

DER Market Integration Consultative Forum



2 February 2023



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

We pay respect to their Elders past, present and emerging.

AEMO Competition Law Meeting Protocol

AEMO is committed to complying with all applicable laws, including the Competition and Consumer Act 2010 (CCA). In any dealings with AEMO regarding proposed reforms or other initiatives, all participants agree to adhere to the CCA at all times and to comply with this Protocol. Participants must arrange for their representatives to be briefed on competition law risks and obligations.

Participants in AEMO discussions **must**:

- Ensure that discussions are limited to the matters contemplated by the agenda for the discussion
- Make independent and unilateral decisions about their commercial positions and approach in relation to the matters under discussion with AEMO
- Immediately and clearly raise an objection with AEMO or the Chair of the meeting if a matter is discussed that the participant is concerned may give rise to competition law risks or a breach of this Protocol

Participants in AEMO meetings **must not** discuss or agree on the following topics:

- Which customers they will supply or market to
- The price or other terms at which Participants will supply
- Bids or tenders, including the nature of a bid that a Participant intends to make or whether the Participant will participate in the bid
- Which suppliers Participants will acquire from (or the price or other terms on which they acquire goods or services)
- Refusing to supply a person or company access to any products, services or inputs they require

Under no circumstances must Participants share Competitively Sensitive Information. Competitively Sensitive Information means confidential information relating to a Participant which if disclosed to a competitor could affect its current or future commercial strategies, such as pricing information, customer terms and conditions, supply terms and conditions, sales, marketing or procurement strategies, product development, margins, costs, capacity or production planning.

Today's meeting

Time	Item	Speaker
11:00 – 11:05	Welcome and Introductions	Rachel Rodrigues McGown (AEMO)
11:05 - 11:15	2022 – What did EDGE achieve?	Nick Regan (AEMO)
11:15 - 11:50	EDGE Preliminary Results	Nick Regan (AEMO)
11:50 - 12:00	Q&A & Meeting Close	All

What have we achieved to date?

Project EDGE is an innovative, first of its kind trial demonstrating a proof-of-concept DER Marketplace to inform current and future reforms in line with Australia's Energy Security Board Post 2025 NEM initiatives.



100+

formal engagements with stakeholders including:

- 3 monthly forums to support communication with key stakeholder groups
- 1-1 engagements with the ESB, AER, AEMC, and ENA
- Engagements with aggregators participating in the project
- Internal engagement to align activities with reform initiatives.



15+

Knowledge Sharing Reports and Presentations published on Project EDGE website:

- Project EDGE Research Plan
- Public Interim Report & Customer Insights Study with recorded webinars
- Cost Benefit Analysis Process and Methodology Report
- 2 Lessons Learnt Reports
- University of Melbourne Public Webinar



350+

DER assets including Rooftop Solar, Batteries, controlled Hot Water systems and other loads

2MW+

Flexible capacity available



200+

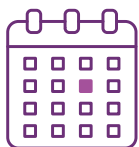
Residential and Commercial & Industrial Customers



Project EDGE brings together:

- Diverse mix of customers
- DER equipment,
- Manufacturers
- DER device control systems

EDGE includes Retailer and Non-Retailer Aggregator business models.



PROJECT ACTIVITIES:

Nov '21 – MVP Marketplace delivered

Dec '21 – Aggregator onboarding requirements published

Mar '22 – Detailed Project Research Plan published

Mar '22 – Full DER Marketplace developed.

June '22 – Public Interim & Customer Insights Report published

June '22 – Public Webinars on Interim and Customer Insight Reports

Sep '22 – Additional aggregators onboarded. **Phase 5 of trial commenced**

Dec '22 – Delivered CBA methodology and process report

Dec '22 – Delivered Lessons Learnt Report #2

INFORMING REFORM

Current and past:

- Scheduled Lite
- Integrating Energy Storage Systems
- DEIP DOE WG
- Dynamic Operating Envelopes (DOE)
- Flexible Trading Arrangements
- DER Data Exchange
- DER Network Services

PRESENTATIONS

Presented at the following Domestic and International conferences in 2022:

- Energy Systems Integration Group
- Australian Renewable Energy Agency DEIP Dive
- Association of Power Exchanges
- International Conference of Renewable & Distributed Energy Resources

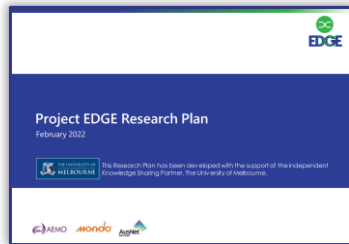
Project EDGE

2022 Highlights & 2023 look ahead

Nick Regan (AEMO)



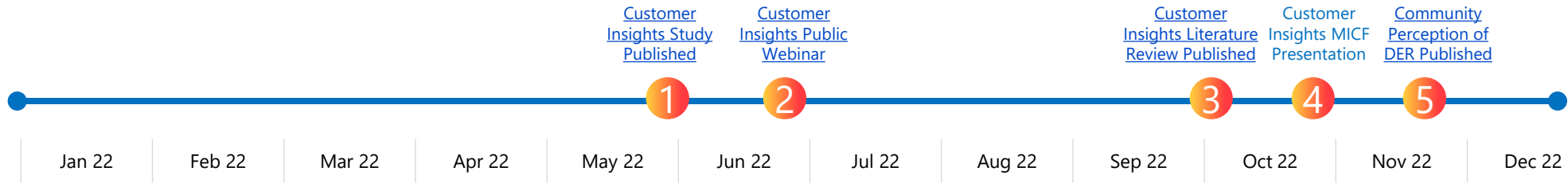
Knowledge Sharing and Conferences



2022 Key Highlights

- Published 3 Knowledge Sharing Reports
 - Project EDGE Research Plan
 - Public Interim Report
 - Lesson Learnt #2
- Presented at 3 international conferences
 - Energy Systems Integration Group 2022 Conference
 - Renewable and Distributed Resources International Conference
 - APEX Congress 2022

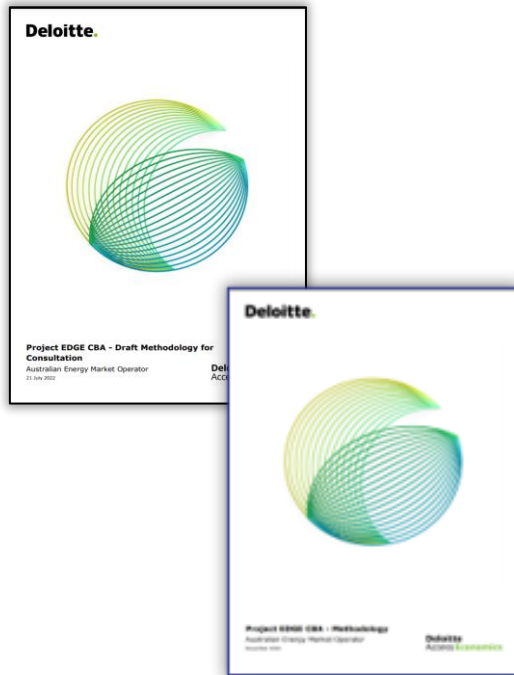
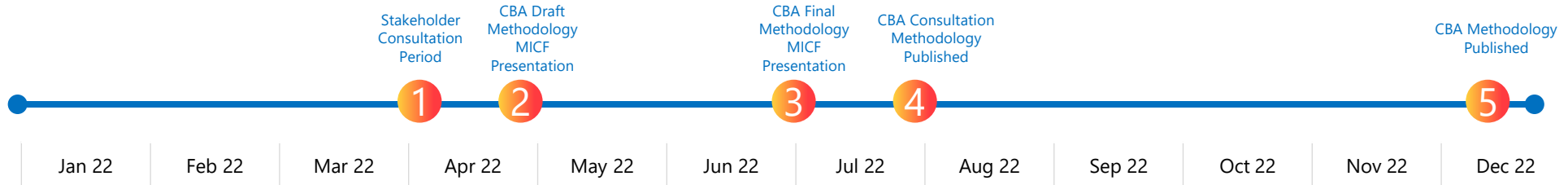
Customer Insights Study



2022 Key Highlights

- 3 Knowledge Sharing Reports published and a Public Webinar
 - The Public Customer Insight and Engagement Study Interim Report
 - The Customer Insights Literature Review
 - The Community Perceptions of DER

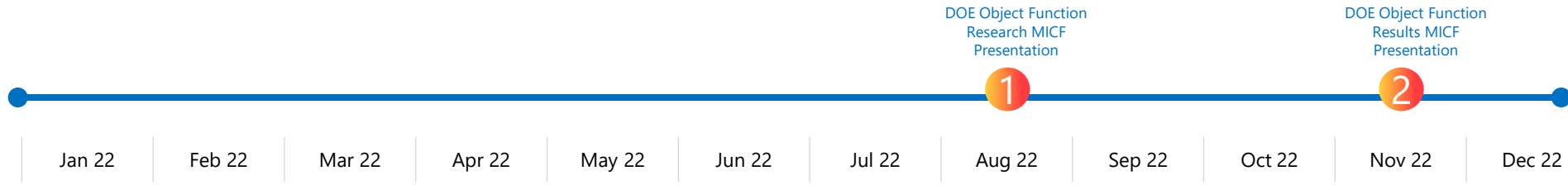
Cost Benefit Analysis



2022 Key Highlights

- 2 CBA Methodology Reports released including an extensive stakeholder consultation period
 - [CBA Consultation Methodology Paper](#)
 - [CBA Final Methodology Paper](#)
- The final CBA report is due in April 2023

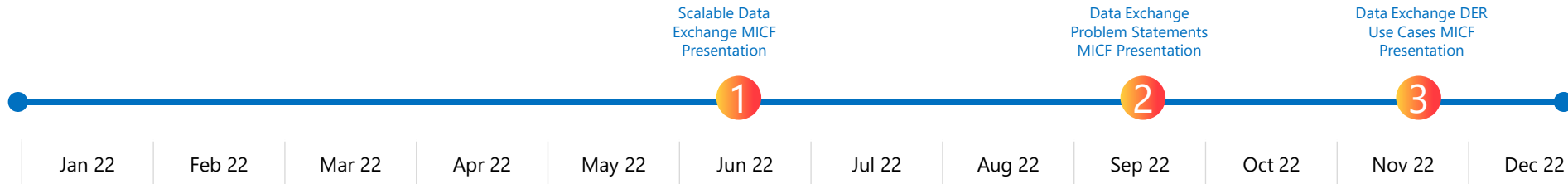
DOE Objective Functions



2022 Key Highlights

- The University of Melbourne presented twice to this forum on:
 - The Framework of Dynamic Operating Envelope capacity allocation (the 'Objective Function')
 - The assessment metrics with each Objective Function including the technical, economic and fairness ratings
 - Preliminary Results and correlation between the metrics
- The Report is due to be released in early 2023

Data Exchange



2022 Key Highlights

- The Project team presented three times to this forum on various elements of the Data Exchange to gain extensive industry feedback. We have covered:
 - The configuration of the Data Exchange model tested in EDGE
 - DER Data Exchange Problem Statements currently facing industry
 - DER Data Exchange Use Cases
- The Technology & Cyber Report is due in early 2023

How can we approach data exchange?

There is a spectrum of approaches to exchange data among many parties, including:

- **Interorganizational Point-to-point (no standards)** - Individual connections to share data with no preferred methods/protocols
- **Point-to-point with standards** - Individual connections to share data with agreed preferred methods/protocols
- **Hub** - connect once to a data exchange hub to share data with all parties. Project EDGE will consider both a centralized and a decentralized/hub approach

EFFICIENCY HYPOTHESIS

LESS EFFICIENT → MORE EFFICIENT

Point-to-point with standards → Point-to-point with standards → Data exchange

We will use Mural to work through the Data Exchange Problem statements and gather relevant feedback

High Data Exchange Costs

Statement (1) Ease of integration "I need to integrate into multiple, separate, and bespoke data exchange systems with DNSPs to know which Dynamic Operating Envelopes to apply, deliver similar but different local network services across the NEM in addition to integrating with AEMO to provide wholesale market services. This complexity means it's difficult, and potentially not scalable or economic, for me to deliver these services using my portfolio or participate in new RIBB services as they arise."

Statement (2) Duplicate Identity Verification Processes "I need to participate in multiple, separate and bespoke organization identity verification processes with DNSPs to deliver similar but different local network services across the NEM as well as AEMO to provide wholesale market services. This adds to my compliance burden and cost to serve customers."

Statement (3) Speed to market "I cannot seamlessly monetise new DER in my portfolio or local (DNSP) services because it takes a long time to register my assets to provide a service."

Statement (4) Duplicated VPP Portfolio registration updates The MSO and DSOs need devices within my portfolio and there is no single mechanism to update all participants that serve customers. For example, if a customer that provides a particular service churns, I need timely manner."

Data Exchange Use Case 1: Dynamic Operating Envelopes

I have a problem that	Therefore, I want to	So that I can
I need to integrate into multiple, separate, and bespoke data exchange systems with each DSO to know which Dynamic Operating Envelopes to apply in operating my portfolio in addition to integrating with AEMO to provide wholesale market services. This adds to my compliance burden and cost to serve customers	Be able to access all DSOs and work to my portfolio across different DSOs in addition to the NEM via one integration point	minimise my operational costs and cost to serve customers

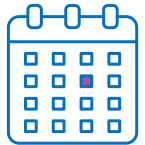
Point to Point Process:

1. DSOs notified of an aggregator site
2. Aggregator registers Portfolio and Details
3. Integration established between aggregator and DSOs
4. DSOs map Hub to portfolio and send a packet of DSOs
5. Aggregator receives and updates with DSOs
6. Aggregator updates their portfolio information
7. This process repeats with any updates to an Aggregator's Portfolio

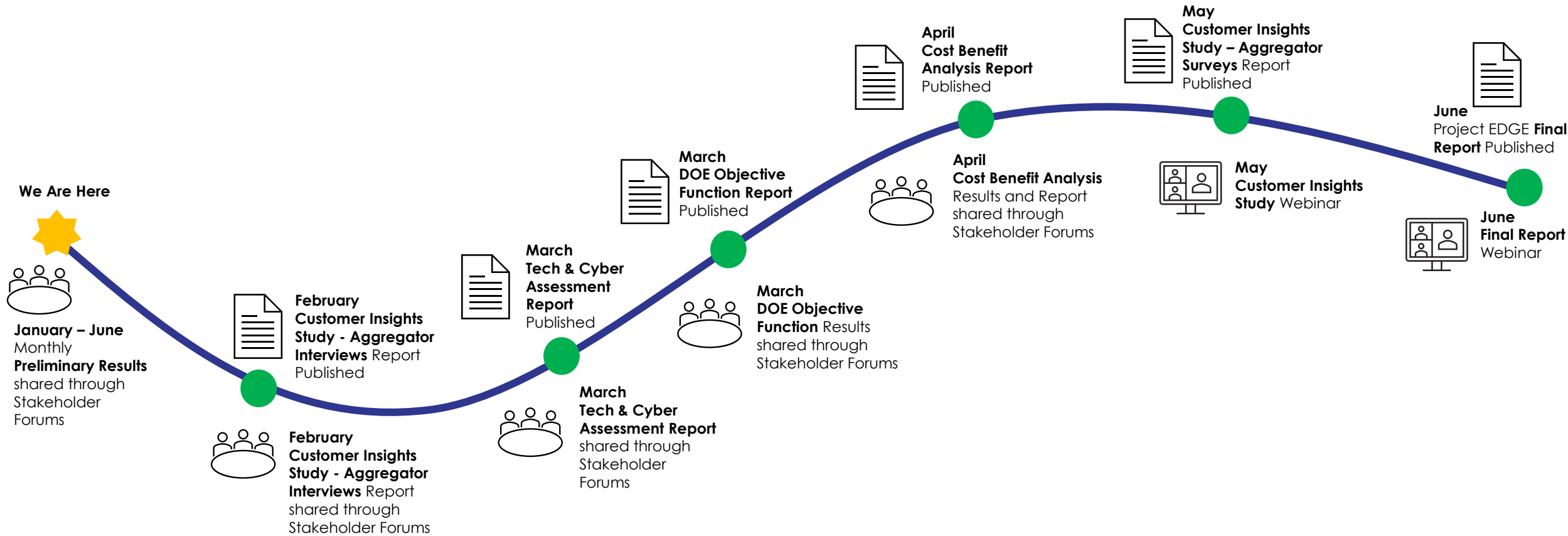
Data Hub Process:

1. DSOs request that a site needs a DCE
2. Aggregator registers Portfolio and identity
3. Integration established between DSOs and DCE Data Hub
4. Integration established between aggregator and DCE Data Hub and DSOs
5. DSOs add new Hub to their DCEs and send one packet of DCEs to the Hub
6. The Hub broker takes the single DCE packet based on portfolio information and sends the correct DCEs to the aggregator
7. Aggregator receives and updates with DCE
8. Aggregator updates their portfolio information
9. This process repeats with any updates to an Aggregator's Portfolio

Project EDGE - 2023 Knowledge Sharing Roadmap



PROJECT EDGE Knowledge Sharing Calendar



*Please note these are currently indicative dates

Project EDGE

Preliminary Results – Aggregator forecasting (Business As Usual conditions)

Nick Regan (AEMO)



Preliminary Results: Aggregator Forecasts & Bidding (BAU)



Focus of this analysis

This sprint delved into a subset of two key elements underpinning the overarching hypothesis:

- Understanding what the aggregator forecasts and rebidding trends mean for the market and wholesale dispatch instructions, are they aligned to bidding of existing scheduled resources?
- Test the ability to provide consistently reliable forecasts for their fleet operations

Analysis focused on trends and changes in aggregator bid files over different time windows leading up to a dispatch interval.

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?

Hypothesis A:

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:

BAU bidding behaviour is similar among aggregators and is driven by 'self-consumption' value proposition

- Bidding self consumption profile means no active portfolio-wide orchestration (beyond individual sites), most of the time.
- Customer expectations of DER control and possible financial value set at enrolment seem to endure
- Non-market participant aggregator business models built on this one revenue stream currently have limited ability to expand into market revenue opportunities (energy & ancillary services).

Differing event 'materiality thresholds' per aggregator influence active pursuit of market opportunities

- Trend of Net NMI customer self-consumption profile being followed under BAU operational conditions represents price taking as opposed to bidding like a scheduled resource, not maximising market revenue for customers except during extreme prices. Trigger price and time horizon for fleet preparation are aggregator-specific.

The impacts of these results are?

- **DER customer trust and understanding needs to be built** on how their overall financial benefit can be increased with some prioritisation of external revenue opportunities over strict site self-consumption by aggregators.
 - Setting customer expectations on the amount of DER control activity at enrolment is crucial.
- **Easier access to market revenue for DER aggregators would support this product innovation**
 - Some limited off market opportunities exist with retailers and networks but reform initiatives such as Flexible Trading Arrangements that aim to open up wholesale market access to non-retailer aggregators of mass market DER, present much needed additional revenue opportunities.

Future field tests will provide high and low price events (forecast and sudden) to observe aggregator bidding strategies outside of 'Business As Usual' conditions and seek to understand their alignment to scheduled resource behaviour and impact on wholesale markets at scale.

BAU bidding behaviour is similar among aggregators and is driven by 'self-consumption'



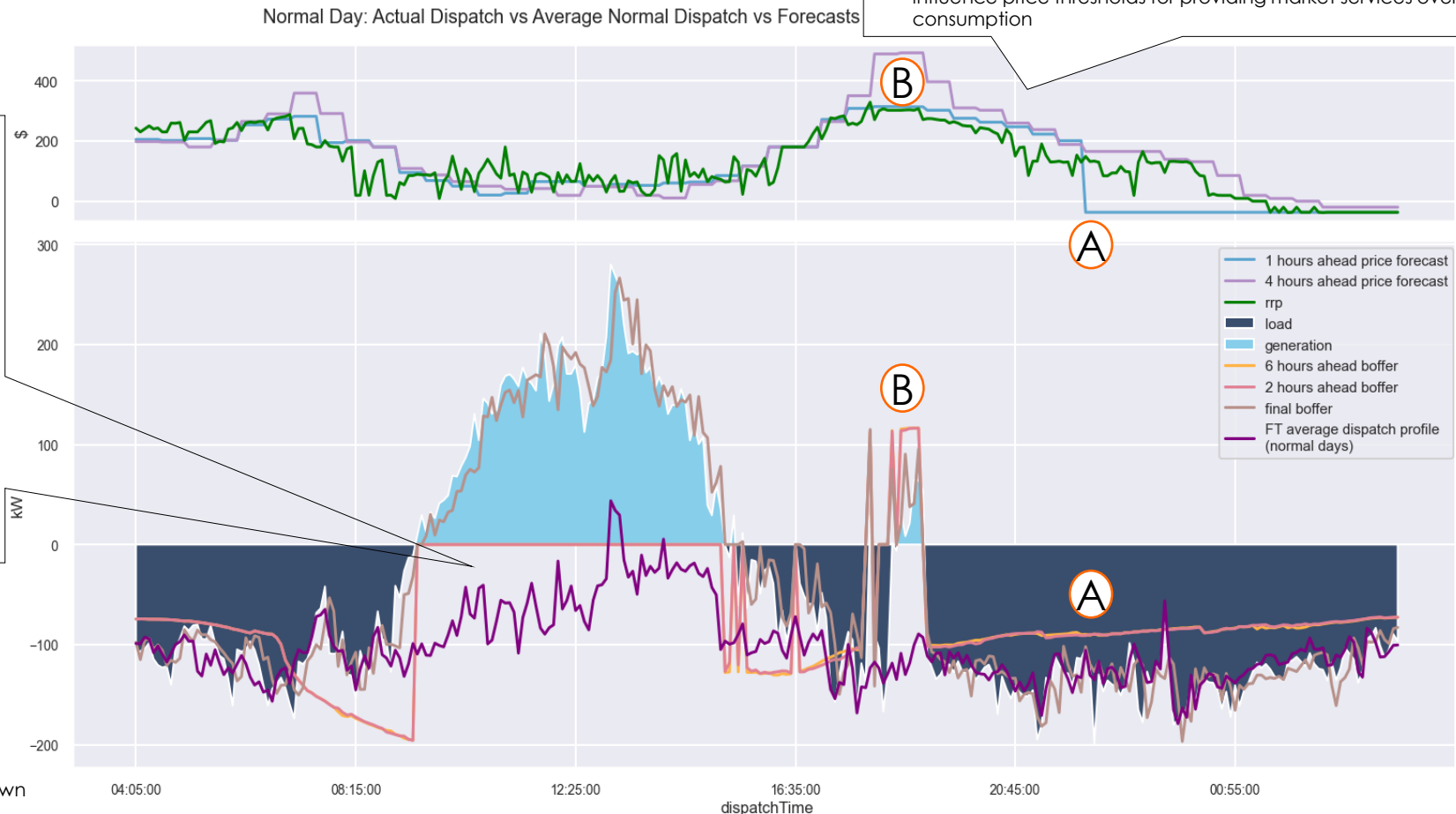
In a BAU context (stable operating conditions, no materially high or low wholesale prices) bidding strategy is generally driven by the solar self-consumption value proposition core to many VPP products today*.

Differing event 'materiality thresholds' per aggregator influence active pursuit of market opportunities

- Low price event (- \$100 / MW)
- Forecast 1 - hour ahead (light blue line)
- Fleet did not prepare for **-\$100 (A)** but appear to have done so for **\$500(B)** (decision to prepare can be driven by time, price or fleet capacity)
- Can be customer driven with expectations set at enrolment in the VPP (customers sign up for limited intervention aside from self-consumption)
- Differing risk positions, customer agreements and costs per aggregator influence price thresholds for providing market services over customer self-consumption

BAU bidding consistent with self-consumption load profile

- Average dispatch profile for the field trial (purple)
- Dynamic Operating Envelop allows plenty of export capacity
- 6 - and 2 - hour boffers are almost identical (orange and pink respectively) and typically follow the self consumption 'BAU' profile (dark purple) where spot price forecasts range from \$400 to -\$100 (top graph, light purple and green lines).
- Net NMI bids leverage DER reaction to uncontrolled customer load (high generation day)
- 'Excess' generation and load are offered 5 minutes before the next interval (final boffer [brown line] is close to fleet telemetry)
- At GW scale this practice may have an adverse effect on market efficiency by not being included in wholesale price formation or AEMO Operational Demand forecasts



*Spring day example, Net NMI bidding, 1x aggregator shown

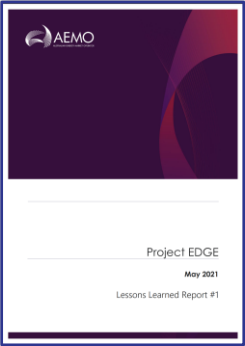
Project EDGE Publications



Knowledge Sharing Reports



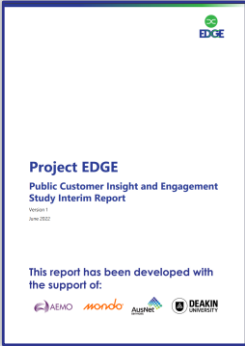
[Fact Sheet](#)



[Lessons Learned #1](#)



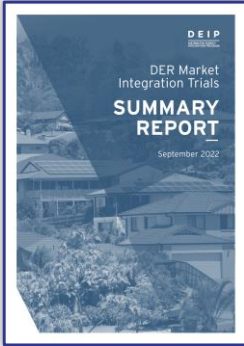
[Public Interim Report](#)



[Customer Insights Study](#)



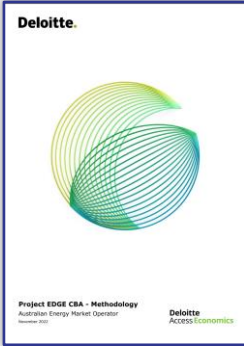
[Customer Insights Literature Review](#)



[DEIP DER Market Integration Report](#)



[Community Perceptions of DER](#)

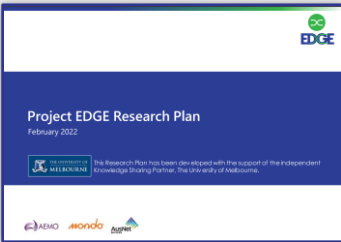


[Cost Benefit Analysis](#)

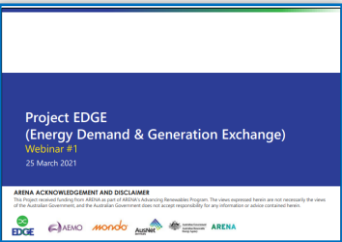


[Lesson Lrnt #2](#)

Presentations & Webinars



[Research Plan](#)



[Webinar #1](#)



[Public Interim Report Webinar](#)

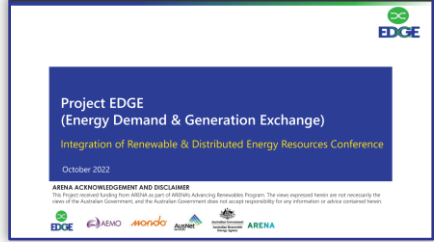
Conferences



[Energy Systems Integration Conference](#)



[DEIP Dive DER Market Integration Conference](#)



[Renewable and Distributed Resources International Conference](#)

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



Next meeting: 23 February 2023

Future Meetings & Close



For more information visit

aemo.com.au