



Virtual Power Plant Demonstrations Consumer Insights Report

15 September 2021

Customer Service Benchmarking Australia

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Important notice

PURPOSE

This document outlines key insights gained from the Virtual Power Plant (VPP) Consumer Insights study undertaken during the VPP Demonstration. It details the framework, final objectives, research program design, methodology and findings of the Consumer Insights study.

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VERSION CONTROL

Final Report

Submission Date 15 September 2021

1 Executive Summary

This report details the experience of consumers within the Australian Energy Market Operator (AEMO) Virtual Power Plant (VPP) Demonstration, exploring how best to improve it in the future and how consumers feel about letting VPP operators utilise their assets.

Recent innovations in technology, energy storage and communications have led to the development of VPPs – groups of households with solar panels and batteries that are coordinated to deliver services for power system operation and electricity markets. VPPs are at an early stage of development in the energy market, although the deployment to consumers across Australia is occurring at a steady pace.

VPPs have demonstrated potential to support the efficient operation of the power system, as well as providing value to consumers who own VPP assets. This is an important study given that it is based on a new way for the industry to interact with consumer-owned devices and a level of ‘social licence’ is required throughout the journey.

Understanding the consumer experience and exploring ways to enhance it will help improve the success of VPPs overall.

The Australian Energy Market Operator (AEMO) conducted VPP Demonstrations, with the support of The Australian Renewable Energy Agency (ARENA) to achieve a number of objectives, and in July 2019 Customer Service Benchmarking Australia (CSBA) was commissioned to conduct a customer experience research program.

The VPP consumer study undertaken by CSBA as part of the AEMO VPP Demonstrations aimed to answer three critical questions:

1. What are consumers’ experiences of participating in Australia’s early stage VPPs?
2. How can consumers’ experience of VPP participation be improved to make it more attractive for consumers to sign up in the future?
3. Is VPP participation attractive enough for consumers to let VPPs utilise their assets?

CSBA developed a multi-staged market research approach, using specific methodologies to tackle the introduction of VPPs to the market and capture insights into consumers’ evolving behaviours and attitudes.

This report details the findings from research undertaken by CSBA, which included a baseline survey of 993 consumers (May 2020-December 2020), a longitudinal qualitative study (July 2020-January 2021) with 50 consumers and a post-Demonstration survey of 1451 consumers (March 2021).

Findings from the three research questions above indicate:

1. Overall, consumers reported having a positive experience of early VPPs in Australia, with most being drawn to the scheme by the opportunity to save money and help the environment or community. The majority were classified as technologically savvy Early Adopters, and so future VPP recruitment initiatives will need to reach beyond this target market for more widespread adoption.
2. Respondents in the study suggested a number of ways in which the VPP experience could be improved in the future, which will be an essential consideration for all VPP Providers, current and future. In particular, clearer communications and more education on the technology, including any

smart phone applications ('apps') that the consumer may use, could help consumers to optimise the value of their rooftop solar and battery investments which, in turn, will aid with ongoing retention.

3. In general, consumers considered the benefits of VPP participation were sufficiently appealing for them to allow external management of their assets by a third party as a means of helping stabilise the grid.

Key Findings:

This section details eight key findings from the study. The text boxes include the recommendations flowing from the key findings.

1. Overall satisfaction with the VPP system remained constant over time.

Consumer satisfaction with VPPs was high and the majority of consumers indicated that they would be willing to promote participation in a VPP to others. See 2.6.3 Assessing the VPP and 3.4 Future directions for VPPs and D3.2 - Overall Satisfaction.

- Consumers' ongoing satisfaction with, and advocacy of, VPPs will be further enhanced with improvements in ongoing communications and transparency. In particular, consumers want to understand:
 - The financial benefits to their household (e.g., how much energy they provided to the grid and what they were paid for this).
 - The environmental benefits (e.g., how much CO₂ was saved and how many trees this is equivalent to planting).
 - The community benefits (e.g., how many minutes of power shortfalls in their state were saved by their household's power contribution).
- Strategies will need to be developed to handle how VPPs are transitioned to new tenants/owners, together with programs for battery replacements as they deplete over time.

2. The expectation that the consumer would be able to save money on energy bills was the most prevalent factor in sign-up and retention.

Attraction to the VPP can be driven by marketing initiatives and focusing on the potential for cost savings. Retention is driven by the realisation of savings by the consumer. Those consumers who did not clearly identify cost savings in their bills after joining and those who were unclear if the VPP would reduce their energy costs became dissatisfied. See 2.4.1 Triggers and 2.6.3 Assessing the VPP.

- Target suitable consumers with a strong and clear marketing strategy.
- Review energy bills for each site/consumer to ensure realistic expectations of savings and other benefits.
- Align reporting metrics with expectations to ensure the actual experience matches or outperforms the promised experience.

3. The pathway to VPP 'membership' influences overall satisfaction.

The journey to participation in the VPP shaped consumers' levels of satisfaction. Previous experience with solar panels and generous revenues led to higher expectations of the value potential. Those who acquired a battery at the same time as joining the VPP tended to see them as intrinsically related. See 2.6.2 The Installation Phase and D3.4 - Overall Satisfaction by Pathway

- The marketing strategy and onboarding process for future VPPs need to reflect the pathway to VPP membership for the consumer.
- People with existing infrastructure will have different needs for re-education and previous arrangements such as high ongoing financial earnings from solar panels and existing discounts need to be considered.
- The marketing should provide positive reinforcement to the consumer that they are helping the community/environment by supporting grid stability.
- Actively marketing to those who do not already have solar and/or a battery will improve the future success of VPPs.. For example, Pathway Four candidates who are offered a package (panels, battery, VPP) are more likely to be highly satisfied and loyal. See section 2.6.1 The Pre-joining Phase.
- Linking with government rebate programs can improve attraction and retention as consumers benefit from both the government program and cost savings from participating in the VPP.

4. Consumers are aware they are letting VPPs utilise their asset when they join the VPP.

Consumers understood that joining the VPP meant giving up some control over the hardware. For those whose expectations of benefits including mainly cost savings, but also community/environmental benefits, were met, this was not considered a problem as they appreciated the increased value potential by joining the hardware to the grid. Indeed, some consumers modified their behaviour, using electrical appliances at different times of day, to try to maximise the value they received from the VPP. See 2.6.3 Assessing the VPP and 2.6.5 Change in Habits.

Inadequate compensation or a lack of understanding of the process were the key factors for dissatisfaction with losing control of the asset See 2.6.3 Assessing the VPP.

For some consumers, especially those who had reached a set and forget mentality, abdication of responsibility was seen as a positive. See 2.5 VPP Consumer Needs and Expectations.

- Consumers need clear information on how the VPP works, for instance why the battery discharges at certain times, to overcome any issues with letting VPPs utilise their assets.
- Positively reinforce the key message for allowing VPPs to utilise assets: "The VPP extends the value of the asset to you and to the community."
- Better education on how VPPs operate is required up front.
- Communication channels should be targeted to the right audiences, and ongoing communications need to be tailored to the needs of consumers.

5. Uptake of VPP membership was primarily driven by 'Early Adopters'.

CSBA undertook segmentation analysis to identify four consumer segments with common characteristics. The four groups were defined as Early Adopters, Going with the Flow, Personal Gain and Caring Community. See 2.5 VPP Consumer Needs and Expectations

Early Adopters were driven by a desire to be pioneers in new energy solutions and were highly motivated and engaged in the VPP Demonstration.

Going with the Flow consumers were pleased to be a part of the VPP, because they could see the benefits for the environment, the wider community and themselves, but there was a lack of engagement with the VPP.

Personal Gain consumers were 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 the evening.

Caring Community consumers were 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.

- In the early stages of VPP deployments, actively market to Early Adopters, key opinion leaders and influencers in the community.
- Develop a strategy to attract other segments over time. As uptake increases, less engaged consumers will be harder to reach and will continue to need validation.
- Use of traditional media such as TV and Radio (e.g., discussion programs such as 'The Drum' or topical programs such as 'War on Waste' or even 'The Checkout') has been identified as a way to reach consumers.
- Identify causes that resonate with the different segments and show how the VPP supports their specific motivations.

6. Consumers desire more information from their VPP Provider to boost engagement

Membership of a VPP means consumers have made an emotional investment in the VPP and they are eager to learn more about how to assess the financial impact of the VPP; how to manage their energy usage; VPP processes; and how the VPP community is progressing.

See 3.3 Consumer Questions.

- There is a need to define the information needed at different points of the consumer's journey. For example, to provide consumers with clear worked examples of financial impacts during onboarding.
- Develop marketing strategies by segment and provide consumers with compelling information, either through a VPP app or through credible media.
- Provide clear information on how the battery is remotely managed.
- Enhance the onboarding experience by ensuring consumers are shown how to use the app and find the data they need.
- Upskill VPP provider call centre staff so they can address consumer questions about the VPP or provide direct access to knowledge experts for support to consumers.
- Provide in-app help and updates targeted to consumers' information needs.

7. An app is the manifestation of the VPP (virtual in their pocket)

The VPP demonstration did not require VPP providers to supply an app, but those consumers with access to an app found it to be a key benefit to their experience. As well as enabling them to check on the battery and see the energy flow between the battery, the panels and the grid, the app was a key means of communicating with consumers and reinforcing the benefits of participation, thereby leading to enhanced satisfaction and retention. There is an opportunity for VPP Providers to create apps to communicate with VPP members and enhance consumer understanding and satisfaction.

See 2.7 Consumers use of apps to interact with the VPP.

- Enhance design of apps to improve ease of understanding through relevant infographics and aligned reporting metrics.
- App development to consider the user experience (UX) and ensure apps deliver and convey the features and benefits of the VPP that are relevant to the consumer.
- Apps need to maintain functionality as phone operating systems evolve.
- Apps are a key means of increasing consumer engagement and retention and could be further enhanced through gamification, personalisation, push notifications (e.g., number of households signed up), coverage maps and virtual rewards (e.g., gold stars, points).

8. The industry needs to develop clear guidelines for what consumers can expect from VPP membership.

Various business models existed within the Demonstration. Consumer experience and satisfaction reflected those differences. Key processes need to be standardised across all providers so consumers know what to expect. See 4 Summary and discussion.

- Transparency in reporting.
- Consistency of language used.
- Contact channels and a clear complaints process.
- Messaging to focus on how consumers are financially better off by joining a VPP and contributing their assets.

VPPs can help consumers realise value from their rooftop solar and battery investments and also help stabilise the power system. Attracting consumers to such initiatives and retaining them over the longer-term will largely depend on the quality of their experience with their VPP provider. This report details the experience of 1966 individual respondents and draws upon their feedback to provide recommendations for how it can be optimised to improve the success of future VPP projects.

Key recommendations:

1. Improve the quality and relevance of information for consumers to enhance engagement and retention.
2. Actively market to early adopters in the early stages of deployment and develop a strategy to attract other segments as the market matures.
3. Focus on the potential for cost savings as the key motivator for participation, supported by individual energy bill reviews to ensure the experience matches the expectation.
4. Explore how best the app experience could be improved and ensure consumers are educated in its use.
5. Develop strategies to handle how VPPs are transitioned to new tenants/owners, together with programs for battery replacements as they deplete over time.
6. Explore initiatives that broaden the appeal to consumers, deliver operational, financial or community benefits and will help attract and retain new consumers, particularly in a maturing and more competitive market.
7. Continue to upskill customer service staff so they can address new types of consumer questions about the VPP and/or to provide direct access to knowledge experts for support to consumers.

Abbreviations and Glossary of Terms

AEMO Australian Energy Market Operator - AEMO manages electricity and gas systems and markets across Australia, helping to ensure Australians have access to affordable, secure, and reliable energy.

ARENA The Australian Renewable Energy Agency (ARENA) improves the competitiveness and increases the supply of renewable energy in Australia.

CSBA Customer Benchmarking Australia - CSBA helps organisations create better customer experiences – through best-practice, independent CX strategy, research, quality assurance and training.

DER Distributed Energy Resource - Distribution level resources which produce electricity or actively manage consumer demand (examples include solar rooftop PV systems and batteries, and demand response via hot water systems, pool pumps, smart appliances, and air conditioning control). DER orchestration programs enable aggregators, such as an electricity retailers or virtual power plants (VPP), to use and optimise behind-the-meter assets like rooftop solar and batteries.

FCAS Frequency Control Ancillary Services - A service that balances, over short intervals (shorter than the dispatch interval), the power supplied by generating units and the power consumed by loads.

'n' The sample or number of respondents that represent the quantitative finding.

NMI The National Metering Identifier (NMI) is a unique 10- or 11-digit number used to identify every electricity network connection point in the National Electricity Market (on the east coast of Australia).

NPS Net Promoter Score*

Respondents indicate their Likelihood to Recommend on a 0 – 10 scale where 0 is Not at all likely and 10 is Extremely likely. To calculate the Net Promoter Score, subtract the percentage of Detractors (Scoring 0 to 6) from the percentage of Promoters (Scoring 9,10). The result is an index which can range from -100 to +100.

**NPS and Net Promoter Score are trademarks of Fred Reichheld, Bain, and Company, and Satmetrix Inc.*

Overall Satisfaction This was measured on a 0 to 10 scale, where 0 is Extremely Dissatisfied and 10 is Extremely Satisfied. Overall Satisfaction is reported as a mean score out of 10. A mean score above 7.5 is high. It can be presented in proportions (%) where Dissatisfied scored 0 to 6, Satisfied 7 or 8 and Extremely Satisfied 9 or 10. It can also be reported as 'Total Satisfaction', which is the proportion (%) of respondents scoring 7 to 10.

PV Solar cells, also called photovoltaic cells, convert sunlight directly into electricity. Photovoltaics (often shortened as PV) gets its name from the process of converting light (photons) to electricity (voltage), which is called the photovoltaic effect.

Respondent(s) The customers or consumers who were surveyed or interviewed.

VPP Virtual Power Plant - An aggregation of resources, coordinated using software and communications technology to deliver services that have traditionally been performed by a conventional power plant. In Australia, grid connected VPPs are focused on coordinating rooftop photovoltaic (PV) systems and battery storage.

VPP Demonstration The VPP program run by AEMO and sponsored by ARENA, in which the VPP Providers enrolled.

VPP Provider(s) The aggregators and retailers whose customers were surveyed and interviewed.

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2 Consumer Insights

2.1 Introduction

Less than a decade ago, there was a negligible amount of consumer-owned energy resources installed on homes across Australia. The power system was built around large, centralised generation assets and electricity flowed in a single direction from the transmission system to consumers in distribution networks. Since 2010 there have been over 2.5 million new small-scale solar PV installations. Since 2014 over 33,000 solar systems had concurrent battery storage and over 9000 of those were installed in 2020 alone. (Clean Energy Regulator, 2021)¹. The rate of investment is increasing annually, driven by a combination of decreasing prices for rooftop PV, consumers' desire to reduce their carbon footprint and/or save money as well as government and retailer incentives linking the acquisition of a battery to joining a VPP.

This combination of factors, together with a highly engaged consumer base, makes Australia an attractive market to test models for VPPs. To inform the development of the sector, this report explores the experiences of consumers who have participated in a VPP within AEMO's VPP Demonstration with the intent of helping the industry understand triggers and barriers to VPP participation, consumer needs and expectations, and attitudes to external management of their assets.

This report provides important insights, given that VPPs provide the energy industry with a new way of interacting with consumer-owned devices. A level of 'social licence' – or an acceptance granted to the VPP Provider by the consumer - for the management of these Distributed Energy Resources (DER) is required throughout the journey.

The Social Licence for Control of Distributed Energy Resources report (CutlerMerz Pty Ltd, 2020)² discusses the VPP Demonstration and points out that 'some effort is likely to be required in gaining and maintaining a social licence for VPPs, given that the consumer may not necessarily have the ability to opt in or out of any given market response' and that 'to maintain a social licence the consumer must have trust that the algorithm is likely to operate in their best interests. A social licence results in consumers perceiving the private benefits of DER control in the VPP to be greater than the private costs or, at least accepting the private costs in exchange for public benefits and where a social licence is obtained it is likely to increase participation and compliance'. Likewise, the Social Licence to Automate - VPP User Research report (Dr Mike Roberts, 2020)³ concluded that 'many users are happy to compromise on that level of control at the right price but retaining a clearly explained opt out function is likely to be crucial in winning support for VPPs.'

Feedback from 1966 unique respondents, collated in this report, will help VPP Providers improve the operation of their VPPs, enhance consumer satisfaction, and inform how the energy industry can better build trust and interact with consumers as the VPP sector matures.

¹ Clean Energy Regulator – Postcode data for small scale installations: <http://www.cleanenergyregulator.gov.au/RET/Forms-and-resources/Postcode-data-for-small-scale-installations#Smallscale-installations-by-installation-year>

²Social Licence for Control of Distributed Energy Resources: <https://energyconsumersaustralia.com.au/wp-content/uploads/Social-Licence-for-DER-Control.pdf#:~:text=For%20the%20purposes%20of%20this%20study%2C%20a%20social,above%20and%20beyond%20what%20is%20required%20by%20la>W.

³ Social Licences to Automate – VPP User Research: https://www.researchgate.net/publication/346411460_VPP_User_Research_Final_Report



2.2 Market Context

VPPs are largely a new concept to Australian consumers and, as such, participating consumers became aware of VPPs in the following ways:

- Over half were approached with an offer either by their energy provider, a VPP Provider or battery installer, indicating that the VPP Provider pre-qualified them to be contacted.
- Others became aware via word of mouth and/or social media.
- A few indicated they had heard about the concept of VPP connected communities on the radio or news media in print or online.

These channels proved effective in reaching consumers and VPPs should continue to use multiple media to reach new consumers in the future.

Some households had already used solar panels for many years, and most were aware of government rebates for solar panels and the generous earnings that had been on offer in the past. They were aware that both solar panels and batteries had come down in price over time and that Australia had some of the highest rates of uptake of rooftop solar in the world.

The word 'Energy' was associated with the functional benefit of powering appliances that are essential to modern day life. Some consumers also linked the word 'Energy' with fossil fuel generation, which they considered unsustainable and damaging to the environment through emissions of CO₂ and other greenhouse gases. Generating energy using solar PV was seen as a cost effective and cleaner strategy. Consumers who already had solar panels recognised that solar energy generation depends on the weather and is not always reliable.

The word 'Battery' was associated with the benefit of energy storage. The VPP allowed them to extend the benefit of solar and battery by sharing the energy generated with the community.

Solar panels were seen as generating a financial benefit by reducing the amount of energy sourced from the grid as well as ongoing potential earnings through feeding energy into the grid. Batteries extended this benefit into times when the sun was not shining. Joining the VPP further extended the financial benefit by consumers being paid for the use of energy stored in their battery at times when it was needed to stabilise the grid.



2.3 The early VPP Consumer

Findings from the qualitative phase indicate that most VPP consumers lived in free-standing homes (93%) and relied on energy hungry appliances such as air conditioners (67%) and electric ovens. Energy was essential to their way of life and while most tried to economise by turning off appliances or lights, their energy use was fundamental to their way of life.

Most consumers intended to remain in their homes for the foreseeable future (at least the next 10 years) and this played a role in decisions around investing in panels and batteries. Some had planned their investment as part of the purchase of their current home or a home renovation. They expected their investment in panels/battery to take at least five years to break even and longer to generate a saving or a return on investment. Many considered the assets an investment in their lifestyle, and, in the current environment, their money was not generating a high interest income elsewhere. Some hoped that it would add value to their home.

The second (quantitative) survey found that most consumers had a high level of education with over half (51%) having tertiary education and an interest in understanding energy. The interviews showed that many read widely and conducted web searches on topics of interest. Some worked or had worked with electrical energy. Most were comfortable discussing energy using language like the grid; the name of the power station that served their community; the potential generation from their PV panels; the capacity of their battery and how much energy their appliances used.

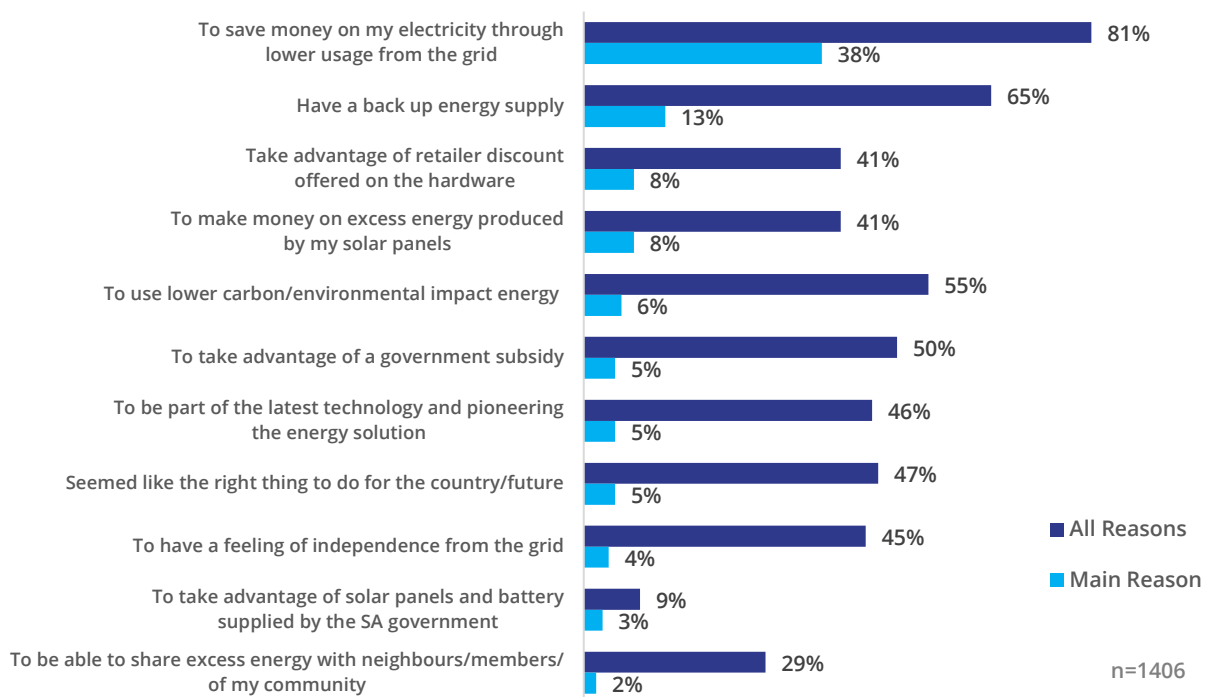
Refer to Appendix D Supplementary Charts for detailed demographic breakdowns.

2.4 Triggers and Barriers to VPP Participation

2.4.1 Triggers

Respondents were asked two questions to explore what made them interested in the VPP program. First, they were asked to choose from a list of options what were all the reasons that interested them. On average, respondents selected five different reasons. They were then asked to identify the main reason from the choices they made in the first question. Results from a total of 1406 respondents (n=1406) are shown in figure 1, with the dark blue bars being one of several reasons selected and the light blue bars being the main reason selected.


Figure 1 - Reasons for Joining the VPP Program



Most respondents (81%) indicated they wanted 'To save money on their electricity through lower usage from the grid' with 38% selecting this as the main reason. This was especially important for self-funded retirees and pensioners who wanted to future proof their outgoings while maintaining their lifestyle. Overall, 41% wanted 'To make money on excess energy produced by their panels' and 8% stated this to be their main reason for interest.

Concern for the environment was a motivation for over half; 55% wanted 'To use lower carbon/environmental impact energy sources' and 6% stated this to be their main reason.

Rebates for solar panels had stimulated demand in the past, with those who had missed out on high rebates now primed to take advantage of VPP-related discounts on batteries. Some solar panel owners, especially those who felt they earned low revenue from rooftop solar, wanted to use more of the energy generated by the solar panels for themselves and expected that their battery would store energy to see them through the night, despite the fact that battery capacity is often not sufficient. As the discounts offered were linked to joining the VPP it was the discount and the desire to own a battery rather than joining the VPP that drove the



interest for these consumers, with 8% stating that the retailer discount was the main reason for being interested in the VPP.

Another driver was 'To have a back-up energy supply' with 65% stating this as one reason and 5% as their main reason. This was especially so in rural areas and South Australia where power outages sometimes caused loss of both power and water. They were aware of needing to have a closed circuit with the battery, so key appliances could run solely off the battery during a grid outage. Some consumers had life support equipment and thought the batteries with their VPP gave security of supply.

One VPP Provider had set up a VPP within a multi-campus educational institution. They had a dual focus on the environment and a wish to operate in the greenest way possible as well as managing limited operational funds and looking for ways to reduce energy consumption and cost. They had been working with an energy consultant for a number of years to install solar panels on all their sites. Keeping a close eye on consumption, they found it actually increased again over time, which became the trigger for investing in a battery. As they have long summer breaks when their consumption reduced their consultant alerted them to the opportunity presented by the VPP concept to utilise this spare capacity and be compensated for it.

More altruistic reasons given included:

- 'Being part of the latest technology and pioneering the energy solution' – This was a reason for 46% with 5% selecting this as their main reason.
- 'Seemed like doing the right thing to do for the country/future'. - This was a reason for 47% with 5% selecting this as their main reason.
- 'Share excess energy' – This was a reason for 29%, with 2% indicating this was their main reason.

Most respondents selected 'saving money' as a reason for being interested in the VPP, making this an important evaluation criteria for the VPP to deliver on.

2.4.2 Barriers

Understanding the barriers to participation can help VPP Providers meet consumer needs and expectations more effectively.

Many consumers felt the need to satisfy themselves on the credentials of the company making the offer, their ethics and their long-term viability prior to agreeing to participate. Other concerns raised were:

- Acquiring the correct assets for their needs. This meant matching the battery and panels to their own consumption patterns. They were worried about over-capitalising and being worse off. Some were taking a stepped approach with future investment in extra panels or batteries planned.
- The financial potential, as they were uncertain about the frequency of VPP events and their future earnings.
- The safety of the system – it was seen that government had a role to regulate to ensure the safety of the equipment.
- The lifetime of the equipment and replacement value at the end of its life.
- The VPP Provider could, or might, use all the energy stored in the battery and not leave anything for the household, and drive up costs as a result.
- The VPP would use their asset – that they invested in and needed to maintain – to profiteer without channelling a fair benefit back to the asset owner.

It is important for VPP Providers to be aware of these consumer concerns and provide the information consumers seek as well as reassurances through their interactions to ensure consumers maintain their participation in the VPP.

2.5 VPP Consumer Needs and Expectations

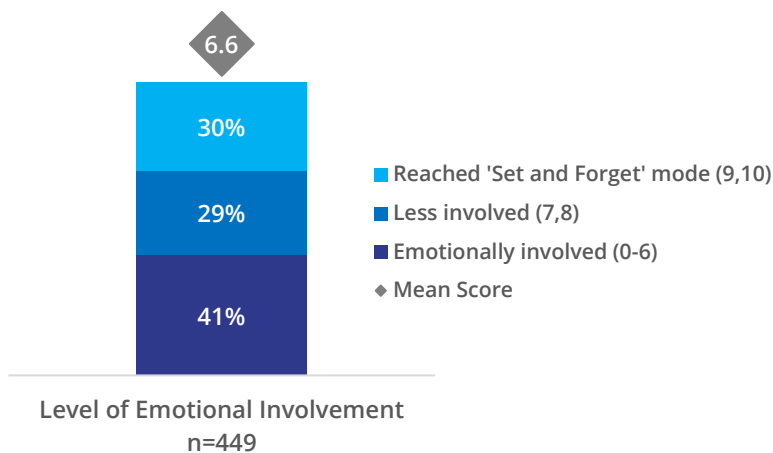
Understanding consumers' needs and expectations can help VPP Providers to meet them more effectively.

In the course of conducting the interviews, it became apparent that the levels of engagement with the VPP varied. Some consumers were highly engaged with their VPP provider, reading up about it on the internet, discussing it with colleagues and friends, drawing as much information as possible from their battery and inverter apps and even drawing up their own spreadsheets to track the performance of the battery, the panels and the VPP. These consumers expressed excitement at being a part of a VPP and optimism about its benefits and potential for other consumers across the country, or indeed the rest of the world. Other consumers were also positive about being part of a VPP but less engaged overall. Some were primarily focused on the monetary benefits of their involvement and/or thought it was "a good thing to do" generally – however, there was much less excitement about the VPP and less involvement in understanding how it worked.

The desires and hopes of consumers tended to polarise either towards their own interests or the interests of others. Those with a greater individual focus mentioned their own interests, especially the financial benefits of being a member of a VPP or their enthusiasm for owning this new technology and being a pioneer in the VPP. Those with a greater community focus were primarily driven to participate by a strong desire to use more green energy and reduce the harm to the planet caused by greenhouse emissions and/or a desire to help stabilise the energy grid ensuring a reliable supply of electricity for others in their area.

In order to measure engagement, respondents who had been with their VPP for more than a year were asked to indicate how involved they remained with the program. After one year, 41% claimed to remain emotionally involved and almost one third (30%) had reached 'set and forget'; mode. – See figure 2.

Figure 2 - Emotional Involvement



Respondents who scored 0 to 6 were considered to be 'Emotionally involved' and were asked their reason why. They indicated that they liked to monitor their usage, to plan the timing of their appliances and to ensure the system was working.

VPP Providers should consider a variety of measures to keep their consumers engaged in their VPP since it becomes difficult to communicate or engage with consumers who disengage. Ongoing validation will be necessary to ensure retention.

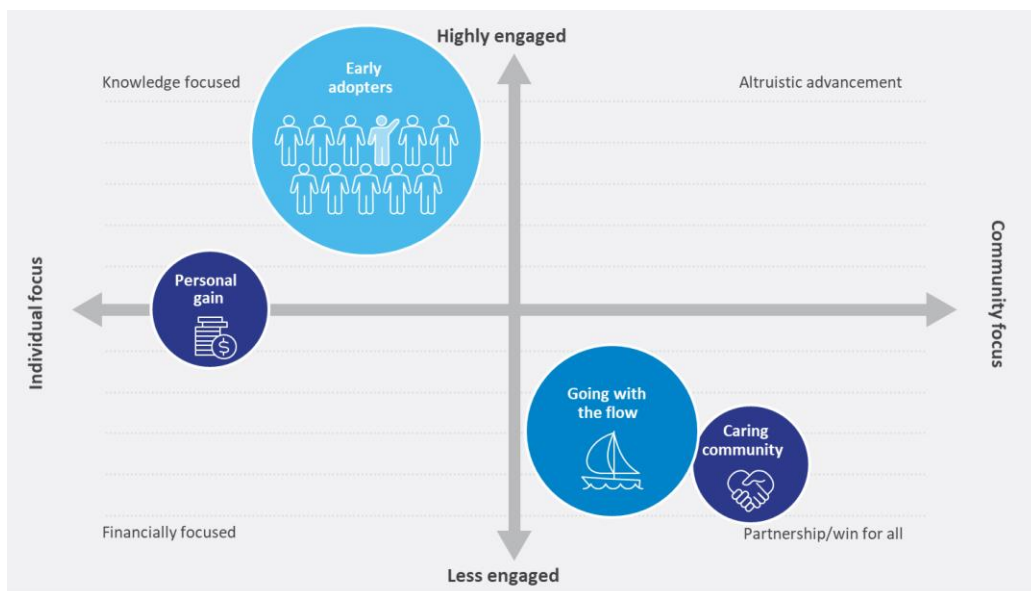
Figure 3 represents the needs of the VPP consumer market and shows two continuums that characterise the different motivations of VPP consumers. The vertical axis relates to the level of engagement of the VPP. The horizontal axis relates to the direction of the consumer's focus with those focused more on their own needs towards the left of the diagram and those more focused on the community towards the right.

Respondents to the second survey were segmented into groups based on their responses to the questions relating to their reasons for being interested in the VPP and their ongoing engagement as demonstrated by whether and how often they used an app to monitor the activity of the battery and also how emotionally engaged they were. - See figure 3. See also Appendix D2 Segmentation.

Four segments were identified, and they are described in detail in the next section.

- Early Adopters (42% of respondents)
- Go with the Flow (30% of respondents)
- Caring Community (16% of respondents)
- Personal Gain (12% of respondents)

Figure 3 - Consumer motivations for joining the VPP program



The four consumer segments based on focus and engagement were:

An understanding of these four segments - their needs, expectations, and drivers for participation, can help VPP decision makers ensure continued participation and growth in the industry overall.

2.5.1 Early Adopter

Early Adopters often had an awareness of the VPP industry and the development of batteries as a potential energy solution and had been following the progress of this technology with interest. Many had a greater than average interest in electricity, renewable energy and the technology surrounding it. In addition, Early Adopters were more likely to converse with friends, family, and colleagues about the technology, sharing information and discussing new developments. These consumers were among the very first to join the Demonstration.

Joining the program was often experienced with a strong degree of excitement. These consumers were driven by a desire to be pioneers in new energy solutions and were very keen to be involved.

“Being part of an experiment and a bigger picture study was very appealing... I am a big fan of Elon Musk and being a part of this battery system excites me. To feel like I’m making a difference, to show the rest of the country we do something weird and funky.” - Early Adopter

This excitement meant that some impatience was often experienced as their batteries and VPP were set up, but this corresponded with a feeling of acceptance if things did not always go to plan – perceived as a consequence of being one of the first.

Being more technologically minded, most understood how their VPP, and batteries worked and had few issues understanding the information in the apps they used. Many of these consumers were so engaged that they drew up their own spreadsheets, inputting information from their apps to track the VPP’s impact. For some, there was a sense of joy in undertaking this analysis, and the system was sometimes described as their ‘toy’. The information gained and their experiences were readily shared with colleagues, friends or family members also interested in this new technology and many Early Adopters became strong advocates for VPPs in general.

“It’s a bit of fun. I’ve convinced friends to do it. I’m a big advocate of doing it.” - Early Adopter

Early Adopters were hungry for even more information about the VPP Demonstration – specifically, they desired big picture information on where the VPP industry is headed, the rate of take-up within Australia and the benefits they and the VPP have passed on.

Early Adopters may drive early uptake of VPP initiatives, but as the industry matures VPP Providers need to develop strategies to attract other segments over time. As uptake increases, less engaged consumers will be harder to reach and will continue to need validation.

2.5.2 Going with the Flow

Going with the Flow consumers tended to be pleased to be a part of the VPP, because they could see the benefits for the environment, the wider community and themselves, but there was a lack of engagement with the VPP. Like Personal Gain, there was an expectation that financial benefits would ensue from participation, but there was not a strong interest in this.

"I feel passive about it. I take it for granted that it is there for the greater good." - Going with the Flow

The decision to join a VPP tended to have been done in conjunction with another – either a partner with a strong desire to participate or a housing authority offering to pay for the hardware.

As a result of this lack of engagement, there was less interest in understanding how the VPP worked or in its specific benefits. There was only sporadic interest in, or understanding of, information on the app and a lack of interest in changing energy consumption behaviour.

"I have the app and I have the intention to monitor it, but I just don't. There's nothing going wrong and there are other things to do." - Going with the Flow

Going with the Flow were happy to be part of the VPP and had a good feeling about having signed up. As long as they did not experience issues, they were likely to remain content with the VPP.

VPP Providers could improve interest and engagement with Going with the Flow consumers 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.

2.5.3 Caring Community

Like Early Adopters, Caring Community consumers had a sense of excitement about being involved in this new energy solution, although the drivers for participation leaned more strongly towards helping the planet, demonstrating to the government that consumers want to move away from coal fired power, helping others in the community to use more green energy or have cheaper energy, stabilising the grid for other Australians and supporting local industry involved in solar panels, inverters and batteries.

“As a consumer doing your bit not just for yourself but for the wise energy use for the state ... we are in a position where we can afford these things, a way of helping out that way, and also send a message that there are people who are prepared to spend money because the environment is important, and development of renewable energy is important because we need to do our bit to save the world.” - Caring Community

“If you take away the confusion, knowing you’re part of something bigger. The initiative is there to reduce the load and share the load, so we don’t burn out our power plants. In South Australia we have power outages every summer, sometimes it is an hour or a day. It’s always when it’s hottest. Knowing I’m there to mitigate it, I can rest easy, knowing I’ve done my bit.” - Caring Community

Caring Community consumers were drawn to the VPP by the expectation of being able to use more green power and therefore “do their bit” for the environment. Some were also initially attracted to the concept of VPPs by the idea of being able to share their excess solar energy with others in the community or not for profit organisations.

The decision to participate in the VPP was largely emotionally driven and in many cases, Caring Community consumers were less likely than other segments to undertake research before committing.

Sometimes Caring Community consumers were less technically minded and, as a consequence, some struggled to understand how their batteries worked, how the VPP worked and what the information on their app was telling them. Some followed up with energy providers or their battery supplier seeking more information, but sometimes found that that this material was not forthcoming. Despite this, there was still a feeling of excitement of being a part of the VPP and, in the face of a lack of information, there was a feeling of trust that the system was working as it should be.

Some apps presented information on the amount of CO₂ that had been reduced or the equivalent of the number of trees planted by their efforts, and this information tended to delight these consumers. Other information that these consumers strongly desired included an understanding of how their excess energy was used, who benefited and how the power system was stabilised.

As VPP deployments continue, VPP Providers and retailers should define and provide the information that the different consumer segments desire – for example, providing in-app help and updates targeted to consumers’ information needs.

Attracting more Caring Community consumers will require 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 segments.

2.5.4 Personal Gain

Personal Gain consumers expressed a feeling of satisfaction at having become involved in an initiative that would give them more control over their energy consumption, reduce their energy bills and allow them to recoup their return on investment within a defined number of years. Motivation for joining the VPP was strongly driven by significant subsidies on batteries, attractive financial offers from VPP Providers and the expectation of being able to use more free solar power during the day or the evening.

"The cost of a battery was AUD \$12K. We thought the return on investment (ROI) would never pay for itself. We wanted to do it, but it was too expensive. Then last year, the South Australian Government said: 'We'll fund private residences and public housing.' I put my name down, then I went through paperwork and cost, and I worked out on cost and what we could have. I thought it would be a good investment, so we said we'd go ahead." - Personal Gain

Some Personal Gain consumers had previously experienced large power bills through circumstances that were beyond their control. Some for instance, lived in rural properties where the water was pumped by electricity; some owned large houses and/or had swimming pools with power-hungry water pumps. One consumer interviewed owned an Airbnb where guests used the air-conditioning and heating liberally. Others had solar panels and could not experience the benefits of that energy when they were at work all day. As a result, some of these consumers thought that their power bills were exceptionally high.

Personal Gain consumers also tended to be savvy with finances and went to some trouble to ensure they were educated about the financial side of the VPP. There was an awareness of how much money had been spent, how to time their own energy use for maximum advantage and how long it would take to generate a return on investment. Some had an awareness of the wholesale energy market and lamented that they were not being paid enough for their exports when compared with the prices on the market.

"Electricity is traded on the wholesale market - VPPs are all about money. My research has shown that. They sell it back to the grid at a peak price." - Personal Gain

Control over their energy was important to some of these consumers, and thus some disliked having energy removed from their battery without notice. Others desired more control over the source of power their homes used and when (i.e., solar panels, battery or grid power). At this stage however, frustration over this lack of control was compensated by adequate financial returns.

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

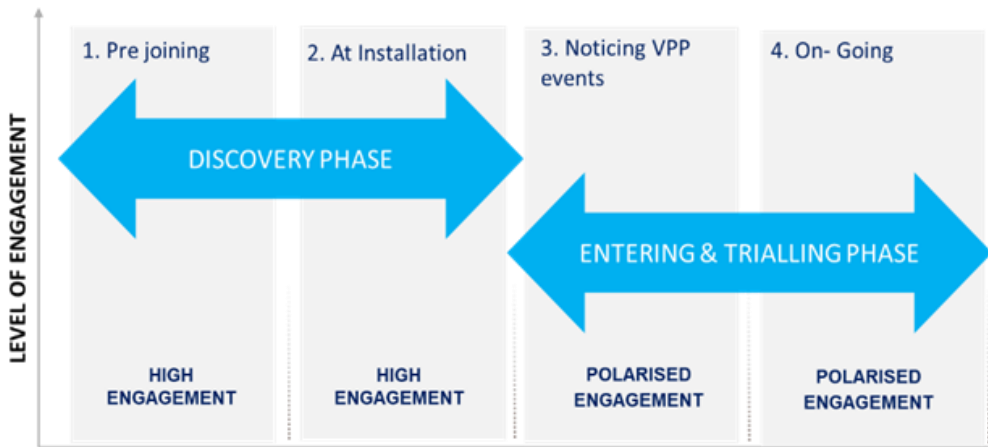
2.6 VPP Journeys

This section details the journey towards becoming a member of a VPP and shows how levels of engagement may shift depending on the particular stage, and the consumer. In general, the journey consists of four primary stages as outlined in figure 4.

- Pre-joining
- At installation
- Noticing VPP events
- Ongoing

The first two stages were characterised by high engagement as the consumer was learning about a new concept and making decisions. Engagement became more polarised in the latter two stages as consumers sought validation according to their interests, with some checking their apps several times a day and others moving towards a set and forget mode and perhaps only checking monthly or quarterly statements. At this stage consumers needed information and feedback that would validate their reasons for joining.

Figure 4 - The consumer journey to VPP



For VPP Providers, understanding how to increase engagement on an ongoing basis will help with consumer retention. Different messages will be required at different stages for the various segments to ensure engagement is not polarised, with some consumers valuing the experience and others feeling disappointed.

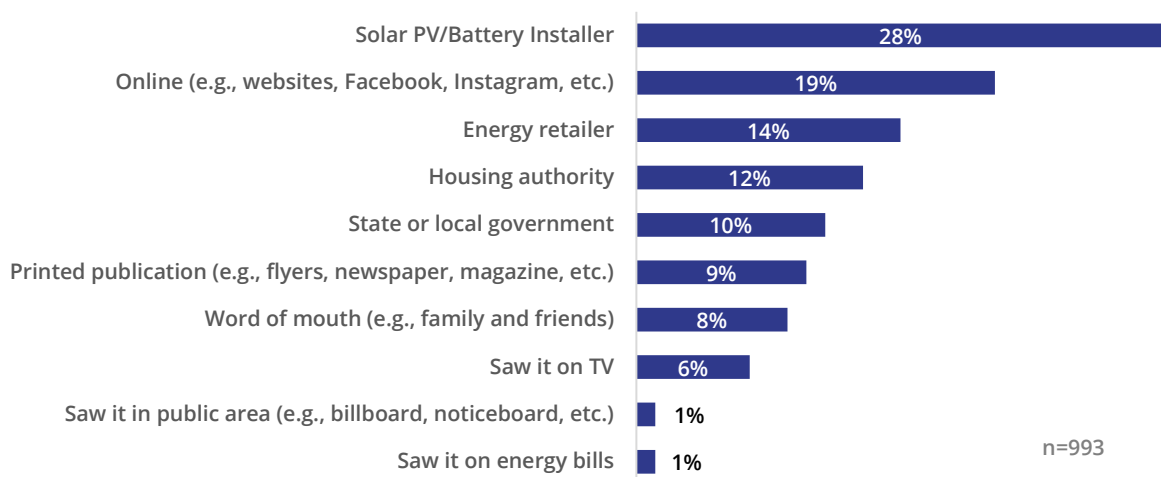
2.6.1 The Pre-joining Phase

The pre-joining phase is the stage where the consumer first learns about the VPP and conducts research to determine if it will be a good option for them. The types of information sources consumers mentioned during the interviews were:

- Reading articles about it in the news media
- Learning about it through industry contacts (either through work or friends and family employed in the industry)
- Social media
- Learning about it from a battery retailer when investigating batteries
- Being approached by a solar panel/battery retailer or manufacturer

Figure 5 quantifies the sources from which respondents to the first quantitative survey heard about the VPP program. Respondents were able to select multiple options.

Figure 5 - Sources of Information



Most were inspired by the concept as it was initially described to them – attaining a battery at a discount price, being able to utilise their solar power when the sun was not shining and being able to share excess power with others and/or sell it back to the grid. Some thought the initial idea was too good to be true, but were inspired to investigate further, searching on the internet, using Google, or speaking to friends or colleagues, their battery provider or energy retailer.

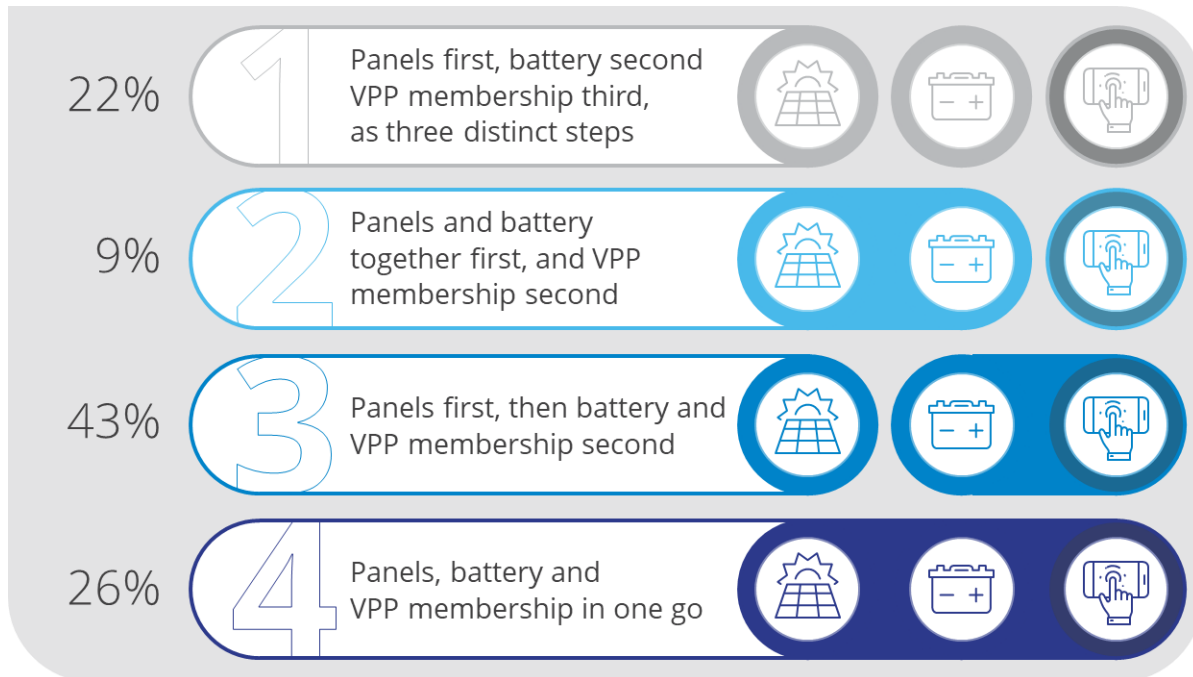
At this stage, engagement with the VPP initiative was high. Consumers were excited about the possibilities of this technology to address climate change issues, save them money and stabilise the grid. Among some, there was a sense that access to this technology was limited, and they would have to be lucky to be selected to participate in the VPP Demonstration.

“I got an email saying I had been chosen and I felt like I had won Lotto.” - Personal Gain

2.6.2 The Installation Phase

The installation phase involved signing up for the VPP and then organising relevant bodies to install the hardware (e.g., solar panels, battery, smart meter). There were four different pathways to joining:

Figure 6 - Pathways to joining the VPP



Pathways One and Two had prior experience with solar panels and batteries before joining the VPP. Together they represented almost one third of respondents. In the interviews some indicated they fully owned their assets and were free to leave if the VPP did not meet their expectations. They saw it as worthwhile experiment.

It is worth noting that people who brought their own equipment to the initiative were not tied to a purchase agreement and felt they could disengage from the VPP at any time. The VPP Provider needs to deliver on the promised level of savings or other benefits to ensure their retention. It should also be noted that the reverse is true: the VPP can terminate if it turns out the battery is not performing, or the household is using more power than expected and not able to contribute to the stability of the power network.

Pathway Three represented just under half (43%) of respondents and pathway Four represented just over one quarter (26%). They acquired their battery as part of joining the VPP. Over half of these two groups had signed contracts linking a substantial discount on the battery and/or panels to remaining in the VPP for up to five years.

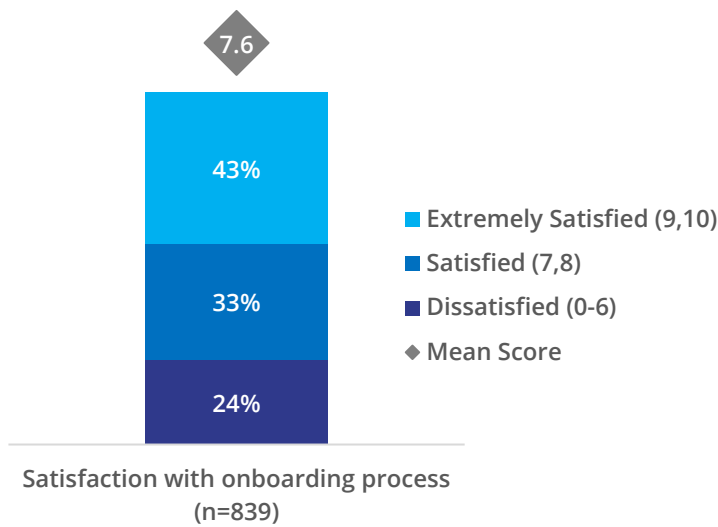
Approaching suitable households without assets (panels or batteries) and bundling the assets with VPP membership is an effective strategy for VPP Providers to drive early uptake.

For many, installation was a stress-free and seamless process, whereby installers arrived at an agreed time, installed the relevant equipment, and then showed consumers how the battery and app worked. Early Adopters tended to be excited about the VPP and were easily frustrated with delays in the set-up, although most had equipment installed within a period of a few weeks.

“Manuals were provided, information sheets, a reasonable supply of information. You could immerse yourself in the how-to manuals. I read about it and then there were communications coming from [energy retailer], an article in the press, an invitation for people to contact [energy retailer] to learn more. It was quite straightforward from then, a great team of people at [energy retailer], I had quite a bit of contact with them, visits from them. It was an enjoyable time” - Early Adopter

Figure 7 shows Satisfaction with the onboarding process. Total Satisfaction, meaning the proportion of respondents rating 7 to 10 out of 10, was 76%. Close to half (43%) indicated they were Extremely satisfied (rating 9 or 10 out of 10). The mean score of 7.6 indicates Overall Satisfaction was high.

Figure 7 - Satisfaction with onboarding process



In the first quantitative survey, respondents were asked to rate various attributes regarding the sign on process and onboarding processes and all delivered high mean scores (above 7.5 out of 10).

Occasionally some interviewees reported particular challenges during the installation process, such as having to have staff from three different organisations present at the same time (i.e. smart meter installer, battery installer, solar panel installer) or delays of several weeks in being able to get hardware installed, especially in country areas. In the first survey, 13% of respondents reported having four or more contacts with the VPP Provider during the sign up and onboarding phase and another 13% had at least three contacts.

For most, engagement and even excitement with the VPP continued through the installation phase and consumers were keen to begin experiencing the anticipated benefits.

“It took one month from enquiry in the system to getting it installed with the app.... I was excited.” Caring Community

In future VPP deployments, further consideration should be given to educating consumers on how the battery and VPP system works and also on use of the app and how to understand the data it shows.

2.6.3 Assessing the VPP

Once consumers had all relevant hardware installed, they were able to begin assessing the VPP and its benefits. Most checked the battery and information on the app, sometimes several times a day, in order to understand what was happening with solar panels, battery and the VPP.

Some, however, especially Caring Community, Going with the Flow and a few Personal Gain consumers struggled to understand how well the VPP was working for them. Some experienced a delay between having their battery installed and being signed onto the VPP, lacking any sign or confirmation that they were already part of the VPP. Others could not understand the information in the app, could not find any information pertaining to the VPP in their apps, nor any information pertaining to the VPP on their electricity bills. Some did call their energy provider, but sometimes found that the customer service person they spoke to knew nothing about the VPP and could not assist them. In this information vacuum, some of these consumers responded by disengaging a little from the VPP. In most cases bills had reduced and the VPP did not seem to be causing any issues, so they trusted the VPP to be beneficial, although they were not sure how.

"I can just take it for granted that it is for the greater good. I don't know what they offer, and I don't understand any of it. It's not really any different to my previous supplier. I just pay the bills." - Going with the Flow

In the qualitative stream two interviewees reported an increase in cost. Both consumers entered their VPP Programs in good faith expecting that their VPP would have a positive effect on their electricity bills – however, they lost a substantial discount available for Concession Card holders with their previous retailer. These consumers have since worked out an acceptable payment arrangement with their energy retailer but were badly disillusioned by their initial VPP experience.

The industry should consider a form of consumer protection or guarantee to ensure consumers are no worse off for joining a VPP.

For the rest of the consumers, while specific VPP financial information was difficult to access at this stage on both apps and bills, most experienced a decrease in their energy bills and at times this decrease was significant.

"I am in \$41 credit, as of today!" - Early Adopter

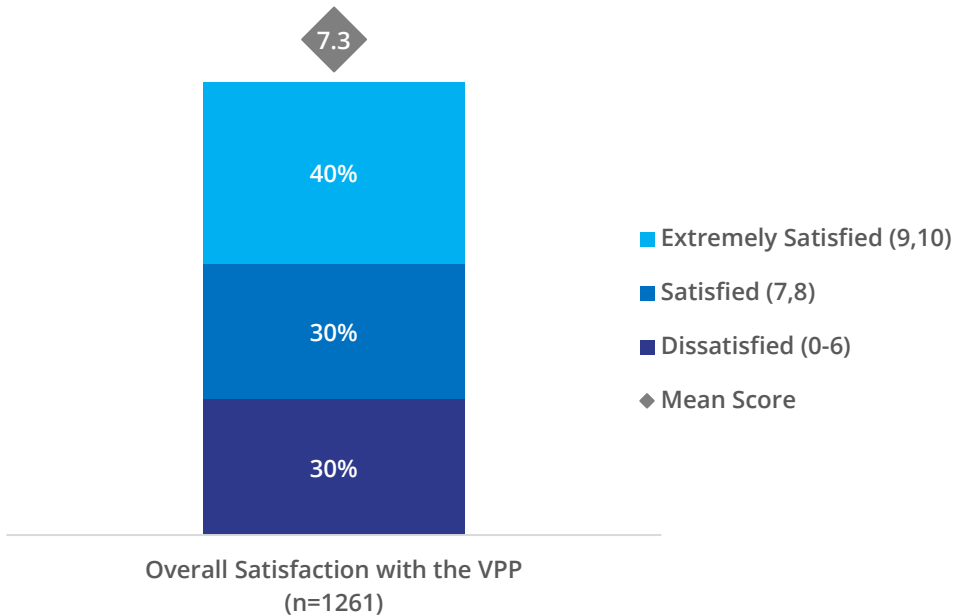
"My bills have reduced from \$1,000-\$1,200 per quarter to \$15-\$100 per quarter!" - Personal Gain

Consumers who experienced a marked decrease in their power bills as a result of VPP participation were delighted with the VPP. The benefits that were more difficult to assess related to environmental or community benefits, however there was widespread faith that the VPP was delivering on these.

In assessing the VPP, a lack of relevant information reduced engagement levels for some. This can be rectified by ensuring that relevant information is available to all consumers through call centres, websites, apps and bills or scheduled messaging.

Despite a lack of information experienced by some consumers, most experienced a reduction in the energy bills and so most respondents remained positive about their VPP with 70% total satisfaction (rating 7 to 10 out of 10) in the second survey. – See figure 8 below (and also Figure 32 - Overall Satisfaction in Appendix D.3).

Figure 8 - Overall Satisfaction with the VPP



Respondents were asked to comment on the reason for their score. A total of 1039 open ended responses were coded by theme. A large proportion 443, representing 42% of all respondents who made a comment expressed a generally positive sentiment, while 333, representing 32% of respondents specifically cited financial benefits as reasons for giving a high score.

Examples of generally positive sentiment:

“As a system it works great.” - Early Adopter

“Happy with the program.” - Early Adopter

“No issues and all is working well.” - Early Adopter

The main reason for expressing dissatisfaction cited by 196 respondents who scored 0 to 6 out of 10, representing 19% of all comments, was that the financial benefits did not meet the expectations they had when they signed up. Some had been promised savings that did not come to fruition, and some had to change retailers and lost previously advantageous terms or saw any savings eroded by new charges. In some cases, the bills post VPP had actually increased.

A sense of a loss of control was observed by 148, representing 14% of respondents. In some instances, loss of control was not a reason for a low rating, it was more an observation, but for others it was in connection to the VPP discharging and charging at unexpected or unsuitable times from the consumers perspective and potentially causing increased costs to the household.



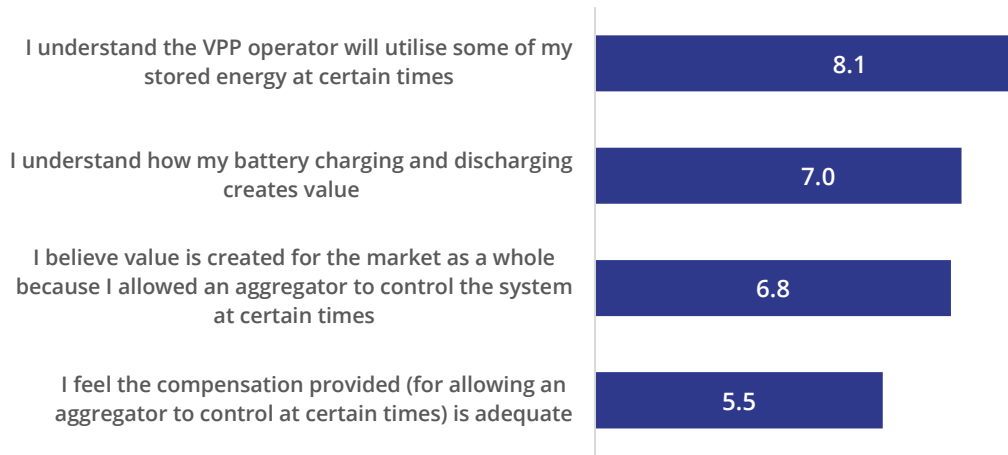
This section explores consumer understanding of how the VPP works and how they saw the benefits of the VPP and whether their expectations were met.

The Cutler Merz report on Social Licence for Control of Distributed Energy Resources report (CutlerMerz Pty Ltd, 2020)⁴ indicates “that to maintain a social licence the consumer must have trust that the algorithm is likely to operate in their best interests”.

In figure 9, levels of agreement with the statement ‘I understand the VPP operator will utilise some of my stored energy at certain times’ was high with a mean score of 8.1 out of 10, but the value perception of allowing an aggregator to control the system’ was low , with a mean score of 6.8 out of 10, as was agreement with ‘the compensation provided is adequate’ with a mean score of 5.5 out of 10.

Figure 9 - Understanding how the VPP works

How much do you agree or disagree with each of the following statements?



Scale 0-10: 0-Strongly Disagree 10- Strongly Agree

⁴ Social Licence for Control of Distributed Energy Resources

Respondents were asked how they assessed the value of the VPP-connected battery versus a stand-alone battery. – See figure 10. Overall, 42% of respondents saw the VPP connected battery as creating more value than a stand-alone battery, while over one third (36%) said they had never thought about it.

In figure 11, almost one in five (19%) thought the household benefited more while 29% thought the grid benefited more.

Figure 10 - Value from the VPP

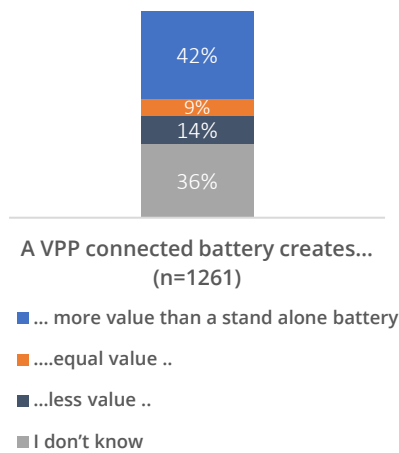
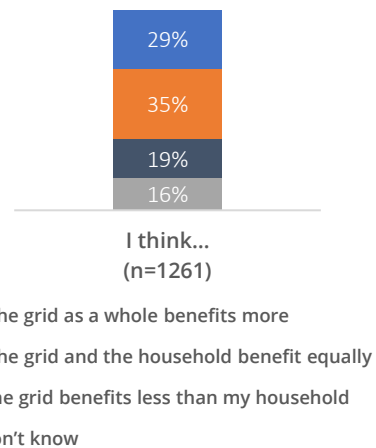


Figure 11 - Who benefits most from the VPP



Figures may not add to 100% due to rounding.

There is a need for VPP Providers to reinforce the benefits of the VPP as over half (58%) either lack awareness of the value generated or do not see the VPP connected battery as generating more value.

In figure 12, respondents were asked how the value they received met with their expectations. Over half (62%) felt the value met or exceeded expectations while just over one quarter, 27%, indicated the value was below expectations. Those who selected the 'Other' option indicated it was too early to tell or they didn't have visibility of the value from the VPP.

Figure 12 - Expectations of value from the VPP

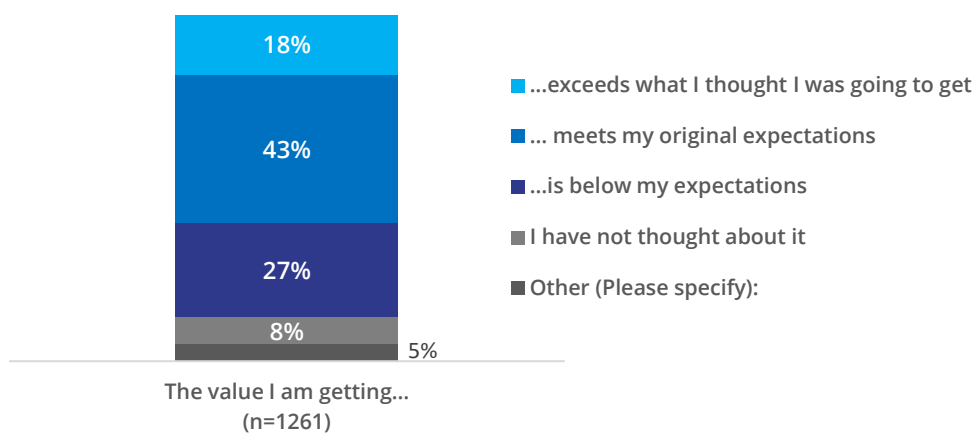


Figure may not add to 100% due to rounding.

VPP Providers with consumers whose expectations were not being met need to address their concerns (mainly financial) to ensure retention.



2.6.4 Ongoing Phase

The ongoing phase is where consumers had been a part of the Demonstration for a year or longer and understood how the VPP system worked, how to optimise their energy usage, and trusted that the system was working as they expected it to and consulted the information in their apps much less often.

Many of the consumers canvassed in this study had only recently joined the VPP Demonstration and had not yet moved into the Ongoing Phase.*

"I allow the system to work as it has been installed. I use the power generated, it feeds the house, if there's excess it goes into the battery and if that's full it goes out to the grid. I use the system as it was set up and I don't really check up on it very much anymore." - Early Adopter

There was a sense of confidence in the VPP and the benefits it was delivering, a feeling that expectations had been met, and plans to either continue being a part of the VPP and in some cases, even expanding solar panels and/or battery capacity in order to experience even greater benefits.

The ongoing phase gives consumers a time to reflect on their decisions and if it was worth it.

The educational institution was still at an early stage of their journey, but they indicated that they were proud to be the first to commercialise their batteries and hoped to see this concept expanded across other institutions.

*See Appendix D.3.1 Figure 31 - Length of time in VPP – 66% of respondents to the second survey had been with their VPP for less than a year.

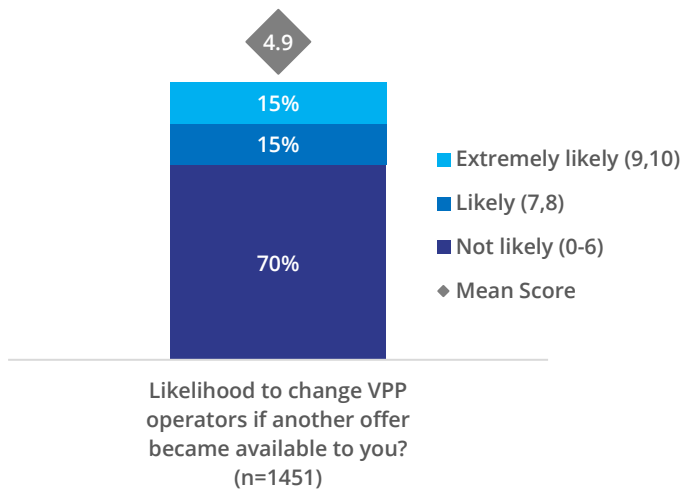
In the ongoing phase it is important for VPP Providers to ensure consumers remain in the VPP.



In figure 13 consumers were asked how likely they would be to change VPP operators if another offer became available to them. The majority (70%) indicated they were Not likely to change (scoring 0-6 out of 10) though the balance (30%) was evenly split between Likely (scoring 7,8 out of 10) and Extremely likely (scoring 9,10 out of 10).

A review of the reasons for wanting to change indicated that these were mostly Dissatisfied consumers (scoring 0-6 out of 10 for Overall Satisfaction), who had not had their expectations (mainly of savings) met, as well as some who indicated they would always be open to a better offer.

Figure 13 - Likelihood to change VPP operators



Most consumers were happy to let VPPs utilise their assets in return for the advantages they perceived of being in the VPP. Consumers who felt they were not getting what they expected (in terms of savings or other benefits) were in danger of exiting the arrangement.

2.6.5 Change in Habits

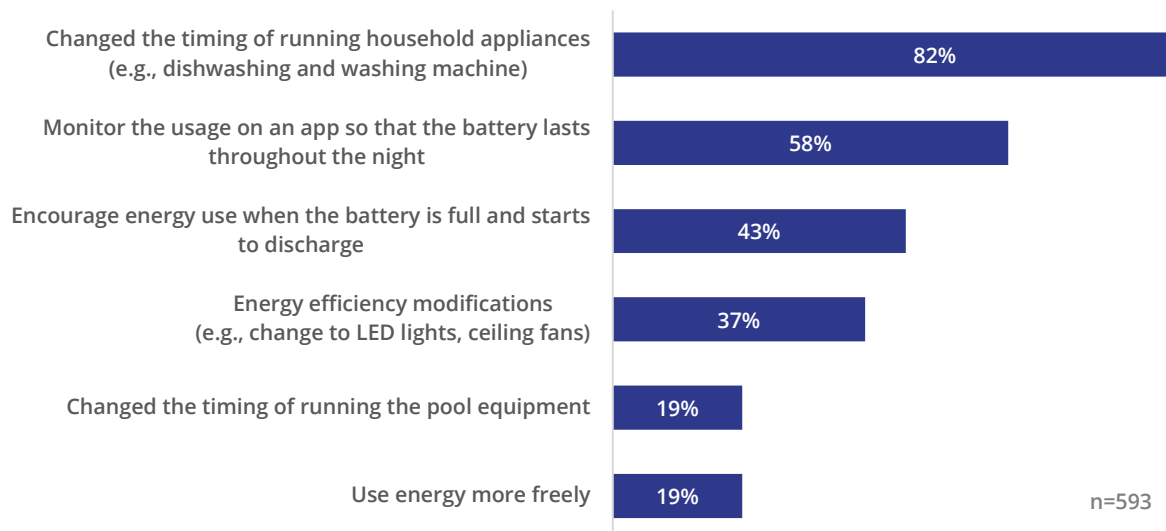
Any change in consumer energy usage habits should be of interest to VPP providers, as this will directly affect the operation of the VPP and how much energy is available to the grid. There is also an opportunity to leverage consumers' natural desire to maximise the value of their battery – to minimise costs and environmental impact.

In the interviews most consumers indicated they changed their habits as a result of installing solar panels, focusing on running appliances during the day. Then once they installed a battery and joined the VPP, they shifted the timing of appliances to later in the day to allow the battery to charge first. Some used the apps to help them identify inefficient appliances and planned to use them less often or purchase more efficient options in the future.

Just under half indicated that they had made changes since joining the VPP. Of those who made changes, the largest proportion (82%) indicated they changed the timing of running appliances. - See figure 14. Anecdotally, respondents in the qualitative stream also indicated that working from home or being at home more as a result of COVID has made this easier to manage.

Many consumers who owned a battery before joining the VPP had already changed habits and the VPP itself did not inspire further changes.

Figure 14 - Changes in electricity use since joining the VPP

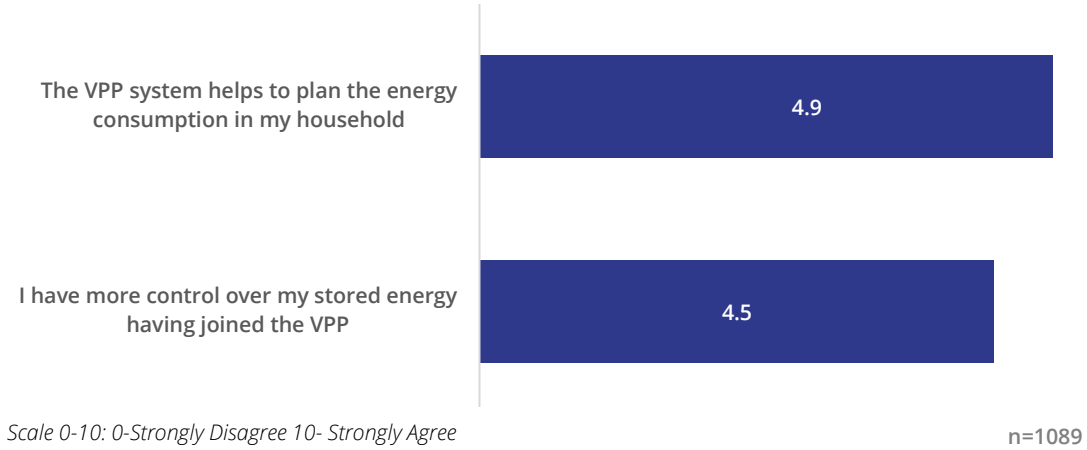


Almost one fifth (19%) indicated they used energy more freely. In the interviews some indicated their retailer charged them a fixed monthly fee regardless of their usage and so they were relaxed about the cost of energy use. Others indicated they knew their panels generated more than they could ever use and so they felt they could use energy more freely.



In figure 15 respondents were asked if the VPP assisted them to control their stored energy and if it helped to plan energy consumption in the household. The mean scores for both questions were low (below 6 out of 10) indicating that they understood that the VPP meant they had less control.

Figure 15 - How much do you agree or disagree with each of the following statements about the VPP?



Respondents understood that they did not have control over their stored energy, but this was not considered a problem as they appreciated the value potential of the VPP.

2.7 Consumers use of apps to interact with the VPP

AEMO did not require VPP Providers to supply an app, but those consumers with access to an app found it key to their experience. As well as enabling them to check on the battery and see energy from panels and the grid, the app represents an opportunity for VPP Providers to communicate with consumers, reinforcing the benefits of participation, thereby leading to enhanced satisfaction and retention.

Over half of the respondents to the second survey (56%) indicated they monitored the impact of VPP events on savings.

Almost two thirds (63%) of those that monitored the impact of the VPP events indicated they use one or multiple apps.

The apps available to consumers might have been provided by the battery manufacturer, the solar panel inverter manufacturer, the VPP Provider or the energy retailer. See Appendix D.4 Figure 36 - Monitoring the Impact of VPP events to Figure 42 - What are your reasons for checking the App?

Consumers received a lot of value from these apps as they provided them with information and education about the VPP. As such the app represents an opportunity for VPP Providers to keep their consumers engaged.

Over time some consumers indicate they monitored their apps less often as they were now more confident in the benefit of being in the VPP. People with flat fees were also less likely to scrutinise their statements adopting a set and forget mentality.

One interviewee who represented an educational institution used multiple apps and monitoring platforms and dedicated resources (staff) to monitor their own usage.

2.8 Perceptions of the VPP – including personification

Respondents expressed hope that the VPP would have a positive impact on their lives, the community and environment.

A personification exercise asked consumers to describe the VPP as a person to explore their relationship with the VPP. Some described it as warm-hearted, reliable, supportive but not quite having attained its potential. *"A middle manager waiting for their time to come"*, or *"A child that needs to be watched and taught to perform"* or *"An acquaintance who will become a lifelong friend."* These consumers have invested emotionally and hope for the VPP to be successful.

There were also some descriptions indicating a more distant "low maintenance" relationship such as *"Facebook friend"* or *"I would not invite it for dinner, but I greatly appreciate its work."* This reflected a more set and forget mentality.

Comments describing the impact of the VPP in their life indicated an overall positive impact ranging from *"Helping us financially"* to *"Improving quality of life as I am not worried about running the air conditioning"* and *"It has helped me budget more accurately"*. Other positive sentiments were *"Feeling part of the solution"* to *"Dealing with our climate emergency"* and *"Beneficial to my wellbeing"* and *"Allows me to get on with my day."*

A minority found the VPP demanded more attention than expected. Some indicated that there were some demands with the VPP, such as monitoring *"We check on it constantly"* or *"It keeps in contact with status updates"*, others indicated that it was *"Meeting expectations"* or hope that it will live up to expectations: *"Made promises I hope it will live up to."*

For most, feelings towards the VPP were positive: *"Happy to contribute to sustainable energy solutions"*; *"Glad to get cheaper energy and give back to the grid"*; *"Reassured"*; *"Calm"*, *"Content"*; *"Joy of cheaper bills"* and *"Secure energy"*.

Most respondents expressed interest in seeing how the trials were going and hope that VPPs would play an important role in Australia's energy future. Reporting back on the results of these trials will be important to consumer retention and satisfaction, and positive sentiments could be leveraged in future campaigns to attract consumers by VPP Providers.

3 Improving VPP consumer experiences

3.1 Understanding of the VPP offer

The early stages of discovering the VPP and signing on are critical touchpoints for setting up expectations and shaping the overall consumer journey and perceptions of the program.

In the second quantitative survey respondents were asked if they were 'Satisfied with their understanding of the VPP offer'. The mean score as shown in figure 16 indicate a moderate level of satisfaction (7.1 out of 10). Those who scored 0 to 6 (Dissatisfied) wanted more transparency around the offer, more clarity on who does what and a better understanding of the information in the app.

Opportunities exist to strengthen and capitalise on the consumers' positive expectations of the VPP concept, including further education about VPPs and the results of trial programs.

Figure 16 - Satisfaction with understanding of the VPP offer

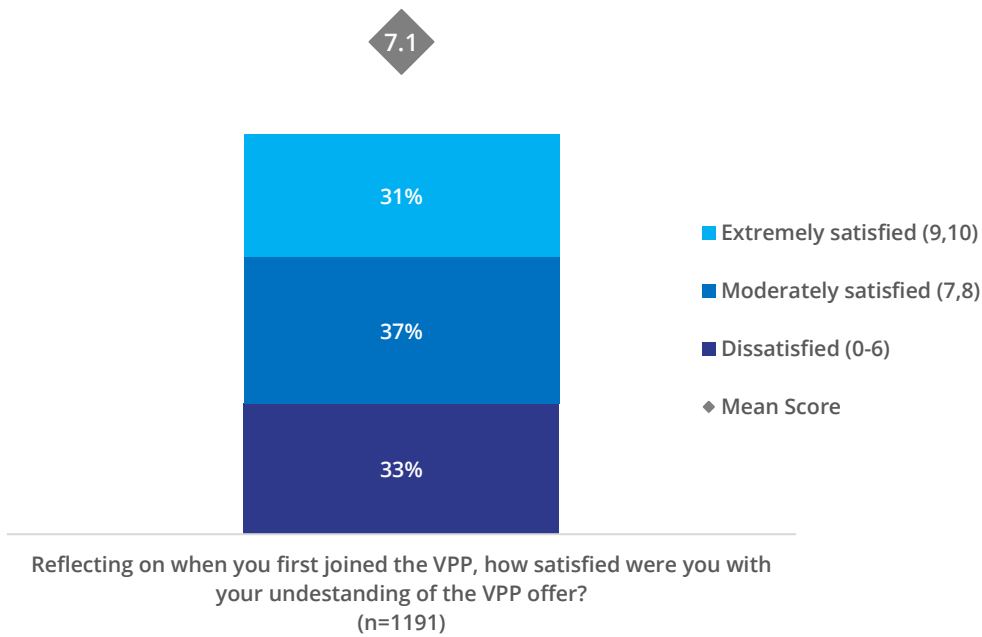


Figure does not add to 100% due to rounding.

3.2 Challenges with the VPP

3.2.1 The VPP not working as the consumers expected

Respondents to the second quantitative survey were asked if they had any specific challenges with their VPP. - See figure 17.

Forty four percent indicated they were aware of the system accessing grid power when there was still power in the battery. While this is a normal part of the orchestration, this was not readily understood.

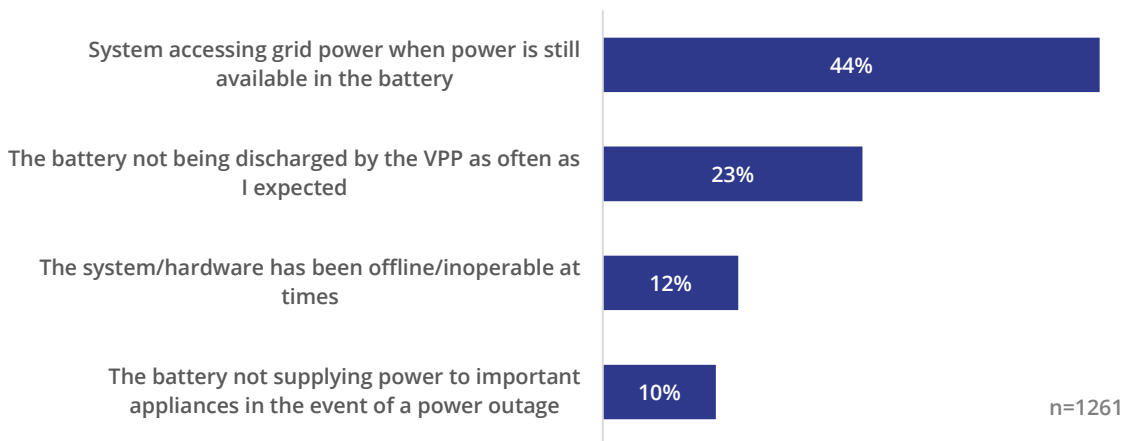
Just over one in five (23%) indicated their VPP was not as active in terms of discharging the battery as they had expected.

Consumers would benefit from having clear information on the frequency, type and timing of normal VPP operations.

One in ten (10%) commented that the battery did not supply power to important appliances in a power outage.

Almost two thirds (65%) of respondents had indicated one their reasons for joining were to enjoy a back-up power supply. It is important these expectations are managed in the onboarding phase. An option to ensure the battery is installed in such a way that it continues to provide power during an outage should be a part of the sign-up process.

Figure 17 - Have you experienced any of the following while you have been part of the VPP?

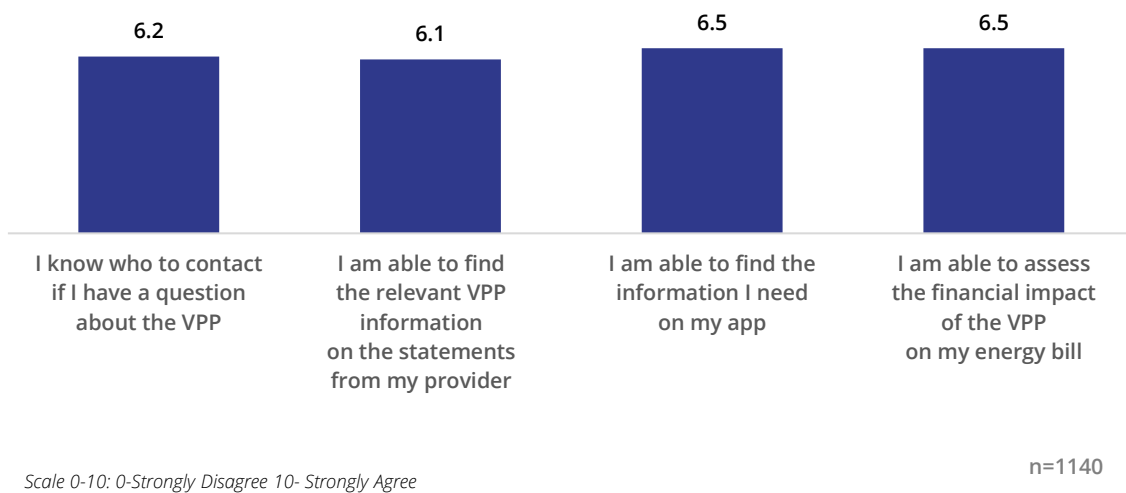


3.2.2 Consumers unable to find the information they need

Consumers were asked their agreement with a number of statements on whether they were able to find the information they needed, and levels of agreement were low with mean scores from 6.1 to 6.5. - See figure 18.

VPP Providers should note that consumers lack the necessary information to help them assess the benefits of the VPP or where to channel an enquiry about the VPP. Over time this could lead to disengagement and dissatisfaction.

Figure 18 - How much do you agree or disagree with each of the following statements regarding information about the VPP?



3.2.3 Consumers left their VPP due to increased cost

Fifty-three respondents to the second survey indicated they were no longer using the VPP. Of those fifty-three over half (58%) had stopped within three months and another 23% had stopped within 6 months of starting. These consumers were quick to act when they found the VPP was not meeting their expectations.

Respondents were asked for a reason why they left and most indicated that they received higher bills after joining, while some indicated the VPP was never installed or connected and a few who had been with their VPP for 12 months indicated that their contract had expired and was not renewed.

"The algorithms? Didn't work for me. It was too expensive to stay with the VPP."

Ongoing participation by consumers is not guaranteed and consumers who are not tied into the VPP with a contract may be quick to opt out, reinforcing the need for VPP Providers to ensure consumers have easy access to information reinforcing all the benefits generated by the VPP.

3.3 Consumer Questions

Perhaps due to the newness of the industry, when prompted during the qualitative research, consumers still had unresolved questions. Some indicated their questions could not be easily answered by calling the electricity provider. The customer service staff sometimes did not know the answers and thus many used a web search. In some cases, their questions were specific to their circumstances, and they were unable to find the answers they sought. The types of questions consumers had come under a number of headings:

- Battery
- App
- Energy providers
- How the VPP works
- VPP events and power outages
- Bigger picture questions about the VPP Demonstration and the future of VPPs

Questions about the Battery:

How long does it last? Will VPP events affect battery life? How does VPP access the battery? Do I have to clean my battery and solar panels? How will use of my battery change over time?

Questions about the App:

Can someone explain what the numbers mean? When will the new app be released? How to use the app, what do I need to look at?

Questions about Energy Providers:

How can I compare offers from different suppliers? Why won't my electricity provider credit me each month? How much money are they making from the VPP? Why is it difficult to get hold of someone to answer my questions? Does it matter if I switch energy providers while I am in the VPP?

Questions about how the VPP works:

Who exactly does the VPP benefit? How does my system contribute to the overall goal? How do you decide how power flows in or out of my system? How do I get maximum value from the VPP? How much do you sell my power for? Do I receive a higher rate for my power during peak periods? Why am I not making money from the VPP when others are? Why has the VPP not taken any of my battery power? What kind of savings could I potentially get? How do I get out of the VPP?

Consumers desire more information from their VPP Provider, and it is important that this is made easily accessible. There is an opportunity for VPP Providers to upskill customer service staff so they can address consumer questions about the VPP or to channel access to knowledge experts for support to consumers. In-app help and updates targeted to consumers' information needs could also help answer specific questions.

3.4 Future directions for VPPs

Some consumers indicated that the VPP could be more financially advantageous and expressed the wish to have more control over who benefits from their asset. A few also wanted to see the VPP extended to include more households, for instance, investment properties and unit blocks and also businesses and public service buildings.

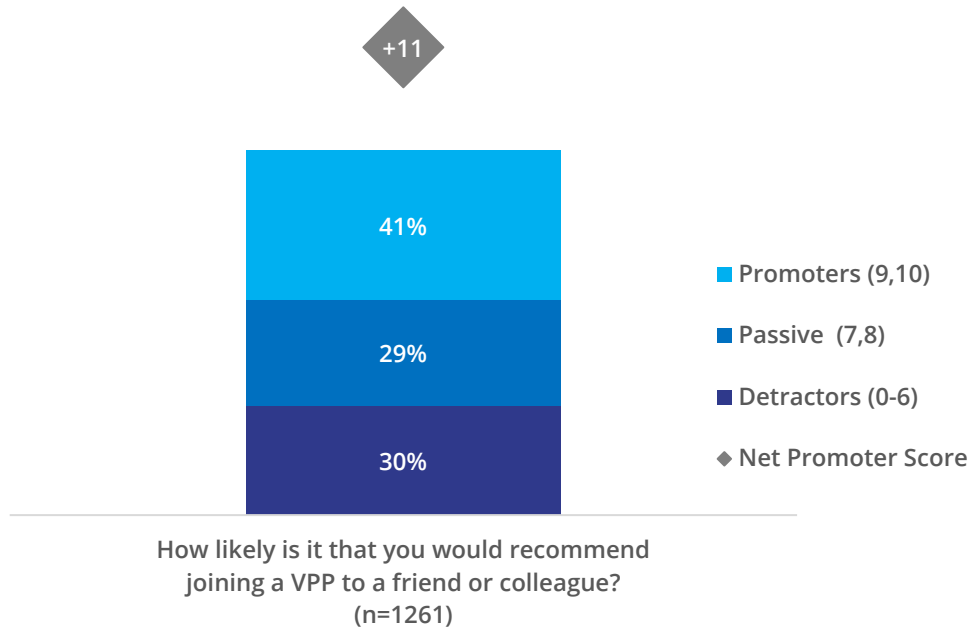
Suggestions for the VPP as it moves into the growth phase included:

- More financially advantageous times for discharging/charging the battery to achieve better revenue or lower costs for the consumer.
- More control over charge/discharge times.
- A better (more efficient) solar panel design.
- A shared servicing arrangement to clean panels and service the battery.
- A single program for the state/region to achieve economies of scale.
- Program to be extended to businesses via rebates and incentives.
- A localised VPP for the local community.
- More batteries, such as one for the home and one for the VPP.
- Include the public built environment – hospitals, utilities, councils, schools.
- Smart appliances that tie in with the weather forecast.
- Being able to nominate who receives your excess energy.
- All new buildings to have solar panels.

All of this should not negate the fact that most consumers thought the VPP program was impressive. There was a desire to see it extended across Australia to encompass more consumers, especially those who may not be able to afford the outlay for solar panels and batteries. Many respondents commented that more needed to be done about our reliance on fossil fuels for energy and that Australian consumers had to lead by demanding cleaner energy. Some saw the VPP as a revolution (environmental, social, political) that will gain momentum to put ‘power’ in the hands of community and consumers. Even among consumers who might find this sentiment too political or revolutionary, there was a sense that it is a positive initiative with the potential to provide wins for everyone involved.

Accordingly, the Likelihood to recommend measures remained positive with 41% of respondents in the second quantitative survey classed as Promoters. - See figure 19.

Figure 19 - Likelihood to recommend and NPS Index



Scale 0-10: 0-Not at all likely; 10- Extremely likely

Respondents in the second quantitative survey were asked how they would explain what a VPP is. Some focused on the benefits to themselves while others focused on the benefits to the grid.

"It spreads the load, placing less pressure on the grid at peak times." - Early Adopter

"Provide grid stability and reduce the duck curve⁵" - Early Adopter

"Allow greater energy independence whilst better utilising solar PV generation onsite by storing the energy for overnight use". - Early Adopter

For VPP Providers, it is evident that there is a diversity of options that merit future consideration and that may prove critical to attracting and retaining consumers, particularly in a maturing and more competitive market.

⁵ The duck curve describes the demand for power which peaks in the mornings and again in the evening while solar PV generation peaks in the middle of the day. Reducing the duck curve in this context refers to batteries catering for the demand peaks that are normally supplied by dispatchable (i.e. coal or gas generators). This verbatim illustrates that some consumers were well versed in terminology commonly used in the industry.

4 Summary and discussion

This study finds that consumers approach the VPP with a set of expectations which for most consumers is a financial benefit in return for allowing VPPs to utilise their assets. Expectations may just be of modest returns, but as long as those expectations are met, consumers will be satisfied and remain with the VPP and indeed want to see VPPs flourish.

Clear and concise communications will be key to the success of future VPP initiatives.

Firstly, consumers need to be appropriately recruited and the PV and battery need to be prequalified to ensure they have both the capacity to cater for the needs of the household and spare capacity to contribute via the VPP.

Consumers need to be appropriately briefed with realistic expectations on the benefits of the VPP to their household under various scenarios, to avoid any mismatch between the anticipated and actual experience of savings and ensure retention. In particular, there needs to be transparency regarding any fees and the risk of having higher costs under certain circumstances.

In particular, consumers would like to understand:


- The financial benefits to their household (how much energy they provided to the grid and what they were paid for this).
- The environmental benefits (for example, how much CO₂ was saved, and how can this be translated into tangible terms such as how many trees it is equivalent to planting).
- The community benefits (for example, how many minutes of power shortfalls in their state were saved by their household's power contribution).

Onboarding is a key step in the process and during this phase consumers should be shown how to use the app. The need for the VPP to access the battery at unexpected times also needs to be made clear so householders can self-manage their appliances to ensure the greatest value from their asset for themselves.

Although the majority of consumers indicated they would continue to carefully monitor their energy use via the app, they were not likely to consider moving providers at the time of the second survey. As long as the VPP continued to meet expectations they would remain loyal. However, 15% of respondents did indicate they were likely to switch and their comments indicated a better financial offer would motivate them to switch providers.

Engagement, satisfaction, and advocacy can be increased by ensuring consumers are kept informed throughout all stages of the journey and the benefits of a VPP are regularly reinforced with information about financial benefits and the impact of using a renewable source of energy on the environment. The VPP Provider could use the opportunity of regular contact with consumers (i.e. statements) to update them on their VPP community and how it is improving the efficiency and stability of the power system. Consumers also need to have a clear understanding of who the various parties are and who to contact in different circumstances.

Important considerations for the future viability of the VPPs are continuation of participation as the batteries age and decline in capacity, whether the consumer will maintain and replace the asset and if a transfer of participation can be arranged when a consumer sells their property or decides to lease it.



Key recommendations

1. Improve the quality and relevance of information for consumers to enhance engagement and retention.
2. Actively market to early adopters in the early stages of deployment and develop a strategy to attract other segments as the market matures.
3. Focus on the potential for cost savings as the key motivator for participation, supported by individual energy bill reviews to ensure the experience matches the expectation.
4. Explore how best the app experience could be improved and ensure consumers are educated in its use.
5. Develop strategies to handle how VPPs are transitioned to new tenants/owners, together with programs for battery replacements as they deplete over time.
6. Explore initiatives that broaden the appeal to consumers, deliver operational, financial or community benefits and will help attract and retain new consumers, particularly in a maturing and more competitive market.
7. Continue to upskill customer service staff so they can address new types of consumer questions about the VPP and/or to provide direct access to knowledge experts for support to consumers.



APPENDICES

Appendix A Background

A.1 Background and Objectives

Recent innovations in technology, energy storage and communications have led to the development of Virtual Power Plants (VPPs). For the purpose of this study, a VPP is defined as a group of households with solar panels and batteries that are coordinated to deliver services for power system operation and electricity markets. These VPPs are at an early stage of development in the energy market, but deployment from VPP providers and uptake from residents is currently taking place at a steady pace across Australia.

AEMO is conducting VPP Demonstrations, with the support of the Australian Renewable Energy Agency (ARENA), to:

1. Demonstrate VPPs' capability to deliver multiple value streams (frequency control ancillary services [FCAS], energy and potential network services).
2. Develop AEMO's operational visibility of VPPs.
3. Assess regulatory arrangements for VPPs and inform appropriate changes.
4. Provide insights on how to improve consumers' experiences of the VPPs in future.
5. Assess the cyber security capabilities of VPPs and determine if augmentation is required.

To meet the consumer insights objective, in July 2019 AEMO commissioned Customer Service Benchmarking Australia (CSBA) to investigate and provide specific insights on how to improve the consumers' experience.

The VPP consumer insight study aims are to answer **three critical questions**:

1. What are consumers' experiences of participating in Australia's early stage VPPs?
2. Is VPP participation attractive enough for consumers to let VPPs utilise their assets?
3. How can consumers' experience of VPP participation be improved to make it more attractive for consumers to sign up in future?

A.2 Why the VPP Demonstrations are important

Since the announcement of the VPP Demonstrations⁶, VPPs have generated interest from state governments:

- New South Wales announced a target of 300,000 battery installations in the next 10 years.
- South Australia is currently rolling out a battery subsidy offer for 40,000 households, while an ongoing demonstration with the South Australian Housing Trust VPP will install up to 50,000 systems.
- Victoria is rolling out battery subsidies for eligible homes with existing solar panels.

In April 2019, AEMO published a report on the Technical Integration of Distributed Energy Resources (DER)⁷ that shared preliminary findings on the behaviour of DER during disturbances. It highlighted potential risks

⁶ With the publication of AEMO's November 2018 Consultation Paper, at <https://aemo.com.au/-/media/files/electricity/nem/der/2018/nem-vpp-demonstrations-program.pdf?la=en&hash=ECB02780C7E3B8AF22A62DFD24C79523>.

⁷ At <https://aemo.com.au/-/media/files/electricity/nem/der/2019/technical-integration/technical-integration-of-der-report.pdf?la=en>.



to system security and proposed the development of improved DER performance standards. The uplift of DER performance standards will contribute to the technical integration of DER, while the VPP Demonstrations program is focused on market integration of DER, noting that these two elements are heavily inter-related.

Based on these findings, it is crucial for AEMO to understand the potential uptake of VPPs from the general population to explore and adapt the capabilities of aggregated DER to deliver contingency FCAS⁸ and also to develop a deep understanding of how VPPs respond to energy market price signals.

Ultimately, VPPs hold a lot of potential to help develop a more efficient power system for all electricity consumers, as well as providing direct value to consumers owning VPP assets.

Understanding consumers' experiences and exploring ways to optimise these experiences will likely improve the success of VPPs overall.

⁸ FCAS maintain frequency within normal operating requirements to avoid negative impact to electricity supply. Contingency FCAS are triggered occasionally by frequency deviations after major contingency events and can be supplied by local plant; regulation FCAS are controlled centrally by AEMO and continually correct minor changes in frequency.

Appendix B Detailed methodology, approach, and rationale

Figure 20 shows the typical lifecycle of a product or service. These are briefly outlined as:

- Development phase – creating a product or service, refining it, and readying it for market.
- Introduction phase – building a market and awareness for the product. VPPs in Australia would currently be considered to be in this phase.
- Growth phase – the product has been accepted by consumers and companies are striving to increase their market share.
- Maturity phase – sales begin to level off, competition increases, and product features are enhanced to maintain market share.
- Decline phase – decreasing revenue due to market saturation, high competition, and changing consumer needs.

Figure 20 - The phases of the Lifecycle progression



CSBA developed a multi-staged market research approach, using specific methodologies to tackle the **introduction** phase of VPPs in the market and capture consumers' evolving behaviours and attitudes.

The approach was carefully developed to provide relevant and meaningful insights to consumers' experience of VPPs in line with emerging drivers and barriers, as VPPs gain traction in the energy market and steadily move from the **introduction** phase to the **growth** phase.

A longitudinal study approach⁹ was adopted to provide solid insights on the VPP Demonstrations and unveil the potential uptake by the mass market across an extended period of time (three to six months). The study included two quantitative surveys three to six months apart (depending on when the VPP Provider came on stream) and a qualitative phase which ran from July to December 2020.

⁹ A longitudinal study in this context is a study conducted among a cohort of consumers at different stages of their journey experiencing the VPP Demonstrations.

B1 VPP Demonstrations consumer insight study streams in detail

Stream 1: Baseline survey – Wave 1

The baseline survey was conducted from May 2020 to December 2020, and incorporated a quantitative online survey programmed by CSBA and sent to at least 75% of consumers who were part of the VPP Demonstrations. The survey captured the current market landscape, perceptions of the VPP, drivers, barriers, attractions, current attitudes, and overall satisfaction with the VPP.

Stream 2: Qualitative stream

The longitudinal study was conducted from July 2020 to January 2021, and involved:

- A series of qualitative activities exploring a range of topics in depth with the same constituent group of 50 consumers. This stream ran for more than six months, and activities included:
 - 60 minute, one-on-one, depth interviews.
 - Online bulletin board activities.
 - Journaling.
- Deriving/identifying segments and underlying motivational VPP uptake.

Stream 3: Post-demonstration survey – Wave 2

The post-demonstration survey was conducted during March 2021 to:

- Quantify and validate findings from the qualitative interview.
- Capture the current market landscape, compare results with Wave 1 and understand the evolution of the VPP industry across consumers.
- Segmentation of the market by engagement and triggers.

Consumers who participated in this study were told their feedback would be used to better understand consumers' experience of VPPs and to drive future improvements in the industry.

CSBA would like to thank the VPP Providers and the research respondents who took part in this research study to uncover the necessary insights to drive the success of the VPP Demonstrations.

B2 Framework and approach for analysis

For each of the streams in Section B1, CSBA used the following framework and approach for analysis.

Stream 1: Baseline survey – Wave 1

CSBA analysed the response to the Wave 1 online survey, which captured perceptions and attitudes, to identify any correlations based on:

- Demographics.
- Time since joining the VPP program (3, 6, 12, or over 12 months).
- Satisfaction scores and triggers to join a VPP.
- Comparison between VPP Providers based on business models.

Stream 2: Longitudinal study – Qualitative

CSBA conducted a brainstorming workshop to analyse the qualitative interviews, online bulletin boards and journaling completed as part of the longitudinal study. This process identified emerging themes related to:

- Current perceptions and mindset towards VPPs.
- Underlying emotional and rational drivers towards participation in a VPP.
- Mapping the VPP Demonstrations consumer journey with key steps.
- Specific typologies framing adoption of VPPs.
- Attitudes and behavioural changes in the household and towards energy consumption in general due to the VPP.
- Barriers and opportunities to leverage the VPP offerings in the Australian market.

Stream 3: Post-demonstration survey – Wave 2

CSBA analysed the quantitative online survey to quantify and validate the findings from the qualitative stream and compare long-term data, to highlight trends related to:

- Satisfaction and likelihood to recommend.
- Demographics.
- Perceptions of value potential of the VPP.



B3 Overview of challenges and adopted solutions

When the VPP Demonstrations consumer insight study began in July 2019, many potential VPP Providers had expressed interest, but some factors – including limited numbers of enrolled consumers and the impacts of COVID-19 – delayed the timing of enrolment.

AEMO worked with CSBA to implement solutions so the insights study could proceed:

1. Extending the study completion to July 2021 giving time for providers to enter the Demonstration.
2. Accelerating participation by establishing deadlines for registration.
3. Changing qualitative interviews to an online methodology that ensured safe social distancing.
4. CSBA maintained stakeholder engagement through quarterly working group meetings with AEMO and ARENA and keeping the aggregators informed at key stages.

B4 Learnings gained for future research in the industry

Since the launch of the VPP Demonstrations, CSBA, AEMO, and the different organisations involved have learned valuable lessons, relating to:

- Working collaboratively to identify challenges and readjust the overall approach.
- Adopting a flexible approach to the analysis. The VPP industry lifecycle is still in an early stage, and stakeholders needed more time to frame their business model around their VPP offerings.
- Maintaining confidentiality of information among stakeholders; commercial sensitivity is paramount in the industry and is being carefully monitored by VPP Providers.
- Engagement and collaboration so everyone's priorities were met.

B5 Caveats regarding the findings

COVID-19 Pandemic during survey period

The COVID pandemic had a significant impact on the research program itself as well as the respondents within the program.

The qualitative stream was unable to execute planned face to face focus groups and was converted into an online community with a set series of tasks to be completed and a one-hour interview using a virtual meeting platform. Where consumers were unable to use the virtual meeting application interviews were conducted over the phone. This flexible approach enabled the research to be conducted to a high standard and on time.

Victoria had an extended lockdown period from 16 March 2020 to 16 August 2020 and Adelaide had a six-day lockdown in November 2020. Respondents from all states reported changes in habits and circumstances due to working from home, having adult children return to live at home, or having taken on more child-minding duties at home, including home schooling. These changes had an impact on their energy use patterns.

Mild summer climate during survey period

The survey period ran from May 2020 (first Wave 1 cohort) to March 2021 (Wave 2 survey for all cohorts). The timing of the Wave 2 survey was to capture the views towards the end of the 20-21 summer season. Three quarters (75%) of the Wave 2 survey respondents resided in South Australia, 16% in NSW and 10% in Victoria. For South Australia, the Bureau of Meteorology (Meteorology, 2021) reported the 'coolest summer' since 01-02. For NSW, it reported a 'wet and cool summer' and for Victoria 'wetter and cooler than average'.¹⁰ This had an impact on the potential for PV solar energy generation, while the demand for electricity to run climate control appliances was reduced. This will have limited the potential for VPPs to generate value during the survey period.

Sample selection bias

The sample for the quantitative stream was generated by inviting households from seven VPP Providers to participate in two online surveys and interviews. Self-selection of respondents typically leads to a sample selection bias of respondents who are motivated to spend the time completing an online survey.

It must also be noted that, with the exception of a social housing group, all online respondents were private homeowners. The respondent base was limited to households who were already part of a VPP and the results from the surveys do not reflect perceptions of the overall population of Australia.

¹⁰Bureau of Meteorology Website http://www.bom.gov.au/climate/current/statement_archives.shtml

Appendix C Response rates

C.1 Quantitative

Seven VPP Providers were enrolled in the VPP demonstrations. Under the terms and conditions of the VPP Demonstration they provided access to contact at least 75% of their consumers for consumer insights research. Two surveys were conducted. The pre-Demonstration survey was launched as VPP Providers joined the VPP Demonstration between June and December 2020. The post-Demonstration survey was conducted in March 2021. Response rates were high at 23% and 27% for the two surveys, respectively, attesting to consumers' level of engagement. Respondents took on average 14 minutes to complete the first survey and 23 minutes to complete the second survey.

Table 1 - Survey population and response

Survey	Population	Timing	Surveys sent	Surveys completed	Response Rate	Error margin* %
Pre demonstration	4293	June to December 2020	4293	993	23%	2.81
Post demonstration	6442	March 2021	5279	1451	27%	2.29

* The margin of error indicates that any results expressed as percentages based on this sample will vary by at most the number of percentage points shown (calculated using a 95% confidence level). For instance, a result of 50% for a sample of n=993 in the Pre demonstration survey may vary from 47.19 to 52.81%. A result greater or smaller than 50% will vary by a smaller percentage point.

C.2 Qualitative

At the end of the first survey, respondents were asked to leave their contact details if they were willing to participate in the qualitative phase of this research program. They were offered an incentive of \$100 for a 1-hour interview and \$100 for completion of the online community tasks that ran over seven days. A total of 50 respondents were interviewed and completed the tasks.

One VPP Provider had an educational institution as a customer. Two interviews were conducted four months apart with staff from the institution and their energy consultant.

Appendix D Supplementary Charts

These tables and charts supplement the key findings.

D.1 Demographics

The quantitative results demonstrated that the respondents were over-represented in some groups: They were more likely to be living in a metropolitan area; more likely to be male; more likely to be aged 50+; less likely to have dependent children, and most lived in a freestanding home.

Figure 21 - Gender

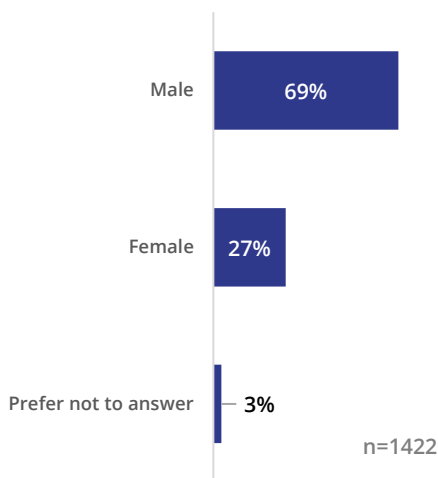


Figure 23 - Age Group

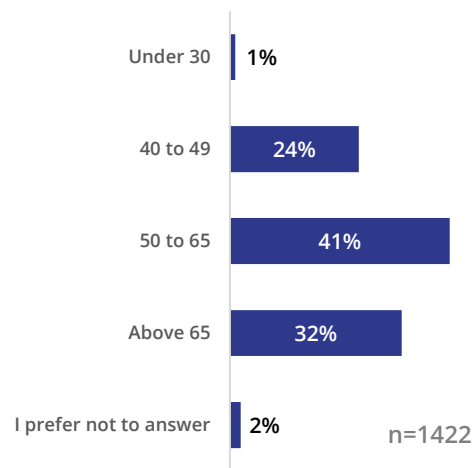


Figure 22 - Annual household income

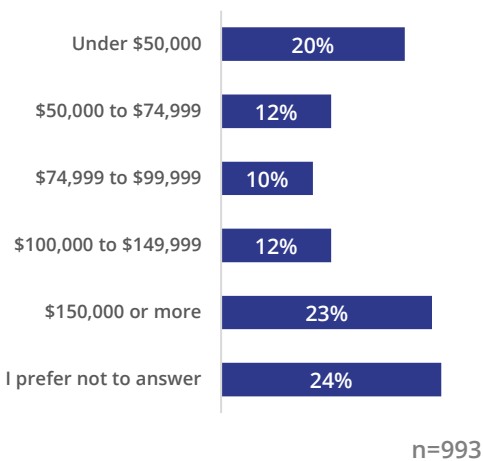
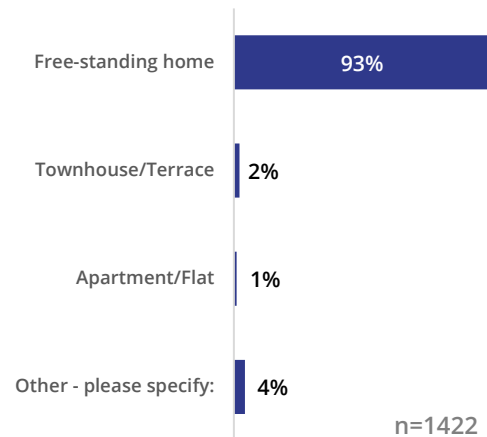


Figure 24 - Property type



Figures may not add to 100% due to rounding.

* The quantitative surveys included consumers from six VPP Providers. Four were located in South Australia, one in New South Wales and one had consumers across NSW and Victoria.

Figure 25 - Location*

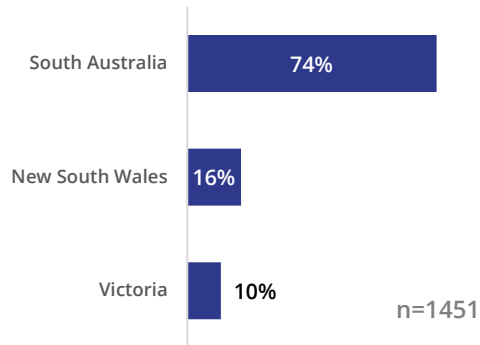


Figure 28 - Region

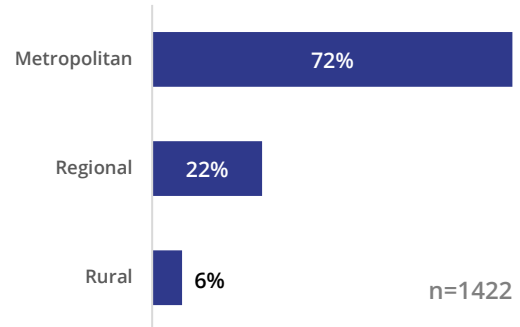


Figure 26 - Household Structure

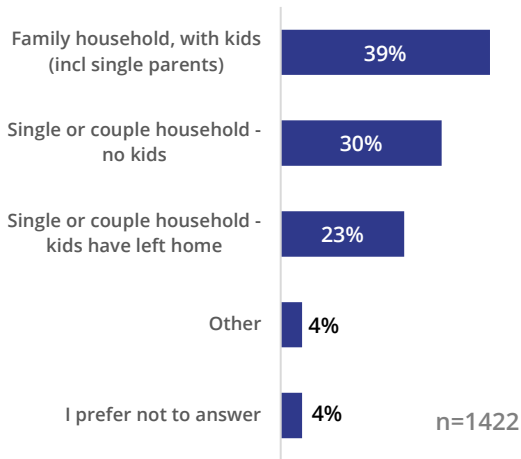


Figure 29 - Mortgage

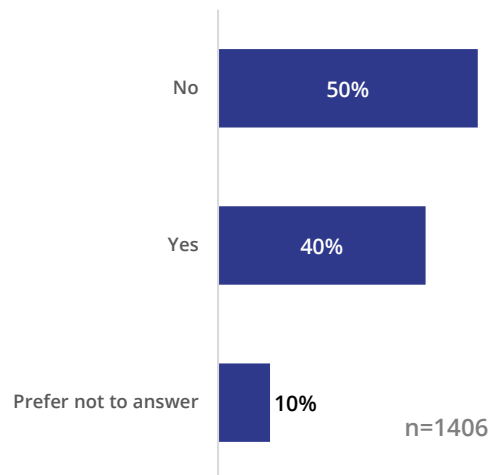


Figure 27 - Education

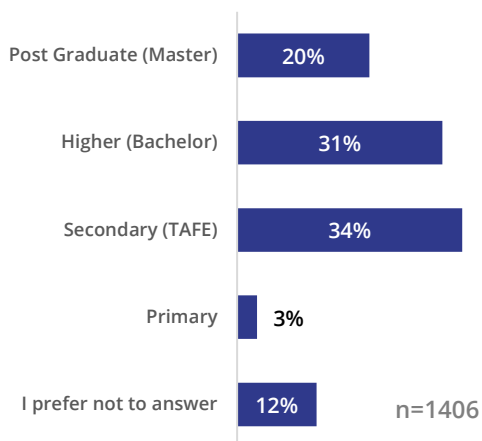
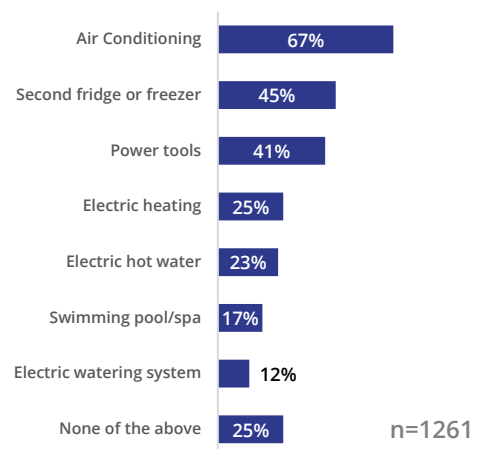


Figure 30 - Appliances in the home during VPP



D.2 Segmentation

Analysis from the qualitative research grouped consumers into segments according to their motivation to join and involvement with the VPP. A segmentation analysis¹¹ was performed on the data generated by the second quantitative survey. The responses to a number of questions were used to segment respondents into four consumer groups based on their combination of answers. Table 2 shows the segment size and the indexed results to various answer options where: Index = % segment/% total respondents.

Table 2 - Segmentation

	Early Adopter	Go with the Flow	Caring Community	Personal Gain
Segment Size:	42%	30%	16%	12%
Main reason for joining:				
<i>To save money on my electricity through lower usage from the grid</i>	95	118	98	66
<i>To have a backup energy supply – avoid the loss of power supply during outages</i>	133	120	73	0
<i>To make money on excess energy produced by my solar panels</i>	73	73	109	182
<i>To use lower carbon/environmental impact energy sources</i>	143	114	143	71
<i>To be part of the latest technology and pioneering the energy solution.</i>	117	133	150	50
<i>It seemed like the right thing to do for the country/future</i>	40	160	40	340
<i>To have a feeling of independence from the grid</i>	83	83	17	333
<i>To be able to share excess energy with neighbours/ members of my community/ not for profit organisations</i>	100	67	267	67
Emotional Involvement				
<i>Remain emotionally involved (0-6)</i>	167	60	40	105
<i>Less involved (7-8)</i>	97	129	97	35
<i>Reached 'set and forget' mode (9,10)</i>	0	130	196	167
Frequency of checking apps				
<i>Several times a day</i>	72	32	36	204
<i>Daily</i>	145	81	0	61
<i>Weekly</i>	142	117	83	17
<i>Ad-hoc, only check when I need it or receive bills</i>	43	29	957	100
<i>Used to check frequently at the start but less often now</i>	0	182	0	95
<i>Never/rarely</i>	0	100	1300	0

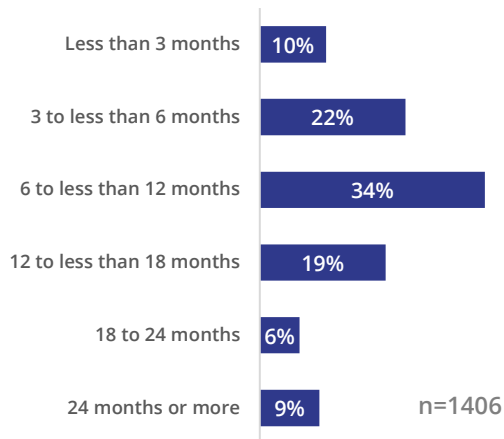
¹¹ Latent class analysis was used as it allows a selection of a wide range of predictor variables.

D.3 Assessing the VPP

D.3.1 Time in VPP

Respondents in the second quantitative survey were asked how long they had been using the VPP in their household. Over half the respondents had been with their VPP for less than 12 months. Those consumers were still early in their customer journey, and they did not have a full year's experience for comparison and reflection.

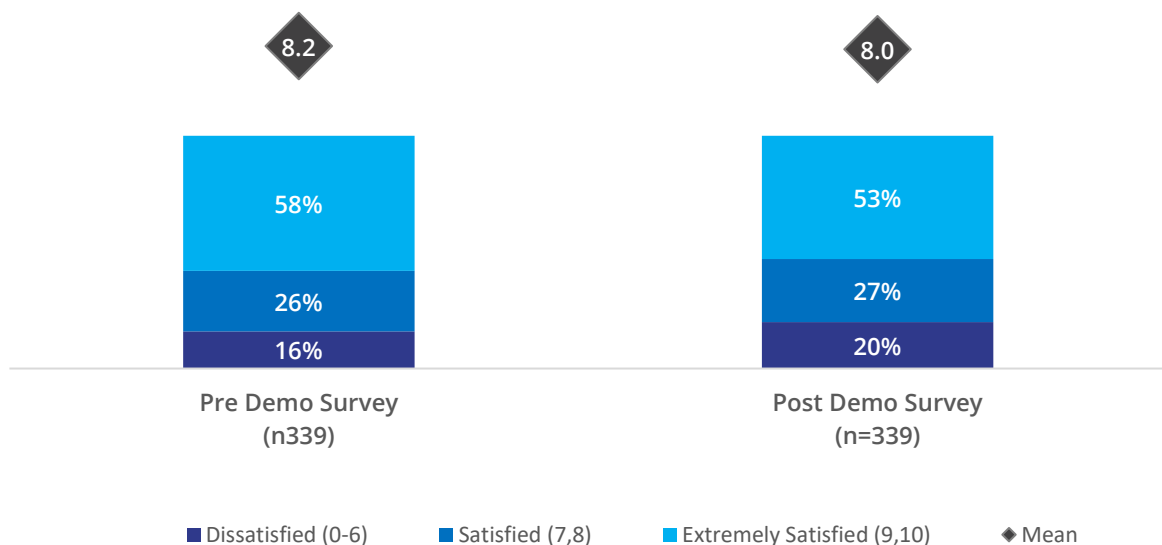
Figure 31 - Length of time in VPP



D.3.2 Overall Satisfaction

Over three hundred respondents completed the Overall Satisfaction question in both quantitative surveys. The results in the chart below indicate that satisfaction levels remained high with the mean Score remaining at 8 out of 10 in the second survey. The majority of respondents (80%) were classed as Satisfied, giving a score of 7 or higher out of 10.

Figure 32 - Overall Satisfaction



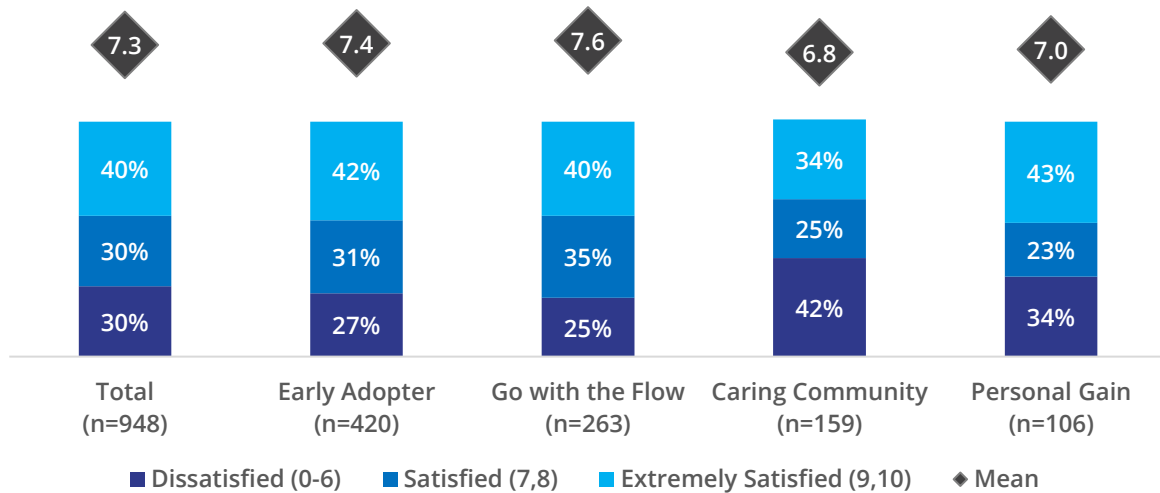
D.3.3 Satisfaction by Segment

Figure 33 shows Overall Satisfaction by segment. Over 40% of the Early Adopters, Go with the Flow and Personal Gain respondents indicated they were Extremely Satisfied, giving a score of 9 or 10 out of 10.

The Caring Community group had a lower mean score of 6.8 out of 10, due to the larger proportion (42%) of respondents classed as Dissatisfied, giving a score of 0 to 6 out of 10.

As VPPs become more prevalent other segments will grow and VPP Providers need to find ways to communicate effectively with less engaged consumers such as Caring Community.

Figure 33 - Overall Satisfaction by Segment



Figures may not add to 100% due to rounding.

D.3.4 Satisfaction by Pathway

Respondents were asked to specify the order in which they acquired the solar panels, the battery and joined the VPP.

Pathway 1 – Solar panels, Battery and Joining VPP as three separate steps.

Pathway 2 – Solar panels and Battery as step one, then VPP as step two.

Pathway 3 – Solar panels as step one, then Battery and VPP as step two.

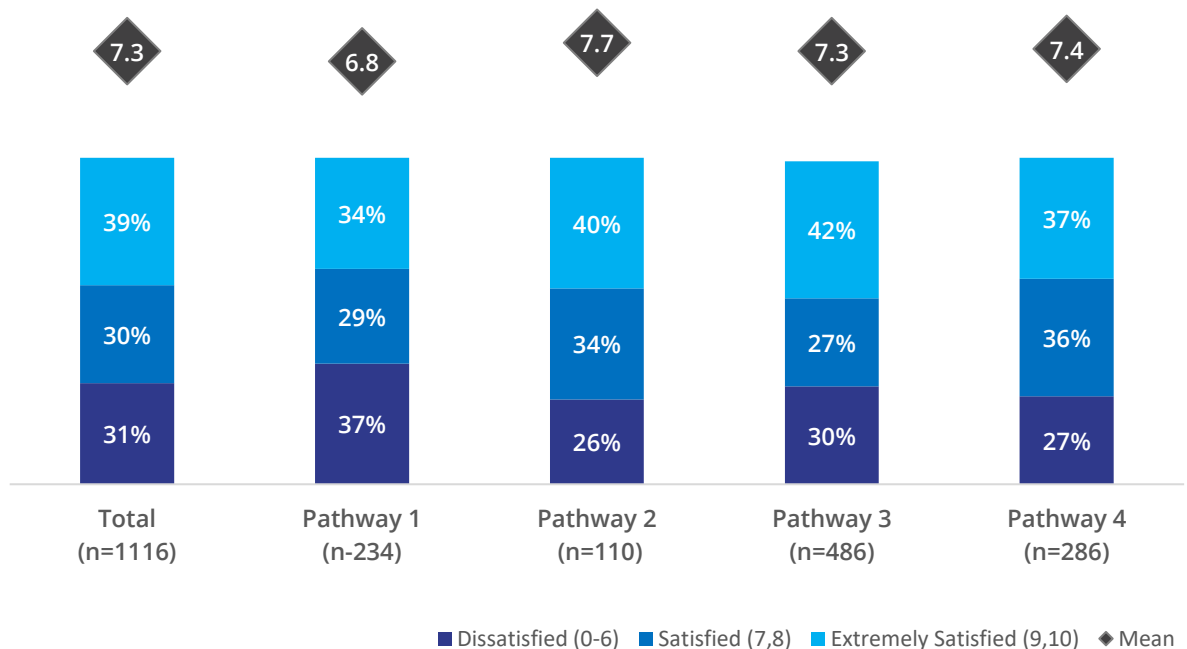
Pathway 4 – Single step, no prior experience with solar panels or batteries.

This analysis excludes the social housing cohort who agreed to have the infrastructure installed at no cost.

Figure 34 shows satisfaction by pathway. Pathway 1, the respondents who had prior experience with solar panels and purchased a battery well before joining a VPP had the lowest Overall Satisfaction scores with over one third (37%) classed as Dissatisfied (rating 0-6, out of 10). The other three pathways generated higher mean scores over 7 out of 10.

A recommendation is to market to pathways 3 and 4 in preference to approaching consumers with existing assets and bundling the battery with the offer.

Figure 34 - Overall Satisfaction by Pathway



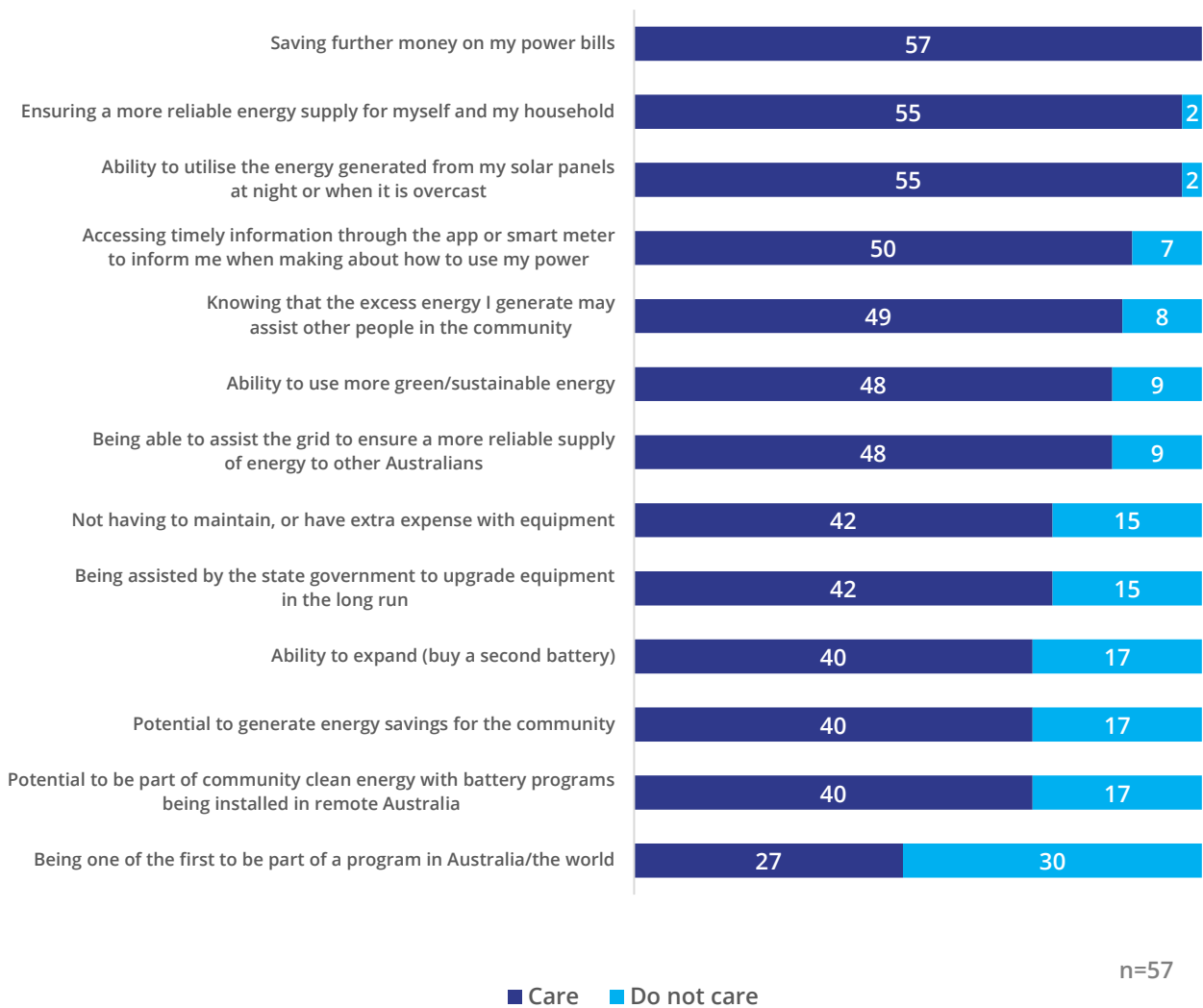
Figures may not add to 100% due to rounding.

D.3.5 Benefits of the VPP

Figure 35 shows the results from a card sort exercise completed by 57 respondents in the qualitative phase. They were asked to sort the various benefits the VPP might offer them into two piles, those they cared about and those they did not care about. All cared about 'Saving further money on my power bills', followed by 'Ensuring a more reliable energy supply for myself' and 'Ability to utilise the energy generated from my solar panels at night or when it is overcast'. The benefit the fewest cared about was 'Being one of the first to be part of a program in Australia/the world'.

This supports the key finding that the expectation of saving money on energy bills was the most important factor in sign up and retention.

Figure 35 - Benefits of the VPP



D.4 The App

Over half (56%) of respondents indicated they monitored the impact of VPP events on savings and of those almost two thirds (63%) indicated they used the app.

Figure 36 - Monitoring the Impact of VPP events

Do you monitor the impact of VPP Events on your solar self-consumption savings?

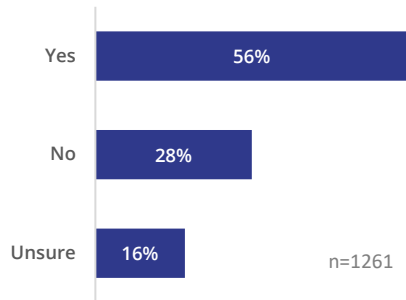


Figure 37 - Number of Apps used:

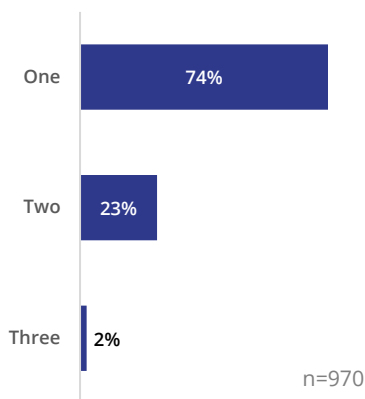


Figure does not add to 100% due to rounding.

Figure 40 - Where App(s) are accessed most:

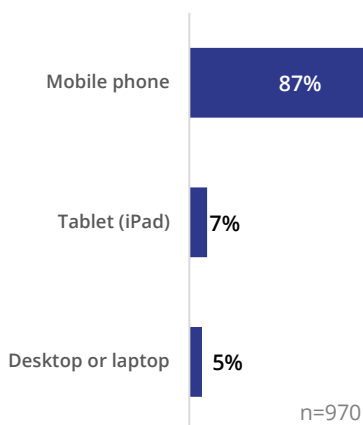
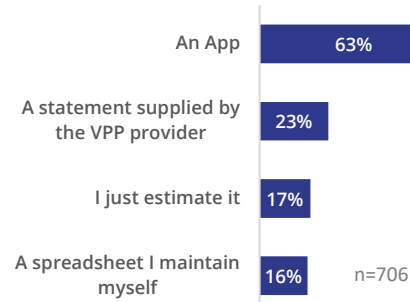


Figure does not add to 100% due to rounding.

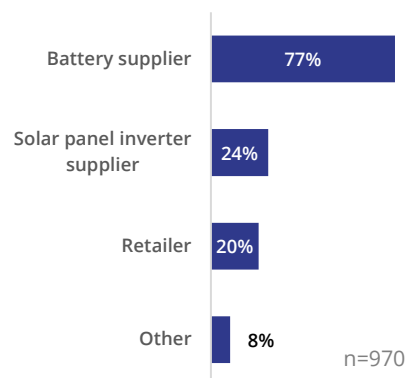
Figure 38 - How consumers measure the impact of the VPP

What do you use to monitor the impact of VPP events on your solar self-consumption savings?



Multiple responses allowed for this question.

Figure 39 - Who supplied the App that consumers used



Multiple responses allowed for this question.

Figure 41 - How often consumers checked their App(s)

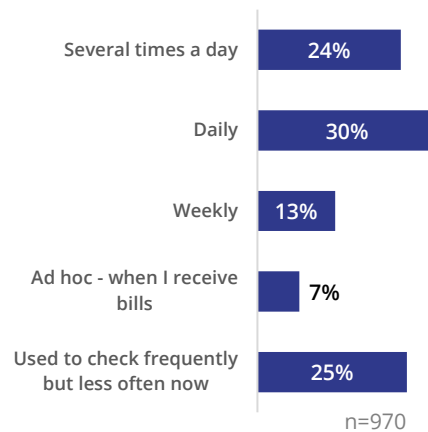
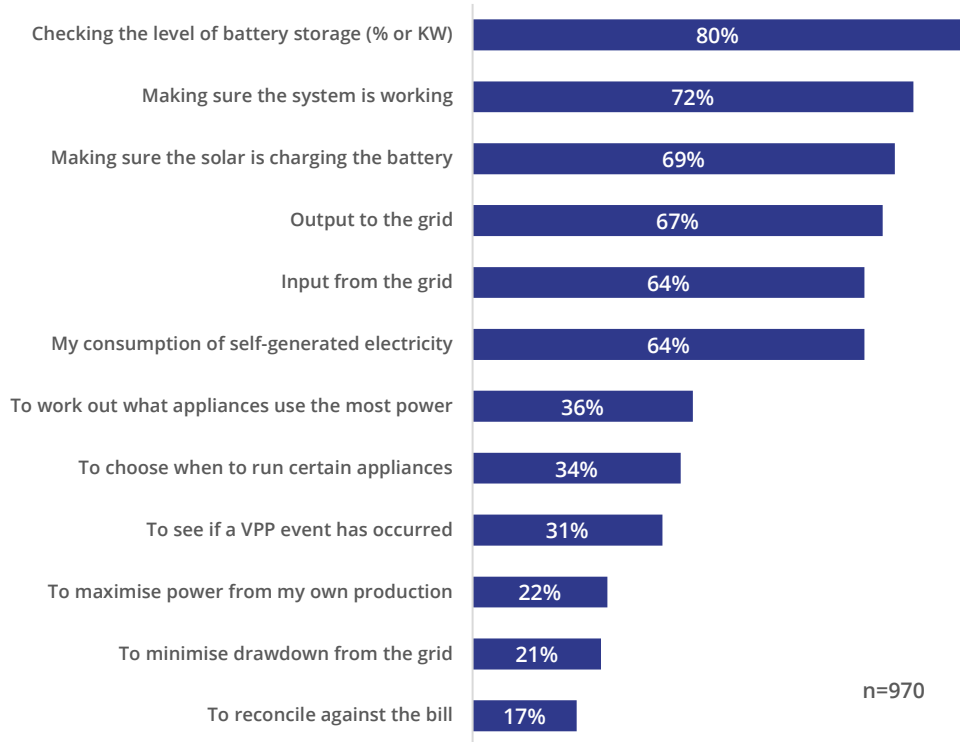


Figure does not add to 100% due to rounding.



The majority of respondents (80%) used the app to 'Check the level of battery storage', followed by 'The system is working' (72%) or 'Making sure the battery was being charged' (69%). Less than one fifth (17%) used the app to 'Reconcile against the bill'. - See figure 42.

Figure 42 - What are your reasons for checking the App?



D.5 Understanding the VPP

Figure 43 shows the areas respondents wanted to learn more about, nominated from a list of options. This supports the recommendation for VPP Providers to ensure continued engagement by offering more information to consumers about the VPP.

Figure 43 - Which of the following areas would you like to learn more about?

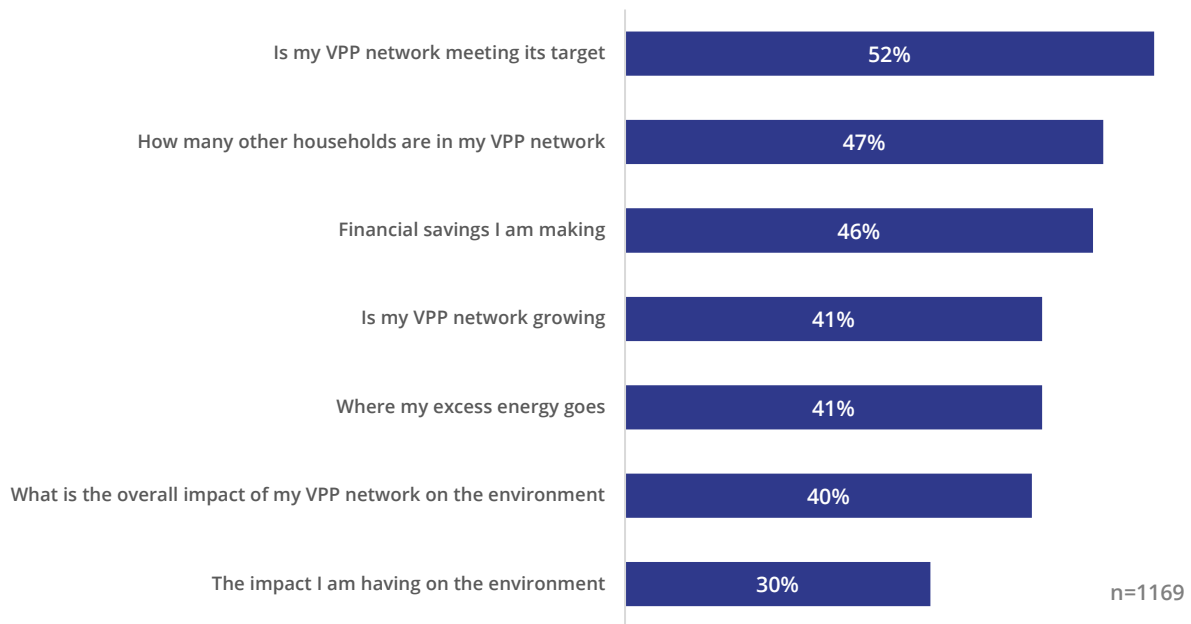
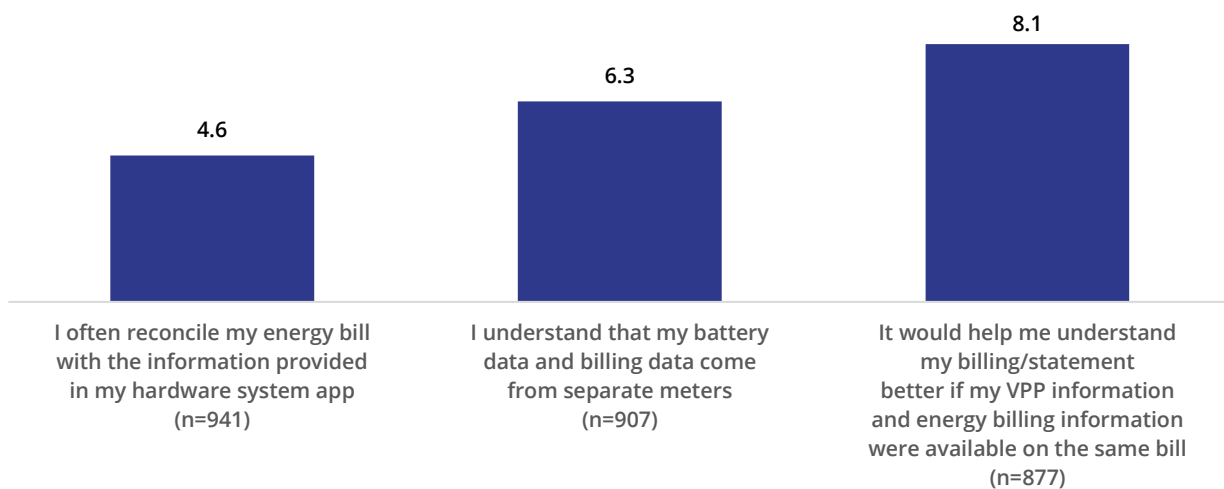


Figure 44 shows consumers indicated low understanding that the battery and billing data were metered separately. They had low agreement with 'I often reconcile the energy bill and the information in the app', mean score of 4.6 out of 10. There was a high level of agreement with 'It would help me if the billing and VPP information were available on the same bill', with a mean score of 8.1 out of 10.

Figure 44 - Billing and reporting - Level of agreement with statements



Scale 0-10: 0-Strongly Disagree 10- Strongly Agree



Respondents were asked who they would contact for information about VPP events. Over half (56%) would contact their retailer and another 22% indicated they would contact their VPP Provider, if the VPP Provider was different from their retailer as was the case for some consumers.

The information on how the battery was used and who should calculate the impact of VPP events also rested with the VPP Provider or VPP Provider/retailer. - See figure 45.

Figure 45 - Information channels for questions about VPP

