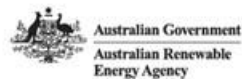


Project EDGE | Customer insights

Demonstrations Insights Forum

9 November 2022



A photograph of a dense forest with tall, thin trees and lush green foliage. The sky is visible through the canopy, showing a clear blue color. The trees are mostly deciduous with green leaves. The ground is covered in grass and some low-lying plants.

Acknowledgment of Country

We acknowledge the Traditional Owners of country throughout Australia and recognise their continuing connection to land, waters and culture.

We pay our respects to their Elders past, present and emerging.

Agenda



Time	Description	Presenter
11.00-11.10am	Project update	EDGE team
11.10am-11.20am	Preliminary insights	Nick Regan - AEMO
11.20am-12.30pm	Customer insights	Josh Newton - Deakin University

Project EDGE update

- Presented at two international forums – the Association of Power Exchanges & the Integration of Renewable and Distributed Energy Resources Conference
- Final CBA methodology available from late November – thanks for your input
- More field test data becoming from late October (aggregator performance today!)
- Ongoing results analysis and input into reform such as Scheduled Lite
- Customer insights study latest instalment published[^]
- With the release of Gamma, we now have the capability to test Local Services Trials and simulating pricing events – will share insights in future forums
- Building from the feedback received, creating use cases from the explored Data Exchange Problem statements to test with interested stakeholders

[^]<https://aemo.com.au/initiatives/major-programs/nem-distributed-energy-resources-der-program/der-demonstrations/project-edge/project-edge-news-and-knowledge-sharing>

Preliminary insights

Aggregator dispatch performance

Analysis seeks to answer how DER participation in wholesale dispatch can be facilitated

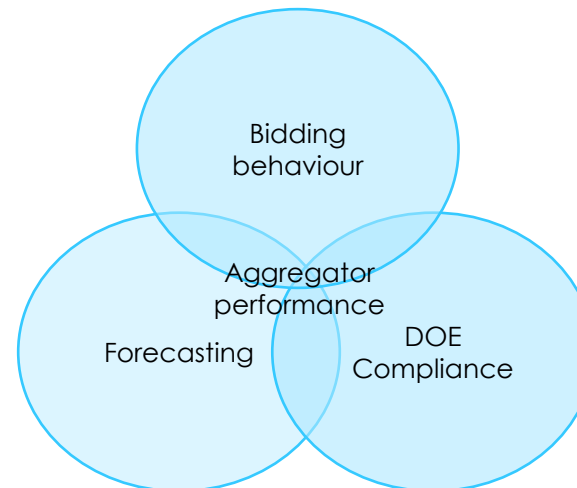
The guiding research question for this analysis was **research question 4**:

How can the Distributed Energy Resource (DER) Marketplace facilitate activation of DER to respond to wholesale price signals, operate within network limits and progress to participation in wholesale dispatch over time?

The **hypothesis** for this research question is:

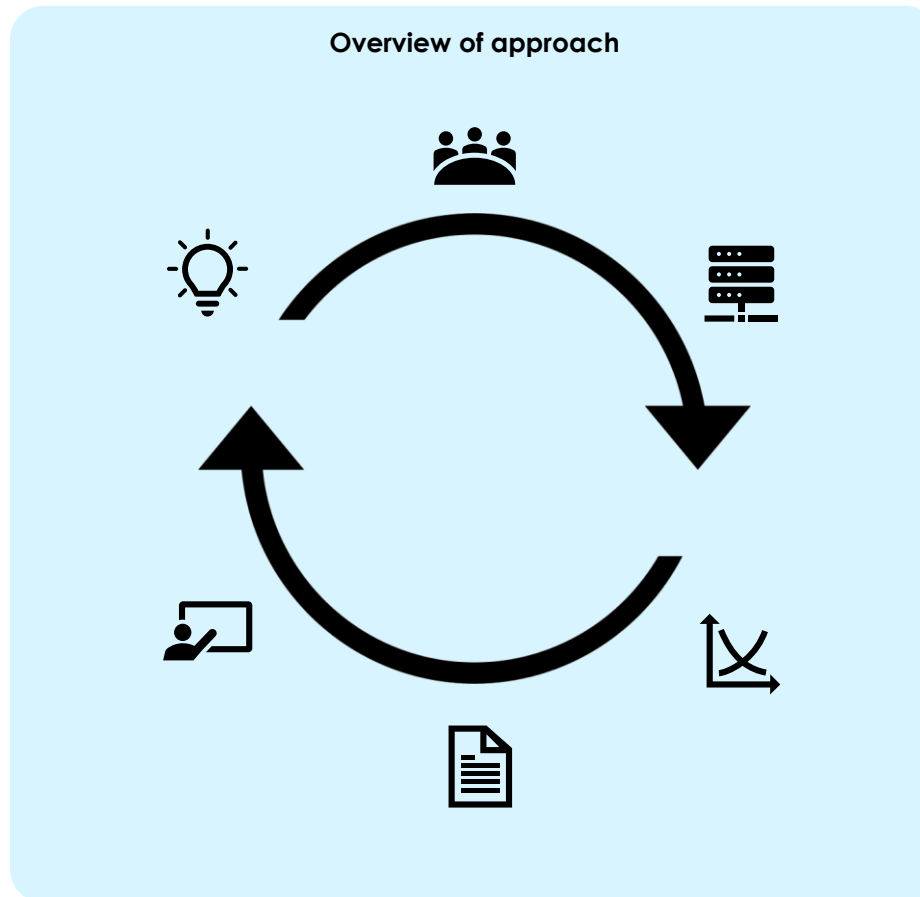
DER participation in wholesale energy markets can be achieved progressively, as DER fleets reach materiality thresholds, aligning with Energy Security Board (ESB) visibility and dispatchability models.

- The focus of the analysis was aggregator performance with dispatch instructions (targets).
- There are several other workstreams connected to this set of results. Overall aggregator performance to dispatch targets has intersection points that have implications on accurately forecasting and DOE compliance. These other activities form part of the same work package and over time will be viewed collectively to identify intersecting insights.



High-level approach to answering research questions and hypothesis

A key learning is that data analysis only reveals so much and much of the 'so what' requires discussions with participants. Therefore, a collaborative approach to answer the research question and generate meaningful insights has been established.



Planning workshop

Co-design methodology with EDGE team and SMEs



Data sourcing

Source trial data from EDP server



Data analysis

Conduct statistical analysis



Generate findings

Produce summary of analysis



Workshops

Draw out insights from aggregators and SMEs

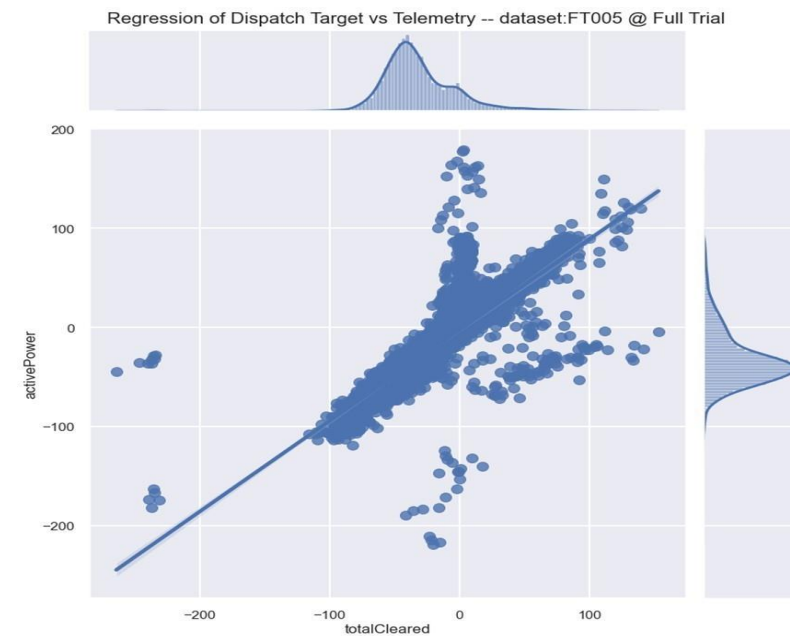
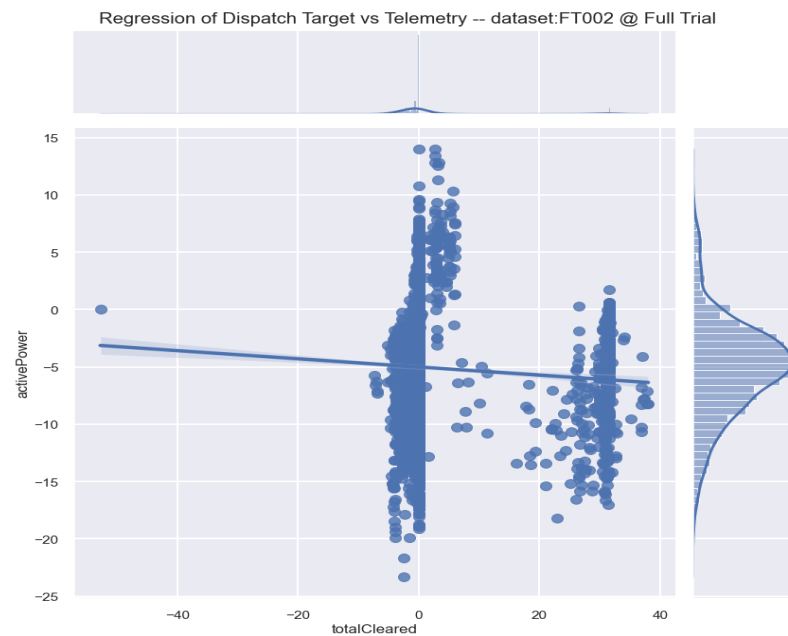


Generate insights

Provide answers to research questions and their impact

The size of an aggregator's fleet supports better performance

- Discussions with the aggregator analysed revealed that there were two key drivers supporting better performance over time:
 - Increased number of customers
 - Deliberate improvements in the algorithms
- This suggests that the size of the fleet is an important factor because it increases the diversity of customers that aggregator can draw upon to meet its dispatch targets
- This, along with the deliberate improvements in the algorithm have led to progression in forecasting available fleet capacity, more refined bidding quantities, and meeting more realistic dispatch targets.
- This progression over time can also be visualised through graphs illustrating the difference between the first field trial tested and a more recent field trial. The graphs show the correlation between targets and telemetry.



Summary of findings



These preliminary findings suggest the hypothesis may be true and begins to answer the research question by providing insights into how activation of DER to progress to participation in wholesale dispatch could be achieved.

Research question	How can the Distributed Energy Resource (DER) Marketplace facilitate activation of DER to respond to wholesale price signals, operate within network limits and progress to participation in wholesale dispatch over time?
Hypothesis	DER participation in wholesale energy markets can be achieved progressively, as DER fleets reach materiality thresholds, aligning with Energy Security Board (ESB) visibility and dispatchability models
Preliminary Insights	<ul style="list-style-type: none"> • Aggregators need a stepping stone approach to participate in the market reliably • Performance improves over time as aggregators develop and refine processes • The size of an aggregator fleet also supports more reliable performance
Next steps	<ul style="list-style-type: none"> • The preliminary results are based on the data of a single aggregator over a 5 month period • The hypothesis needs to be tested further to robustly answer that element of the research question <ul style="list-style-type: none"> • 3x Aggregators, differing fleet size and DER makeup, greater total customers • Further calibrate aggregator telemetry with smart meter data – trusted physical measurement is critical to market, system and settlement operations!

- The implication of these insights – if they hold true when stress-tested with additional data over the course of the trial – is that DER participation in wholesale markets is best achieved progressively in the interest of system security. Progressive participation allows DER fleets to reach a materiality threshold and refine processes to support reliable performance aligned with instructions from the market and system operator.
- These results support the Visibility and Dispatchability Model approaches proposed by Scheduled Lite.

Customer insights

Close and next steps

Overview



Today's presentation will focus on select findings from two recently completed reports:

- Literature review of consumer insights research on different DER offerings
- Survey of potential residential customers

Literature review

Overview



Several reports have recently reviewed the literature on consumer perceptions of DER-related offerings

- ACIL Allen (2022). *Barriers and enablers for rewarding consumers for access to flexible DER and energy use: Rapid evidence review*
- ARENA (2020). *DER customer insights: The customer journey*
- ARENA (2020). *DER customer insights: Values and motivations*

The purpose of our literature review was not to replicate these reports but instead to identify those areas where insufficient or insufficiently detailed research has been conducted to date

The aim was to provide a roadmap for future DER-focused consumer insights research

Findings



We identified 21 research gaps. What follows here is therefore only a subset of the broader gaps we identified in our review

- We know more about:
 - Early adopters than about other customer segments
 - How to motivate adoption of DER-related offerings than on how to retain customers long-term
- Our understanding of how different consumer segments perceive DER-related offerings remains limited
- Emotional DER benefits have not been examined as extensively as rational DER benefits
- Consumer expectations about what would be an attractive financial return from adopting DER-related offerings remain unclear

Findings



We identified 21 research gaps. What follows here is therefore only a subset of the broader gaps we identified in our review

- From a perceptual perspective, how do DERs compare with the status quo or to other energy products?
- What can organisations do to:
 - Communicate with consumers of varying levels of expertise?
 - Increase trust and reduce risk perceptions?
 - Develop relational (vs. transactional) interactions with customers?
- Who are the voices that consumers listen to and trust when considering whether to adopt DER-related offerings?
- What must a DER aggregator do to ensure a smooth onboarding experience?

Survey of potential residential customers

Sample



We surveyed 893 participants who:

- Resided in New South Wales, Queensland, South Australia, or Tasmania
- Lived in a detached or semi-detached dwelling
- Owned their primary place of residence, either outright or with a mortgage

Recruitment took place in September 2022

Study focus



We were interested in understanding community perceptions of:

- Adopting DER (rooftop solar PV and/or household battery)
- Joining a DER energy aggregation service focused on households with rooftop solar PV and a battery

Segmentation variable: Solar panel status

Whether participants had rooftop solar PV (henceforth referred to as solar panel status) was used as a consumer segmentation variable because:

- Consumers with some DER may have different perceptions about adopting additional DER or joining an aggregator
- Consumers who already have rooftop solar panels are closer to having the DER necessary to join aggregators focused on solar panel + battery offerings

Segment	n	%
Solar panels: No	417	46.7%
Solar panels: Yes	476	53.7%

Segmentation variable: Adopter category



Our second segmentation variable was self-identified adopter category, which we used to better understand how to motivate consumers who are not innovators or early adopters

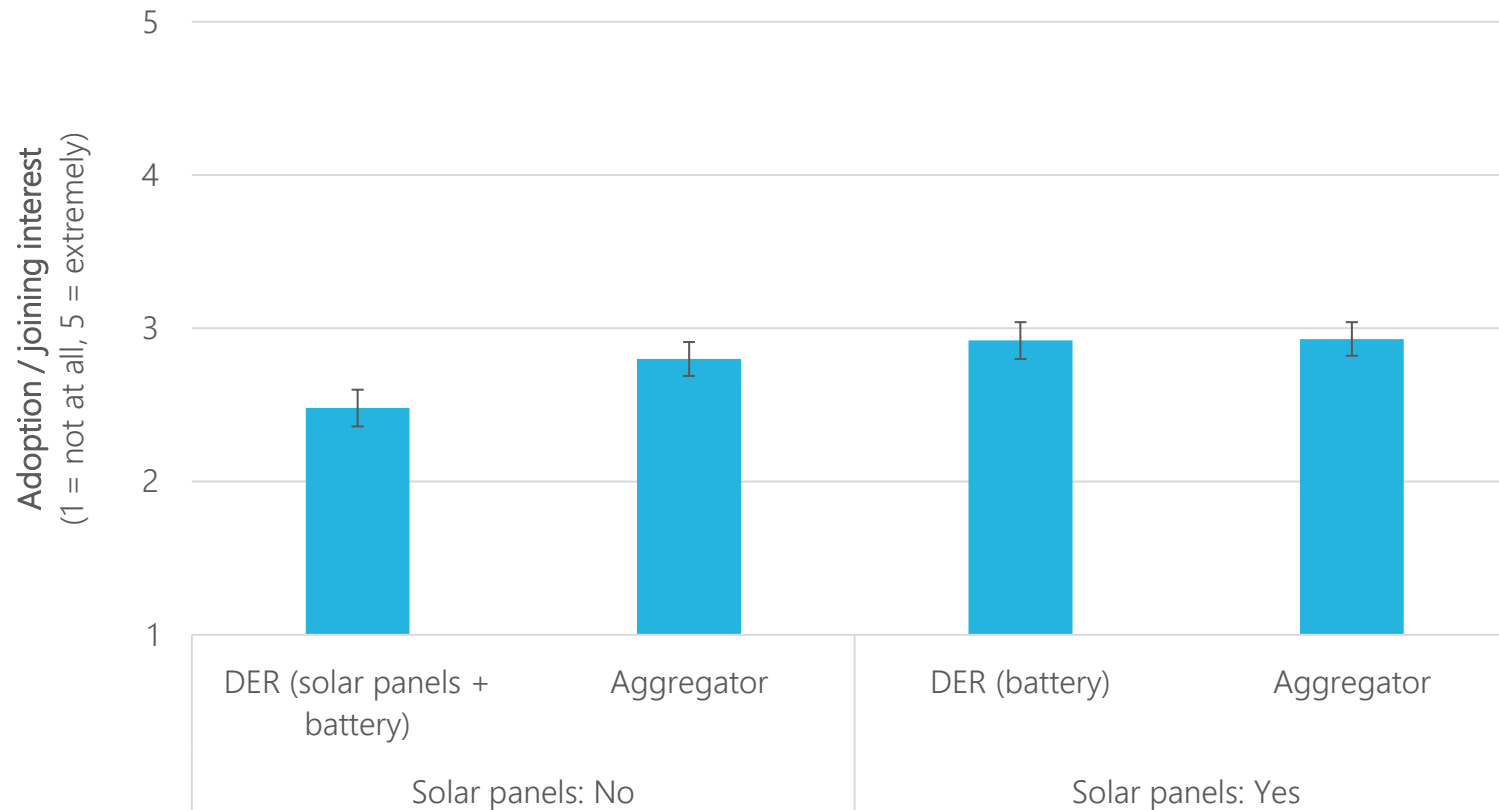
Category	Label	n	%
Innovator	I like to be one of the very first to try new energy technologies	31	3.5%
Early adopter	I like to be a leader in trying new energy technologies	65	7.3%
Early majority	I like to hear about other peoples' experiences before I try new energy technologies	473	53.0%
Late majority	I only try new energy technologies when the people I trust have already done so	229	25.6%
Laggard	I don't see much need for trying new energy technologies	95	10.6%

Due to their small group sizes, participants in the innovator and early adopter categories were combined in all subsequent analyses

Interest: Adopting DER vs. joining an aggregator



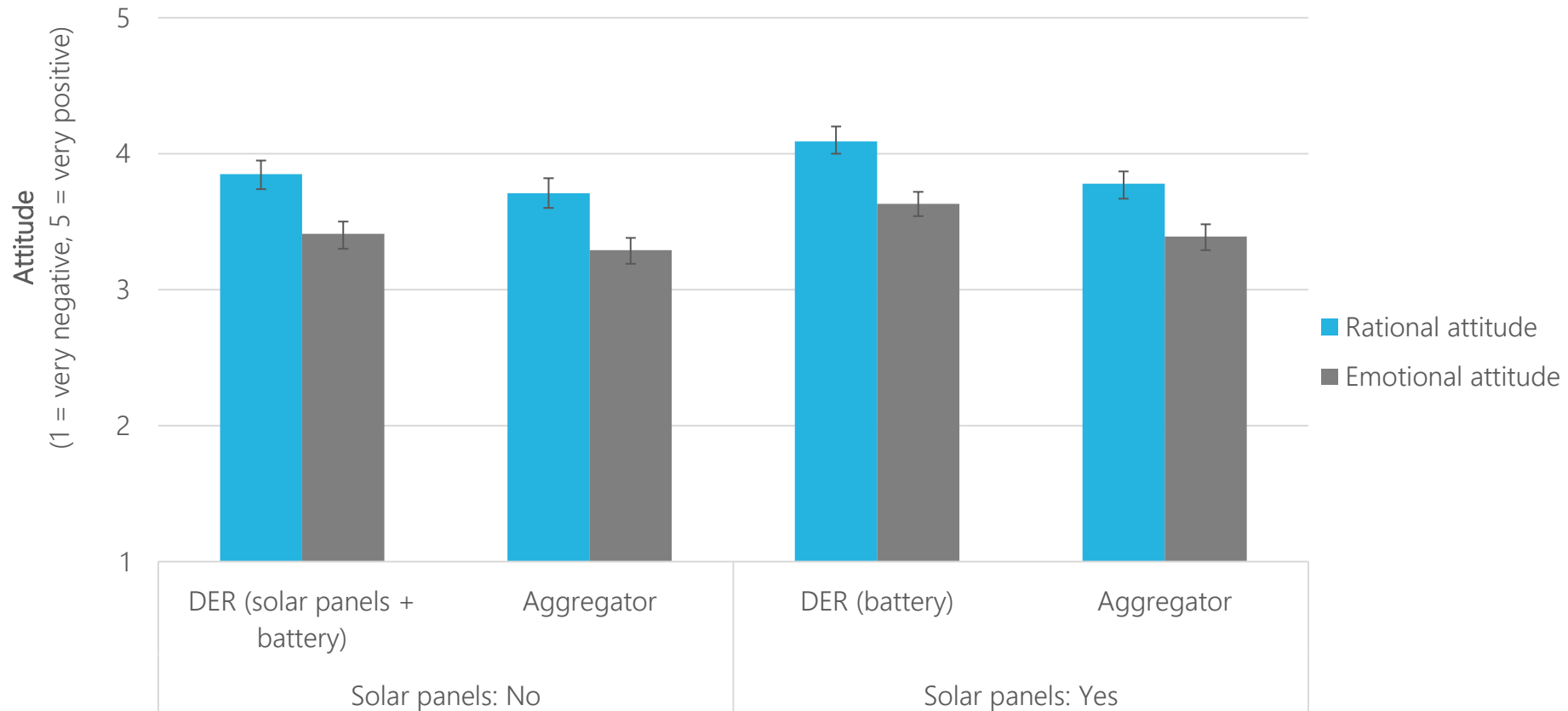
Interest in adopting DER/joining an aggregator was lukewarm



Attitude: Adopting DER vs. joining an aggregator



Rational attitude (useful, wise) toward adopting DER/joining an aggregator was more favourable than **emotional attitude** (exciting, enjoyable)



Attitude: Predictors of adoption/joining interest



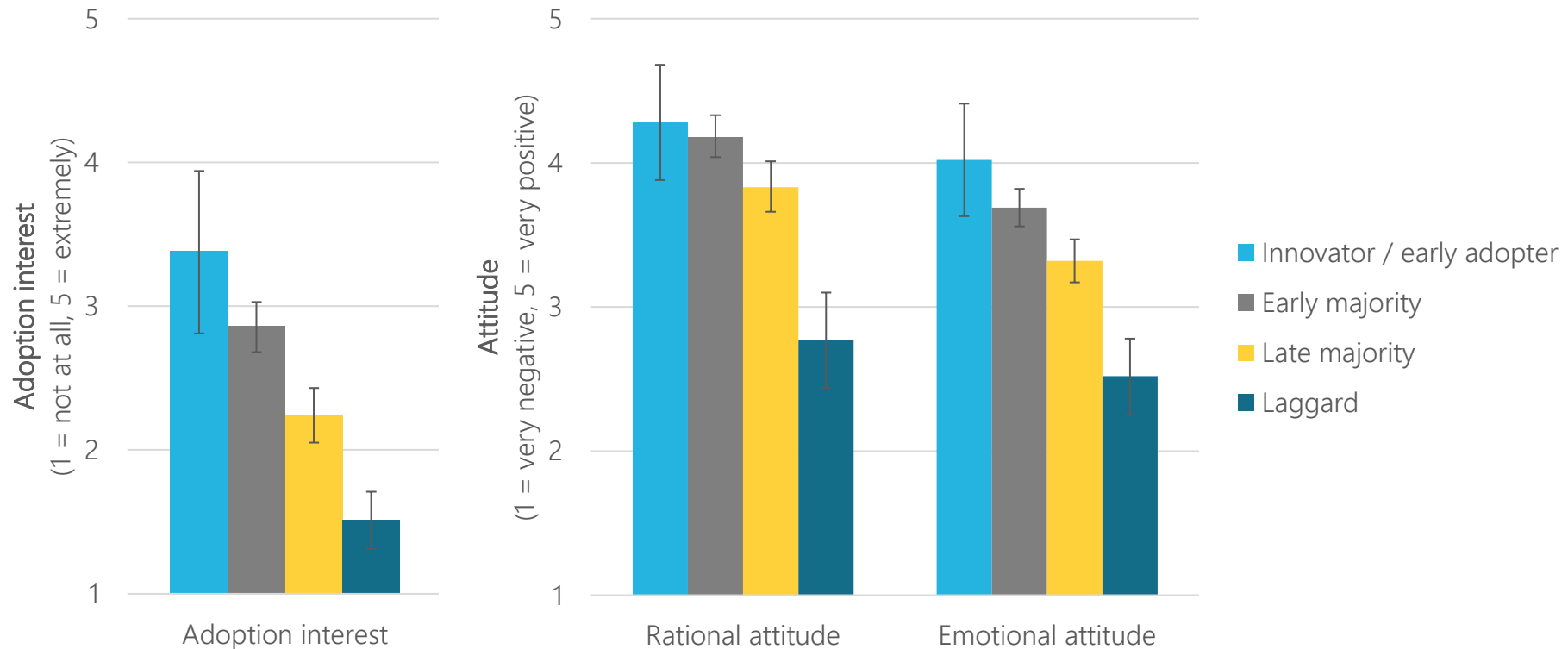
When evaluating whether to **join an aggregator**, participants thought more with the head (rational attitude) than the heart (emotional attitude)

Attitude dimension	Interest in adopting DER		Interest in joining an aggregator	
	Solar panels + battery	Battery	Solar panels: No	Solar panels: Yes
Rational attitude	$\beta = 0.48$	$\beta = 0.43$	$\beta = 0.67$	$\beta = 0.59$
Emotional attitude	$\beta = 0.21$	$\beta = 0.28$	$\beta = 0.09$	$\beta = 0.21$

Attitude and interest: Adopting DER (solar + battery), segmented by adopter category



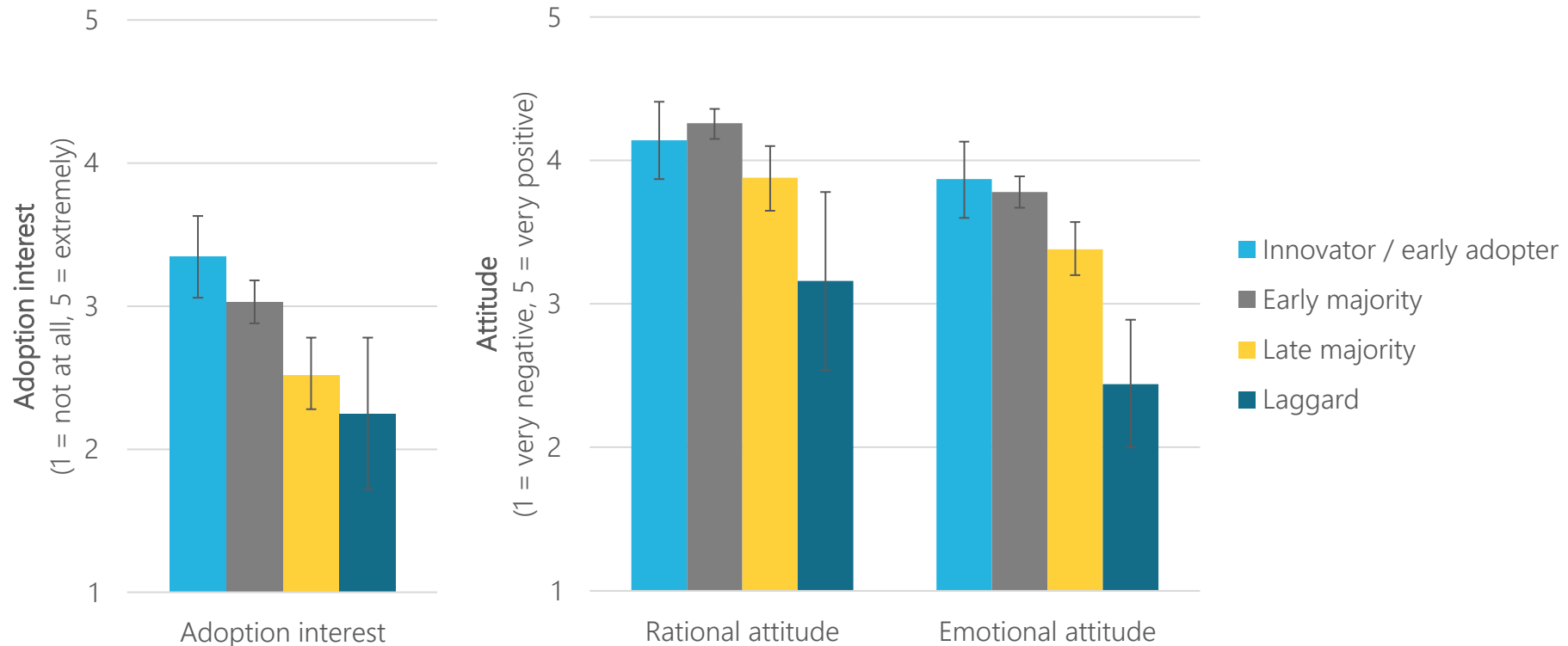
Innovators/early adopters and the early majority reported **stronger adoption interest** and **more favourable emotional attitude** for adopting DER (solar + battery) than the other adopter categories



Attitude and interest: Adopting DER (battery), segmented by adopter category



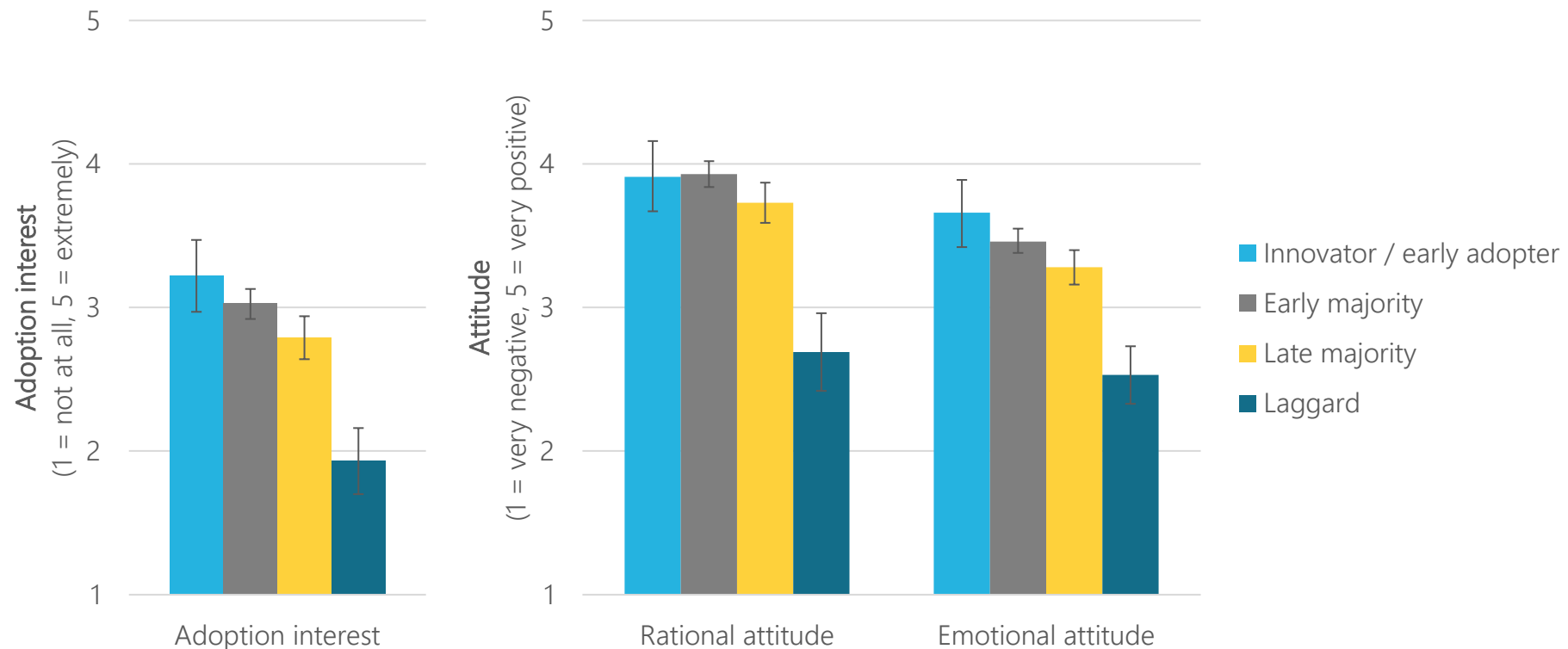
Innovators/early adopters and the early majority reported **stronger adoption interest** and **more favourable emotional attitude** for adopting DER (battery) than the other adopter categories



Attitude and interest: Joining an aggregator, segmented by adopter category



The innovator/early adopter category reported **stronger adoption interest** and **more favourable emotional attitude** than those in the late majority and laggard categories



Goal outcomes: Background



“People don’t want a quarter-inch drill, they want a quarter-inch hole”

Theodore Levitt

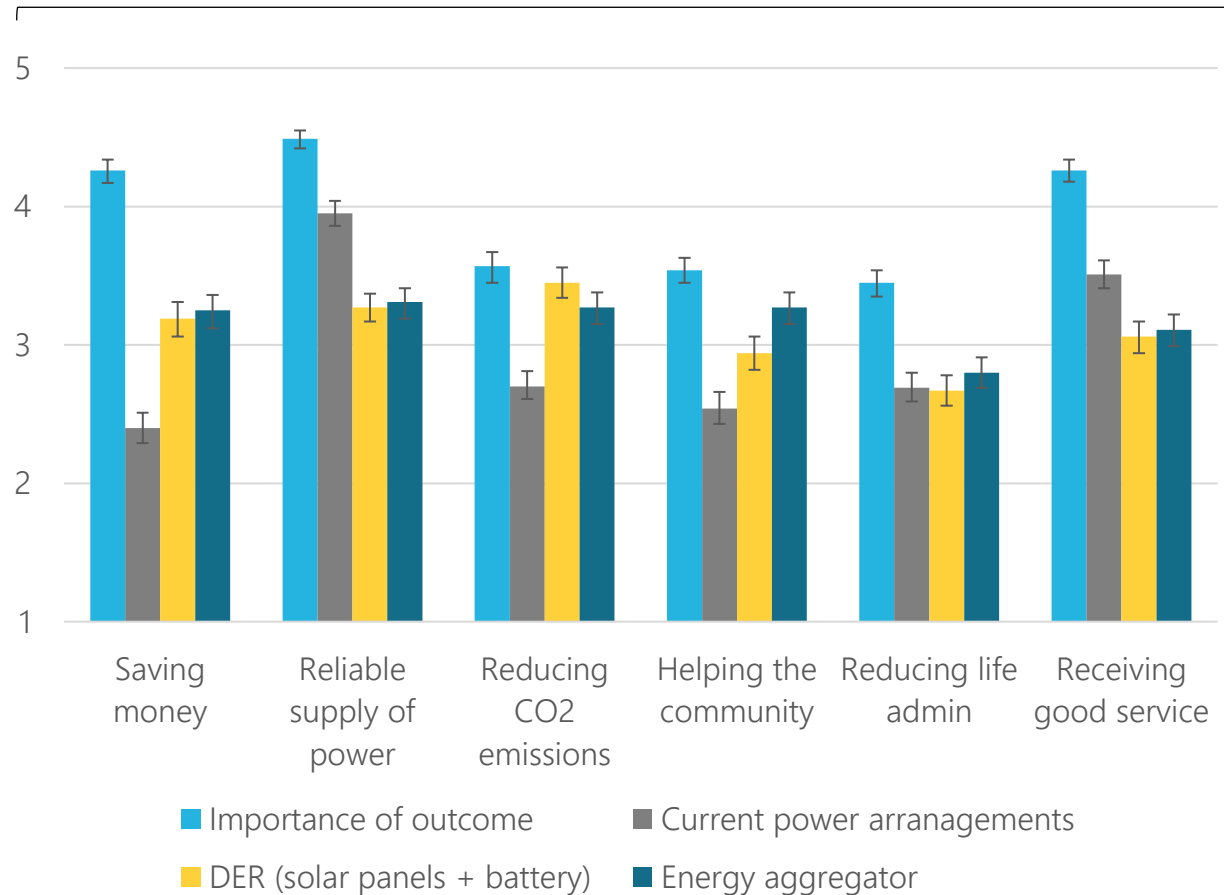
In other words, we need to understand:

- The goals that consumers are looking to satisfy
- The extent to which different energy-related offerings are seen as satisfying those goals

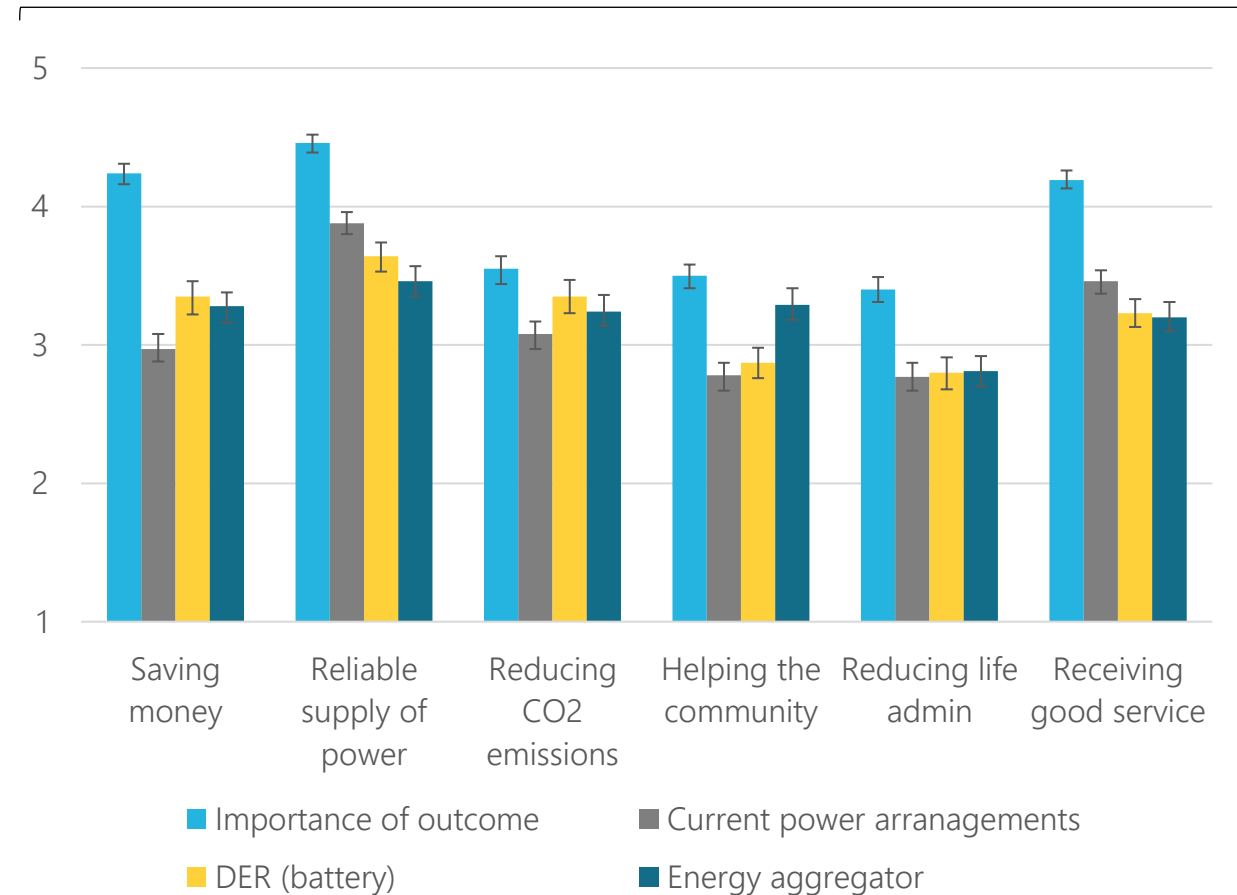
Goal outcomes: Segmented by solar panel status



Solar panels: No



Solar panels: Yes

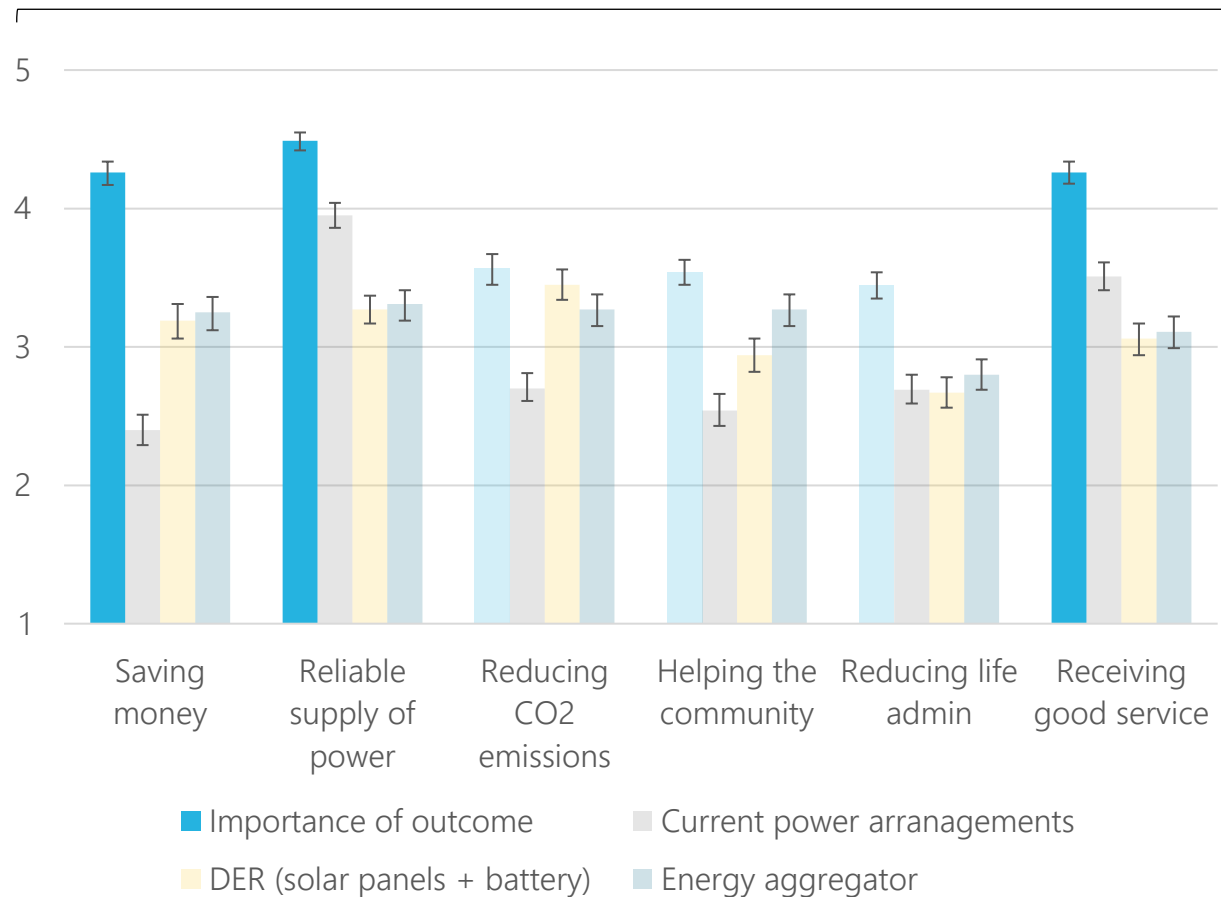


Goal outcomes: Segmented by solar panel status

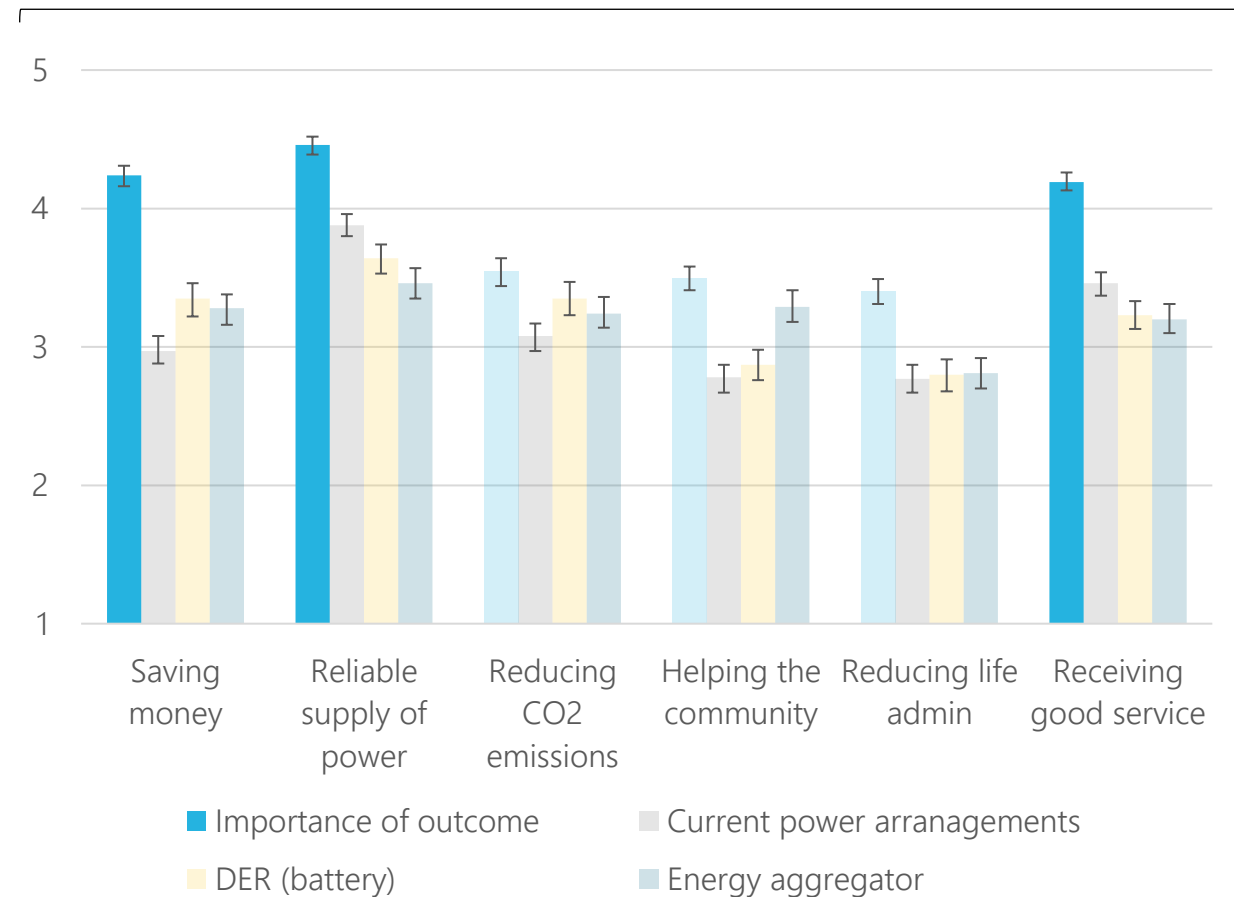


The most important goals were **saving money**, having a **reliable supply of power**, and **receiving good service**

Solar panels: No



Solar panels: Yes

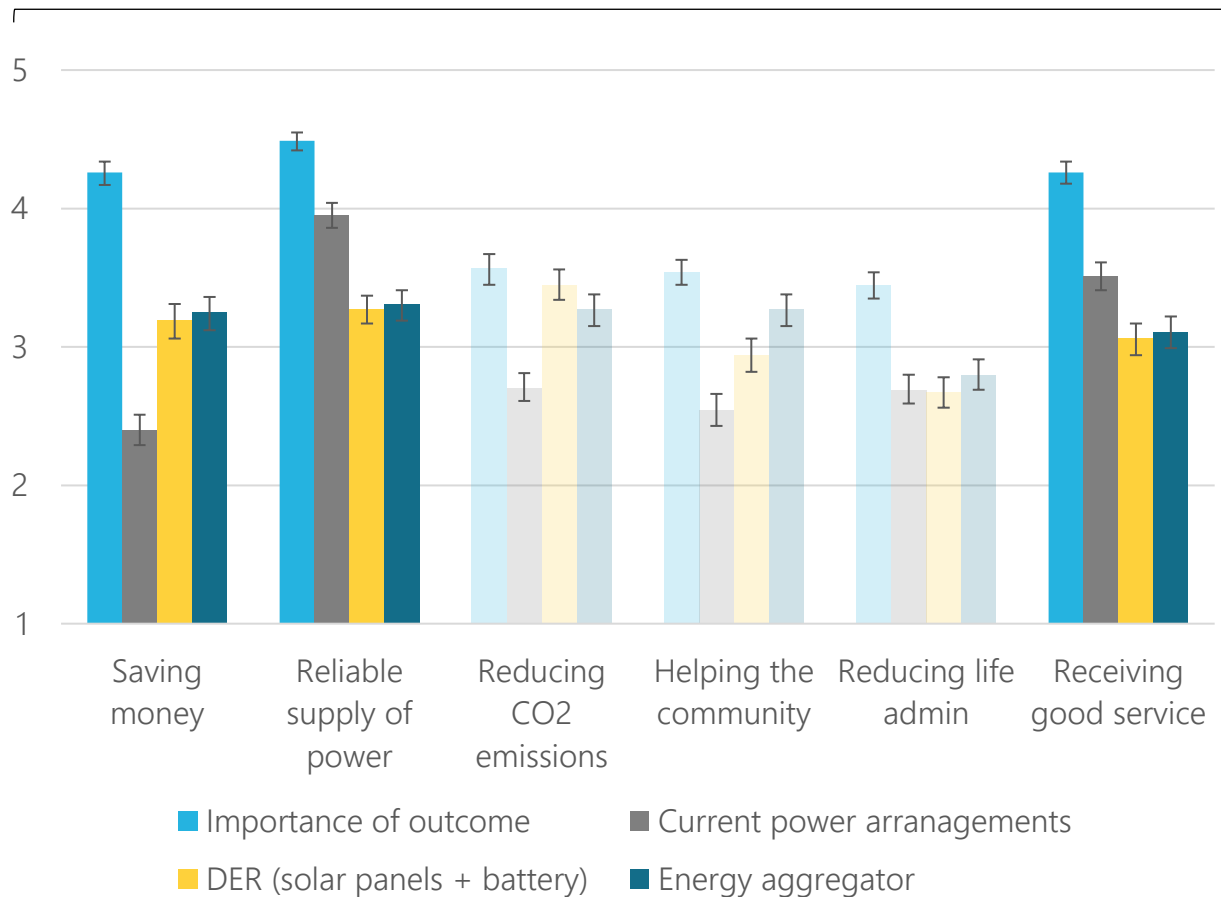


Goal outcomes: Segmented by solar panel status

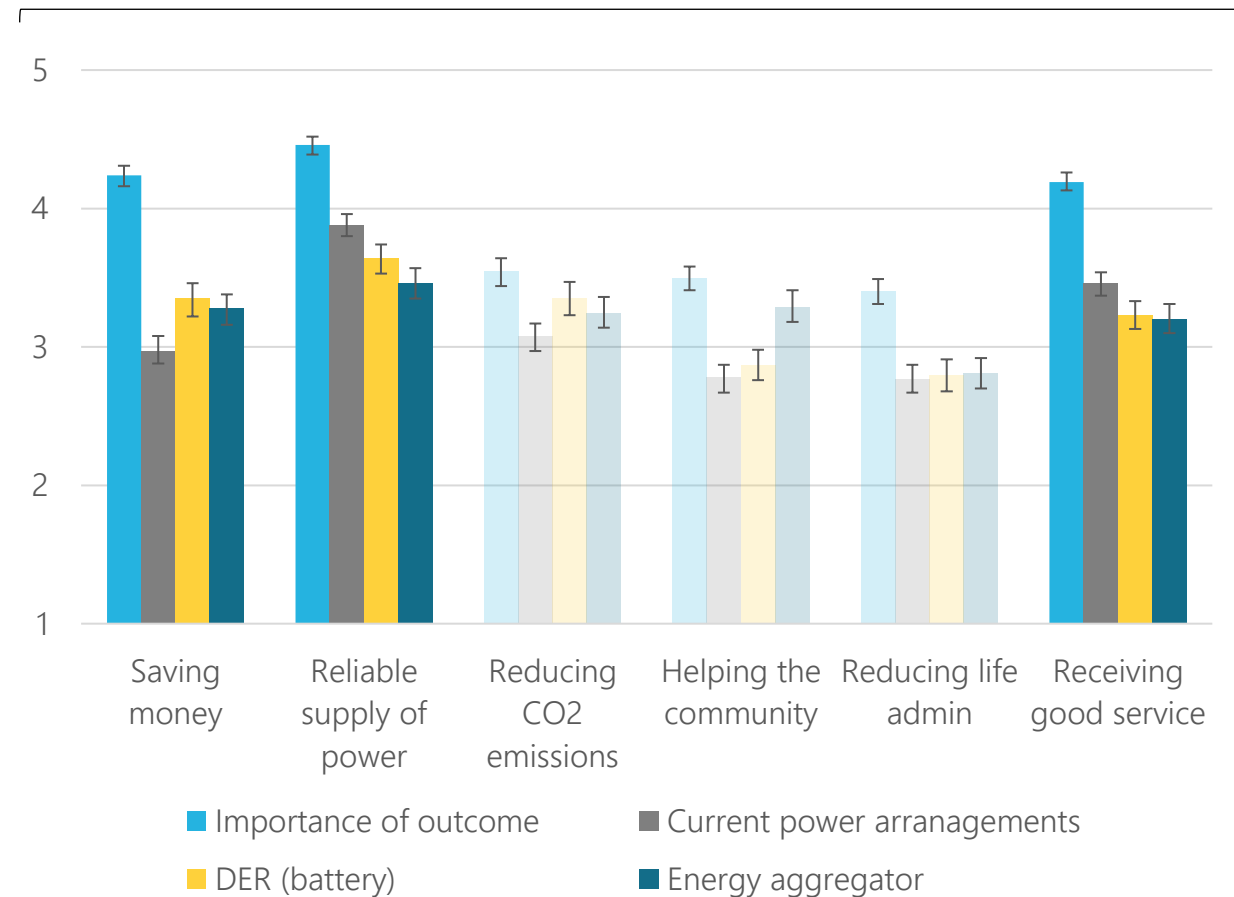


Relative to current power arrangements, adopting DER/joining an aggregator was seen as more likely to satisfy only one (**saving money**) of the three most important goals

Solar panels: No



Solar panels: Yes

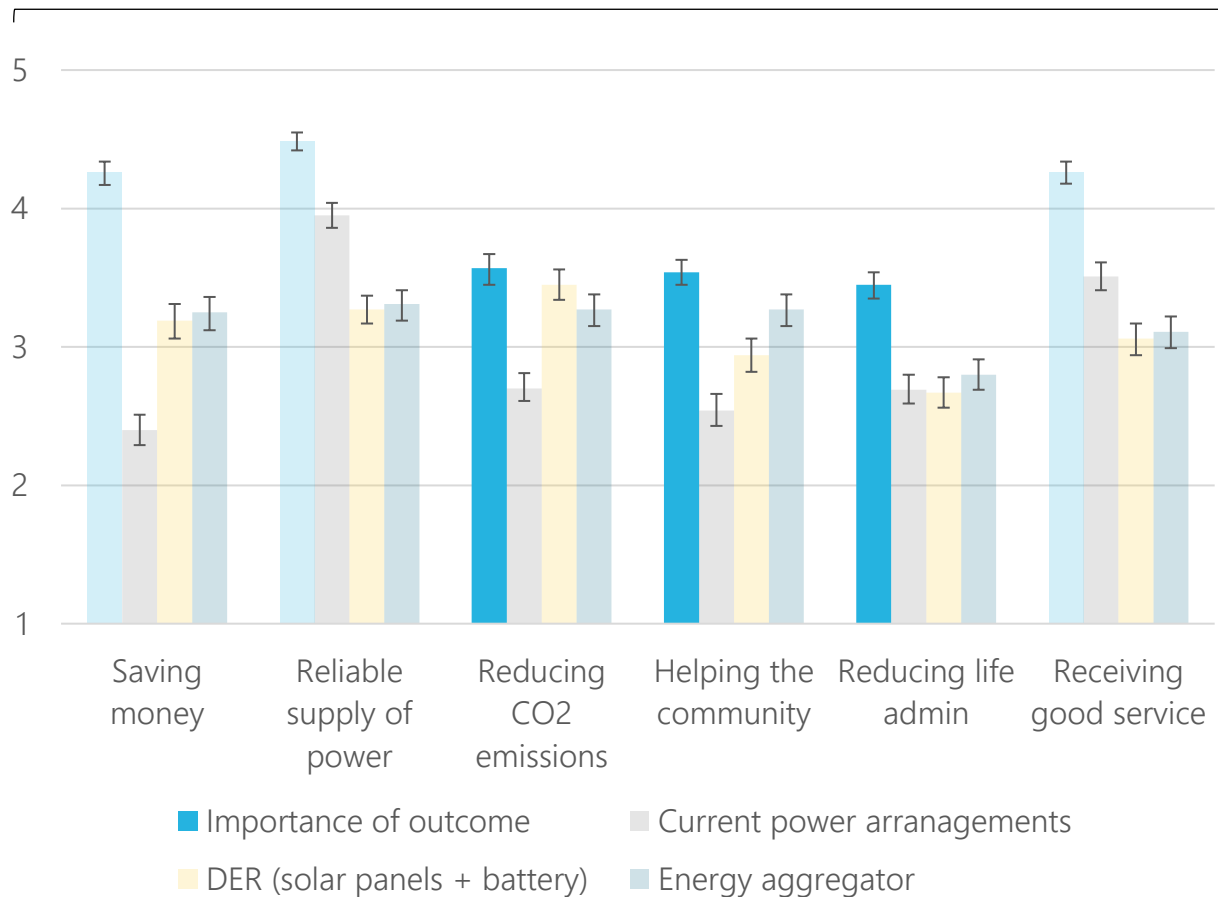


Goal outcomes: Segmented by solar panel status

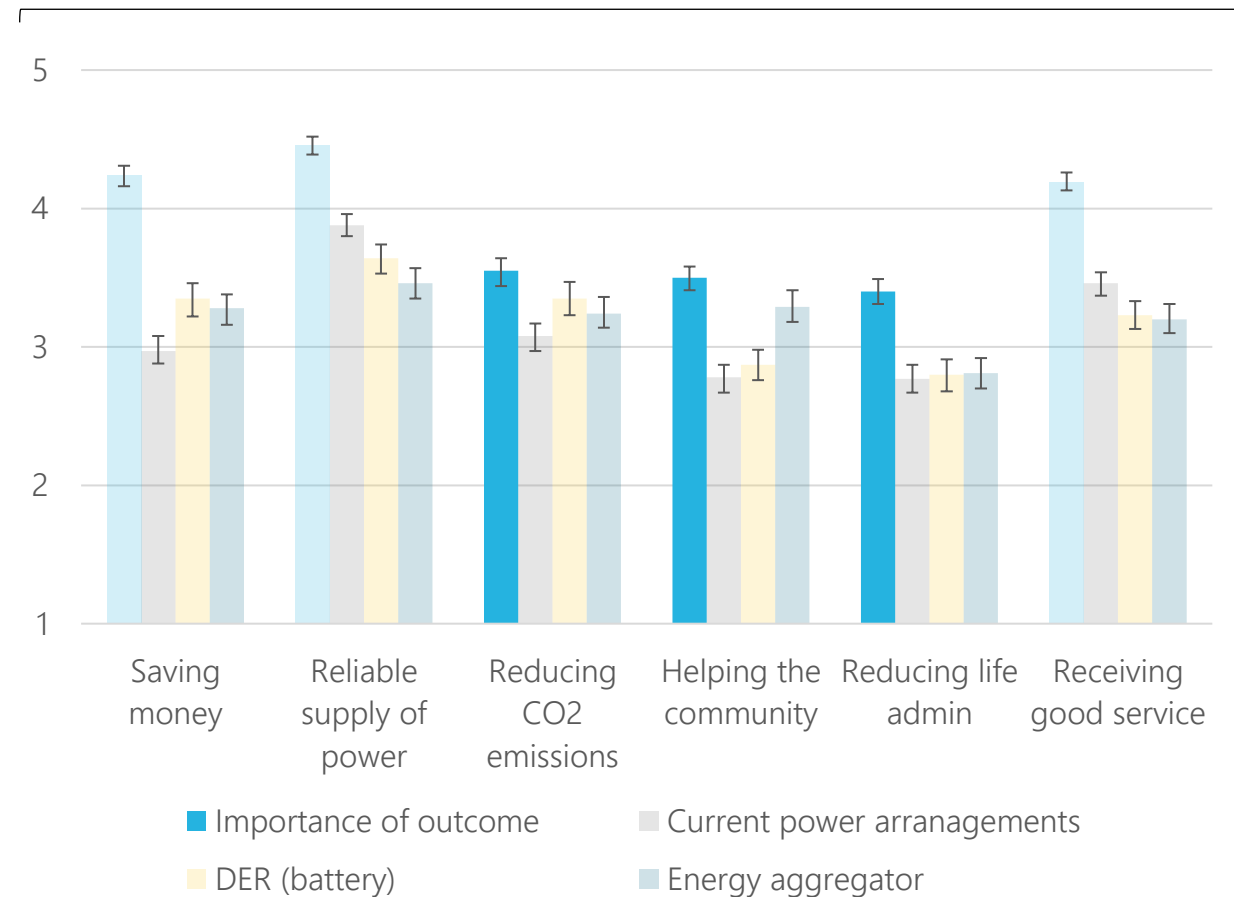


Less important goals were **reducing CO₂ emissions, helping the community, and reducing life admin**

Solar panels: No



Solar panels: Yes

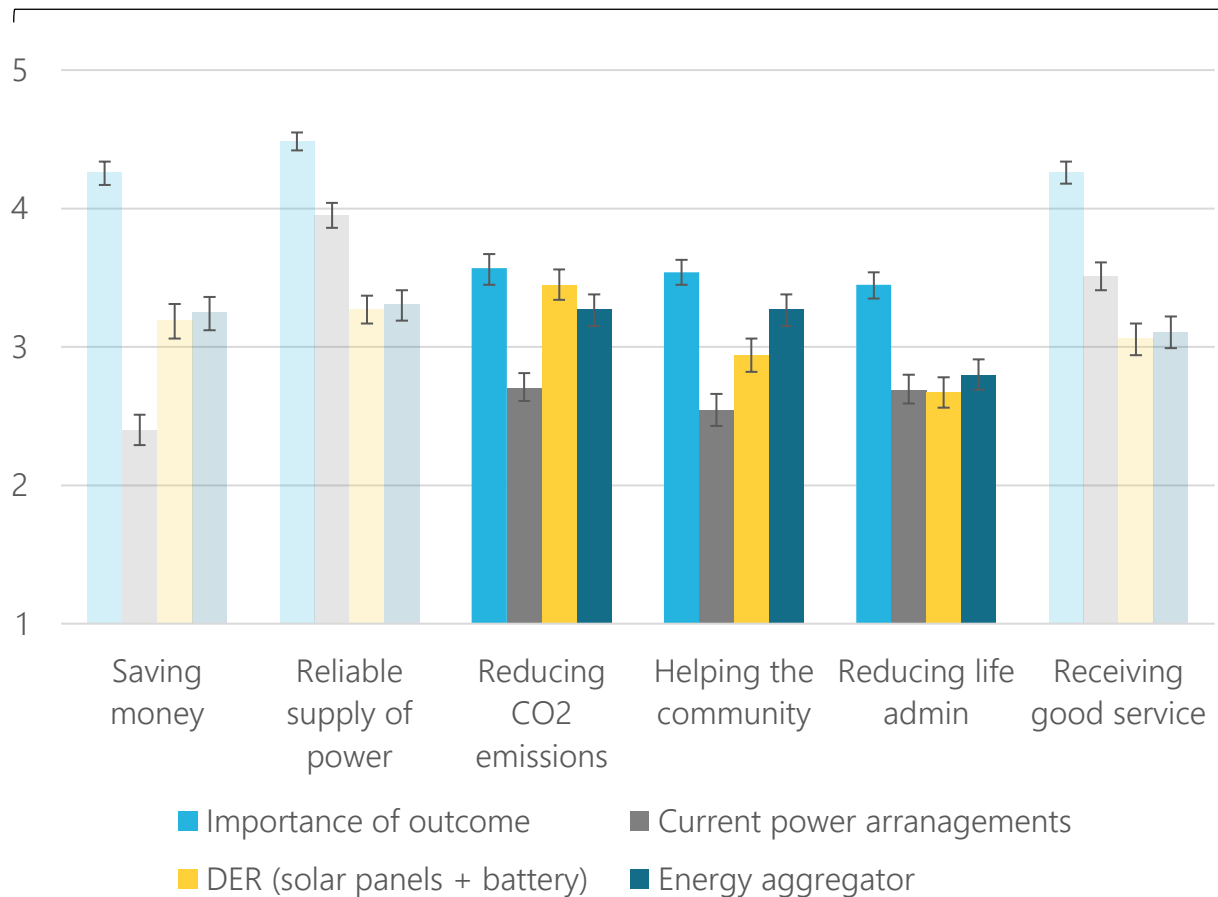


Goal outcomes: Segmented by solar panel status

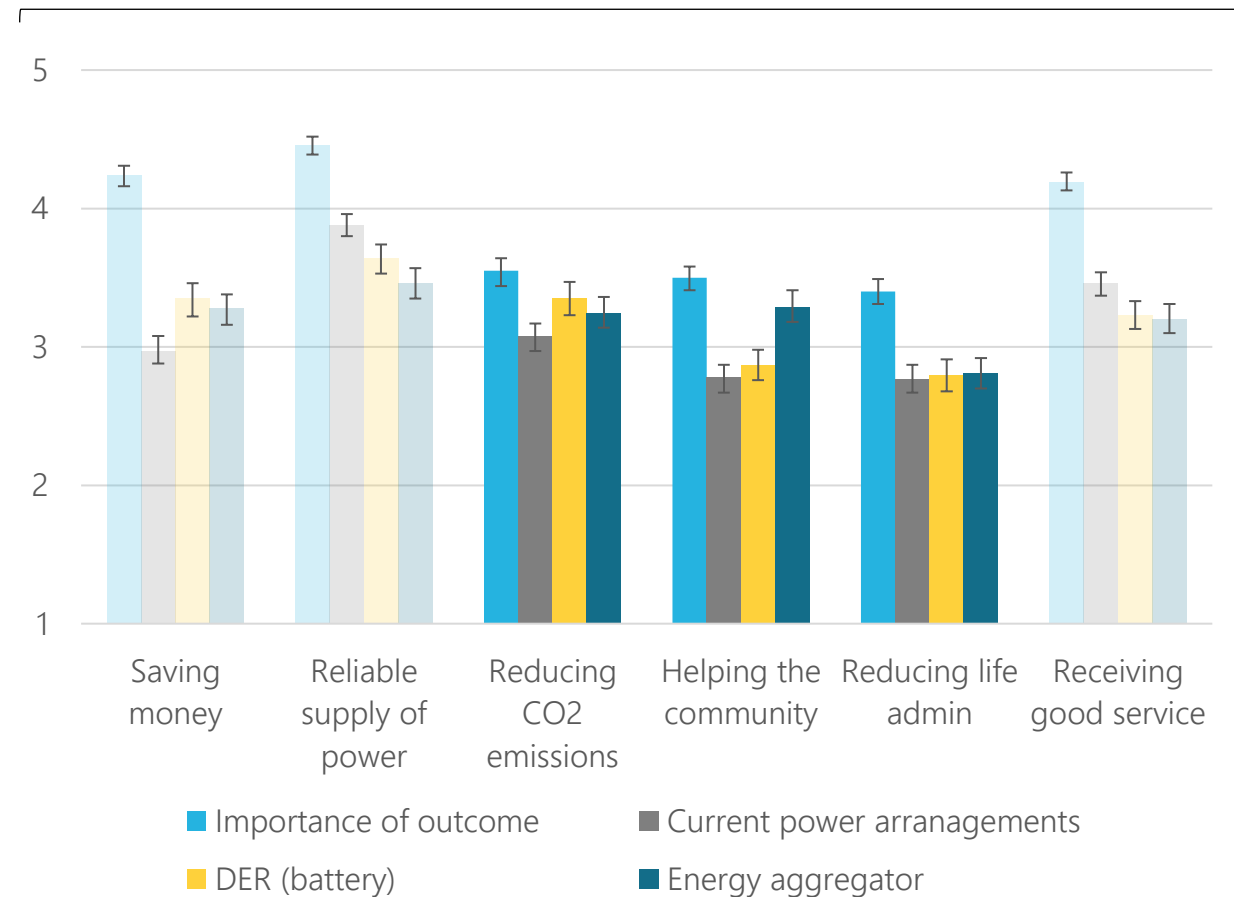


Relative to current power arrangements, adopting DER/joining an aggregator was seen as more likely to satisfy two (**reducing CO₂ emissions, helping community**) of the three less important goals

Solar panels: No



Solar panels: Yes

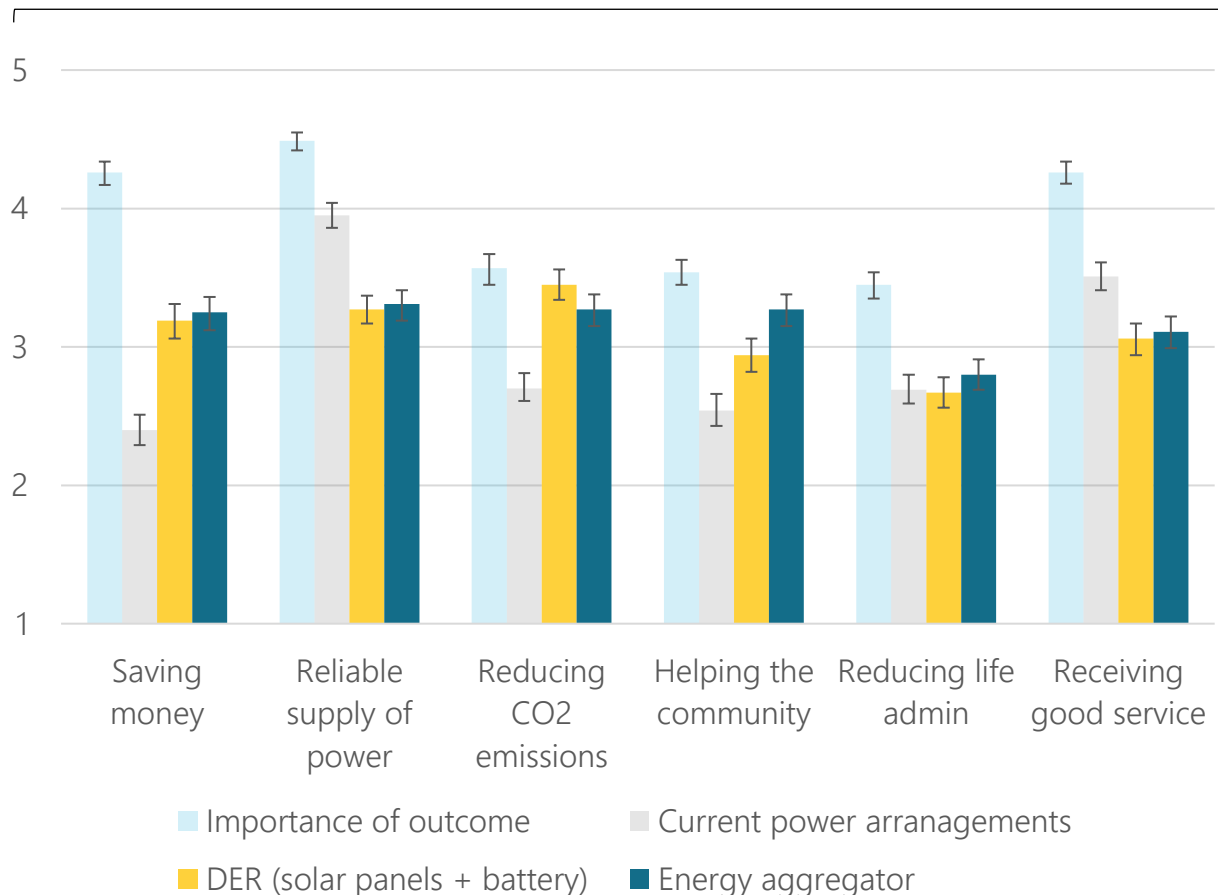


Goal outcomes: Segmented by solar panel status

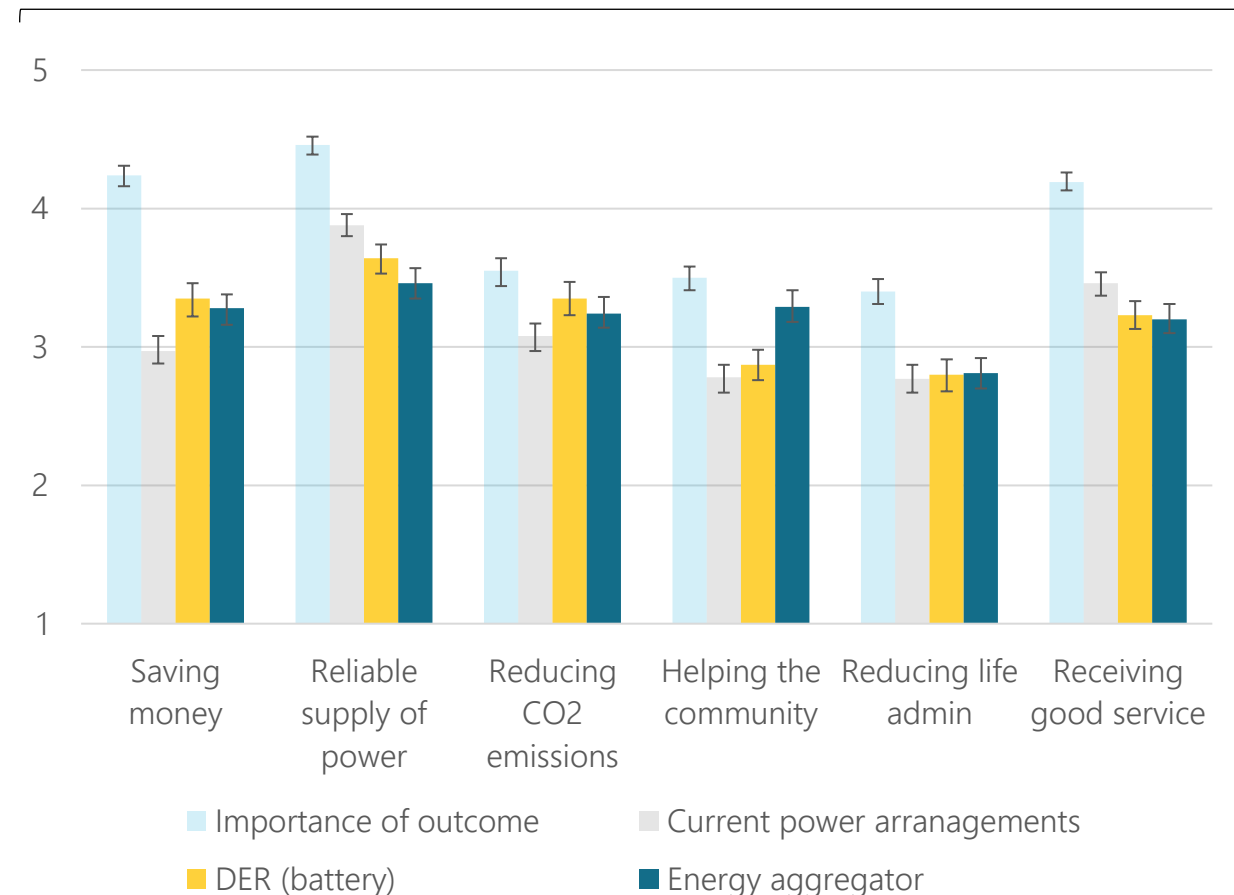


With one exception (**helping the community**), joining an aggregator was not seen as helping to satisfy any additional goals relative to adopting DER

Solar panels: No



Solar panels: Yes



Goal outcomes: Predictors of adoption/joining interest



Perceived financial savings and energy reliability were key predictors in whether participants were interested in adopting DER and joining an aggregator

Perceived goal outcomes	Interest in adopting DER		Interest in joining an aggregator	
	Solar panels + battery	Battery	Solar panels: No	Solar panels: Yes
Saving money	$\beta = 0.17$	$\beta = 0.28$	$\beta = 0.46$	$\beta = 0.39$
Receiving a reliable supply of power	$\beta = 0.26$	$\beta = 0.34$	$\beta = 0.20$	$\beta = 0.23$
Reducing CO ₂ emissions	-	-	-	-
Helping the community	-	-	-	-
Reducing life admin (routine tasks)	-	-	-	-
Receiving good service	-	-	-	-

Financial: Price sensitivity for purchasing rooftop solar panels



Participants tended to underestimate the price of purchasing rooftop solar panels

Consumer segment	Acceptable price range	Optimal price point
Overall	\$2,200 - \$3,600	\$2,200
Adopter category		
Innovator / early adopter	\$1,600 - \$2,500	\$1,800
Early majority	\$2,200 - \$4,100	\$2,800
Late majority	\$2,200 - \$3,200	\$2,200
Laggard	\$2,000 - \$2,500	\$2,100

Financial: Price sensitivity for purchasing a battery



Participants also tended to underestimate the price of purchasing a battery

Consumer segment	Acceptable price range	Optimal price point	Acceptable price range	Optimal price point
	Solar panel: No	Solar panel: No	Solar panel: Yes	Solar panel: Yes
Overall	\$900 - \$1,300	\$1,100	\$2,200 - \$4,000	\$3,000
Adopter category				
Innovator / early adopter	\$800 - \$1,500	\$900	\$2,600 - \$3,200	\$3,000
Early majority	\$1,100 - \$2,000	\$1,200	\$2,800 - \$4,500	\$3,100
Late majority	\$800 - \$1,100	\$1000	\$2,000 - \$3,700	\$2,200
Laggard	\$700 - \$1,100	\$900	\$1,000 - \$1,200	\$1,100

Financial: Desired annual savings from adopting DER



Although sizeable differences in desired annual savings were observed across consumer segments, these differences were not statistically significant

Consumer segment	Solar panels	Battery	
		Solar panel: No	Solar panel: Yes
Overall	\$1,093	\$933	\$1,006
Adopter category			
Innovator / early adopter	\$1,010	\$870	\$1,197
Early majority	\$1,201	\$1,029	\$1,042
Late majority	\$1,064	\$856	\$834
Laggard	\$849	\$809	\$800

Financial: Desired annual savings from joining an aggregator



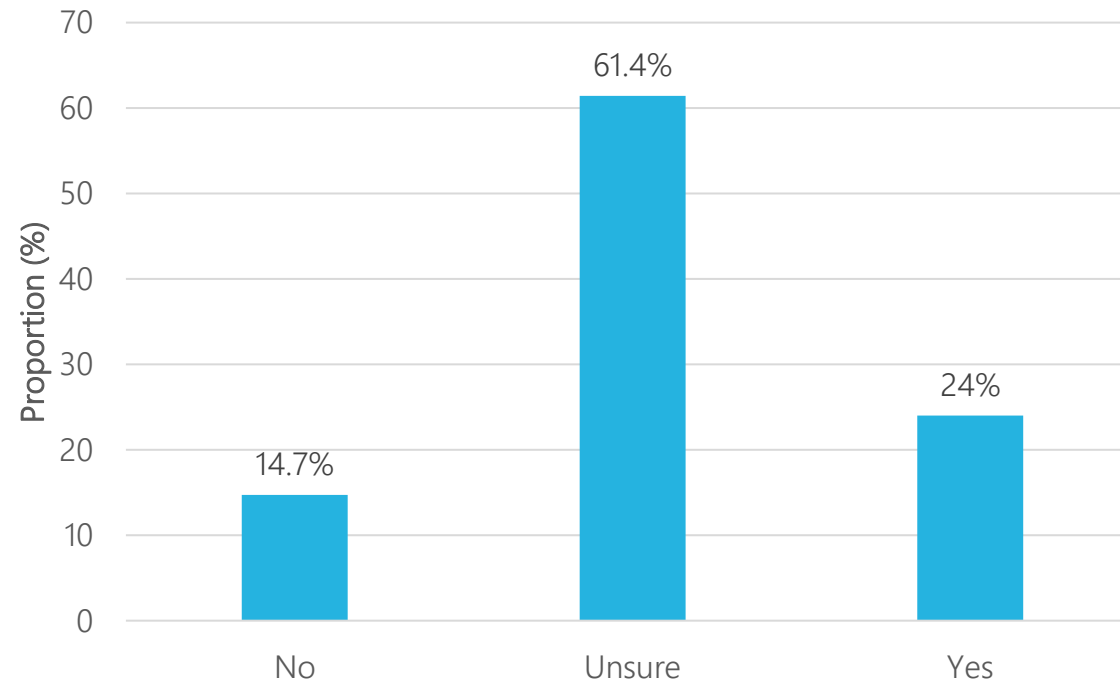
Desired annual savings from joining an aggregator were relatively consistent across consumer segments

Consumer segment	Annual savings
Overall	\$970
Solar panel status	
Solar panels: No	\$945
Solar panels: Yes	\$992
Adopter category	
Innovator / early adopter	\$998
Early majority	\$961
Late majority	\$970
Laggard	\$986

Trust



Most participants were withholding judgement about whether they could trust an aggregator to trade stored power on their behalf



Trust: Segmented by adopter category



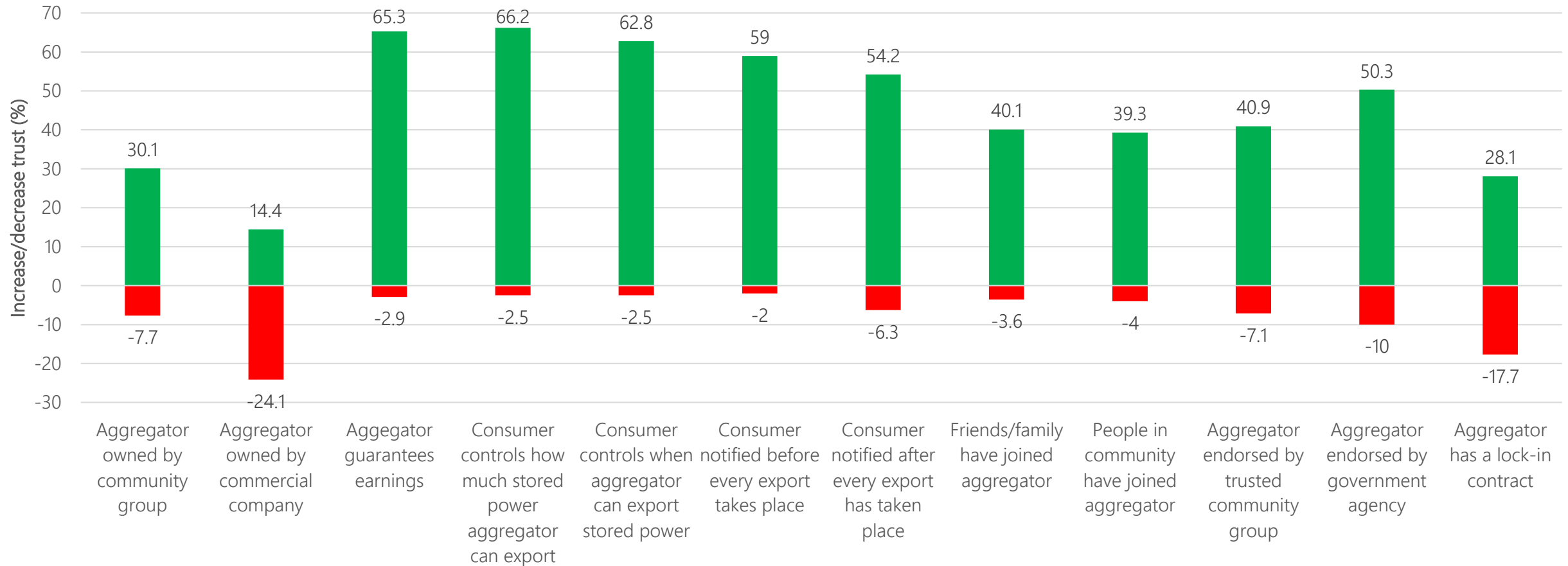
The innovator/early adopter category were more likely than the other categories to trust an aggregator, while the early majority were more likely to report being unsure

Trust aggregator to access and export stored energy	Innovator / early adopter	Early majority	Late majority	Laggard
No	11.5%	10.8%	11.8%	44.2%
Unsure	49.0%	64.5%	65.5%	48.4%
Yes	39.6%	24.7%	22.7%	7.4%

Trust: Strategies for enhancing aggregator trust



Consumer control, transparency, and consumer safeguards were perceived by participants as activities that would enhance their trust in an aggregator



Trust: Strategies for enhancing aggregator trust, segmented by solar panel status



Potential ways to enhance trust in an aggregator	Solar panels: No	Solar panels: Yes
Aggregator owned by community group	31.4%	29.1%
Aggregator owned by commercial company	14.2%	14.7%
Aggregator guarantees earnings	61.4%	68.7%
Consumer controls how much stored power aggregator can export	64.3%	67.9%
Consumer controls when aggregator can export stored power	63.1%	62.7%
Consumer notified before every export takes place	61.5%	57.1%
Consumer notified after every export has taken place	53.0%	55.3%
Friends/family have joined aggregator	42.2%	38.3%
People in community have joined aggregator	38.6%	40.0%
Aggregator endorsed by trusted community group	43.4%	38.7%
Aggregator endorsed by government agency	50.6%	50.0%
Aggregator has a lock-in contract	26.1%	30.0%

Trust: Strategies for enhancing aggregator trust, segmented by adopter category

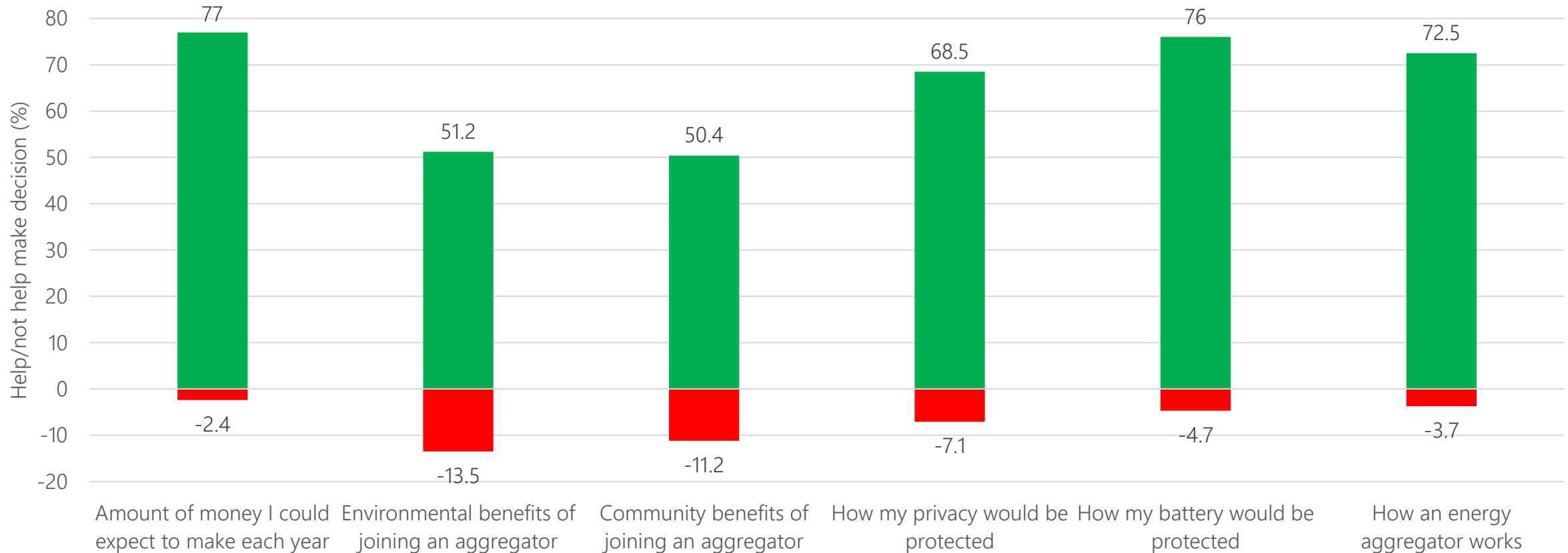


Strategy for enhancing trust in an aggregator	Innovator / early adopter	Early majority	Late majority	Laggard
Aggregator owned by community group	36.5%	32.6%	28.5%	15.8%
Aggregator owned by commercial company	25.0%	14.2%	13.2%	8.4%
Aggregator guarantees earnings	59.4%	69.8%	68.1%	42.1%
Consumer controls how much stored power aggregator can export	63.5%	71.0%	65.1%	47.4%
Consumer controls when aggregator can export stored power	59.4%	66.6%	60.1%	54.7%
Consumer notified before every export takes place	54.2%	63.6%	56.8%	47.4%
Consumer notified after every export has taken place	52.1%	57.7%	54.1%	38.9%
Friends/family have joined aggregator	32.3%	42.3%	46.9%	21.1%
People in community have joined aggregator	38.5%	41.7%	43.2%	18.9%
Aggregator endorsed by trusted community group	41.7%	44.2%	42.5%	20.0%
Aggregator endorsed by government agency	54.2%	52.6%	53.3%	27.4%
Aggregator has a lock-in contract	33.3%	29.7%	27.6%	16.8%

Information to aid decision-making



Information about consumer safeguards and financial benefits was seen as being helpful in deciding whether to join an aggregator



Information to aid decision-making: Segmented by adopter category



The early majority were especially eager for information to help them decide whether to join an aggregator

Type of information	Innovator / early adopter	Early majority	Late majority	Laggard
Amount of money I could expect to make each year	68.8%	82.8%	78.6%	55.8%
Environmental benefits associated with joining an aggregator	53.1%	56.9%	48.9%	26.3%
Community benefits associated with joining an aggregator	59.4%	55.4%	46.1%	27.4%
How my privacy would be protected	64.6%	73.8%	68.6%	46.3%
How my battery would be protected	71.9%	82.0%	77.7%	46.3%
How an energy aggregator works	69.8%	78.0%	72.9%	46.3%

**Next steps and further
information**

Next steps



Research currently underway or soon to commence includes:

- Interviewing energy aggregator customers and non-customers to identify:
 - Experiences to date
 - Discrepancies between expectations and reality
 - How to motivate enhanced exporting vs. self-consumption
 - Equitable sharing of value
- Surveying energy aggregator customers to evaluate:
 - Experiences to date
 - Satisfaction with the aggregator
 - Perceptions of information, notifications, and incentives received by the aggregator
 - How to motivate enhanced exporting vs. self-consumption

Further information

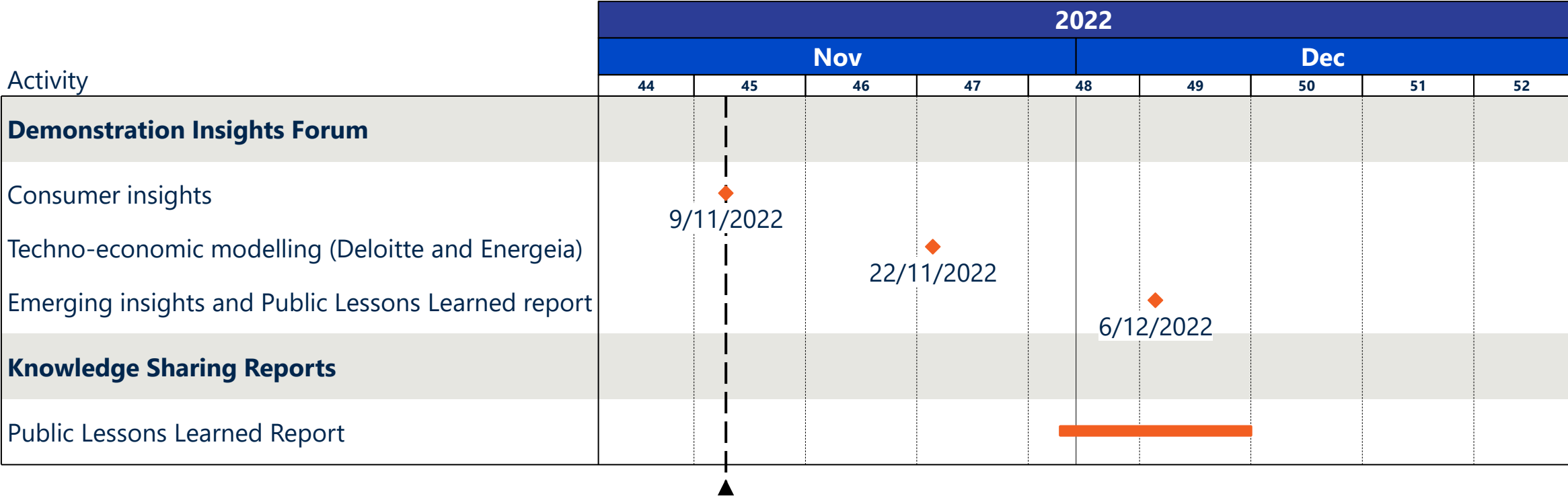


Reports will continue to be made available via AEMO's Project EDGE news and knowledge sharing page:

<https://aemo.com.au/initiatives/major-programs/nem-distributed-energy-resources-der-program/der-demonstrations/project-edge/project-edge-news-and-knowledge-sharing>

If you have any queries about the research, please email me at j.newton@deakin.edu.au

Upcoming Demonstrations Insights Forums



Project EDGE Publications



Publications	Publication Date
Project EDGE: Community Perceptions of DER & Aggregation Services	November 2022
Project EDGE: Literature Review : DER Customer Insights Research	October 2022
Project EDGE CBA Methodology Consultation Paper	July 2022
Project EDGE Public Interim Report	June 2022
Project EDGE Customer Insights Study	June 2022
Project EDGE Research Plan	March 2022
Project EDGE MVP Showcase	December 2021
Project EDGE Lessons Learned Report #1	May 2021
Project EDGE Public Webinar #1	March 2021
Project EDGE Factsheet	January 2021

For further news and knowledge sharing publications, please visit the [Project EDGE website](#)

For any questions, comments or feedback please contact: EDGE@aemo.com.au