Project EDGE
(Energy Demand & Generation Exchange)

Webinar #1

25 March 2021

ARENA ACKNOWLEDGEMENT 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.

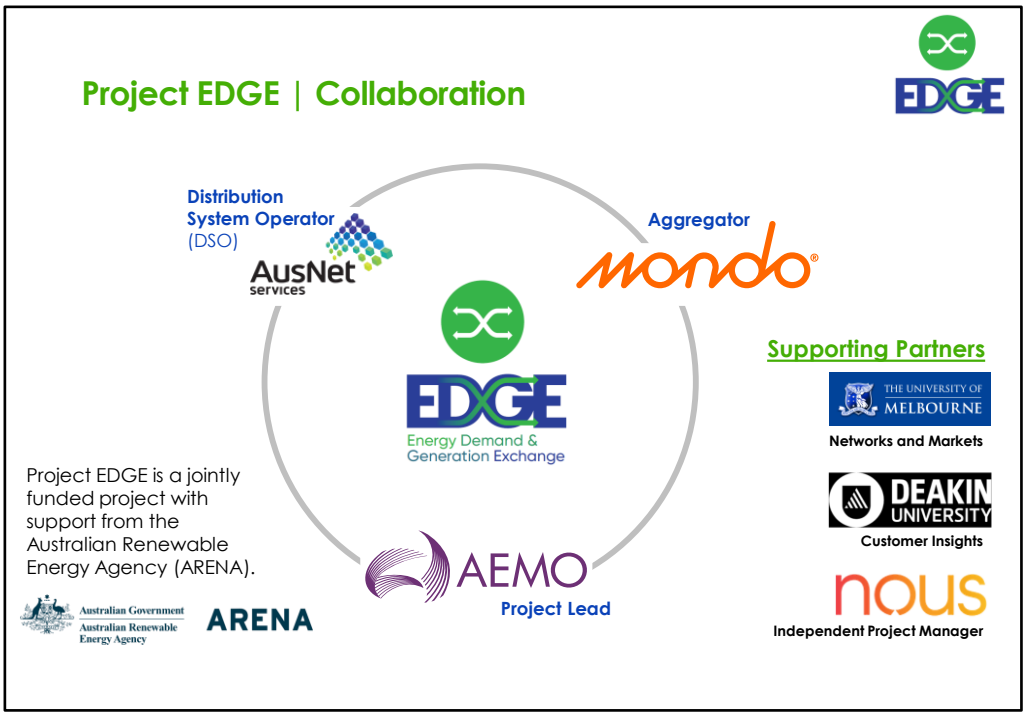

Acknowledgment of Country
We acknowledge the Traditional Owners of country throughout Australia and recognise their continuing connection to land, waters and culture.
We pay our respects to their Elders past, present and emerging.

Agenda

Item
Introduction
EDGE overview
EDGE design thinking and context
Wholesale Integration
Data Exchange
Local Services Exchange
Customer Focus
Questions – via Slido.com using code **#EDGE1**

Introduction

Anoop Nambiar - Mondo
Craig Chambers - ARENA
John Theunissen - AusNet
Matthew Armitage - AEMO
Nick Regan - AEMO



Project EDGE is a collaborative effort between AEMO, AusNet and Mondo who have jointly funded it with support from the Australian Renewable Energy Agency (ARENA).

The project will develop a proof-of-concept marketplace to efficiently dispatch Distributed Energy Resources (DER) for wholesale markets and local network support services, and to do so within the constraints of the distribution grid in the north-east region of Victoria.

Project Roles and Responsibilities:
ARENA: Will provide governance support and review of deliverables throughout the project.

AEMO: As project lead is responsible for delivery on the ARENA contract and playing the role of Market Operator within the demonstration.
Key responsibilities include:

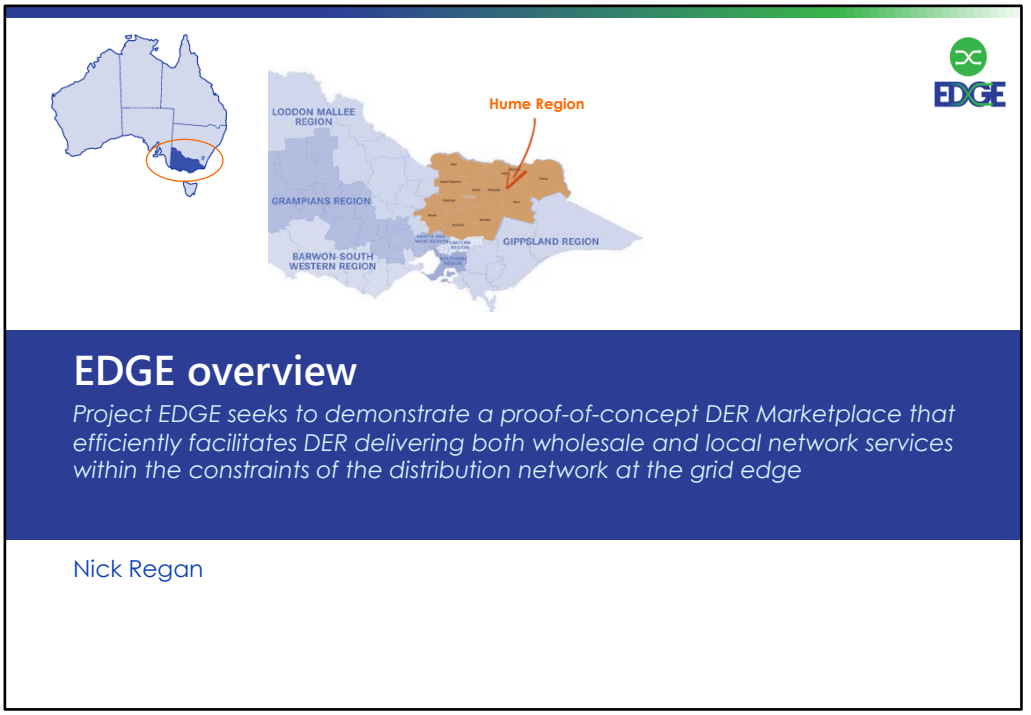
- Establish and manage the trial DER Marketplace.
- Use the DER Marketplace to test different approaches to integrating DER/VPPs into the wholesale market.

AusNet: Will test the role of the Distribution System Operator (DSO)
Key Responsibilities include:
- Dynamic network operation / optimisation
- Determine distribution network limits for DER participation and publish network operating envelopes to aggregators.
- Design of Local Network Services and test how they could be procured from aggregators in the DER Marketplace.

Mondo: Will perform the role of the Aggregator and drive the project's Customer Insights Study.
Key responsibilities include:
- Recruiting and managing a portfolio of customer DER
- Develop incentives and business models for sharing revenue among all parties involved
- Deliver a range of electricity services (both wholesale and local services) via the DER Marketplace.

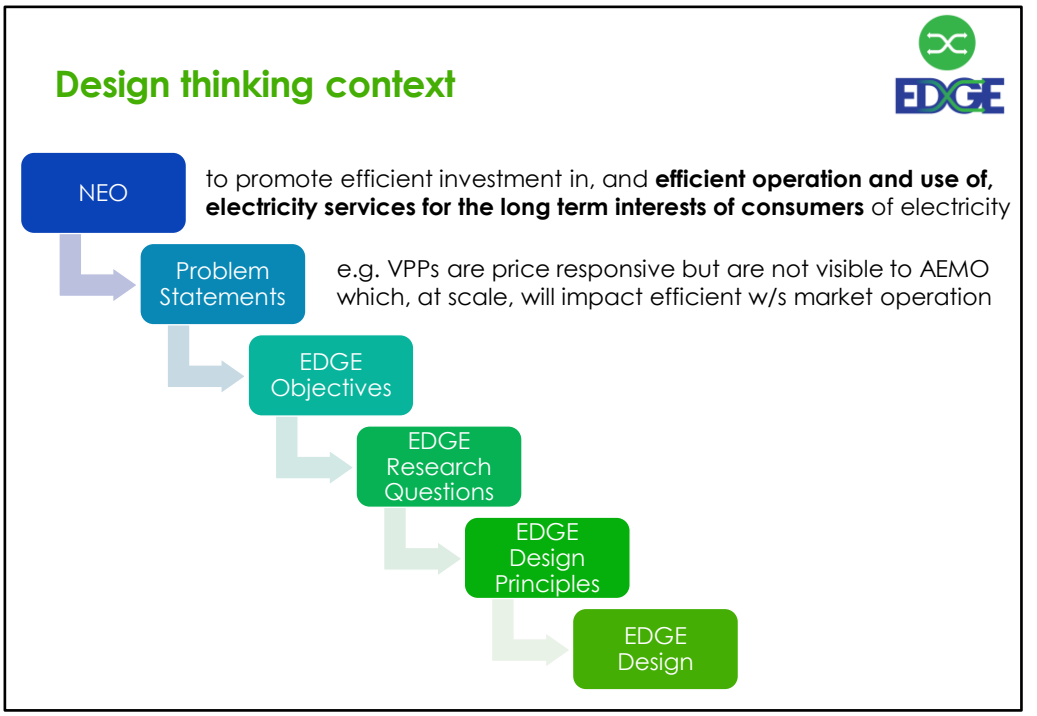
Supporting partners
- University of Melbourne – Undertake supporting Network and Market research enabling project participants to fulfill project roles.
- Deakin University – Undertake and deliver the project's Customer Insights Study.
- Nous will coordinate the project partners as independent project manager and report to the Steering Committee.

Project Governance
Project EDGE is governed by a joint Steering Committee with representatives from ARENA, AEMO, AusNet and Mondo.

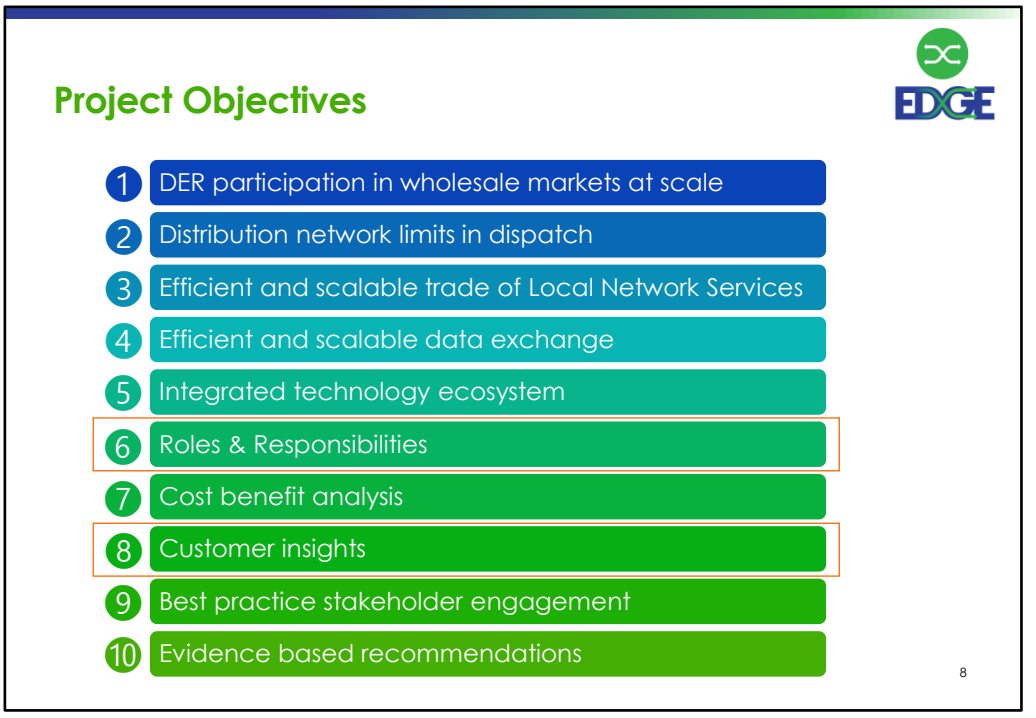


Project EDGE aims to test concepts that may be required to efficiently integrate very large quantities of DER (e.g. in the High DER or Step Change scenarios of the Integrated System Plan) into the power system over the medium to long term horizon, whilst maintaining the operability of the power system.

Although the size of this POC is small in scale, it aims to test efficient approaches to scaled DER integration that could provide substantial savings to consumers in the long-term by avoiding inefficient approaches.



- In co-designing the Project and high-level DER marketplace AusNet, Mondo and AEMO started with the National Electricity Objective as our ultimate guide.
- This diagram shows how we're linking the NEO with our project objectives, research plan and ultimately project design.



Project Objectives

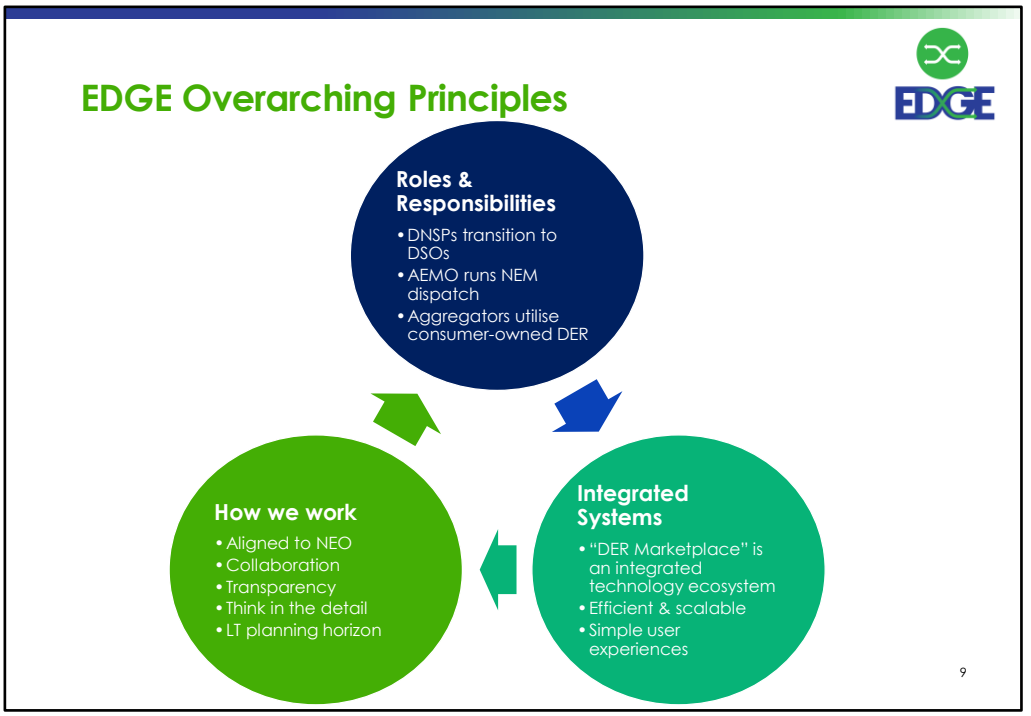
- EDGE aims to understand and inform the most efficient and scalable way to integrate DER into the system and markets so that all consumers benefit from a high DER future, even those that don't own DER.
- When we say scalable, we're looking to learn for a future where DER is at very large scale in the NEM, millions of devices, dozens of aggregators, consistent with ISP High DER and Step change scenarios
- The evidence gathered through the demonstration will culminate in a Cost Benefit Analysis on various progressions and options for how a DER Marketplace could be implemented and under what conditions e.g the level of DER penetration
- This evidence will be used to back regulatory change and technology investment recommendations to make this a reality provided it is proven successful.

The first 4 objectives relate to the marketplace function sets that will be covered later in this webinar.

- Wholesale DER Integration: Objectives 1 and 2
- Local Services Exchange: Objective 3
- Data Exchange: Objective 4
- Objective 5: Integrated technology system required to facilitate objectives 1-4

There are critically important non-technological objectives to highlight, in particular:
6: Roles and Responsibilities: EDGE is seeking to understand in detail, based on evidence, how AEMO and AusNet as the DSO should work together in the future.
8: Customer Insights. This demonstration will undertake a targeted customer insights study to understand how customers perceive the benefits of a DER Marketplace and their needs for incentives, education and engagement from energy companies.

Project objectives in full:
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.



DER Marketplace Roles & Responsibilities

- DNSPs are DSOs: and are accountable for operating their network to remain within secure limits (using operating envelopes and dynamic connection agreements)
- AEMO is accountable for operating a central dispatch process that considers networks constraints (both Tx & Dx) - NER 3.8.1
- DNSPs/DSOs are responsible for incorporating operating envelopes into the dispatch process
- Aggregators should control consumer owned DER to deliver services according to their preferences – not AEMO or DSOs
- Aggregator controlled VPPs should progressively participate in wholesale dispatch as they grow in materiality in order to contribute towards system operability

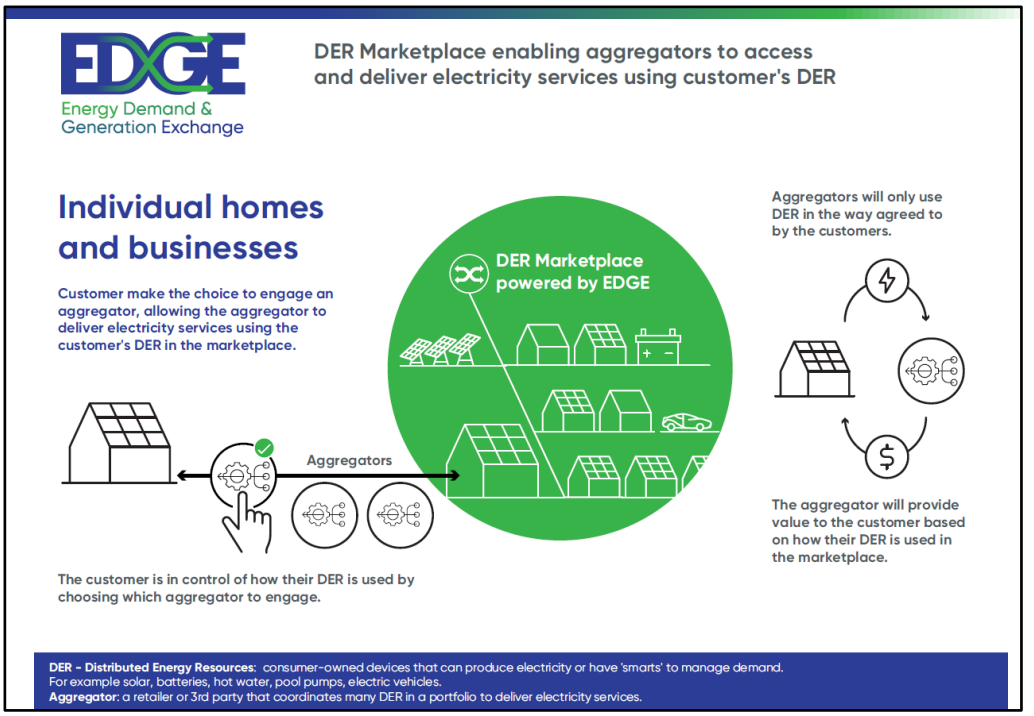
Integrated Systems

- "DER Marketplace" is an integrated and scalable technology ecosystem that connects AEMO, DSOs and aggregators with respect to 3 key functions: wholesale integration, data exchange & local services trade
- System/market operation and participation should be highly automated, efficient and scalable

- Systems should facilitate simple user experiences for all involved – AEMO, DSOs, Aggregators & Consumers

How we work

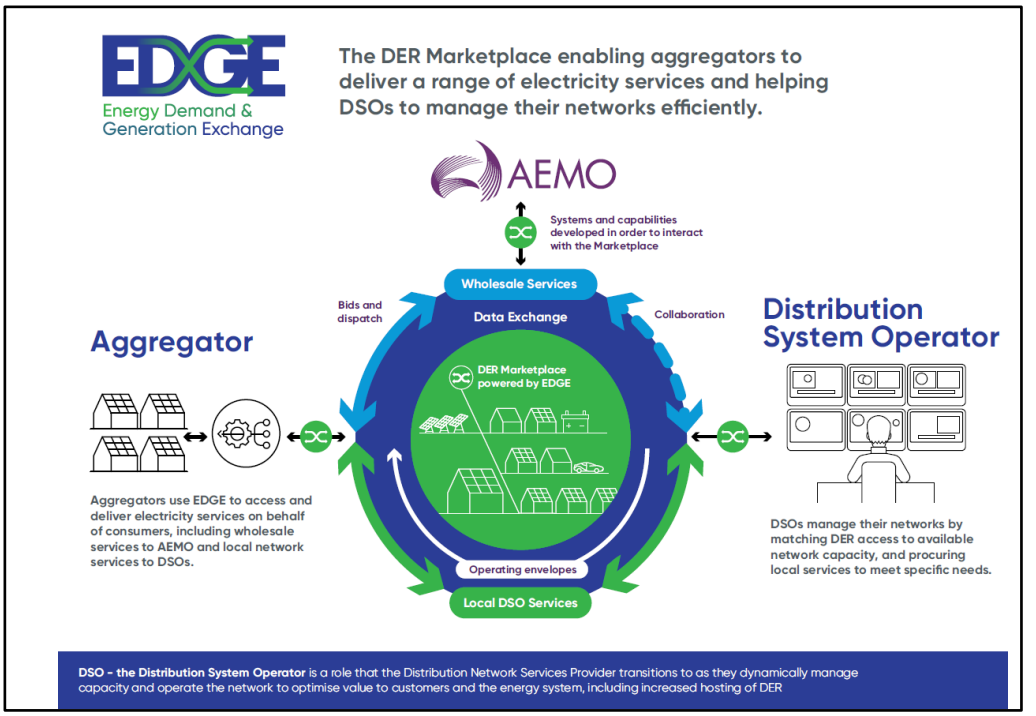
- Everything we do in EDGE is aligned to the National Electricity Objective
- AEMO, DNSPs and Aggregators need to collaborate to maintain system operability and deliver on consumers' interests in a very high DER future
- EDGE is being delivered for the benefit of the broader industry and consumers, so EDGE is committed to transparency and knowledge sharing throughout the project
- EDGE requires deep thinking to design for the detailed practicalities of DER integration at scale
- EDGE has a long term horizon - testing systems that may (or may not) be required for a high DER future over the next 2 decades



This is a high level conceptual view of the DER Marketplace from consumer perspective to show their relationship with the aggregator / agent.

Key point to emphasise are:

- The aggregator has a key role in represent consumers' DER the deliver electricity services in this marketplace
- Importantly, customers are in control. Customers can 'opt-in' and choose to enrol with an Aggregator – there is no obligation.
- In line with their preferences, customers allow aggregators to utilise their DER to deliver services, in exchange for value
    - This value can take various forms, such as a discount on the cost of the DER, a regular payment for use of the DER, or a share of the profits/revenues earnt from delivering services with the DER.



This second conceptual diagram is for an energy industry audience to show how the DER Marketplace contains 3 core function sets (shown by the 3 the rings), and how key parties interact with the DER Marketplace (through systems and capabilities that each party develop that, together, represent an 'integrated technology ecosystem').

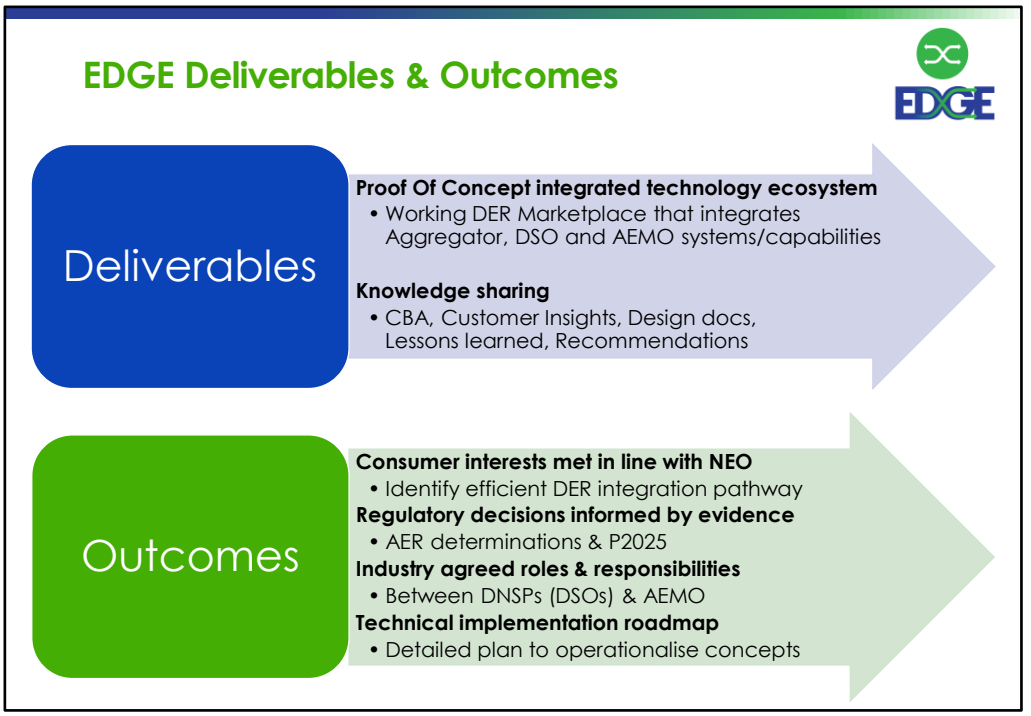
The intent of EDGE is to build off the extensive work done in the collaborative industry initiative Open Energy Networks (https://www.energynetworks.com.au/projects/open-energy-networks), which identified that DNSPs and AEMO need to work together in a 'hybrid' model to efficiently integrate DER at scale.

EDGE is the first example of AEMO and a DNSP working together to test how a hybrid model could work in practice.

The key functions that EDGE is looking to test:

- **Wholesale integration of DER**: how should VPPs progressively participate in the wholesale dispatch process, and how should AEMO and DNSPs work together to ensure distribution network limits are considered in that dispatch process.

- **Data Exchange**: how to exchange data between all actors in an efficient and scalable way. An example is shown of how DSOs share operating envelopes with aggregators via the DER Marketplace.
- **Local Network Services**: the DER Marketplace facilitates efficient and scalable trade of local network/'DSO' services that DSOs procure from aggregators bilaterally. For example, DSOs could use the DER Marketplace to identify and engage services as a non-network alternative to augmenting the network to meet a specific need. This also enables aggregators to stack value streams efficiently and provide better offers to consumers.



Deliverables

- Deliverables include a working Proof Of Concept (POC) DER Marketplace that integrates Aggregator, DSO and AEMO systems and capabilities.
- This DER Marketplace will be used to generate data, insights and learnings that will be shared publicly in knowledge sharing deliverables including Cost Benefit Analysis (CBA), customer insights, lessons learned, design documentation and recommendations on how to operationalise feasible concepts.
- Importantly, the CBA will investigate the feasibility of scaling up the concepts tested from the perspective of all electricity consumers, whether they own DER or not.

Outcomes

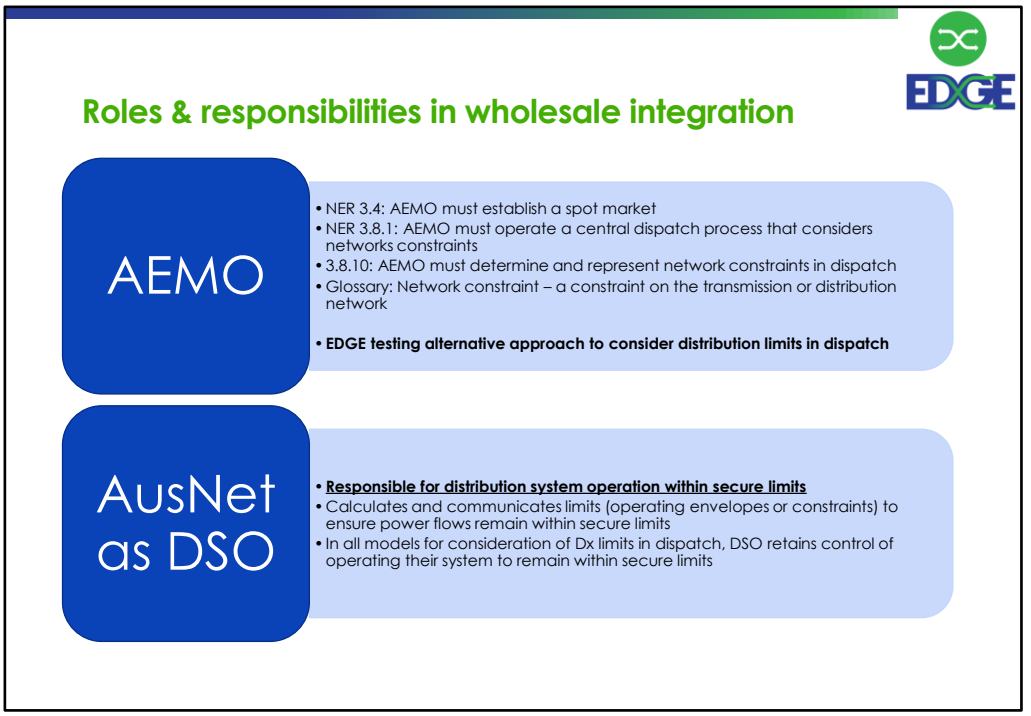
- The insights and learnings will culminate in an evidence base from which the project Outcomes can be achieved.
- In essence, recommendations will relate to the changes needed to integrate DER into Australian market frameworks at scale.
- Recommendations will relate to how electricity market rules need to change, how AEMO and networks will work together and the technological pathway with its design centred around the long term interests of all electricity consumers.

Project Influence and Importance

- Project EDGE's distinction and importance lies in that it is seeking to bring together a number of core functions required for DER integration into market frameworks in Australia for the first time to prove the concept of a DER Marketplace.
- To do this, Project EDGE aims to build on the learnings from a number of existing ARENA funded projects that separately address a number of core functions required for DER integration in Australia. These projects include:
    - Evolve
    - Networks Renewed
    - AEMO VPP Demonstrations
    - Simply VPPx
    - Advanced VPP Grid Integration
    - Project Consort

Wholesale Integration

Nick Regan
John Theunissen

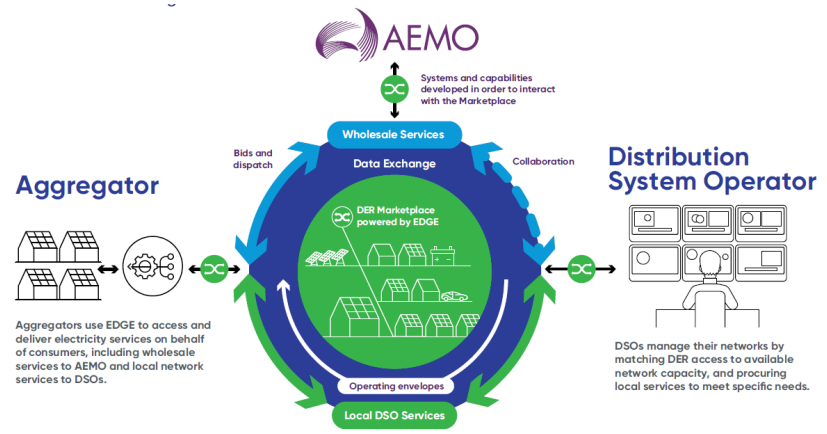


AEMO has a statutory obligation to operate the central dispatch process that considers network constraints (defined as both transmission or distribution, but only transmission level constraints are currently considered in the dispatch process)

AEMO's congestion modelling team receives network information from transmission network service providers, and then creates the constraint equations that are considered in the NEM dispatch engine (the algorithm that determines the dispatch outcomes).

In EDGE AEMO and Ausnet Services are testing a different way to consider distribution limits in the dispatch process, in which Ausnet (as a DSO function) dynamically optimises their network, calculates the network limits and communicates them as 'operating envelopes' to aggregators. A compliance process then ensures that aggregators are operating their portfolio within the envelopes provided by Ausnet. This process should give AEMO confidence that wholesale dispatch will not lead to distribution network limits being breached.

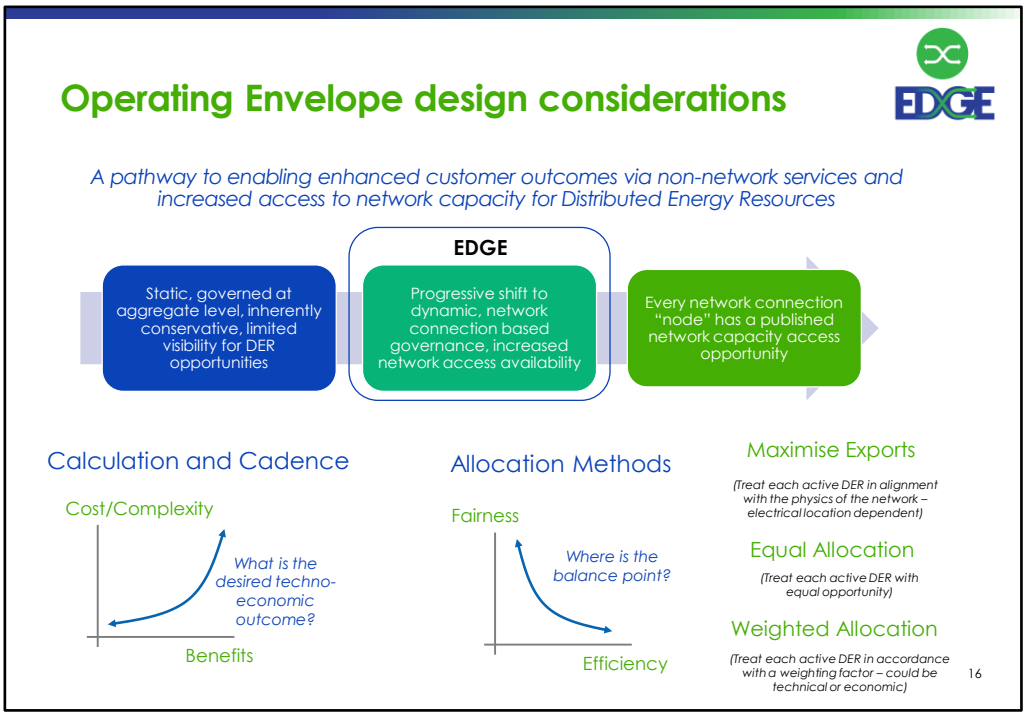
Wholesale integration



Wholesale integration key functions:

- **DER dispatchability**
  - How VPPs participate in wholesale dispatch with progressive levels of sophistication
- **Distribution Networks Limits**
  - How Distribution limits are considered in the dispatch of DER
  - Represented by Operating Envelopes developed and communicated by DSOs

- **Wholesale integration of DER covers 2 key functions, and there is a spectrum of approaches to each ranging from least cost/complex but also least efficient, to more efficient but also more costly/complex to implement**
  - DER dispatchability spectrum runs from no visibility, to operational visibility, to self-dispatching to full Price/Quantity bidding
  - The spectrum for distribution network limits starts with a simple approach of DSOs sending NMI level operating envelopes to aggregators day ahead, and adds sophistication by communicating the OEs more regularly, incorporating economic considerations or classifying the OE for groups of NMIs.
- **EDGE is seeking to test a variety of approaches to each function, to create an evidence based cost benefit analysis of the different approaches, and to identify the approach that delivers the most net benefit for a given penetration of DER**



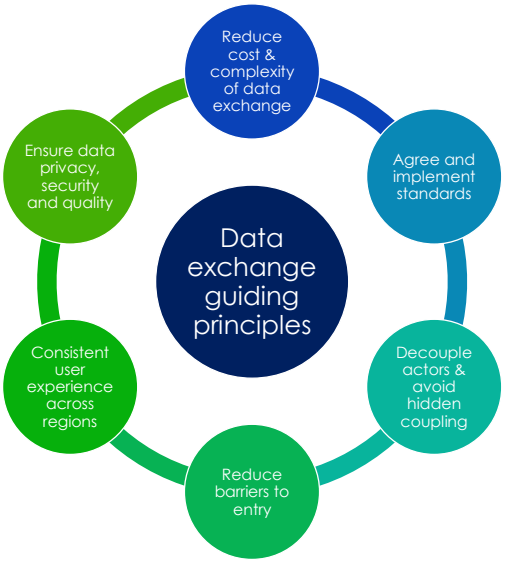
- For those who are not familiar with this concept, operating envelopes define the operational "playing field" for connected DER – essentially the boundaries within which the DER must operate to keep the electricity supply network safe and secure.
- At a strategic level, there is a growing need within the electricity supply industry to evolve to a more dynamic method of allocating and managing network capacity, which facilitates bi-directional energy flows and increases customer DER hosting capacity.
- In EDGE we are exploring ways to calculate and allocate these dynamic operating envelopes, with the aim of building evidence that supports what might be the most cost-effective solution that can scale in future, and to inform what might be the most widely accepted or stakeholder supported allocation of network capacity to customer DER.
- As shown on the slide, there are varying levels of complexity in the calculation of the operating envelopes, and we're hoping to understand where the "sweet spot" might be in terms of the techno-economic outcomes through the tests in EDGE.
- Also, the allocation methods that we aim to test in EDGE (maximising exports, equal access, and one with a bias towards market economic outcomes) are designed to provide insights into the fairness and efficiency trade-offs that result

from adopting specific rules around the sharing of available network capacity for DER operation. We recognise that any decisions ultimately made here impact customers and so we are mindful that practical evidence is produced from EDGE that can help shape and guide the decisions that need to be made within the industry.

Data Exchange

Nick Regan

Data Exchange design principles



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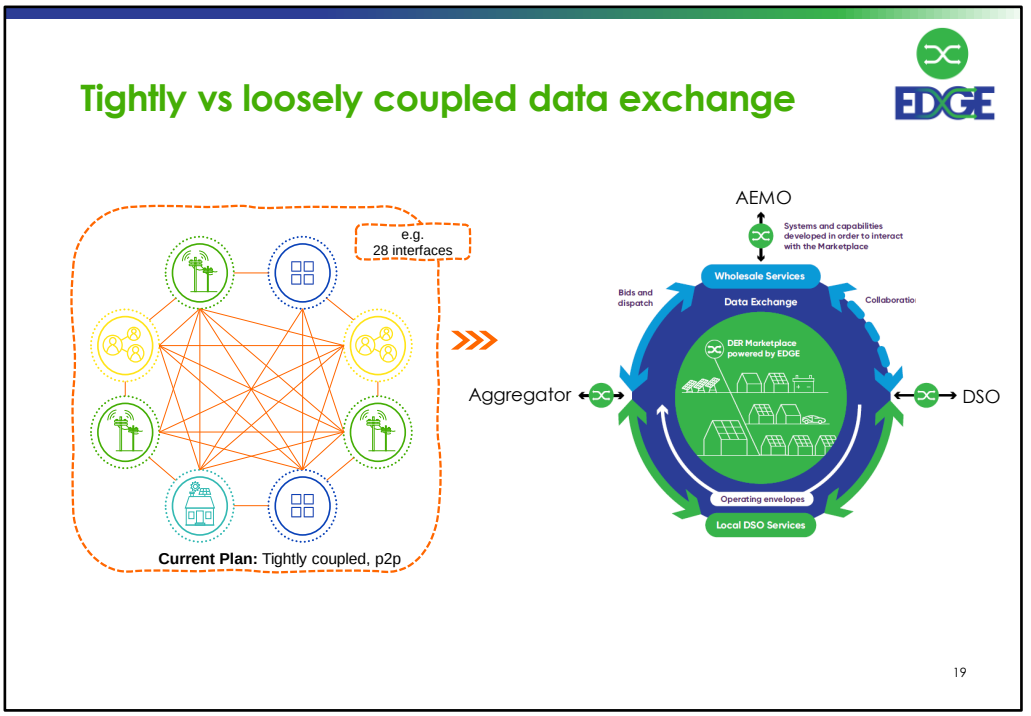
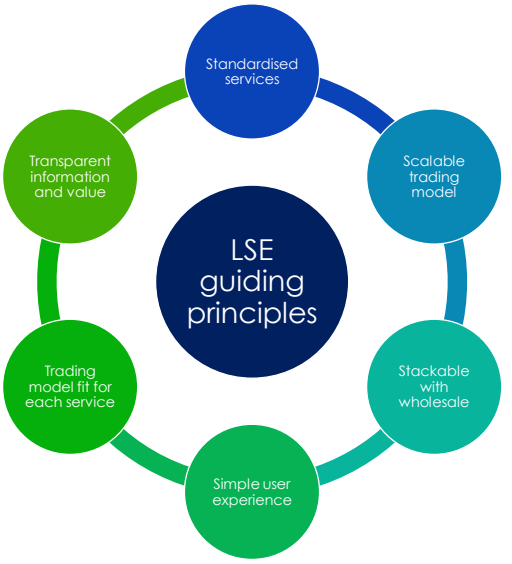


- One of Project EDGE's objectives is to test efficient and scalable approach to data exchange.
- The hypothesis to test is that many "tightly coupled" point to point integrations is inefficient and costly if scaled in a high DER future, and that a potentially more efficient solution would enable any party connected to the DER Marketplace to share data and messages with anyone else connected to it.
- Key principles in the design are simplicity and standardisation.
- The solution to facilitate testing this hypothesis has not yet been settled but AEMO, AusNet and Mondo are actively working through this and will share further information in due course.

Local Services Exchange

John Theunissen

Local Service design principles



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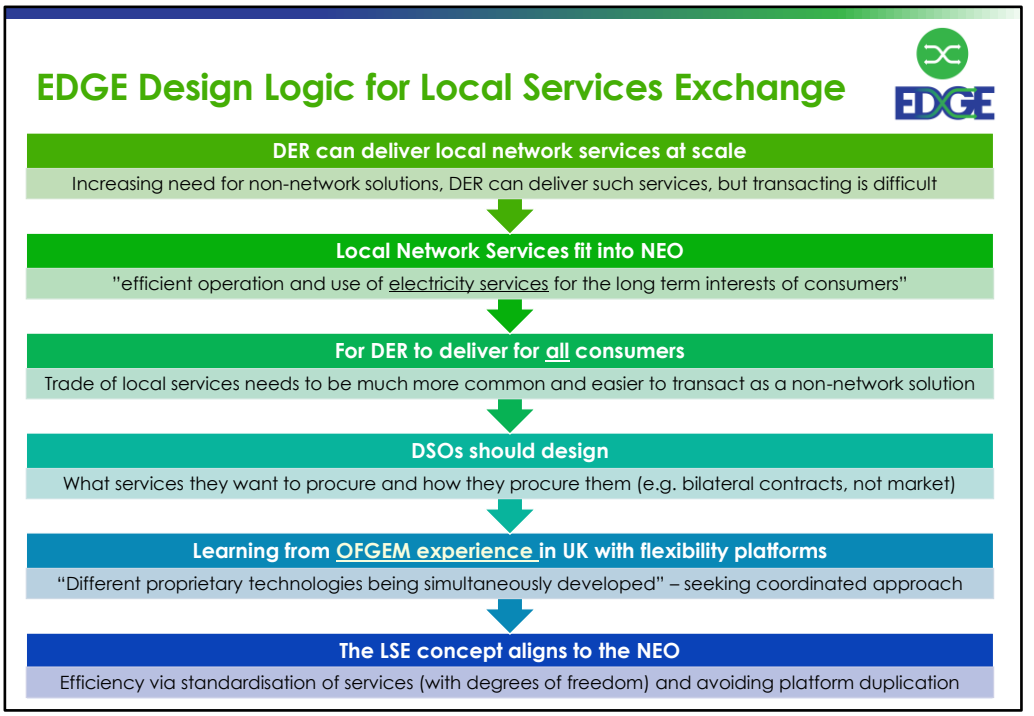
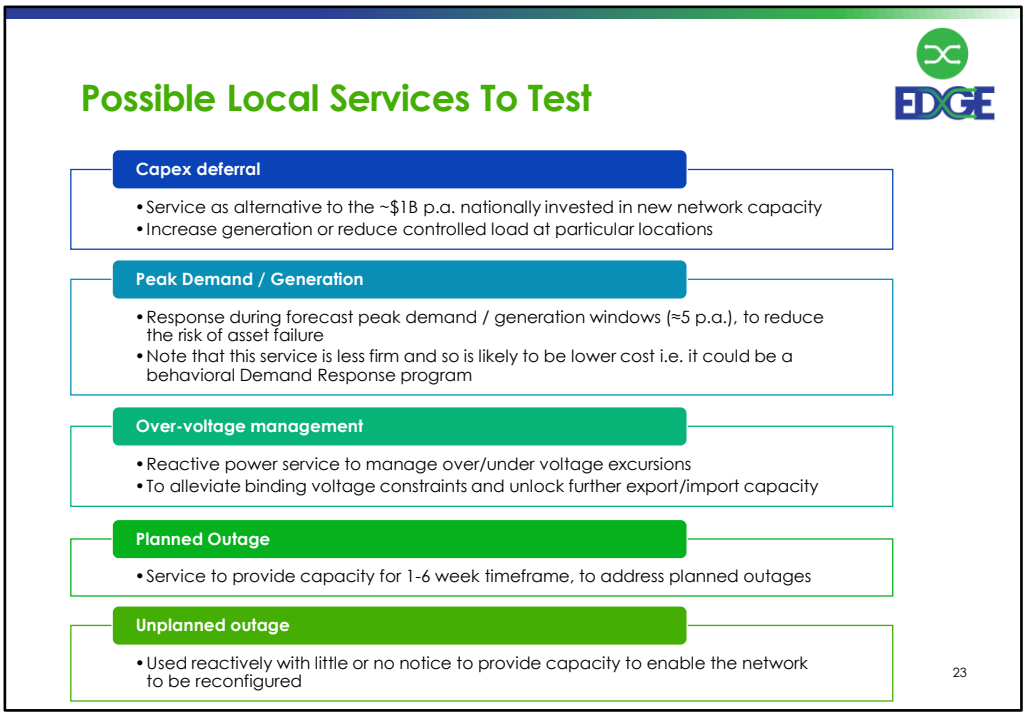


- We are anticipating a very high DER future with increases in both demand (EVs & load electrification) and generation (PV)
- We are anticipating this will drive a need for local network services to defer/displace network capex, and that DER could deliver such services through aggregators
- Local network services are a type of electricity service and fit into the NEO: ”efficient operation and use of electricity services for the long term interests of consumers”
- Currently local network services are difficult to transact as they are bilaterally negotiated between DNSP-aggregators in a bespoke process each time
- If DER are going to work for all consumers by displacing network capex then trade of local services needs to be much more common and easier to transact
- DSOs should design what services they want to procure and how they do it
- The LSE is not a ‘market’ for local services, but rather a ‘marketplace’ in which services are still traded in bilateral contracts between DSOs and aggregators - it is just that the contracts are standardised (with degrees of freedom)
- Aligns to the NEO - AEMO (and technology vendor) implement the DSO led design and administer the LSE to provide the best user experience for DSOs and aggregators - the logic being this is more efficient than every DSO setting up their own different platform that aggregators have to engage with

- OFGEM, 2019 – “Our findings show that despite the involvement of key stakeholders such as government, Platform Operators and UK distribution network operators as well as a significant amount of engagement and discussion between the parties, such as through the Energy Networks Association Open Networks Project, the current environment is one where different proprietary technologies are being simultaneously developed. There is duplication in activity and a risk of locking in a future world which doesn’t achieve some of the key benefits that flexibility and a mature Flexibility Platform sector could deliver. In this quickly developing area, there could be significant benefits from a coordinated approach, focussed on the beneficial outcomes to consumers, the grid and the companies who operate in this space.”



- The DER marketplace enables a range of potential local services that can be procured and supplied. These local services can be grouped into at least two categories – firstly, DER services that can be used to support the network in an economic manner, and secondly services that enable greater economic value from other accessible markets, like the wholesale energy market. For the EDGE project we are focussing primarily on the network services component.
- This slide lists the range of local service types we are considering to test in EDGE. The first three on the list are the ones that arguably will deliver most value, so we intend to start with those – Capex deferral, managing abnormal load or generation scenarios, and maintaining network connection voltages within Code tolerances.
- The latter ones that could address network outage situations are inherently more complex and less certain in terms of their cost-benefit, so we may decide not to proceed with those, but we're keeping them in view, in case we have an opportunity to explore them further.
- The local services are procured and delivered via the EDGE data exchange hub in a standardised manner, and rely on the smarts that are being built into both the DNSP and Aggregator environments.

- As you can imagine, these services need to match the needs of the network – the confidence and assurance that the services can be relied on, as well as the economic outcomes from the services that are delivered. As such, both longer-term contractual and shorter-term procurement use cases are being explored.

Consumer focus

Anoop Nambiar

Role of the Aggregator

Mondo will act as the Aggregator for the first 2 trial phases of the EDGE program. In that role Mondo will engage with energy users within the Hume region to promote interest in the trial and sign up sufficient residential and DER sites to participate in EDGE.

- Be the **voice of the customer**, understand and represent their energy services needs, requirements and interests
- **Engage** the community and key stakeholders
- Develop strong customer **value propositions** that incentivise market participation
- Be **transparent** and operate on an agreed set of principles
- Demonstrate the capability required to deliver **DER services**
- Contribute to the **design of the future 2-sided electricity market**
- Develop and implement a reliable **DER aggregation platform** and **behind the meter** technology

Meeting customer needs

The Mondo team will approach this through two workstreams – Customer Insights research and Product Development and Delivery

Understand what customers need and want

Understand customer needs and identify ways of maximising customer adoption of – and retention of – DER-focused product offerings.

Focus Areas –

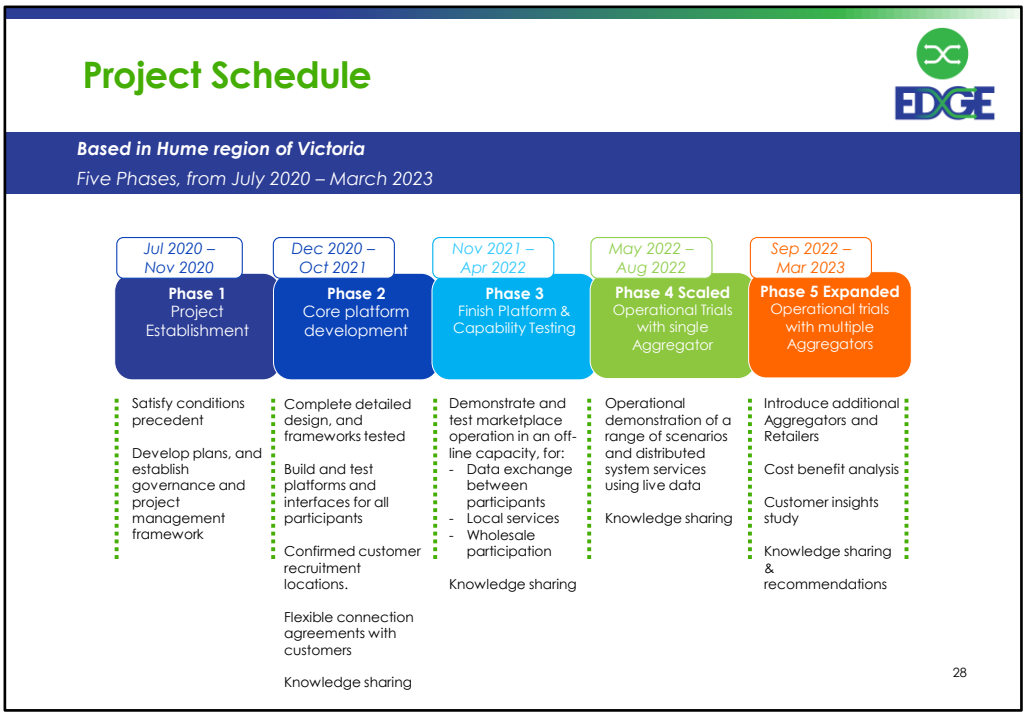
- Pre Use perceptions
- Target DER product offerings
- Customers journey
- Post Adoption Evaluation

Customer Segments -

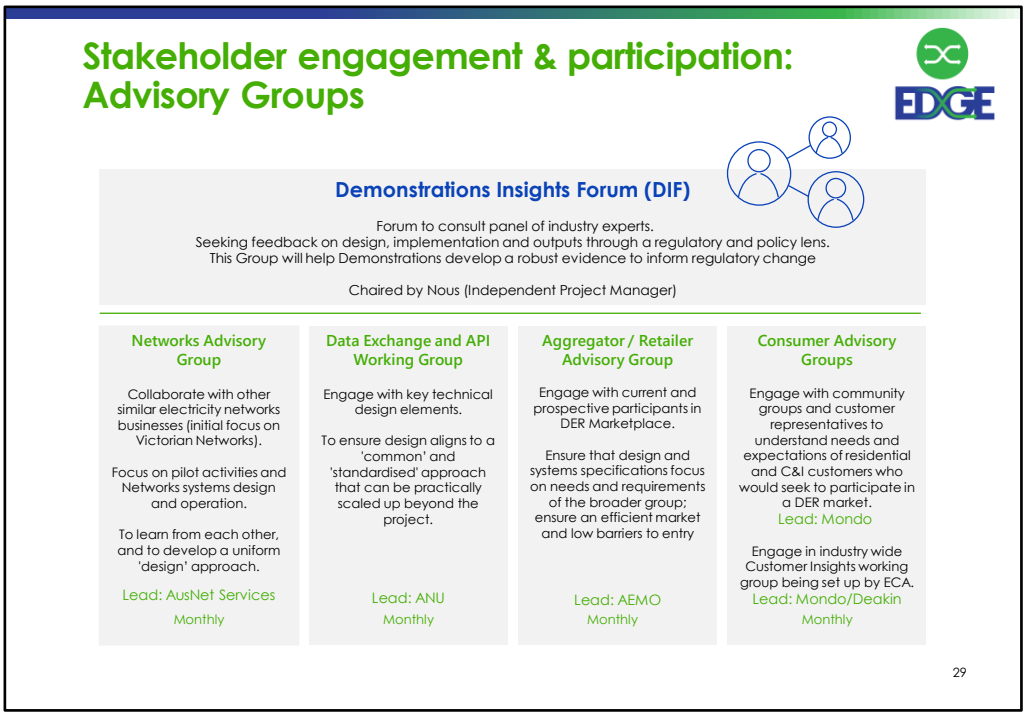
- Residential household
- Commercial & Industry
- Local Government

Create aggregation products and incentives that meet customer needs and wants

Next Steps



- Whilst ambitious in the content being tested, Project EDGE will intentionally remain a small-scale trial to ensure its off-market testing does not interfere with live energy markets.
- Initial Platform testing (Phase 3) will be undertaken with less than 100 customers and less than 1 MW of flexible capacity.
- By Phase 5, the project aims to scale to a cap of approx. 10 MW of flexible capacity or a mix of 1,000 Residential, Commercial and Industrial customers.
- The project aims to recruit a minimum of 2 additional aggregators to participate in Phase 5 (or before) and has already commenced discussions with several candidates.



EDGE's high level consultation plan consists of two broad elements:
1) Focussed industry advisory and working groups to ensure broad industry input is considered in design, operation and outputs of the project marketplace.
2) In addition to these forums, public knowledge sharing reports, webinars and other presentations are planned to inform a broader audience that may not want all the technical detail.

Contact:
EDGE@aemo.com.au