certificate of Electrical Safety and a Feed-in Tariff application form
- Electricity distributor – solar connection forms, a copy of the Electrical Work Request form, a Certificate of Electrical Safety and a service order request from the electricity retailer
- Energy Safe Victoria – a copy of the Certificate of Electrical Safety.

Source: CALC 2019

Installers are a form of knowledge broker. However, there is a lack of appropriately skilled/motivated installers (Temby et al 2021), and installers can vary greatly in terms of the level of education and support they provide for households. In most cases the installers in the Bruny Island Battery Trial did not have the capacity to provide follow-up support to households (Watson et al 2019). As a consequence, there is great variability in installation experiences with consumers distrusting 'cowboy' or 'rogue' installers (ARENA 2020b).

Installers can also vary in terms of quality with materials being delivered to site ahead of time (EWOV 2022), solar panels not fitting (EWOV 2022) or being connected to the grid properly (CALC 2019), poor aesthetics of the installed equipment (ARENA 2020a), potential safety risks, damage to the roof and incorrect orientation of solar panels (Temby et al 2021). A December 2018 independent performance audit report by the Auditor-General's office found that between 21.7 per cent and 25.7 per cent of small generation unit installations inspected were rated as 'unsafe' or 'sub-standard' each year, other than in 2012 and 2013. A 2018 consumer survey by CHOICE found that one third of respondents experienced a problem with their solar system and one third experienced a problem with their installer. The top five problems reported were:

- significant installation delays
- incorrect or faulty wiring
- roof damage
- missing or inadequate documentation and paperwork
- a failure to honour or facilitate the warranty period (CALC 2019).

If the installation is delayed, pre-approvals and solar rebate applications can expire (EWOV 2022).

The role of installers is likely to evolve as they learn and establish installation practices, and the market becomes more familiar with DER technologies (Watson et al 2019).

5.2.2 Enablers during the installation phase

To remove the barriers during the installation phase to consumers being rewarded for access to their flexible DER and energy use, and given that installation is a critical moment in the customer's DER journey, ARENA (2020a) identified the need for 'super installers' – well trained, knowledgeable installers who know their customers.

In addition, ARENA (2020a), Temby et al (2021), Watson et al (2019) and EWOV (2022) identified the following enablers:

- building **trust** through:

  - including installers in the design phase
  - conducting an in-person site assessment rather than relying on satellite images to ensure a smooth installation, and minimise cost variations or physical placement of technology that conflicts with household's preferences
  - recruiting more installers and comprehensively training them, including in customer service
  - providing early indication to the consumer if a non-standard installation is required
  - providing timely effective response to issues
  - surveying customer emotions before and after installation
- effectively **communicating** the flexible DER and energy use service through the installers showing the consumer how the equipment, including the app, works
- reducing the **complexity** by:
  - providing firm pricing options with no hidden costs
  - simplifying the processes of installation, rebate application and grid connection
  - devoting resources (people, time, expertise, money) to the installation phase
  - planning for internet connectivity issues, and cater for low levels of technical expertise
- reducing the **burden** on consumers by undertaking a quick, effective installation with a single site visit by installers arriving at an agreed time.

Consistent with these themes, Newgate (2021) found in a smart meter survey that 73 per cent of participants with a smart meter rated the installation process as very or somewhat easy with the process being convenient and/ or quick, and/or the smart meter being provided with a solar system.

5.3 Operating and maintenance phase

ARENA (2020a) describes the operating and maintenance phase as covering:

> *… all ongoing activities related to the operation of the DER system (firmware and hardware), including any scheduled or unscheduled maintenance.*

5.3.1 Barriers during the operating and maintenance phase

As discussed in section 2.2.8, there are a range of motivations for consumers to use flexible DER and energy use. Some participants may have issues or discomfort with third party ownership or control of DER technologies. Greater control and independence over energy are important motivators, sometimes more important than financial benefits (ARENA 2020a).

Operating and maintaining flexible DER and energy use services can be complex. Available technologies can be difficult to coordinate and generally lack necessary functionalities, particularly the ability to more easily control load (Temby et al 2021). In the context of demand response, there is a level of interoperability required to knit devices and appliances together that requires a level of coordination around standards. Customers will not see good outcomes unless they can knit devices and appliances together (ECA 2020). EV charging is mostly done at home, but is complex and poorly understood, with limitations to high speed EV charging in terms of availability, reliability and interoperability (Temby et al 2021).

The Bruny Island Battery Trial utilised multiple technologies, which when combined on-site at homes, created a rather complex overall system. There was a need for householders to combine and synthesise information from different components of the system. No stakeholders (other than installers) are in a position to provide knowledge support and problem resolution for the overall flexible DER and energy use system (Watson et al 2019).

During the operating and maintenance phase, technology issues may be experienced. For example, during the Bruny Island Battery Trial, there were:

— challenges understanding the technical support and app interface
— a lack of communication from the installer about basic functionalities of the installed technology, TOU tariff and different financial benefit streams, resulting in 29 of the 34 households reporting problematic information gaps
— technical glitches with faults emerging in many parts of the hardware, and glitches in the software integration and electricals.

The support required by householders to resolve these technical issues took considerably more time than anticipated (Watson et al 2019).

Technology issues have also been experienced during demand response trials. In a demand response trial of remote controlled air conditioning, AGL (2019) experienced issues, including air conditioners responding differently to standard control commands, a requirement for supplementary hardware units in many cases (adding cost and complexity), and the air conditioner controller (which met the Australian standard[26]) not allowing any opt-out or override capability. However, it notes that this basic one-way communication is now out-dated, replaced by WiFi-enabled smart devices.

Issues experienced by Intelligent Automation (2022) included:

— occasional loss of connection due to summer storms and internet outages
— change of routers / modems (when consumers change internet service providers).

Monitoring apps can also show errors and be "down" (EWOV 2022).

VPP participants raised a number of concerns during the operating and maintenance phase including the impact of frequent discharging on battery life; limitations of battery recycling; battery malfunction, safety and insurance; who is responsible if the battery malfunctions or causes damage; and what would happen if the battery is not available (Roberts et al 2020).

In the context of demand management, 'smart' technologies do not always neatly slot into people's everyday lives. Personal, family and employment circumstances can limit the ability and/or desire to shift load. As a consequence, the potential positive impacts are highly uneven and may cause intra-household conflict. In some cases, energy use practices can be adapted after installation of technologies but some are less flexible, such as food preparation and storage (Temby et al 2021). and for dairy farmers to milk at different times of day (ARENA 2020b).

Given the complexity of the technology, information and clarity of processes are required. But there may be gaps in processes and a lack of documentation (ARENA 2020a). Roberts et al (2020) identified information as a significant barrier with consumers not knowing how their VPP operates and would impact them. This led to concerns that they may be taken advantage of, particularly if they are dealing with actors considered untrustworthy, such as retailers.

Leaving complex written material at the time of installation does not meet the informational needs for many with other demands on time, and varying technical backgrounds, education and literacy levels. Additionally, some technology providers fail to comply with informational requirements of accreditation (for solar panels), including information on how to measure performance and maintain equipment, on warranties, and on estimated production and return on investment (Temby et al 2021). At times, the information provided can be conflicting (Temby et al 2021).

Consumers may rely on the warranty for the product or service during the operating and maintenance phase. However, warranties can vary between manufacturers and between products,

[26] AS4755

and the party providing the warranty may no longer be in business when a fault occurs (EWOV 2022).

5.3.2 Enablers during the operating and maintenance phase

Post-installation roles are an important element for consumers during the operating and maintenance phase, in particular, the handover process and after sales support (Temby et al 2021).

The handover process is very important in helping consumers understand how to operate the product and how to access help if that is required. Information needs to be delivered in the right way, in the right format and at the right time to the right person. Information from, and participation in, community groups is highly valued and helps with the use of technology (Temby et al 2021).

The after sales support includes:

- providing contact channels and a clear complaints process (CSBA 2021)
- effective fast follow-ups to customer issues
- providing detailed and accessible technical documentation to the customer
- keeping online resources current and up-to-date
- providing clear end-to-end processes for the entire project (ARENA 2020a)
- providing assistance with inspections and maintenance (Forethought 2020).

Consumer support staff should be provided with comprehensive technical and customer engagement training (ARENA 2020a). CSBA (2021) identified that VPP call centre staff should be upskilled so that they can address consumer questions about VPPs or provide direct access to knowledge experts to support consumers.

The different ways in which consumers interact with their flexible DER and energy use services during the operating and maintenance phase needs to be understood and recognised. Some want to monitor exactly when and how the battery is participating in the VPP at any given time (Roberts et al 2020) as they do not have sufficient trust to 'set and forget'. The monitoring empowers them with information to help make energy use and driving decisions (in the case of EVs), and informs them when something goes wrong (Temby et al 2021). Others do not want to monitor their flexible DER or energy use service constantly (Roberts et al 2020, EnergyAustralia 2018) – they find it confusing and time consuming (Temby et al 2021). Some need to understand the costs and benefits for their household, potentially through a simple interface with energy and financial flows, and the wider implications (Roberts et al 2020).

For those consumers wanting to monitor their VPP, access to an app was found to be a key benefit to their experience. It enabled them to check on the battery and the energy flow between the battery, the solar panels and the grid, and could be further enhanced through gamification and personalisation. However, consumers need to be shown how to use the app and find the data they need (CSBA 2021).

5.4 Retention phase

ARENA (2020a) describes the retention phase as:

> *… the post-installation phase that ensures customers continue to be satisfied with their product and service, leading to on-going engagement and the customer becoming an important advocate of DER.*

5.4.1 Barriers during the retention phase

The key barriers during the retention phase include:

— difficulty accessing or assessing the benefits
— misalignment with expectations
— lack of engagement
— lack of trust
— legacy issues.

Difficulty accessing or assessing the benefits

Complex pricing structures or value propositions may be used to access the benefits associated with flexible DER and energy use, and may change over time, confusing consumers and leading them to disengage (ARENA 2020a). Some consumers may be worse off on the VPP program if these result in a loss of access to a concession (CSBA 2021).

Watson et al (2019) found that a significant number of participants in the Bruny Island Battery Trial did not choose TOU tariffs, despite analysis they would be better off financially. The process for changing the tariff involved several steps and was not straight forward for them.

Roberts et al (2020) identified a preference for a fixed payment as the VPP operator could cease to operate after the VPP trial or the battery could cease to function.

Watson et al (2019) expected that households would be happy to share their battery with the network if they were well-paid for its use but found that this is not necessarily the case. This was particularly the case in locations where the reliability of the electricity supply was poor. Additionally, some were concerned with sharing their energy data as it could be exploited by unknown parties for economic advantage (Roberts et al 2020).

As discussed in section 2.2.8, some consumers are motivated more by the environmental or community benefits than the financial benefits. However, compared to the financial benefits, it is harder to assess the environmental or community benefits that have been realised over time (CSBA 2021).

Misalignment with expectations

For some participants in trials of flexible DER and energy use, the operational experience did not align with their expectations. For example, CSBA (2021) found that, for some participants, the VPP was charging and discharging at unexpected or unsuitable times:

— 44 per cent were accessing grid power when power was still available in the battery
— for 23 per cent, the battery was not being discharged by the VPP as often as expected
— for 12 per cent, the system was offline or inoperable at times
— for 10 per cent, the battery was not supplying power to important appliances in the event of a power outage.

As a consequence, 53 out of 1,451 respondents in a post demonstration survey had stopped using the VPP – 58 per cent of these within three months and 23 per cent within six months.

The potential for misalignment with expectations when solar panels are installed may arise due to:

— export constraints
— energy bill reductions being less than expected
— credits missing from the energy bill
— for consumers connected to an embedded network, not being offered a feed-in tariff
— a mismatch between the inverter readings or app and the energy bill (EWOV 2022, Woolcott 2021).

For those participating in a VPP, there is the additional potential for a misalignment with expectations as there is no regulated price for VPP earnings and/or they are locked into a VPP plan (EWOV 2022).

Lack of engagement

The level of engagement with the flexible DER and energy use services varied over time. For example, CSBA (2021) found that, after a year with a VPP program:

— 41 per cent claimed to be emotionally involved – they liked to monitor usage, plan the timing of their appliances and ensure the system was working

— 29 per cent were less involved

— 30 per cent were in 'set and forget' mode.

This lack of engagement may be caused in part through the design of optimisation algorithms without consumer participation, which leads to systems that lack the ability to adapt to the operational schedules and demands of different types of customers (ARENA 2020a).

In the Bruny Island Battery Trial, there was a lack of engagement in the app by:

— 8 out of 30 after installation

— 7 out of 30 a year later.

This was attributed to a lack of information at the time of installation, time constraints and/or a more general reluctance to use technology, in some cases because of poor internet coverage (Watson et al 2019).

Lack of trust

For many, the level of trust in the flexible DER and energy use services and the providers of those products and services eroded over time.

Temby et al (2021) identified issues with the quality of technology and the quality of providers:

— providers refusing to take responsibility for failed technology, even within warranty periods, particularly for inverters and batteries

— lengthy timeframes to resolve issues

— high rates of bankruptcy among providers[27]

— difficulties for regional households accessing suppliers.

Where people lack critical information, or situations that are complex or uncertain, evaluations tend to be based on affective (emotional) responses – particularly beliefs about trustworthiness – rather than deliberative cognitive evaluations (Watson et al 2019). In the Bruny Island Battery Trial:

— 23 out of 32 were relaxed and confident in the technology and trial, but experienced some level of frustration and confusion, and therefore had criticisms of the installation and technology.

— Nine expressed more negative emotions in regard to the technology and experience of installation. Coping strategies included reframing the technology from something that needs their active input and understanding to a technology that can be seen as 'set and forget'.

— Only one participant was relaxed, confident and enthusiastic about the technology.

Watson et al (2019) found that those more likely to accept the technology had either:

— little knowledge of technology, but trusted it, or

[27] Also identified by CALC (2019)

— more knowledge and confidence.

Legacy issues

A variety of legacy issues were identified in the review including:

— What happens if a consumer that has bought a discounted battery or committed to contract to participate in a VPP moves house (Roberts et al 2020, CSBA 2021)?
— How are VPPs transitioned to new tenants (CSBA 2021)?
— What programs are in place to replace batteries as they deplete over time (CSBA 2021)?

5.4.2 Enablers during the retention phase

McKinsey (2018) note that customer service and experience will drive customer retention. To facilitate customer retention, the key enablers include:

— providing ongoing certainty on the benefits
— providing ongoing and planned engagement
— offering ongoing support
— understanding how different types of customers prefer to engage and be engaged with.

Ongoing certainty on the benefits

The means of providing ongoing certainty on the benefits varies by consumer.

CSBA (2021) found that retention is driven by the realisation of savings by customers. It found that most VPP participants experienced a reduction in energy bills so most of those that responded to a survey were positive:

— 40 per cent were extremely satisfied
— 30 per cent were satisfied
— 30 per cent were dissatisfied.

Participants were dissatisfied when the financial benefits did not meet expectations. Accordingly, some form of consumer protection or guarantee may be required that consumers will be no worse off for joining a VPP (CSBA 2021). Additionally, ARENA (2020a) found that consumers can adapt their behaviour as required, and so could be influenced to change their behaviour to realise financial benefits.

While CSBA (2021) found that retention is driven by the realisation of savings by customers, ongoing certainty may be preferred by some over greater savings, for example, lower capped earnings may be preferred to higher variable ones (ARENA 2020a).

Two types of network support payments were trialled in the Bruny Island Battery Trial – Energy Reserve and Energy Use. While most participants did not have a preference between the two, it was only on prompting that five out of 30 indicated a preference for the Energy Reserve support payment as there was a perception it would pay more (Watson et al 2019).

While some consumers prefer a rolling contract or ability to opt out of the contract rather than being locked in, others prefer a fixed contract (Roberts et al 2020).

For some, greater control and independence are more important motivators than financial rewards (ARENA 2020a). Control can be retained by providing advanced notice of VPP battery use with the capacity to opt out of any given event (Roberts et al 2020), and providing an 'override option' for direct load control (CSIRO 2021). Additionally, the option should be provided to install the battery in such a way that it continues to provide power during an outage (CSBA 2021)

Providing VPP participants with access to an app provides a key means of communicating with consumers and reinforcing the benefits of participation, which enhance satisfaction and retention. Apps could be further enhanced through push notifications, coverage maps and virtual rewards (CSBA 2021). In the Bruny Island Battery Trial, 21 out of 30 participants were using the Reposit app after one year, 12 out of 30 were using the inverter app and portal, and two out of 30 were using the traditional electricity bills to receive feedback. A key finding from that trial was that any changes in behaviour (energy practices use of feedback) soon after installation (approximately two weeks) tended to persist over time (12-18 months) (Watson et al 2019).

The realisation of benefits may be dependent on the sharing of energy data. Roberts et al (2020) found that some may be willing to share energy data if it is anonymised and understand how it is to be used. Purposes for which the sharing of data is considered to be legitimate are where its use is not driven by profit, and is in the community's interests, supports the environment or supports the grid (Roberts et al 2020).

Ongoing and planned engagement

ARENA (2020a) found that ongoing and planned engagement is required for the years beyond installation that the project is likely to last, including, for example, community forums and events, online forums and/or social media 'communities. The ongoing and planned engagement should be directed at customer retention and building advocacy.

Ongoing support

Good providers provide extensive after sales support, providing advice on how best to operate and care for the flexible DER and energy use product and assistance dealing with issues (Temby et al 2021).

Understanding different types of customers

Ongoing validation is necessary to ensure retention (CSBA 2021). However, different types of customers prefer different ways to engage and be engaged with, for example:

— 'optimisers' prefer regular notifications

— 'set and forgetters' switch off notifications (ARENA 2020a).

Given the diversity of consumers and that it is difficult to communicate or engage with consumers who disengage, a variety of measures need to be considered to keep consumers engaged. This includes ensuring that relevant information is available to all consumers through call centres, websites, apps and bills or scheduled messaging (CSBA 2021).

5.5 Indicative significance of barriers by DER technology

The significance of the barriers at each phase will vary by DER technology. Table 5.1 provides ACIL Allen's indicative view as to the significance of the barriers at each phase of the DER customer journey for each DER technology, based on the literature review.

As illustrated in Table 5.1:

— Engagement and acquisition phase – a higher level of engagement is required to facilitate acquisition by consumers of VPPs, for which there is a low level of awareness, than solar panels, for which there is a relatively high level of awareness.

— Installation phase – the installation phase for VPPs is more complex than the installation phase for behavioural demand response or new forms of load control.

- Operating and maintenance phase – some products, such as behavioural demand response and load control, require little to no effort to operate and maintain, while others, such as solar panels and electric vehicles require significant effort to operate and maintain.
- Retention phase – it is relatively easy to retain consumers for existing forms of load control, but harder to retain consumers for behavioural demand response, new forms of load control and VPPs as it is easier for them to opt out.

Table 5.1 Indicative significance of barriers by phase of the DER customer journey, by DER technology

DER technology	Engagement and acquisition	Installation	Operating and maintenance	Retention
Behavioural demand response	Level of awareness currently relatively low, requiring a higher level of engagement	May require a new meter	Not applicable	Retention decision effectively made each time demand response required
Controlled load – existing (e.g. off peak hot water and pool pumps)	Product has been around for a long period of time, requiring a low level of engagement	Not applicable – existing arrangements	Minimal	Set and forget
Controlled load – new (e.g. air conditioning)	Level of awareness currently relatively low, requiring a higher level of engagement	Requires a dedicated circuit and potentially a new meter	Minimal	Retention decision effectively made each time load controlled
Solar panels	Level of awareness reasonably high	Requires solar panels to be installed, a grid connection and potentially a new meter	Ongoing operation and maintenance required	Consumer highly likely to be retained for the life of the solar panels
Battery storage	Medium level of awareness	Requires battery storage to be installed and interconnectivity with solar panels	Ongoing operation and maintenance required, but less than for solar panels and electric vehicles	Consumer highly likely to be retained for the life of the battery storage
Electric vehicles	Medium level of awareness, and growing	May require a dedicated circuit and new meter for electricity vehicle charging, and interconnectivity with solar panels	Ongoing operation and maintenance required	Consumer retained until the end of the life for the electric vehicle or until it is disposed
VPPs	Level of awareness currently relatively low, requiring a higher level of engagement	Complexity during installation depends on pathway	Ongoing operation and maintenance required	Higher risk that consumer will not be retained (and revert to stand-alone solar panels and battery storage)

Note: Red – Barriers on DER technology significant; Orange – Barriers will have some significance for DER technology; Green – Barriers will have less significance for DER technology.

Source: ACIL Allen based on literature reviewed

6 Gaps in the research

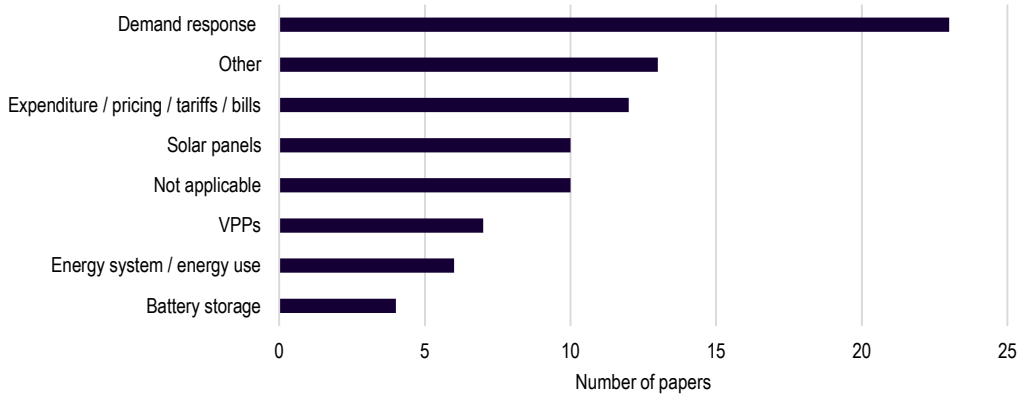
A select number of papers have been reviewed for this report. Based on the papers that have been reviewed, a number of gaps in the research have been identified.

6.1 Technologies considered in the literature reviewed

As discussed in chapter 4, there has been little research undertaken on a longitudinal basis to fully understand the barriers and enablers during the later phases of the DER customer journey. Most of the literature is focused on the engagement and acquisition phase, with the focus decreasing progressively through the latter stages (installation, operation and maintenance, and retention).

The literature covered a range of different DER technologies, as well as other related products and services, such as electricity pricing (refer Figure 6.1). However, the research does not provide an in-depth analysis of each DER technology across all phases of the DER customer journey. Findings that are made in relation to one DER technology may or may not apply across all forms of DER technology.

Figure 6.1 Technology considered in the literature reviewed

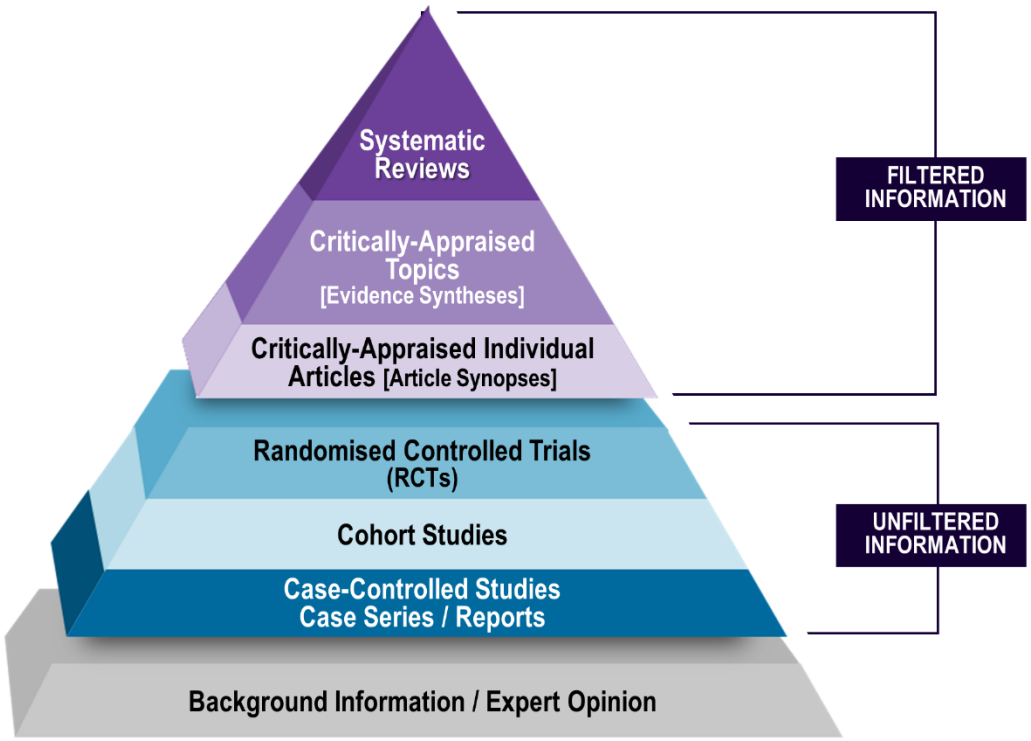


Source: ACIL Allen

6.2 Types of research undertaken

As discussed in section 1.3, a comprehensive literature search was not undertaken as part of this rapid evidence review. The papers reviewed were largely provided by the ESB and stakeholders in response to the call for evidence. A relatively small number of the papers reviewed would be considered high quality evidence by reference to the Levels of Evidence Pyramid which is used in the health sector, refer Figure 6.2.

Figure 6.2 Levels of evidence

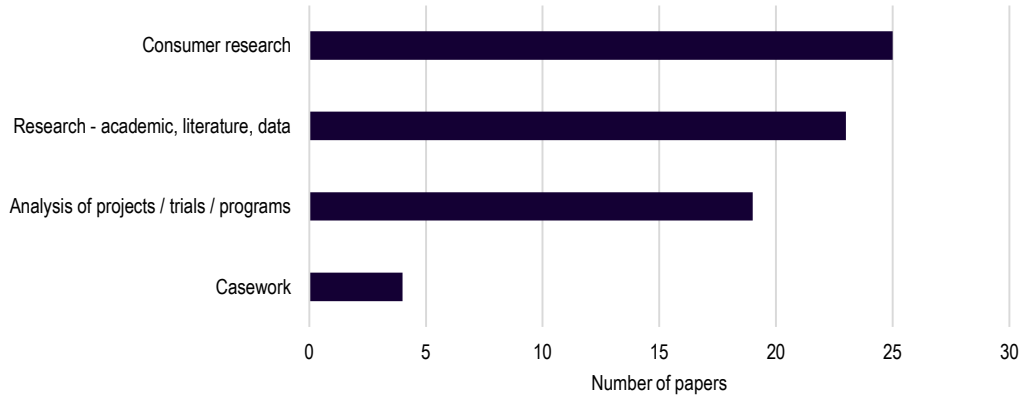


Source: Evidence Based Medicine Pyramid, Dartmouth University / Yale University 2006

The literature reviewed was largely analysis of projects or trials, or consumer research (refer Figure 6.3). As discussed in section 2.2, consumers with low motivation and/or low ability generally do not participate in trials or consumer research. Accordingly, many of the findings from the research are based on consumers with high motivation and/or high ability.

In particular, a large proportion of participants in trials are early adopters. It can be inferred from the literature reviewed that early adopters are likely to represent a relatively small proportion of all consumers (in the order of 10 per cent or less). Importantly for this review, Watson et al (2019) identified that the early experiences with early adopters may not translate well to other types of consumers. Different strategies will need to be developed over time to attract different segments that will be less engaged and harder to reach than the early adopters (CSBA 2021).

Figure 6.3 Types of research undertaken



Source: ACIL Allen

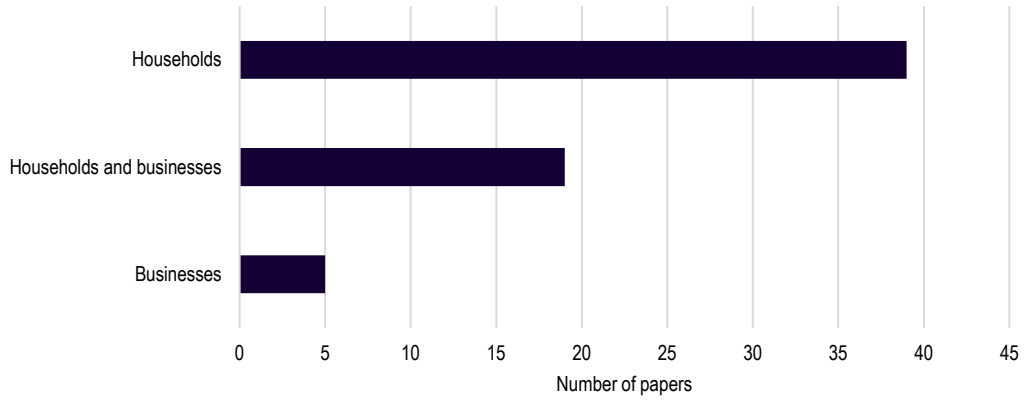
6.3 Prioritisation or sequencing of barriers and enablers

A range of barriers to, and enablers for, consumers being rewarded for access to their flexible DER and energy use have been identified through the research. However, there is little evidence in the literature reviewed as to an appropriate prioritisation or sequencing for addressing barriers or facilitating enablers. For example, the literature does not clearly identify whether addressing a relatively small number of barriers will result in a significant increase in the participation of consumers being rewarded for access to their flexible DER and energy use.

6.4 Types of consumers considered in the research

Households were the focus of most of the literature reviewed (refer Figure 6.4), with relatively few papers considering only the experience of businesses with flexible DER and energy use. Some of the papers reviewed considered households and businesses.

Figure 6.4 Types of consumers considered in the literature review



Source: ACIL Allen

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