Project EDGE – DER Marketplace Demonstration
March 2022
Acknowledgements and Disclaimer

This project received funding from ARENA as part of ARENA's Advancing Renewables Program. The views expressed herein are not necessarily the views of the Australian Government, and the Australian Government does not accept responsibility for any information or advice contained herein.
Introduction
Project EDGE (Energy Demand and Generation Exchange) is a collaboration between the Australian Energy Market Operator (AEMO), AusNet Services (AusNet) and Mondo (collectively, the Project Partners), with financial support from the Australian Renewable Energy Agency (ARENA).
EDGE overview

Project EDGE seeks to demonstrate a proof-of-concept DER Marketplace that enables efficient & secure coordination of aggregated DER, and facilitates the delivery of both wholesale and local network services at the grid edge.

Target outcome is to provide an evidence base to inform Australia’s Post 2025 NEM reforms regarding an efficient DER integration pathway to the benefit of all consumers.
Project EDGE | Collaboration

Tech. Partners
- opus one solutions
  - DSO capability
- energy web
  - Digital identity & data exchange
- PXiSE
  - Energy Solutions, LLC
    - Market logic/intelligence

Supporting Partners
- Australian Government
- ARENA
  - Funding Partner
- Distribution System Operator
- AusNet services
- Aggregator
- Mondo
- Networks, Research & Knowledge Sharing
- Customer Insights
- Deloitte
  - Cost Benefit Analysis
- Knowledge Sharing
- EY
- Independent Project Manager
- Project EDGE
  - Energy Demand & Generation Exchange
- AEMO
  - Power System & Market Operator
Project EDGE uses and builds on the **Hybrid model** adapted from the [Open Energy Networks project](#).

Project EDGE tests 3 core functions:

1. **Wholesale integration of DER**
2. **Data exchange**
3. **Local Services Exchange**

**Aggregator**

Aggregators use EDGE to access and deliver electricity services on behalf of consumers, including wholesale services to AEMO and local network services to DSOs.

**Distribution System Operator**

DSOs manage their networks by matching DER access to available network capacity, and procuring local services to meet specific needs.
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<tr>
<td>Satisfy conditions precedent</td>
<td>Complete detailed design, and frameworks tested</td>
<td>Demonstrate and test marketplace operation in an off-line capacity, for: - Data exchange between participants - Local services - Wholesale participation</td>
<td>Operational demonstration of a range of scenarios and distributed system services using live data</td>
<td>Introduce additional Aggregators and Retailers</td>
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<td>Develop plans, and establish governance and project management framework</td>
<td>Build and test platforms and interfaces for all participants</td>
<td>Know ledge sharing</td>
<td>Cost benefit analysis</td>
<td>Customer insights study</td>
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<td>Confirmed customer recruitment locations.</td>
<td>Flexible connection agreements with customers</td>
<td>Knowledge sharing</td>
<td>Knowledge sharing</td>
<td>Knowledge sharing &amp; recommendations</td>
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Project Research Plan
An iterative approach was applied by University of Melbourne in development of research questions

Key stakeholders engaged in one-to-one discussions:
- Australian Energy Council
- Australian Energy Market Commission
- Australian Energy Regulator
- Australian Renewable Energy Agency
- Clean Energy Council

Forums for engaging with a broader audience:
- DER Demonstrations Insights Forum
- Market Integration Consultative Forum
- Networks Advisory Group

Project EDGE Research questions

1. NEO
2. EDGE objectives
3. Literature review
4. Broader research questions
5. Research questions refinement
6. Project EDGE scope
7. Research questions mapped to actors
8. Prioritised research questions
9. Stakeholder engagement
10. Hypotheses
11. Test scenarios and cases
12. Field trials and research activities
13. Data collection and analysis

An iterative approach was applied by University of Melbourne in development of research questions.
The research questions will test fundamental elements and trace to the NEO

The seven research questions test key elements of the core functions and mechanisms and capabilities needed to facilitate an efficient DER Marketplace.

- **RQ.1** How can the DER Marketplace be designed to enable simple customer experiences, deliver the needs of customers and improve social license for active DER participation?
- **Operating envelope design**
  - **RQ.3** How does operating envelope design impact on the efficient allocation of network capacity while enabling the provision of wholesale energy and local network services?
- **Local network services**
  - **RQ.5** How can the DER Marketplace facilitate efficient and scalable provision of local network support services from DER so that network efficiency benefits are realised for all customers?
- **DNSP investment and capability**
  - **RQ.7** How could DNSP investment to develop DSO capabilities improve the economic efficiency of the DER Marketplace?
- **Efficient data exchange**
  - **RQ.6** What is the most efficient and scalable way to exchange data between industry actors, considering data privacy and cyber security, to benefit all consumers?
Research Outputs
Research outputs will provide an evidence base to inform stakeholder decision-making

- Research Plan
- Design Process
- Test DER Marketplace concept
- Collate evidence and deliver CBA

Roles and responsibilities
- ESB Scheduled Lite reforms
- ESB Operating Envelopes
- Dynamic Operating Envelopes
- Data Exchange
- ESB Data Strategy
- DER Register
- Flexible Trading Arrangements

Inform development of business capabilities
Inform industry technology investment decisions
Drive business model innovation
Project EDGE Function Sets
Wholesale Integration Function
Target Operating Model progression

Horizon 1
- Static export limits
- Status quo

Horizon 2
- OE Basic
- Bi-directional offers

Horizon 3
- Static Bid optimised
- OE adjusted for aggregator offers and preferences

Horizon 4
- Static Nodal Constraints model
- NMI OE have regard only to voltage constraints. AEMO considers thermal constraints provided by DSO

Horizon 5
- Fully decentralised
- Optimal Power Flow (OPF) or Decentralised Dynamic Limits (DDL) (may not be highest cost)

SYSTEM EFFICIENCY

COST/COMPLEXITY OF SYSTEM

* System efficiency = network and market efficiency
Aggregator bidding progression

Horizon 1
- Non-scheduled
- DER is non-scheduled and invisible to Market Operator (status quo)

Horizon 2
- Visibility only
- There is some limited forecasting

Horizon 3
- Self-dispatch
- Price-taking

Horizon 4
- Scheduled
- Price-setting ability

* System efficiency = network and market efficiency
Operating Envelope design considerations

A pathway to enabling enhanced customer outcomes via non-network services and increased access to network capacity for Distributed Energy Resources

**EDGE**
- Static, governed at aggregate level, inherently conservative, limited visibility for DER opportunities
- Progressive shift to dynamic, network connection based governance, increased network access availability
- Every network connection "node" has a published network capacity access opportunity

**Calculation and Cadence**
- Cost/Complexity
  - What is the desired techno-economic outcome?

**Allocation Methods**
- Fairness
  - Where is the balance point?
- Efficiency

**Maximise Exports**
- (Treat each active DER in alignment with the physics of the network – electrical location dependent)

**Equal Allocation**
- (Treat each active DER with equal opportunity)

**Weighted Allocation**
- (Treat each active DER in accordance with a weighting factor – could be technical or economic)
Local Services Exchange Function Set
Local Services Exchange – Proposed process/roles

- **Define**
  - Define service characteristics and contractual terms

- **Enrol**
  - Assess performance test data and pre-approve to participate
  - Post service opportunity, assess offers from pre-approved participants, exchange contracts

- **Engage**
  - Schedule service delivery or trigger dispatch via EDGE

- **Deliver**
  - Download/view data on EDGE
  - Assess data to verify performance

- **Verify**
  - Set up standard queries for reporting

- **Report**
  - Set up standard queries for reporting

- **Proposed process/roles**

- **Aggregator**
  - View service and assess whether to enrol
  - Submit enrolment information and performance test data
  - Submit offer - if accepted, exchange contracts per pre-agreed terms
  - Respond to dispatch signal to deliver service
  - Submit service verification data

- **Distribution System Operator**
  - Systems and capabilities developed in order to interact with the Marketplace
  - DSOs manage their networks by matching DSO access to available network capacity, and procuring local services to meet specific needs.
Summary classification of local services

Demand increase / reduction

High Firmness
(typically linked to a network planning capex deferral use-case, EDPR Augex funded)

- Trial example: Feeder with high overloading probability/incidence – peak demand reduction service required
- Future example: Reverse power during solar PV generation peak causes sustained or regular network operation/asset issues – local generation reduction or load increase service required
- Treatment: Likely to require services over a prolonged period (>1 year), hence suited to a longer-term contract with guaranteed availability and agreed pricing

Medium Firmness
(typically linked to an operational planning use-case, weather related, EDPR Opex funded)

- Trial example: Forecast asset overload as a result of heat wave activity or picking up additional customer load due to a planned temporary network reconfiguration - peak demand reduction service required
- Future example: Minimum demand system issue forecast - local generation reduction or load increase service required
- Treatment: Likely to require services on a seasonal basis, hence suited to a shorter-term contract with negotiated availability and pricing

Low Firmness
(typically linked to a spontaneous operational use-case trigger, event related, EDPR Opex funded)

- Trial example: Unexpected occurrence of abnormal local network loading as a result of a community event, or a combination of weather and special calendar days - peak demand reduction service required
- Future example: AEMO declared system contingent scenario – services required would relate to the event
- Treatment: Akin to NEM spot market - no guaranteed availability, pricing is set by the market or negotiated earlier, hence suited to a shorter-term contract with negotiated pricing
**Summary classification of local services**

**Voltage management**

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<th><strong>High Firmness</strong></th>
<th><strong>Medium Firmness</strong></th>
<th><strong>Low Firmness</strong></th>
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<td>(typically linked to a network planning capex deferral use-case, EDPR Augex funded)</td>
<td>(typically linked to a forecast market need use-case, high price related, funding to be clarified)</td>
<td>(typically linked to a spontaneous market need use-case trigger, event related, funding to be clarified)</td>
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- **Example**: LV network with known limited capacity for energy export/import – local voltage management service required to temporarily relieve network constraint for market economic benefit
- **Treatment**: Likely to require services on a seasonal basis or until constraints are remediated, hence suited to a shorter-term contract with negotiated availability and pricing

- **Example**: Opportunistic expanded local DER export / import portfolio requires additional local network capacity (market motivated, voltage limited local network) – local voltage management service required to temporarily enable increased DER activity for market economic benefit
- **Treatment**: Likely to require ad-hoc services, hence suited to a shorter-term contract with uncertain availability, pricing is set by the market or negotiated earlier

- **Trial example**: LV network with known regular or sustained Code voltage breaches – local voltage management service required
- **Future example**: Support of additional DER hosting capacity (e.g. for export / EV charging) where known voltage constraints exist – local voltage management service required
- **Treatment**: Likely to require services over a prolonged period (>1 year), hence suited to a longer-term contract with guaranteed availability, agreed pricing and autonomous operation

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Market service oriented
Data Exchange Function Set
What’s coming: a DER-rich landscape

AEMO’s draft 2022 Integrated System Plan’s most likely scenario (Step Change scenario) projects capacity in the National Electricity Market (NEM) in 2050 to be over 280 GW, of which 114 GW (40%) is connected to the distribution network¹

There will be times when the entire NEM demand for electricity could be met with distribution connected resources, aka Distributed Energy Resources (DER). This distribution-based capacity is also 2-way: it can export and import (or reduce demand). So DERs can also provide support to distribution grids ("network services")

DER-rich is decentralised and requires data exchange capabilities scaled by orders of magnitude

With the exponentially greater number of participants, markets, services, and especially devices, a DER rich landscape means industry must consider the basic challenges like:

- **Establishing & maintaining relationships** between customers, devices, and participants for processes like service enrolment, registration, and facilitating customer / device churn
- **Scaling to handle the volume of data** (and storage) being exchanged across all markets and participants (and ensuring for performance, maintenance, security, and resilience)
- **Managing communication, credentials and integrations** between all market participants (and relevant 3rd parties like “agents” who can control the output of solar PV)

*Retailers and aggregators are confronting over 100 different OEMs, with over 1,400 different products, on the CEC’s approved inverter list*
Data Exchange Approaches

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

- **Heterogenous 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 centralised and a decentralised hub approach

EDGE Hypothesis

Recent practice
Tightly coupled, point-to-point
No standards

Current plan
Tightly coupled, point-to-point, Agreed standards
(e.g. DNSP-agent 2030.5)

EDGE Hypothesis
Loosely coupled, data hub/message bus
Agreed standards
(e.g. DNSP-agent 2030.5)
Customers and the Aggregator Role
EDGE Aggregation Scope

- **Customer Acquisition**
  - Engagement
  - Education
  - Incentives
  - Support

- **Aggregation Capabilities Development**
  - Monitoring and Control
  - Forecasting
  - Dispatch
  - Customer UI

- **Customer Insights**
  - Awareness and Perceptions
  - Social License
  - Incentives
  - Blockers
Customers and the Aggregator Role

Customer Insights Study Scope

Supported by Deakin University

Composed of **four research** components

Across all aggregator customers

Feeds into Project knowledge sharing, including customer insights specific reports and webinars

Valuable insights for industry, aggregators, the cost benefit analysis and more…

Research Components

1. Literature review – building on existing knowledge
2. Potential customer surveys – understanding perceptions, comfort levels, motivations to participate and impacts on equity
3. Current customer interviews – understanding the types of compensation accepted, what encourages customer behaviour, perceptions on how value is shared and views on equity
4. Broader DER aggregator customer surveys – see how they interact with DER settings, why/how prioritisation of different consumption patterns are influenced, what information and incentives must be provided and how different segments respond to DER and aggregators
Customer Insights - Preliminary Findings

Residential

- Participation was motivated by non-financial benefits but impeded by immediate financial costs of participation

- Energy trading is viewed to be at odds with perception that batteries are a personal energy asset

C&I / Local Gov’t

- Financial, environmental and energy resilience benefits of VPPs was positively viewed by insufficient to warrant VPP adoption

- Lengthy payback period on investment into VPPs was considered a barrier to adoption of VPPs by C&Is and Local Gov’ts.

- Overcoming objections may be achieved through finding organisational champions that encourage adoption and demonstrate positive case studies.

Findings from 16 in-depth interviews conducted with 19 residents in the Hume Region.

Findings from 10 in-depth interviews conducted with staff from 5 C&I and 5 LGAs from regional Victoria.
Q&A
Want to know more?

• Mondo’s Project EDGE webpage: https://mondo.com.au/edge
• Contact EDGE@aemo.com.au to request ongoing updates on Project EDGE and invites to public webinars by providing your:
  • Full name
  • Email address
  • Organisation