Demonstrations Insights Forum

Workshop 2

Thursday 28 January 2021 | 3.00 – 4.00pm

EDGE AEMO mondo AusNet services Australian Government Australian Renewable Energy Agency ARENA

Acknowledgment of Country

We acknowledge the Traditional Custodians 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.

Objectives

1. Build awareness of the Project EDGE intent of wholesale integration research and the current proposed high-level design

2. Obtain feedback on the sufficiency of research themes to meet Project Objectives

3. Obtain feedback on the sufficiency of the proposed design to support the research intention

Agenda

Item	Lead	Timing
Welcome, Acknowledgement of Country	Steve Lennon (Nous)	5 min
Provide update on EDGE • Objectives • Core function sets of EDGE	Nick Regan (AEMO)	15 min
Deep dive into wholesale integration and test intended research questions and discuss sufficiency of design to meet research objectives	Matthew Armitage (AEMO) and Richard Cornwell (Nous)	35 min
Close and next steps	Steve Lennon (Nous)	5 min

Project Overview

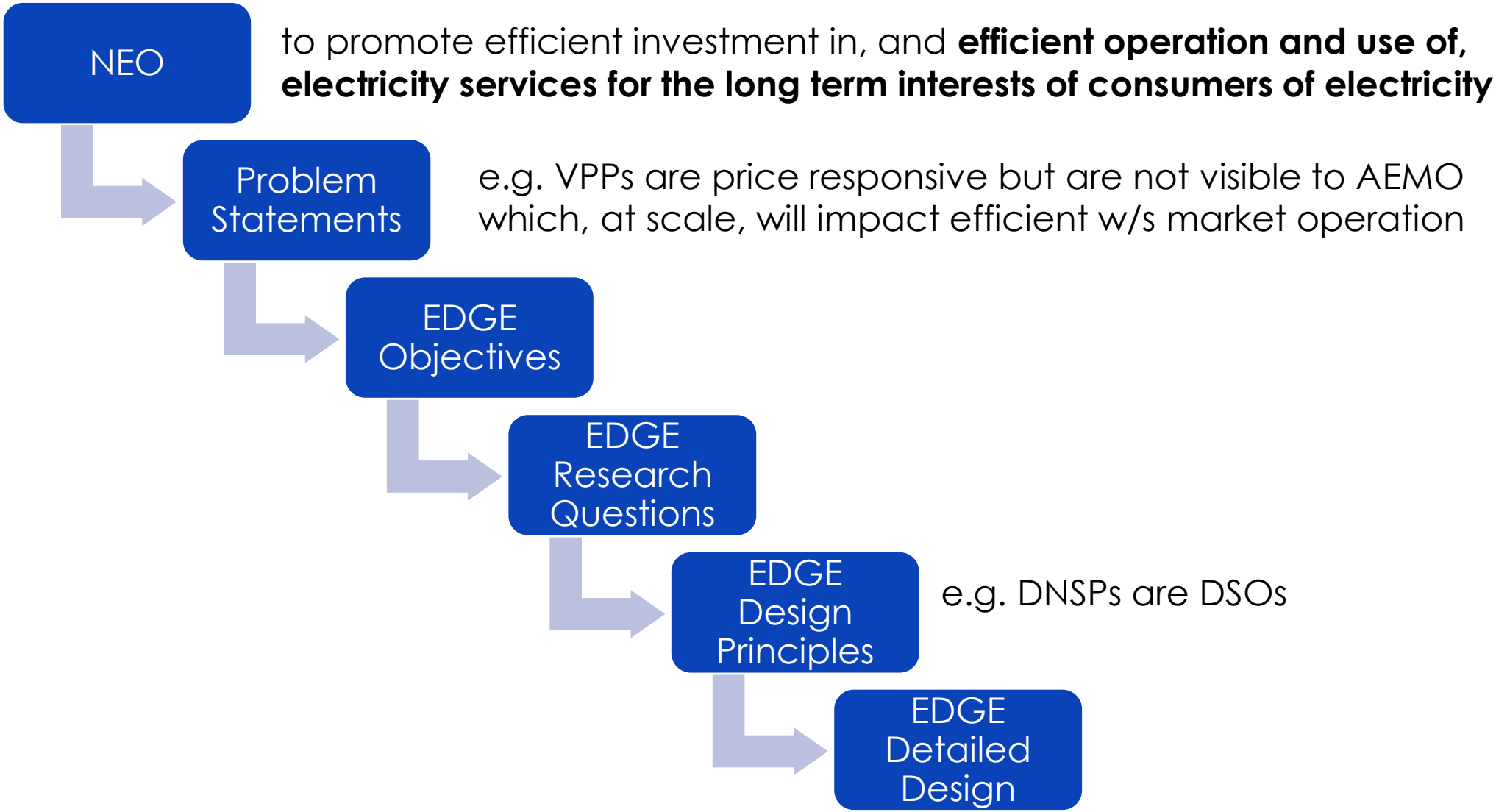
Project summary

Project EDGE (Energy Demand & Generation Exchange) seeks to demonstrate an off-market proof of-concept DER Marketplace which enables efficient, secure, coordinated DER aggregation, delivering both wholesale and local network support services at the grid edge.

Located in the Hume region in North-East Victoria and targeting 1,000 consumers (residential and small commercial to participate)

Project EDGE seeks to deliver an evidence base (supported by cost-benefit analysis) on how a two sided market can work in practice, which can inform the implementation of P2025 reforms.

Design thinking context



Project Objectives

1. Demonstrate how DER fleets could participate in existing and future wholesale energy markets at scale.
2. Demonstrate different ways to consider distribution network limits in the wholesale dispatch process.
3. Demonstrate how to facilitate standardised, scalable and competitive trade of local network services.
4. Demonstrate how data should be exchanged efficiently and securely between interested parties to support delivery of distributed energy services.
5. Develop a proof of concept, integrated software platform to facilitate delivery of objectives 1-4 in an efficient and scalable way.
6. Develop a detailed understanding of roles and specific responsibilities that each industry actor should play.
7. Conduct comprehensive cost benefit analysis to provide an evidence base for future regulatory decision making.
8. Conduct a customer focused social science study to understand customer opinions on the complexities of DER integration.
9. Deliver best practice stakeholder engagement throughout the project with a commitment to knowledge sharing.
10. Deliver recommendations, supported with evidence, on how and when the concepts demonstrated should be implemented operationally.

Conceptual vision for DER Platform in Project EDGE: Designed with DNSP/aggregator partners

Platform Vision

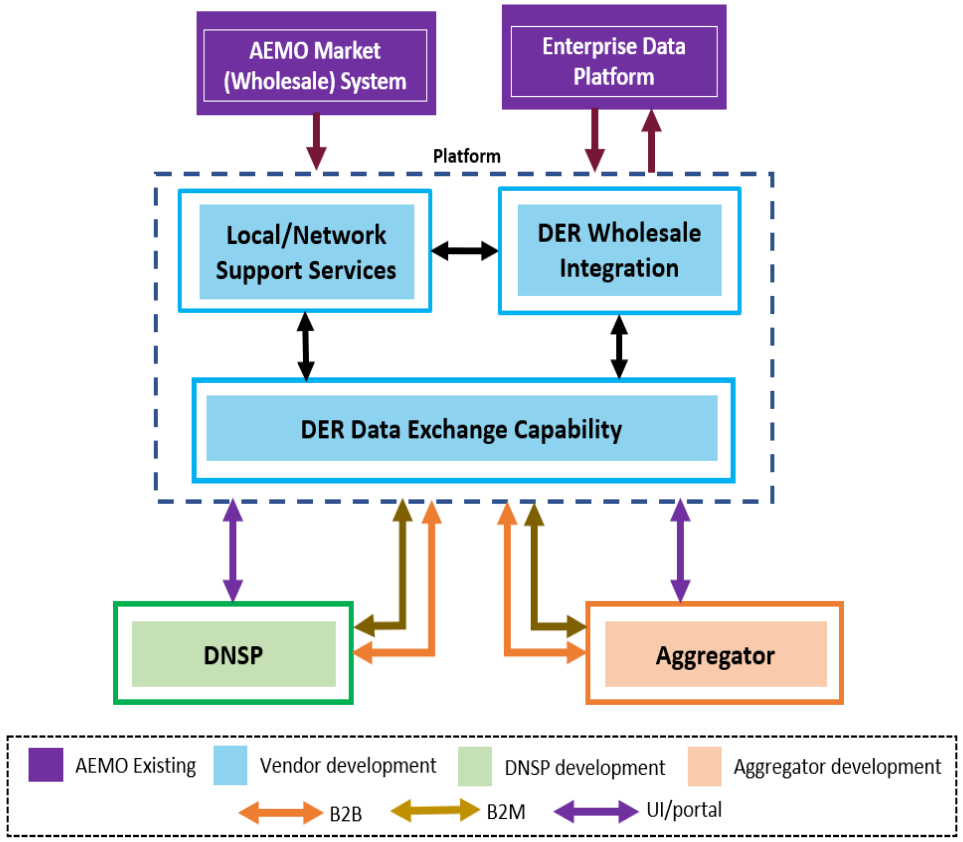
An efficient, scalable and integrated system that enables DER to deliver wholesale and local services within Dx & Tx network limits.

DNSP outcomes

- Design and procure local services via platform
- Communicate with multiple VPPs / OEMs via integration with platform
- Industry agreed standards for operating envelopes (definition & communication)
- Industry agreed standards for data exchange via platform (incl. CIM)
- Reduced transaction costs to procure local services

Aggregator outcomes

- Single access point to multiple services (energy, FCAS, WDR, RERT, Local)
- Receive operating envelopes from multiple DNSPs via single platform
- Receive dispatch instructions from AEMO or DNSP via platform
- Industry agreed standards for data exchange via platform
- Standardisation of local services across regions – simplifies consumer offers



Wholesale Integration

Roles & responsibilities in wholesale integration

AEMO

- NER 3.4: AEMO must establish a spot market
- NER 3.8.1: AEMO must operate a central dispatch process that considers networks constraints
- 3.8.10: AEMO must determine and represent network constraints in dispatch
- Glossary: Network constraint – a constraint on the transmission or distribution network

- **EDGE testing alternative approach to consider distribution constraints in dispatch**

AusNet as DSO

- **Responsible for distribution system operation within secure limits**
- Calculates and communicates limits (operating envelopes or constraints) to ensure power flows remain within secure limits
- In all models for consideration of Dx limits in dispatch, DSO retains control of operating their system to remain within secure limits

Wholesale Integration:
Two key functions - a spectrum of approaches for each

1. DER Dispatchability

Low cost/low visibility
Increasing system risks

Higher cost/visibility
High system operability

Today
- Non-scheduled/exempt
- Invisible to AEMO

VPP Demos
- Forecasts
- Visibility

- Scheduled 'lite'
- Price taking
- Scheduled in central dispatch
- Price setting ability

2. How to consider Dx limits in dispatch

Low cost/complexity
Low system efficiency*

High cost/complexity
High system efficiency

Static export limits **(Today)**

Operating Envelopes - Basic

Operating Envelopes – Bid Optimised

Nodal constraints

Fully decentralised models – OPF or DDL
(may not be highest cost)

Only move up the spectrum when sufficient net benefit

* System efficiency = network and market efficiency

DER Dispatchability: how DER fleets could participate in wholesale dispatch process

Boffer characteristic	Step 1: Visibility / Forecast-ability	Step 2: Dispatch-ability
Definition of kW / measurement point	Aggregated connection point flows	Aggregated connection point flows
Frequency of boffer	Continuous	Continuous
NMIs in boffer	All NMIs in registered cap	All NMIs in registered cap
Energy fixed loading	Rebid aggregated CP flows every 5 mins	Submit Boffers in price bands May use EFL in some intervals
Bi-directional bidding	N/A – EFL could be +ve/-ve	Yes
Price setting ability	None	Yes

	Max Avail	ROC Up	ROC Down	Fixed	Pasa	Band 10 $14953.50	Band 9 $1495.35	Band 8 $298.07	Band 7 $144.55	Band 6 $94.71	Band 5 $84.74	Band 4 $78.76	Band 3 $68.79	Band 2 $0.00	Band 1 -$996.90
04:30	0	120	120		245	0	0	0	0	0	0	245	245	245	245
05:00	0	120	120		245	0	0	0	0	0	0	245	245	245	245
05:30	0	120	120		245	0	0	0	0	0	0	245	245	245	245
06:00	0	120	120		245	0	0	0	0	0	0	245	245	245	245
06:30	0	120	120		245	0	0	0	0	0	0	245	245	245	245
07:00	0	120	120		245	0	0	0	0	0	0	245	245	245	245
07:30	0	120	120		245	0	0	0	0	0	0	245	245	245	245
08:00	0	120	120		245	0	0	0	0	0	0	245	245	245	245
08:30	0	120	120		245	0	0	0	0	0	0	245	245	245	245
09:00	0	120	120		245	0	0	0	0	0	0	245	245	245	245
09:30	0	120	120		245	0	0	0	0	0	0	245	245	245	245
10:00	0	120	120		245	0	0	0	0	0	0	245	245	245	245

Operating Envelope consideration in wholesale dispatch process

Operating Models to be Tested

1 **Operating Envelope (Basic Model)**

- *Operating envelopes for voltage and thermal constraints (optimised on forecast info only) sent from AusNet to Aggregator*
- *Aggregator bids made with knowledge of operating envelope*
- *AEMO performs bid validation; compares to wholesale clearing price; conducts wholesale dispatch; AusNet performs OE compliance assessment*

Hypothesis
↑ Simple and lowest cost to implement
↓ Unused network capacity where resource forecast deviate from dispatch

---

2 **Operating Envelope (Bid Optimised)**

As above, but

- *Operating envelopes adjusted for Aggregator offers and preferences*

Hypothesis
↑ Increased market value by prioritising capacity to maximise economic value
↓ Increased complexity and integration between market-network platforms

---

3 **Static Nodal Constraints Model**

As above, but

- *NMI Operating envelopes have regard only to voltage constraints*
- *AusNet communicates nodal thermal constraints (for collection of NMIs) to AEMO*
- *Aggregators submit boffers compliant with voltage constraints*
- *AEMO economic dispatch considers thermal constraints provided by AusNet (SCED)*

Hypothesis
↑ Closer alignment of local market to wholesale market architecture
↓ Increased comparative complexity to perform security constrained dispatch

Research question target zones

DER Services
- What services can DER reliably deli (wholesale, network support, essen system services)?
- What products/frameworks best incentivise delivery of these services?
- How can wholesale and local services definitions align to enable value stacking?

Data exchange
- How should data be exchanged between actors in a scalable and efficient way?
- Who should have access to what data?
- How should standards for data models and exchange protocols be agreed?

Local services
- What services do DNSPs need to manage their networks, and how to incentivise them?
- How can Local Services reliably defer/displace network augmentation?
- How to facilitate standardised, scalable and competitive trade of local services?

Cyber Security
- How to protect against cyber security risks throughout the distributed supply chain?
- What international standard(s) should Australia align to for cyber security purposes?

DER Integration
- How can very high levels of DER efficiently and securely integrate into existing and future electricity markets and networks?*

DER integration
Distribution network visibility
New DNSP capabilities
DER services
Data Exchange
Wholesale Integration models
Local Services
Cyber security
Consumer insights
Scalability

Scalability
- How scalable are different approaches to DER integration?
- Should different approaches be adopted for different levels of DER penetration?

Distribution network visibility
- What level of network visibility is optimal to enable wholesale integration and local services?
- Do DNSPs need physical monitoring devices, or can state estimation be used with data purchased from third parties?
- What level of visibility does AEMO require of DER as the penetration continues to grow?

New DNSP capabilities
- When do DNSPs need to invest in sophisticated systems such as ADMS / DERMS platforms?
- Can stricter DER standards be used as a way to mitigate DSO's need for sophisticated systems?
- To what extent can dynamic topology switching increase network hosting capacity?

Wholesale Integration Operating Models
- How should DER participation in central dispatch be progressively achieved?
- How should distribution network limits be considered in wholesale dispatch?
- How to obtain operational visibility of DER fleets?
- Should local services dispatch be automatically reflected in wholesale dispatch?

nsumer insights
- How can increasing market complexity be distilled into simple value for consumers?
- Are consumers willing to give up control of their DER if value is presented to them simply?
- Does actual value delivered equal perceived value when consumers sign up their DER?

**Efficiently means finding the framework that delivers greatest net benefit to consumers. Securely means including distribution level network constraints in security constrained dispatch.*

The Project is seeking input to test the proposed research themes

NEO: to promote efficient investment in, and **efficient operation and use of, electricity services for the long term interests of consumers of electricity.**

EDGE Project Objectives summary:

Demonstrate:

- how DER fleets could participate in existing future wholesale energy markets at scale [1] and
- different ways to consider different network limits in the wholesale dispatch process [2],

in an efficient and scalable way [5].

Wholesale Integration research themes

- How should DER participation in central dispatch be progressively achieved?
- How should distribution network limits be considered in wholesale dispatch?
- How should operational visibility of DER fleets be obtained?
- Should local services dispatch be automatically reflected in wholesale dispatch?

Activity:

1. Do the draft research themes sufficiently reflect the Project Objectives relating to wholesale integration?
2. Does the proposed operating model for wholesale integration that was co-designed by the Project Participants provide the evidence base needed to advance these research themes? If not, what are the recommended adjustments?

Provide your feedback through discussion (or in the chat).