

Project EDGE

Summarising key customer insights into perceptions of and experiences with Virtual Power Plants

Better Consumption Lab, Deakin University
2023

This research has been conducted with the support of:



AusNet



Background

Background: Context and research gaps

New energy technologies

- Distributed Energy Resources (DERs) are technologies that allow households to generate, store, or distribute energy
- Examples of DER include rooftop solar photovoltaics (solar PV), household batteries, solar hot water systems, and electric vehicles
- Third-party providers have started to offer energy services that aggregate the distribution capabilities of many household DERs through the formation of virtual power plants (VPPs)
- Through these VPPs, aggregators can control when connected DERs import or export power to the National Electricity Market (NEM), allowing them to trade in this market and deliver a range of network services

Project EDGE

- Project EDGE (Energy Demand and Generation Exchange) was a multi-year field trial aimed at demonstrating a proof-of-concept DER marketplace
- Through the marketplace, customers' DER were aggregated to deliver wholesale and network support services
- The Project EDGE field trial occurred within the AusNet Services distribution network in Victoria and involved three DER aggregators: Discover Energy, Mondo, and Rheem

Research gaps ①

- There is a growing awareness of the potential network benefits that VPPs can deliver
- What is less clear are the VPP perceptions and experiences of current and potential customers
- A literature review conducted by Deakin University's Better Consumption Lab identified a range of gaps in the existing literature on DERs and VPPs, including:
 - An over-emphasis on early adopters at the expense of other customer segments
 - Limited understanding of customers' expectations for financial returns
 - An unresolved tension around how ease of use can be reconciled with a desire for customisation
 - Uncertainty about how perceptions of DERs and VPPs compare with the status quo or to other energy products
 - Limited information on how best to communicate with customers
 - How trust in aggregators can be increased and risk perceptions reduced
 - What is required to develop relational interactions with customers
 - Unsophisticated segmentation analyses for understanding customer perceptions

Guide to the notation used in this report



Background: Overview of research program



Aim of the research

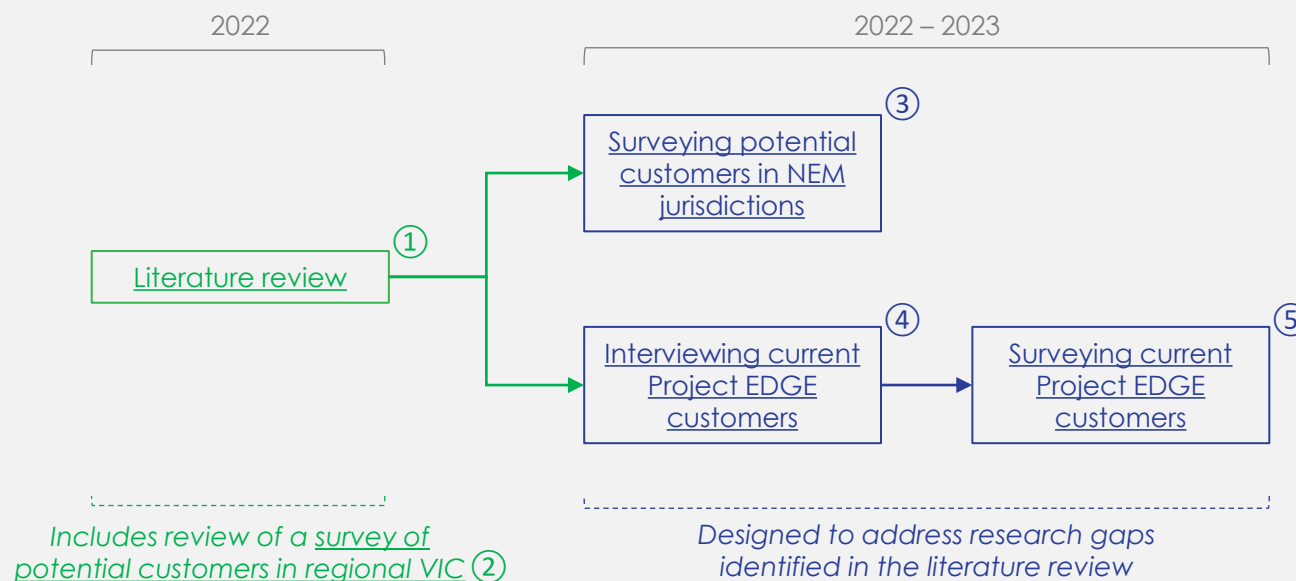
- The overarching aim of the Project EDGE research undertaken by Deakin University's Better Consumption Lab was to examine how potential and current residential VPP customers perceive VPPs with a view to understanding how to:
 - Accelerate the adoption of VPPs
 - Enhance VPP customer satisfaction and retention
 - Build trust in the aggregators managing customers' DER
 - Encourage additional VPP exports
 - Develop policies that fairly facilitate DER exports

Purpose of this report

- As shown in the righthand pane, Deakin University's Better Consumption Lab generated VPP customer insights across an extensive program of research
- The purpose of this report is to broadly summarise some of the key insights identified across this program of research
- Links to the full reports that form the basis of this program of research can be found at the bottom of the pages on which each report is mentioned

Program of research

- The Project EDGE customer insights were identified through a multiyear program of research conducted by Deakin University's Better Consumption Lab



Potential customers

Potential customers: Overview

Method

399 regional Victorians surveyed ^②

893 Australians in NEM jurisdictions (excluding Victoria) surveyed ^③

Key learnings

- Consumers might like the VPP concept, but they're lukewarm about joining a VPP
- Of the outcomes that mattered most to consumers, DERs and VPPs were seen as helping to achieve only one: saving money
- Consumers had very high expectations about how much money they would save from joining a VPP
- Consumers could not see a clear benefit for joining a VPP, over and above adopting DERs
- Most consumers were reserving judgement about whether aggregators could be trusted
- Information about financial benefits and consumer safeguards were deemed useful in helping consumers decide whether to join an aggregator

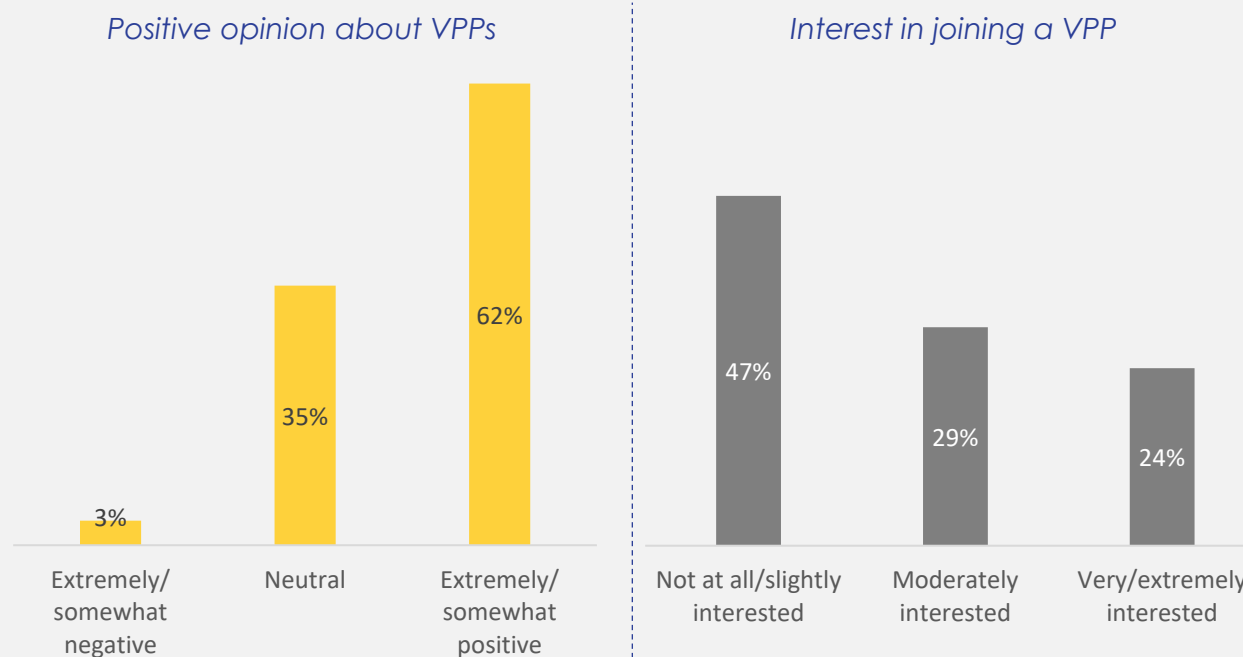
Reports ^② [Surveying potential customers in regional VIC](#)
^③ [Surveying potential customers in NEM jurisdictions](#)

VPP awareness was low ^②

92% were either unaware of VPPs or aware of VPPs but knew nothing about them

Consumers might like the concept of a VPP, but they're lukewarm about joining a VPP ^②

Most (62%) consumers were positive about VPPs after reading a summary about them, but this positive perception did not automatically translate into an interest in joining a VPP



Potential customers: What do they want?

Show consumers the money ■ ③

Consumers who saw VPPs and DERs as saving them money and/or providing a more reliable supply of power reported stronger intentions to adopt DER and VPP

Predictors of interest in adopting...	...DER	...VPP
Saving money	Yes	Yes
Receiving a reliable supply of power	Yes	Yes
Reducing CO ₂ emissions	No	No
Helping the community	No	No
Reducing life admin (routine tasks)	No	No
Receiving good service	No	No

Consumers had high expectations about how much they would save from joining a VPP ■ ③

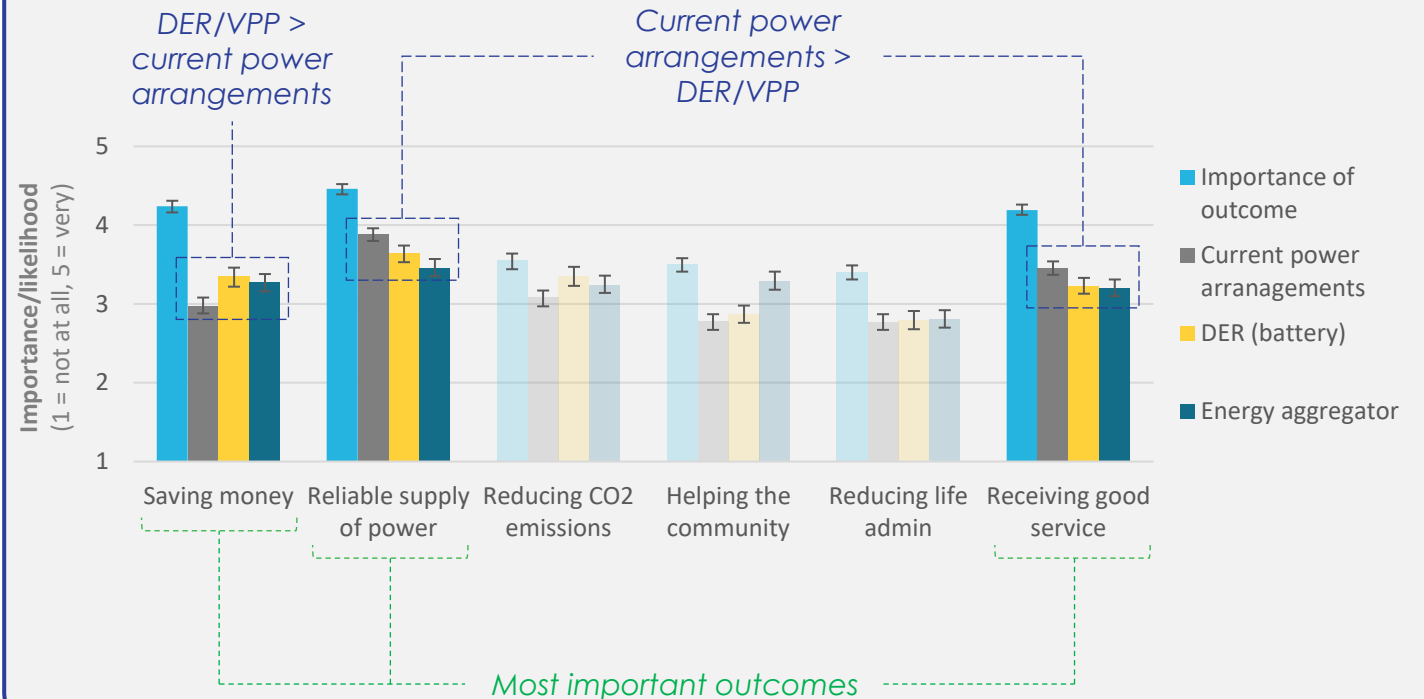
Consumers desired ~\$1k in annual savings from joining a VPP

Desired annual savings from...	Solar PV: No	Solar PV: Yes
...installing solar panels	\$1,093	n/a
...installing a battery	\$933	\$1,006
...joining a VPP	\$945	\$992

Reports ③ [Surveying potential customers in NEM jurisdictions](#)

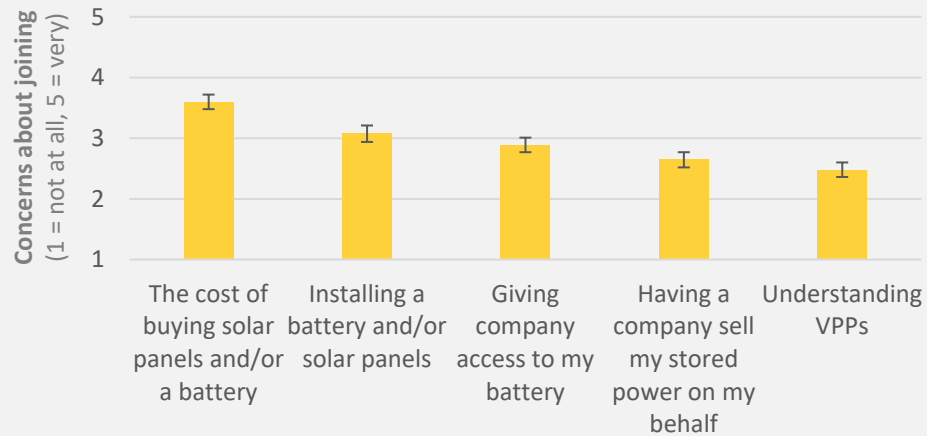
Of the outcomes that mattered most to consumers, DERs and VPPs were seen as helping to achieve only one: saving money ■ ■ ③

- The graph below shows perceived outcomes among consumers with solar PV; equivalent results were found for consumers without solar PV
- Consumers identified three outcomes that they were most interested in achieving: **saving money, receiving a reliable supply of power, and receiving good service**
- Relative to their current power arrangements, adopting DER and joining a VPP were seen as being better at achieving only one of these three outcomes: **saving money**

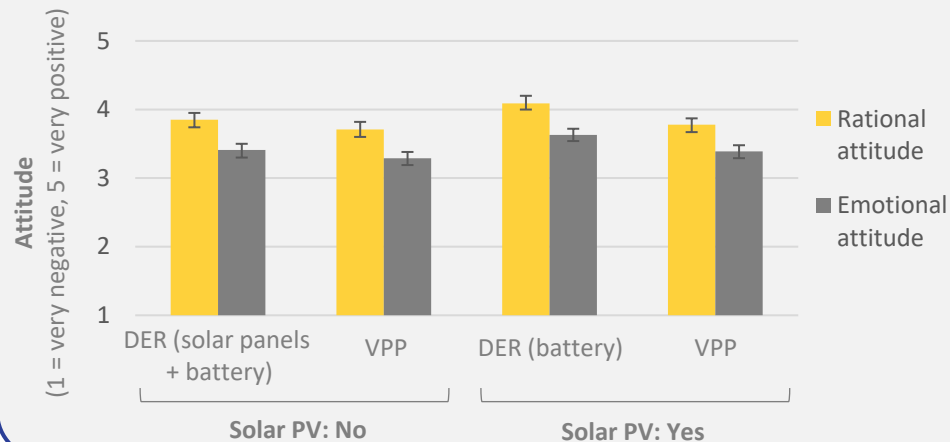


Potential customers: What do they want?

The biggest perceived barrier to joining a VPP was the cost of purchasing the necessary DER ②

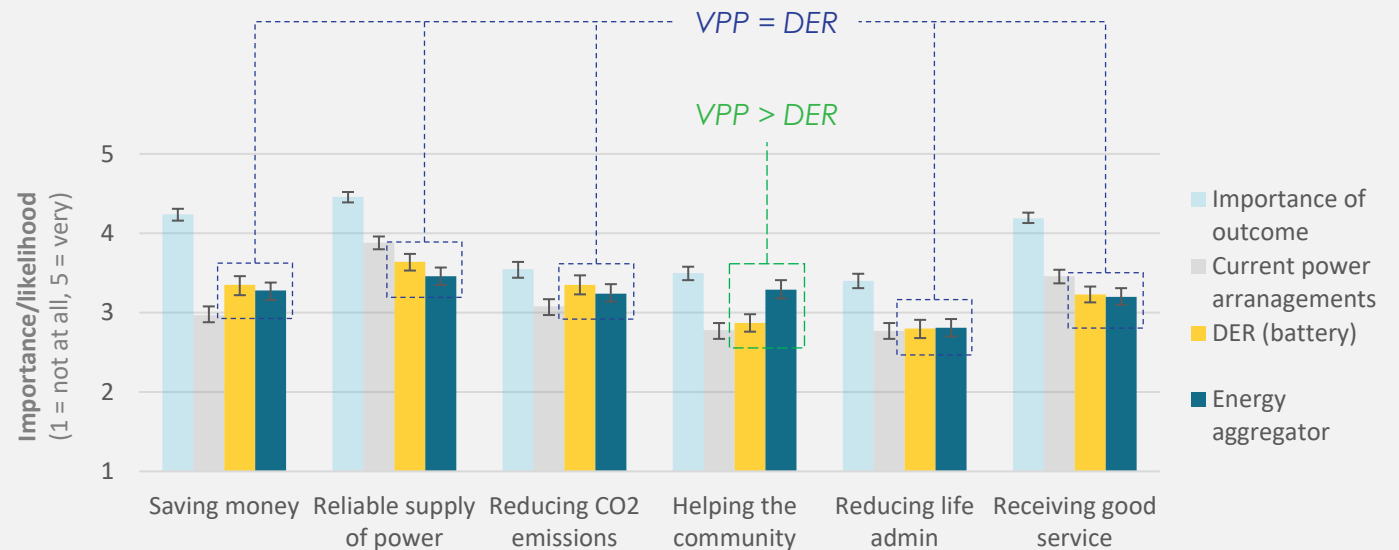


Consumers saw DERs and VPPs as delivering more rational than emotional benefits ③



Consumers could see little clear benefit in joining a VPP, over and above adopting DER ③

- The graph below shows perceived outcomes among consumers with solar PV; equivalent results were found for consumers without solar PV
- With one exception (**helping the community**), joining an aggregator was not seen as assisting consumers in satisfying any additional outcomes relative to adopting DER
- Notably, helping the community was not one of the three outcomes that consumers were most interested in achieving



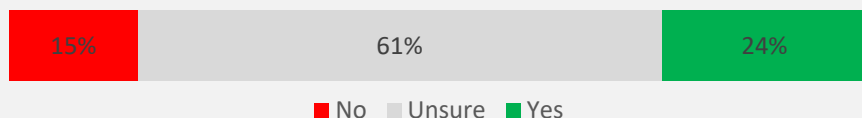
Reports ② [Surveying potential customers in regional VIC](#)

③ [Surveying potential customers in NEM jurisdictions](#)

Potential customers: How can trust be built?

Most consumers were reserving judgement about whether aggregators could be trusted... ③

Can an aggregator be trusted to access and export power on your behalf?



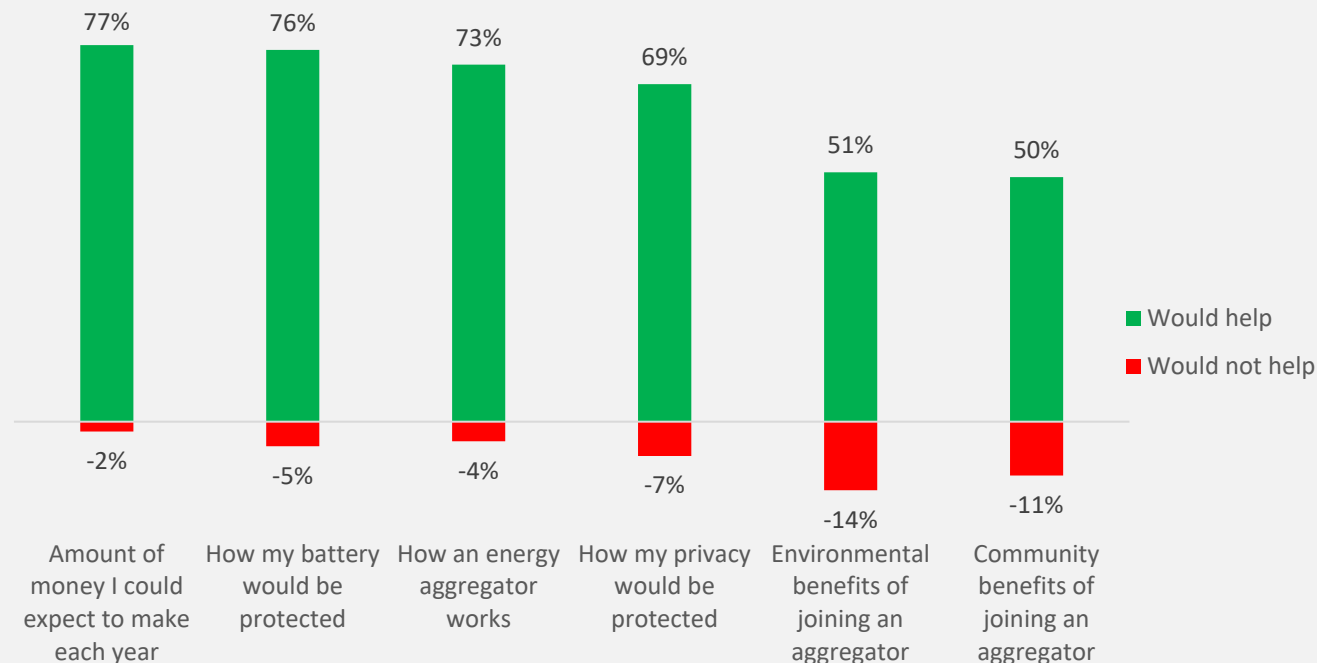
...but the following proportions of consumers rated these features as enhancing their trust in an aggregator: ④

- 66%** consumer controls how much stored power an aggregator can export
- 65%** aggregator guarantees earnings
- 63%** consumer controls when an aggregator can export stored power
- 59%** consumer notified before every export takes place
- 54%** consumer notified after every export has taken place

Reports ③ [Surveying potential customers in NEM jurisdictions](#)

Information about financial benefits and consumer safeguards were deemed useful in helping decide whether to join an aggregator ③

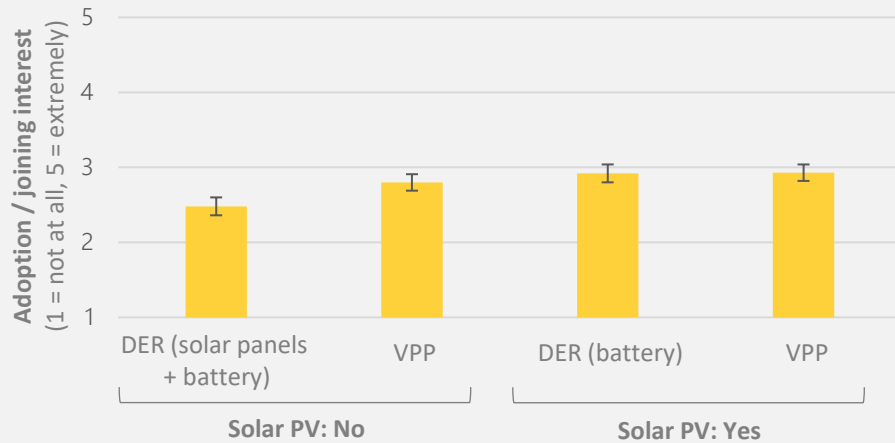
- The graph below shows the proportion of consumers who think that a given type of information would (or would not) help them decide whether to join a VPP
- Most (77%) desired information about the likely financial returns they would receive
- Information about consumer safeguards was also desired, with 76% and 69% seeking content about how their battery and privacy, respectively, would be protected



Potential customers: Who is most interested?

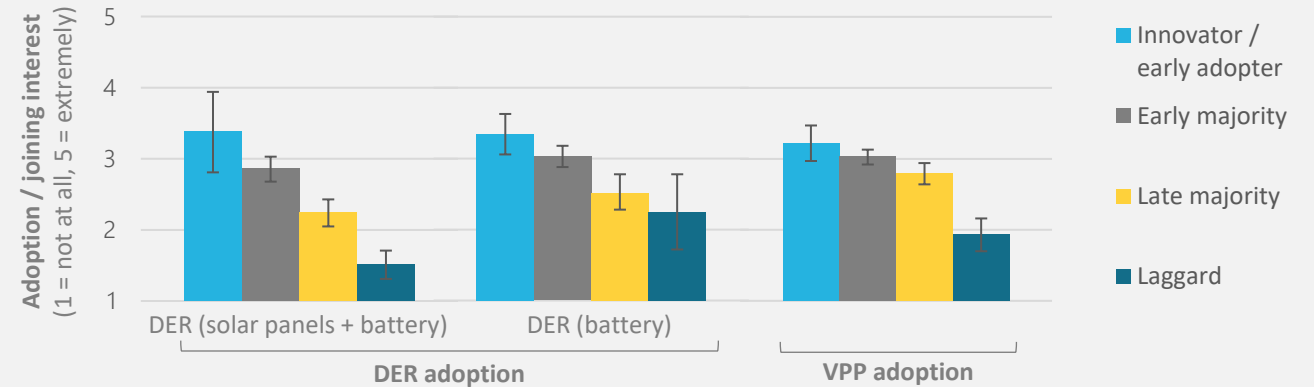
Consumers with solar PV ■ ③

- The graph below shows interest in adopting DER and joining a VPP, segmented by solar PV status
- Consumers with solar PVs were more interested in adopting DER (battery) than consumers without solar PVs were in adopting DER (battery + solar PV)
- Interest in joining a VPP did not differ by solar PV status



Early adopters and the early majority ■ ■ ③

Consumers who self-rated themselves as early adopters or the early majority with respect to new energy technologies were most interested in adopting DER and joining a VPP



Sociodemographic profile of interested consumers ■ ③

Younger, university-educated, politically progressive consumers who resided in larger, middle-income households tended to be more interested in adopting DER and/or joining a VPP

Predictors of interest in adopting...	...DER		...VPP	
	Solar PV: No	Solar PV: Yes	Solar PV: No	Solar PV: Yes
Younger age	Yes	Yes	No	No
University educated	Yes	No	No	No
\$80k - \$119k income	No	No	Yes	Yes
3+ household occupants	No	Yes	No	No
Politically progressive	Yes	No	Yes	No

Potential customers: What do non-early adopters think?



Adopter categories ■ ③

Consumers fell into different adopter categories:

- **Innovator/early adopter (11%):** like to be one of the first, or a leader, in trying new energy technologies
- **Early majority (53%):** like to hear about other peoples' experiences before trying new energy technologies
- **Late majority (26%):** only try new energy technologies when the people they trust have already done so
- **Laggard (11%):** not interested in new energy technologies

The early majority were unsure about whether they could trust aggregators ■ ■ ③

- Innovators/early adopters were more likely to trust aggregators to manage their DER, while the early majority were more likely to be unsure

Trust aggregator	Innovator / early adopter	Early majority	Late majority	Laggard
No	12%	11%	12%	44%
Unsure	49%	65%	66%	48%
Yes	40%	25%	23%	7%

Green = over-represented relative to the other adopter groups

Red = under-represented relative to the other adopter groups

Control, transparency, and consumer safeguards are trust-enhancing strategies that particularly resonate with the early majority ■ ■ ■ ③

- The table below shows the proportion of each adopter category that endorsed a given strategy as likely to enhance their trust in an aggregator
- Trust-enhancing strategies that resonated with the early majority included guaranteed earnings, control over the size of exports, and being notified before exports occurred

Strategy for enhancing trust in an aggregator	Innovator / early adopter	Early majority	Late majority	Laggard
Aggregator owned by community group	37%	33%	29%	16%
Aggregator owned by commercial company	25%	14%	13%	8%
Aggregator guarantees earnings	59%	70%	68%	42%
Consumer controls how much stored power aggregator can export	64%	71%	65%	47%
Consumer controls when aggregator can export stored power	59%	67%	60%	55%
Consumer notified before every export takes place	54%	64%	57%	47%
Consumer notified after every export has taken place	52%	58%	54%	39%
Friends/family have joined aggregator	32%	42%	47%	21%
People in community have joined aggregator	39%	42%	43%	19%
Aggregator endorsed by trusted community group	42%	44%	43%	20%
Aggregator endorsed by government agency	54%	53%	53%	27%
Aggregator has a lock-in contract	33%	30%	28%	17%

Green = over-represented relative to the other adopter groups

Red = under-represented relative to the other adopter groups

Potential customers: What is a fair DER export policy?

Background ③

- To help them understand the policy scenarios, consumers were first presented with a metaphor equating transmission lines to big pipes and distribution lines to small pipes
- The metaphor also stressed that grid safety and stability depended on 'pipe' capacity not being exceeded
- Consumers were then presented with four export scenarios:

Scenario 1: *The capacity of the smaller pipes is not increased, so there are no upgrade costs. This means that as more households install solar panels, pipe capacity is reached more quickly, limiting the amount of power households can export and increasing the price of power for everyone.*

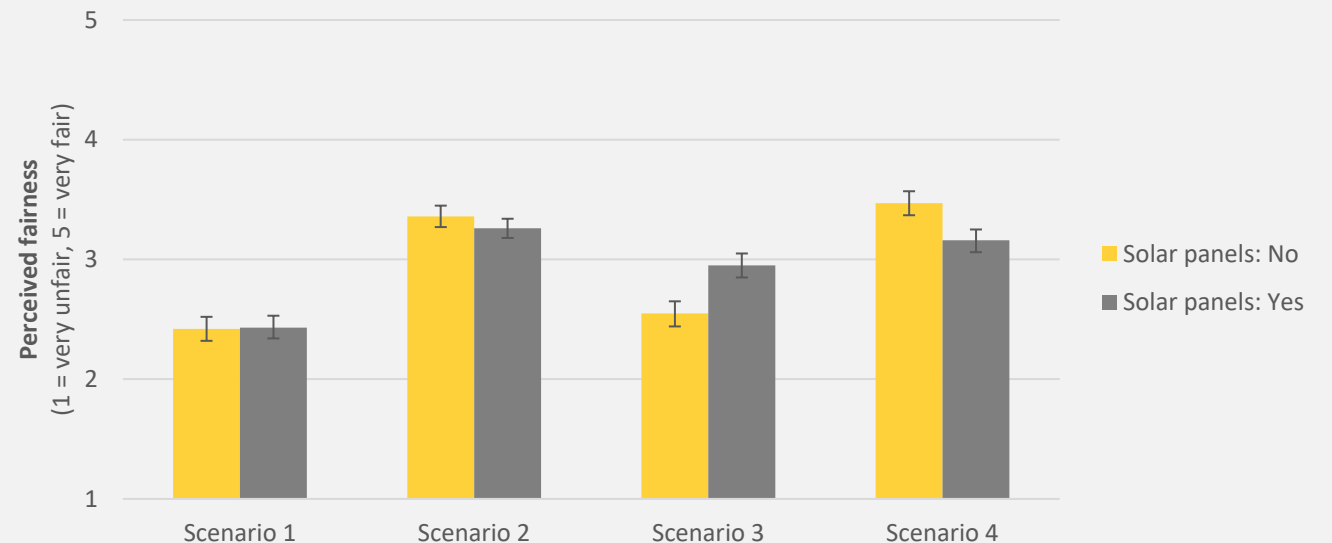
Scenario 2: *The capacity of the smaller pipes is not increased, so there are no upgrade costs. Instead, households are allowed to export more than they currently can when demand for power is high, but less than they currently can once the pipes come close to capacity.*

Scenario 3: *The capacity of the smaller pipes is increased so that more households can export more power. The cost of these upgrades is shared by all households (including those without solar panels or batteries).*

Scenario 4: *The capacity of the smaller pipes is increased so that more households can export more power. The cost of these upgrades is covered by export charges, which are only applied to households that export power to the grid.*

A 'fair' policy was one that delivered the greatest benefits to one's own household ■ ③

- The graph below shows customers' perceptions of policy scenario fairness, segmented by solar PV status
- Consumers with solar PV believed **Scenario 3** (upgraded 'small pipe' capacity; upgrade costs borne by all consumers) was fairer than those without solar PV
- Consumers without solar PV believed **Scenario 4** (upgraded 'small pipe' capacity; upgrade costs borne by consumers with exporting DER) was fairer than those with solar PV
- **Scenario 2** (no upgrades to 'small pipe' capacity; dynamic export limits) received equivalent fairness ratings across consumers with and without solar PV



**Current Project EDGE
customers**

Current customers: Overview



Method

35 Project EDGE customers interviewed ^④

63 Project EDGE customers surveyed ^⑤

Key learnings

- Satisfaction with the Project EDGE VPPs was broad but fragile
- The sociodemographic profile of Project EDGE customers differed to that of the broader Australian population
- Bundling VPPs with other services may help to accelerate VPP adoption
- Customers were seeking improved comms and transparency
- Whether by default or choice, customers liked automated VPP exports, but this resulted in the export process being seen as a 'black box'
- The value proposition for joining a VPP requires work
- Short-term, philanthropically-focused requests for additional exports may be motivating, provided the impact of those exports is communicated

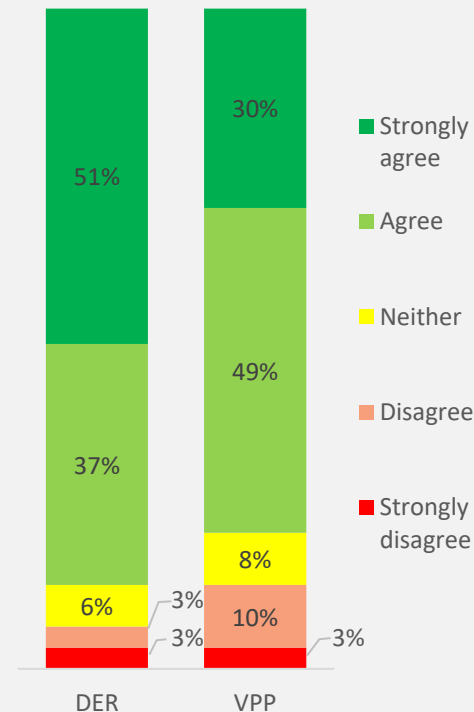
Reports ^④ [Interviewing Project EDGE customers](#)

^⑤ [Surveying Project EDGE customers](#)

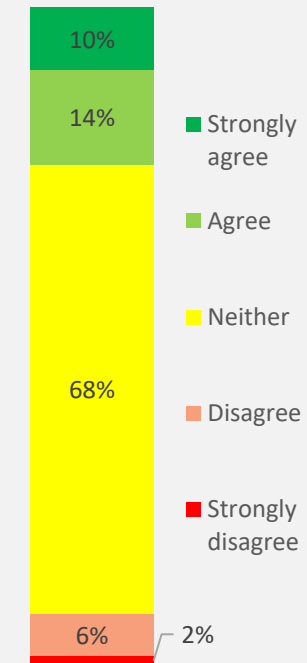
Overall satisfaction was broad but fragile ^⑤

- While 79% of customers either agreed or strongly agreed to being satisfied with their VPP, 68% were unsure whether their VPP was competitive relative to other VPPs
- Only 59% were very or extremely comfortable with their aggregator managing their DER, which is noteworthy given that DER management is a fundamental feature of VPPs

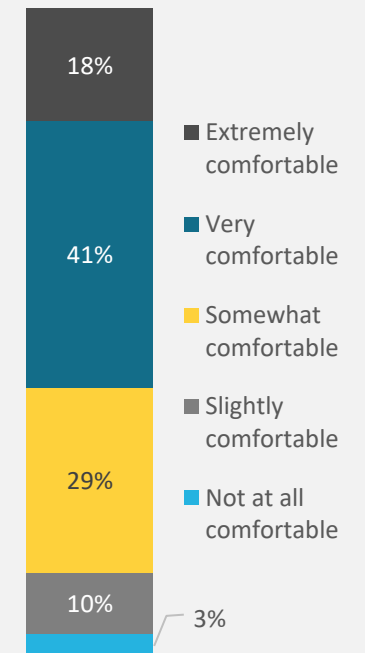
Satisfaction with DER and VPP



VPP is competitive relative to other VPPs



Comfort with aggregator managing DER



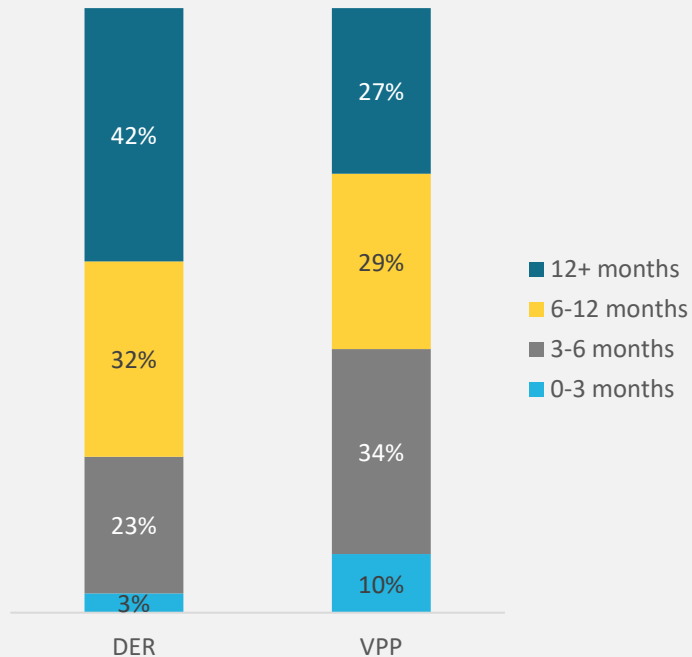
Current customers: Who were they?

DER profile ⑤

56% of customers had purchased DER as part of joining the VPP

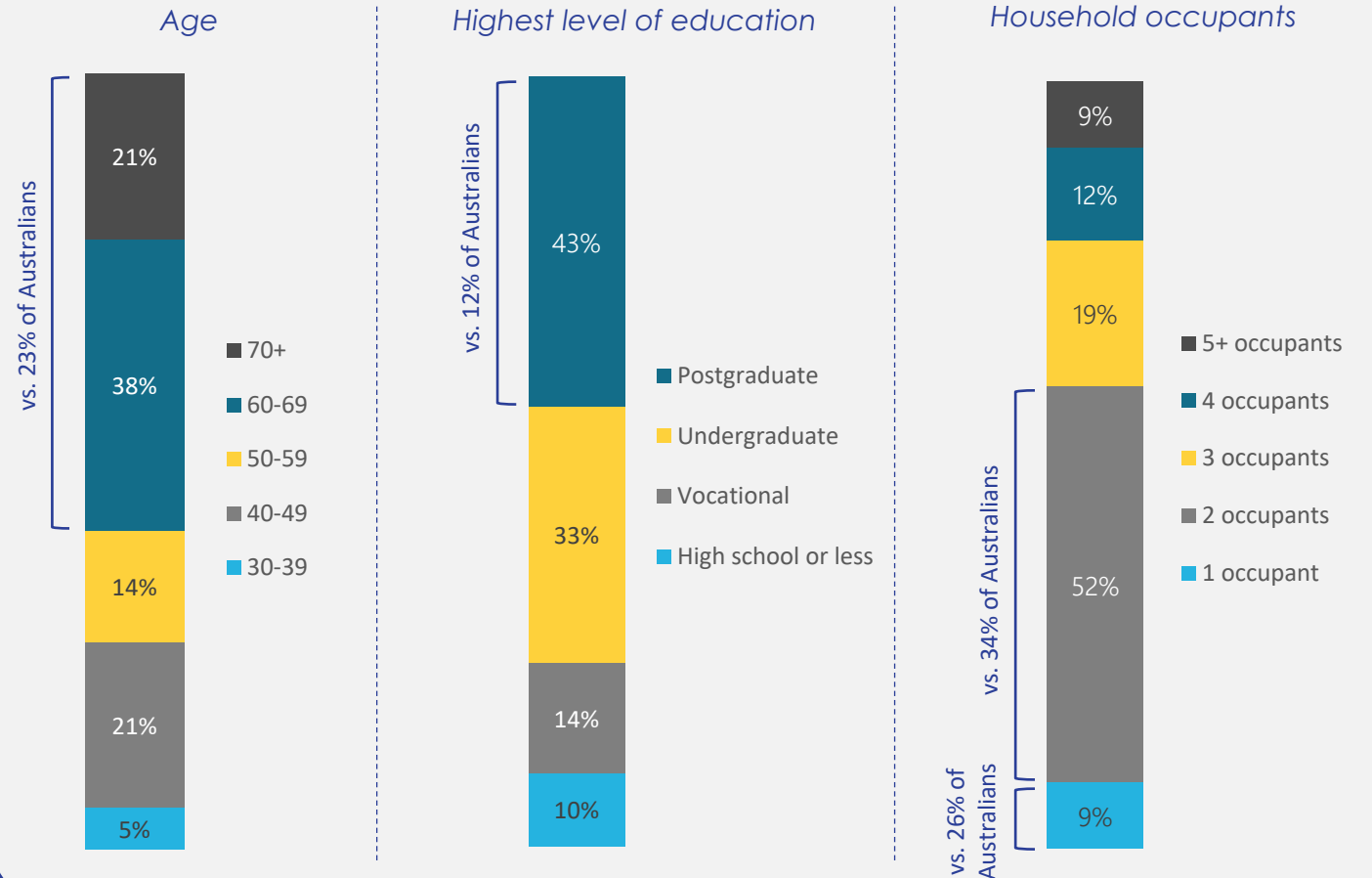
DER and VPP experience ⑤

- Most customers had had first-hand experience with the VPP for at least 3 months



The sociodemographic profile of Project EDGE customers differed to that of the broader Australian population ⑤

- Customers were older, more likely to have a postgraduate degree, and more likely to reside in two-person households than the average Australian



Current customers: Why did they join?

Bundling VPPs with other services may help to accelerate VPP adoption ④

- Some customers were not deeply invested in energy

“ One of the thing that attracted me to [aggregator], it wasn't the VPP that attracted me so much, but it was quite useful because they said that they could manage our electricity and our gas, and then if we had credit in the electricity account, they said, 'You can use that credit in the electricity account to offset your gas bill.' ”

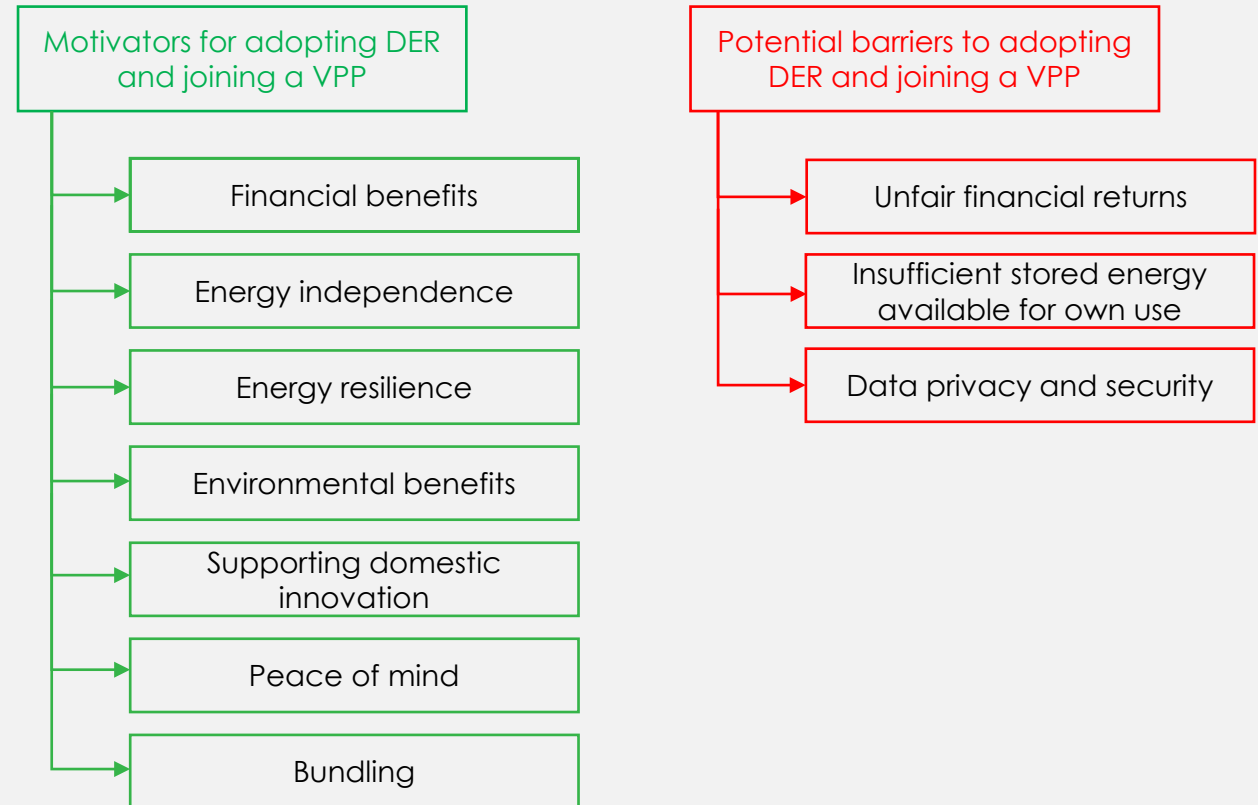
- For this cohort, bundling VPPs into an attractive, integrated service may represent an alternative strategy to trying to drive the adoption of VPPs as a standalone service

Expectation management may be necessary to ensure that customers' original motivations for adoption can be fulfilled ■ ④

- Some customers had unrealistic expectations about what their DER could achieve or how it would interact with the VPP
- Others had hoped that joining a VPP would deliver greater direct benefits to their community than were achieved
- Actively managing customers' expectations so that they are better aligned with their eventual experiences will be key to maintaining longer-term customer satisfaction

Customers considered multiple factors when evaluating whether to adopt DER and join the VPP ■ ④

- Adoption was motivated by reasons that spanned micro (household), intermediate (local community), and macro (societal, environmental) considerations
- Customers also identified potential barriers, and while these barriers hadn't prevented them from adopting, they could adversely affect the adoption decisions of others



Current customers: What did they experience?

Customers were seeking improved comms and transparency ■■⑤

51% of customers who recalled receiving comms from their VPP were satisfied with those comms

Suggestions for improving VPP comms included:

- **Real-time impact of VPP activity** so that customers could know when and why their DER assets were being used
- **Forewarning of VPP activity** wherever possible so customers could plan their household appliance use accordingly
- Information about **Project EDGE learnings**, highlighting that for some customers, their involvement in the trial was driven by a desire to support a technology they saw as key to achieving community and environmental outcomes

These suggestions were separately also identified as ways to **enhance comfort with an aggregator** managing their DER

For some, joining had been a leap of faith ④

- Some customers reported struggling to understand the charges and terminology used to describe the VPP or wanted (and failed to find) information about the net financial implications of joining the VPP

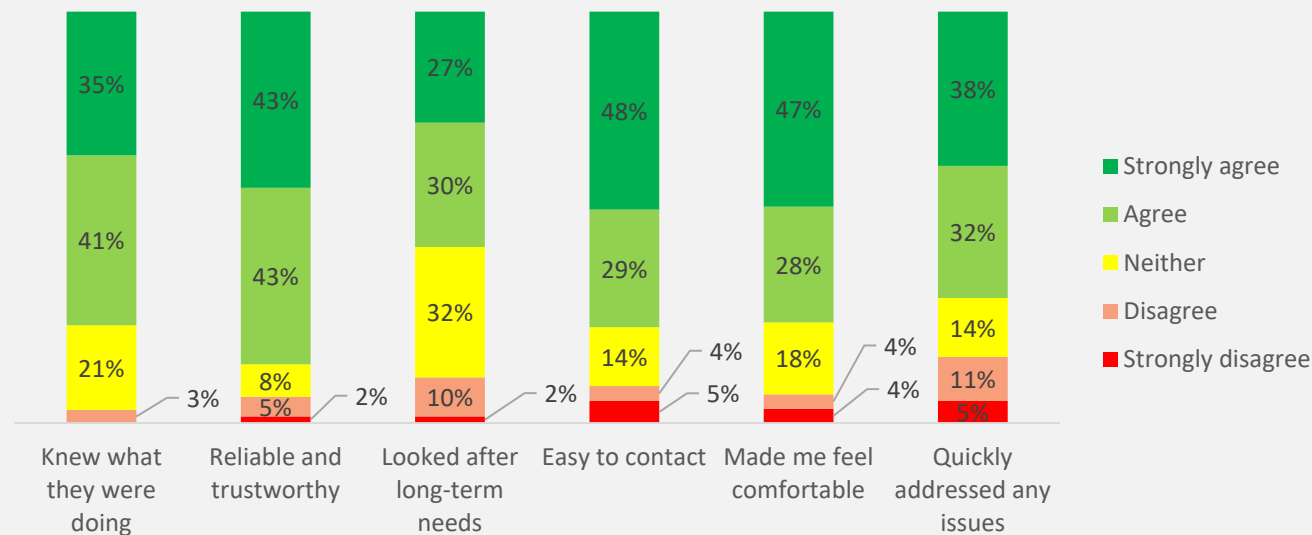
Reports ④ [Interviewing Project EDGE customers](#)
⑤ [Surveying Project EDGE customers](#)

Most customers liked VPP exports to be automated, although this resulted in the exporting process being seen as a 'black box' ■④

- While some customers were keen to customise their VPP settings (if the option to do so was available), most preferred for VPP activities to occur in an automated fashion
- One consequence of this preference was that the VPP remained a 'black box' for many customers in that they were not always aware of when – or even if – active management of their DER asset was occurring

While customer service was generally seen as good, opportunities for improvement were identified ⑤

- While 86% agreed that their aggregator was reliable and trustworthy, only 57% agreed that their aggregator was looking after their long-term needs



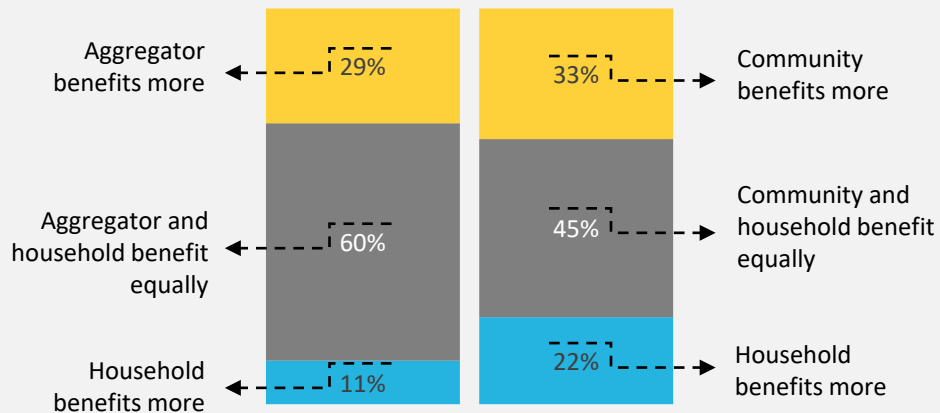
Current customers: Who shared the benefits?

Financial rewards were satisfying but difficult to contextualise ■ ⑤

- 71%** were somewhat or very satisfied with the financial rewards received for participating in the VPP
- 30%** were unsure what financial impact their VPP participation had had on their energy bills

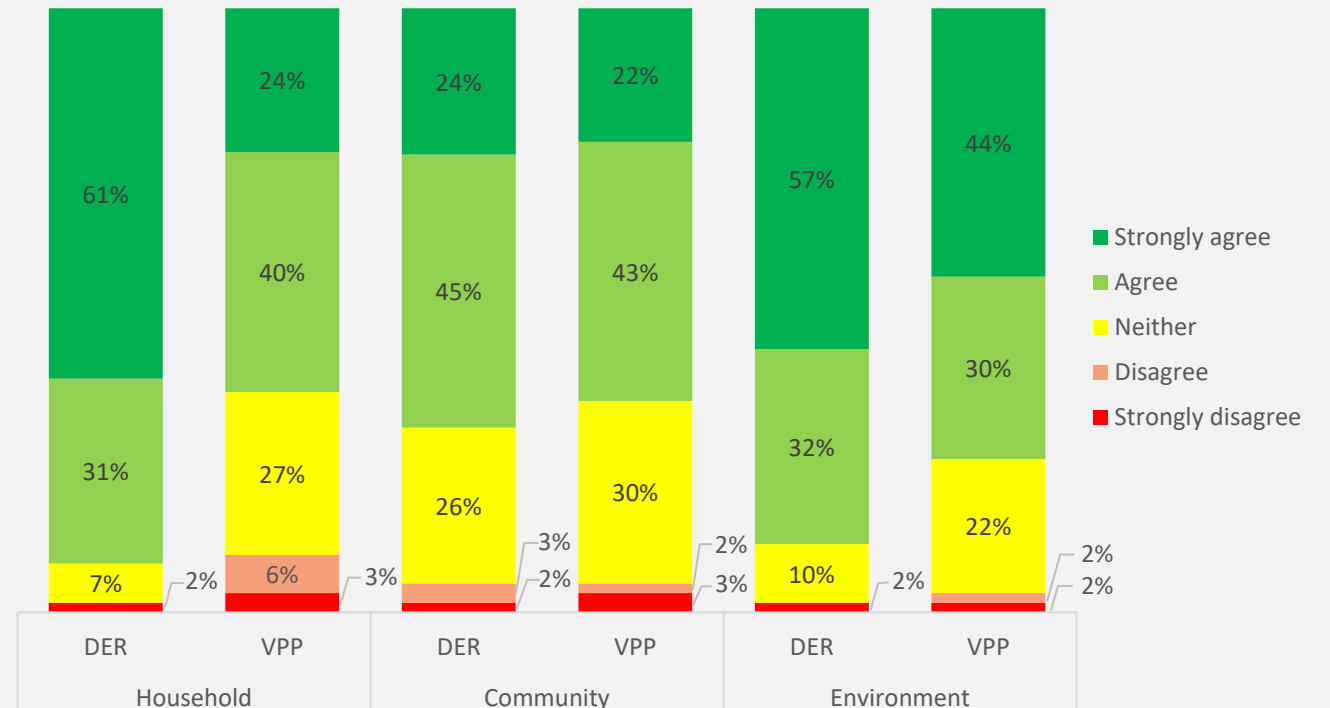
Aggregators were seen to benefit more from VPP participation than households ■ ⑤

- 29% believed that aggregators benefitted more from VPP participation than households (vs. 11% who believed that households benefitted more than aggregators)



Value proposition for joining a VPP requires work ■ ⑤

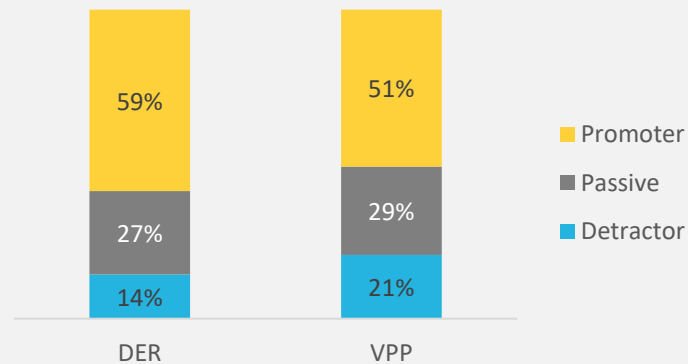
- The graph below shows customers' perceptions of who benefits from DER and VPP adoption: their household, the community, and/or the environment
- While 61% of customers strongly agreed that adopting DER had benefitted their household, only 24% held a similar opinion with respect to joining the VPP
- These findings, alongside those outlined in the lefthand panel, suggest that further work is required to enhance the value proposition for joining a VPP
- This includes better showing the benefits for joining a VPP over and above adopting DER



Current customers: Would they remain?

Net Promoter Scores were favourable ⑤

- Net Promoter Score (NPS) is an industry metric used to assess the likelihood that a customer would **recommend a product or service to others**
- NPS is calculated by categorising customers into three groups (promoter, passive, detractor) and then subtracting the proportion of detractors from the proportion of promoters



- The NPS for the VPP was positive and compared favourably with those of other Australian VPPs:

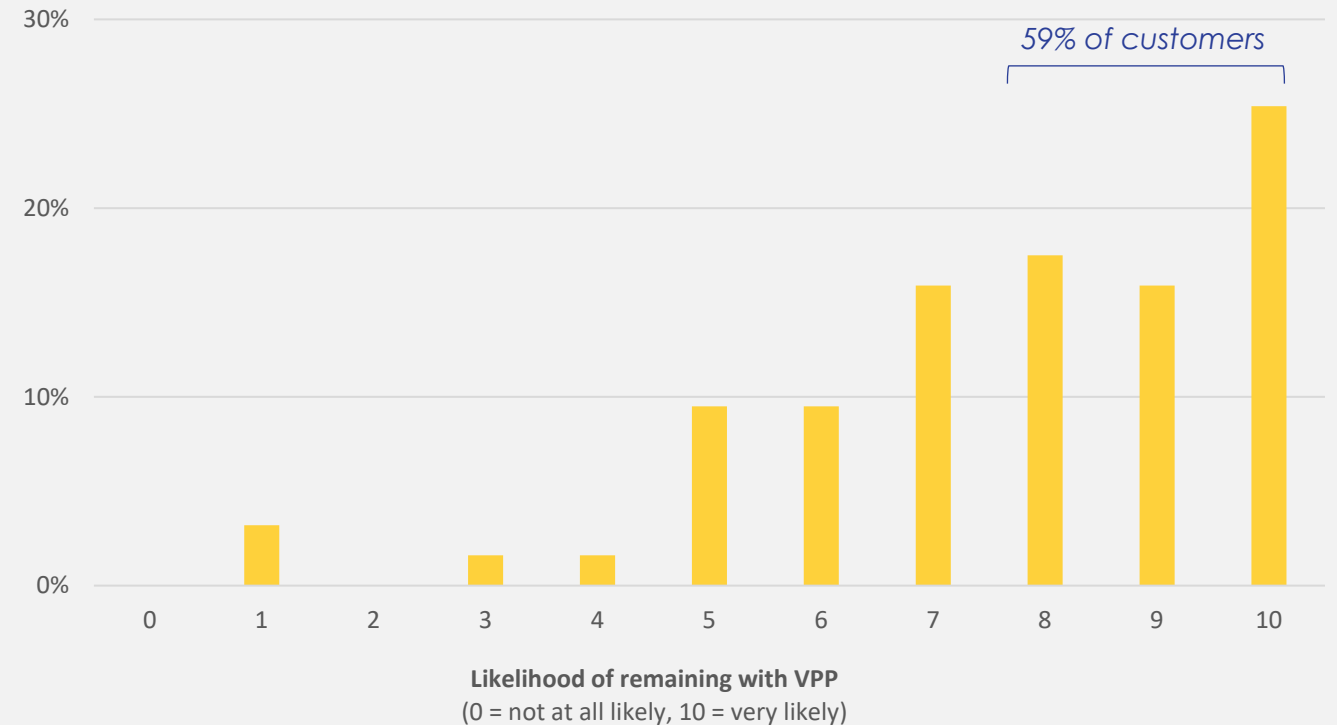
+30 NPS for Project EDGE VPPs

+11 comparison NPS for seven Australian VPPs

+65 comparison NPS for Simply Energy VPPx

A majority of customers reported a high likelihood of remaining with the VPP ⑤

- The graph below shows customers' self-rated likelihood of remaining with the VPP following the conclusion of the Project EDGE trial
- Consistent with findings outlined earlier, customers were broadly satisfied with their VPP, with 59% reporting a high likelihood of remaining with the VPP



Current customers: Can more exports be motivated?

Efforts to motivate additional export activity should pass a 'better off overall test' ④

- Customers were not averse to increasing the amount of energy they exported through a VPP, so long as it passed a 'better off overall test'
- Customers wanted assurances that additional export activity would not accelerate DER depreciation
- Customers also wanted certainty about the financial implications of engaging in additional VPP exporting activity relative to benefitting from self-consumption

Customers want to know the impact of their philanthropically-focused exports ④

- If short-term, philanthropically-focused requests for additional VPP exports are implemented (see righthand pane), customers would want to be kept apprised of the tangible impacts of those philanthropic exports

“ I think it needs to be something that you can quantify that's not tonnes of greenhouse gases, because no one knows what that looks like.

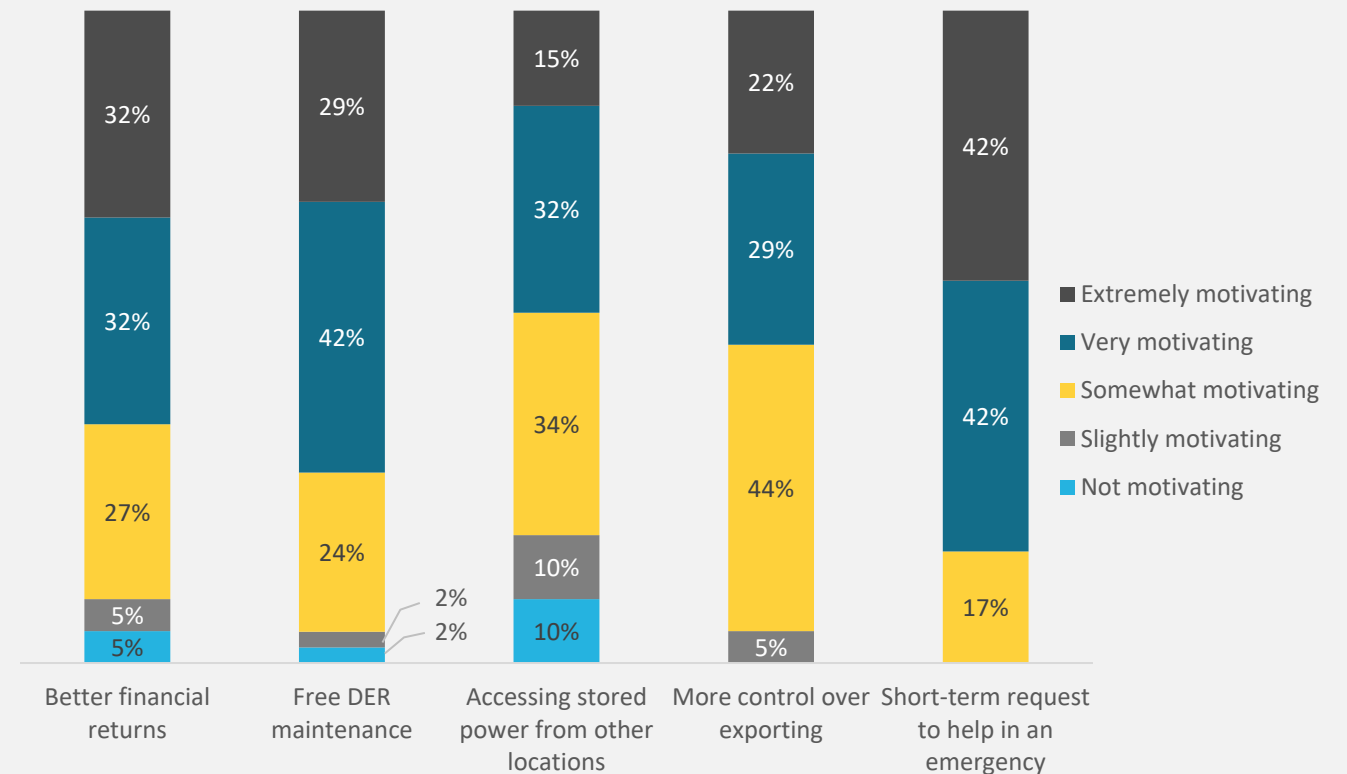
- Philanthropically-focused exports didn't negate the need for exports to still pass the 'better off overall test'

Reports ④ [Interviewing Project EDGE customers](#)

⑤ [Surveying Project EDGE customers](#)

Financial and non-financial strategies may be successful in motivating additional export activity ⑤

- The graph below shows the perceived motivating influence of different strategies for increasing VPP export activity
- All strategies were rated as very or extremely motivating by at least 47% of customers
- One strategy – **short-term, philanthropically-focused export requests to assist in an emergency** – was deemed very or extremely motivating by 84% of customers



Implications

Implications



Implications for policy makers

- Consumers consider the personal costs and benefits of DER export policies when assessing the fairness of those policies
- Of the examined DER export policies, the one deemed most fair involved no costly distribution upgrades (benefits all households) and included dynamic export limits (benefits households with solar PV)

Areas for future research

- What is a VPP value proposition that is equally attractive to potential and current customers while also being financially sustainable for aggregators to operate?
- What will motivate more customers to join a VPP: bundling the VPP with a broader package of energy (or other) services, or developing a standalone VPP offering?
- What algorithms can be developed to help potential customers obtain a reasonable estimate of the potential financial implications associated with joining a VPP?
- What is the most effective way to transparently communicate with customers about how their VPP is being used while simultaneously respecting the desire that most customers have of not being involved in the day-to-day functioning of the VPP?

Implications for aggregators

- *Value proposition*
 - Potential customers expect VPPs to save (or generate) them money, so the value proposition for joining a VPP should include tangible financial benefits
 - Potential and current customers struggle to see the personal benefits of joining a VPP over and above adopting DER, highlighting that the value proposition for joining a VPP requires further refinement
- *Communication and trust*
 - Customers expect transparency from aggregators, both when considering whether to join a VPP (e.g., estimates of the financial implications of joining) and after joining a VPP (e.g., information about how their DER assets are being used; linking VPP participation to financial benefits)
 - Aggregators that can provide customers with sought-after transparency are well-placed to develop the trust of customers
 - While customers may desire information about how their DER assets are being used, most do not want to be involved in the day-to-day management of the VPP, so how aggregators balance this potential tension will be key
- *Motivating additional exports*
 - Customers are not averse to increasing the amount of power they export through a VPP, provided they will be better off overall
 - Short-term, irregular requests for additional VPP exports to address an emergency need could be motivated by philanthropically-framed requests
 - For more regular export requests, relational strategies that deliver longer-term value for customers (e.g., free DER maintenance, better financial returns) may prove motivating

Contact

Lead researcher

A/Prof Josh Newton
Better Consumption Lab
Deakin University
E: j.newton@deakin.edu.au
T: +61 3 9251 7830

Better Consumption Lab research team

A/Prof Josh Newton
Dr Virginia Weber
Dr Jeff Rotman
Dr Jay Zenkić
Dr Jubin Jacob John
Dr Michael Gatumu