Project EDGE – DER Marketplace Demonstration

March 2022

Acknowledgements and Disclaimer

Australian Government
Australian Renewable Energy Agency
ARENA

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 | A collaboration between AEMO, AusNet & Mondo

Nick Regan
AEMO

John Theunissen
AusNet Services

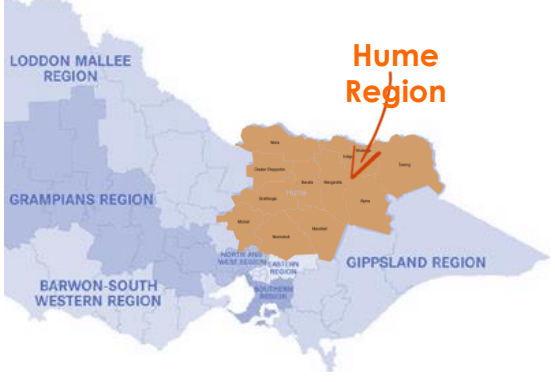
Anoop Nambiar
Mondo Power

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

Australian Government
Australian Renewable Energy Agency

ARENA
Funding Partner

Tech. Partners

opus one solutions
DSO capability

energy web
Digital identity & data exchange

PXiSE Energy Solutions, LLC
Market logic/intelligence

Distribution System Operator
AusNet services

Aggregator
mondo

EDGE
Energy Demand & Generation Exchange

AEMO
Power System & Market Operator

Supporting Partners

THE UNIVERSITY OF MELBOURNE
Networks, Research & Knowledge Sharing

DEAKIN UNIVERSITY
Customer Insights

Deloitte.
Cost Benefit Analysis

EY
Knowledge Sharing

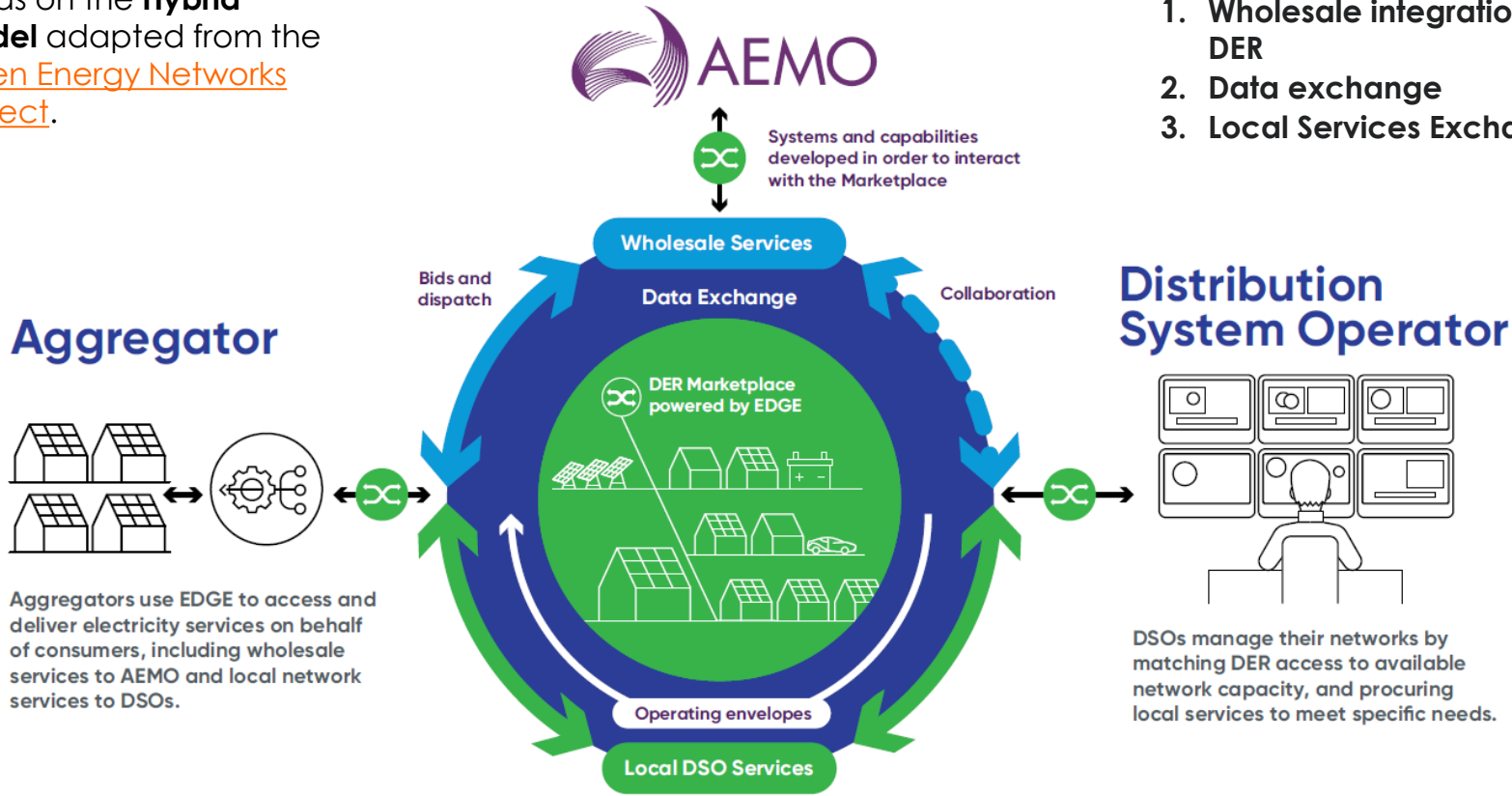
nous
Independent Project Manager

Project EDGE | DER Marketplace model

Project EDGE uses and builds on the **Hybrid model** adapted from the Open Energy Networks project.

EDGE tests 3 core functions:

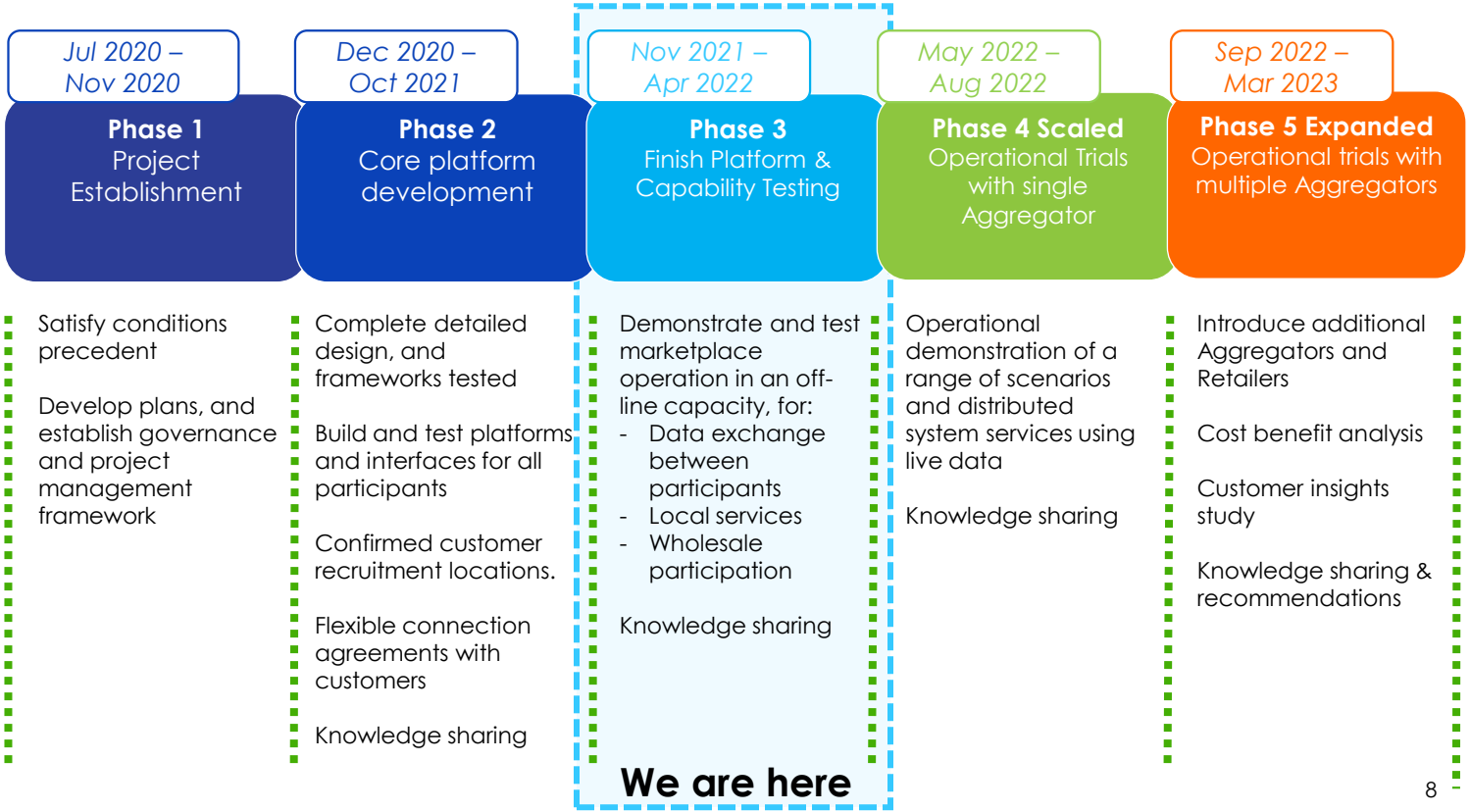
1. **Wholesale integration of DER**
2. **Data exchange**
3. **Local Services Exchange**



Project EDGE | Schedule

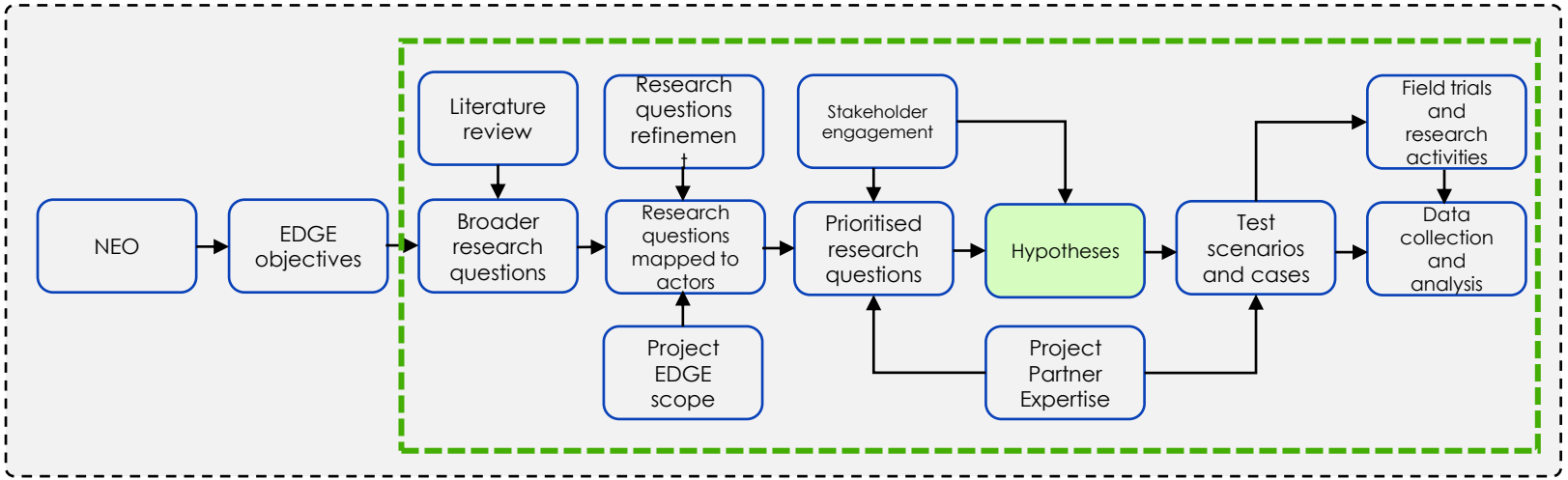
Based in Hume region of Victoria

Five Phases, from July 2020 – March 2023



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
- Energy Consumers Australia
- Energy Networks Australia
- Energy Security Board
- SA Power Networks

Forums for engaging with a broader audience

- DER Demonstrations Insights Forum
- Market Integration Consultative Forum
- Networks Advisory Group

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.

Customer

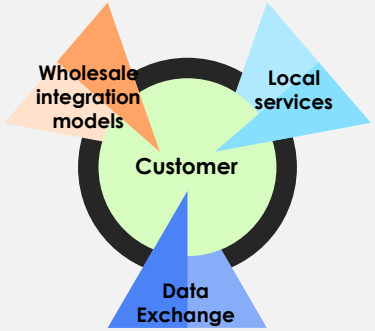
RQ.1 How can the DER Marketplace be designed to enable simple customer experiences, deliver the needs of customers and improve social license for active DER participation?

CBA/ NEO

RQ.2 Does the DER Marketplace promote efficient investment in, and efficient operation and use of, electricity services for the long-term interests of consumers?

Wholesale integration

RQ.4 How can the DER Marketplace facilitate efficient activation of DER to respond to wholesale price signals, operate within network limits and progress to participation in wholesale dispatch over time?



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

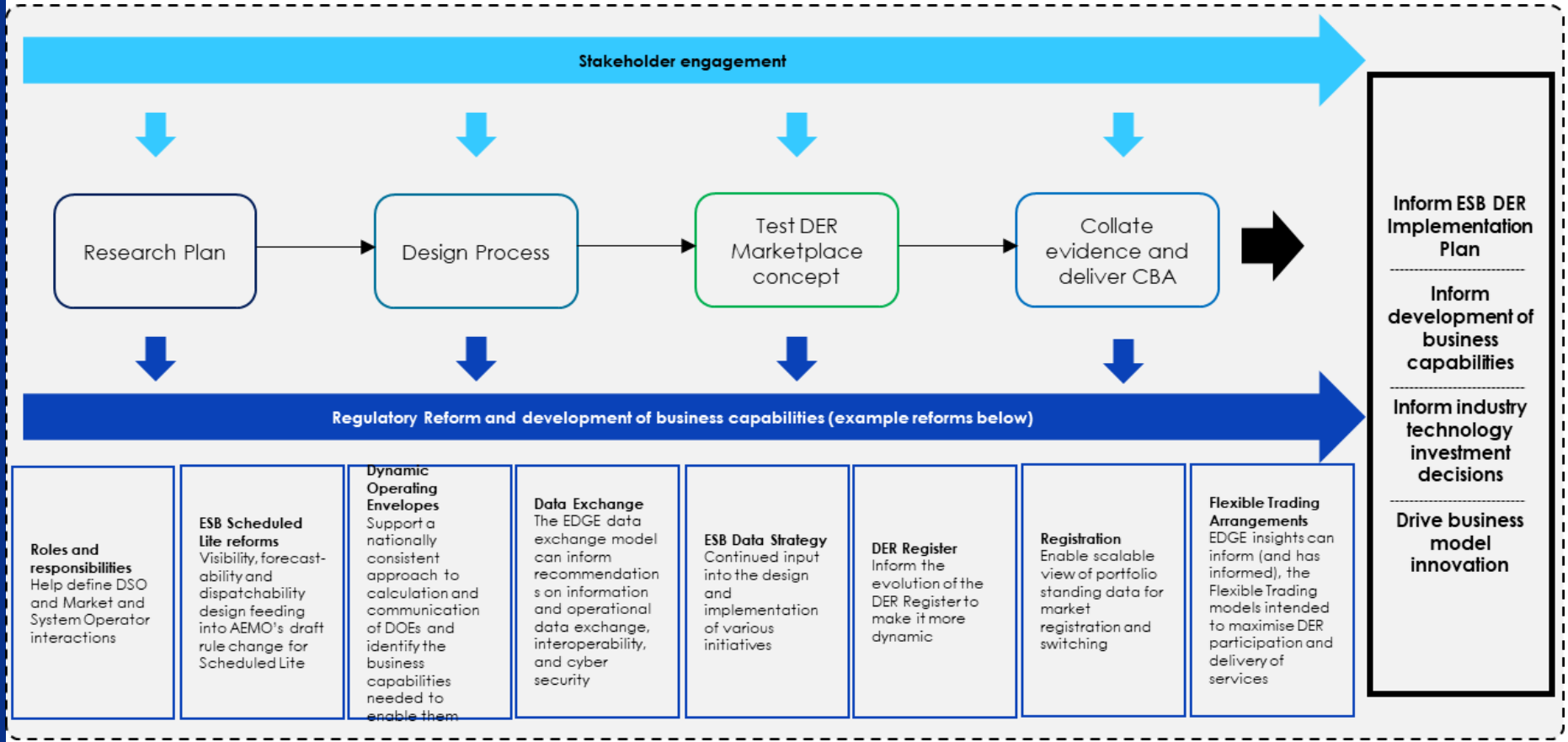
RQ.7 How could DNSP investment to develop DSO capabilities improve the economic efficiency of the DER Marketplace?

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

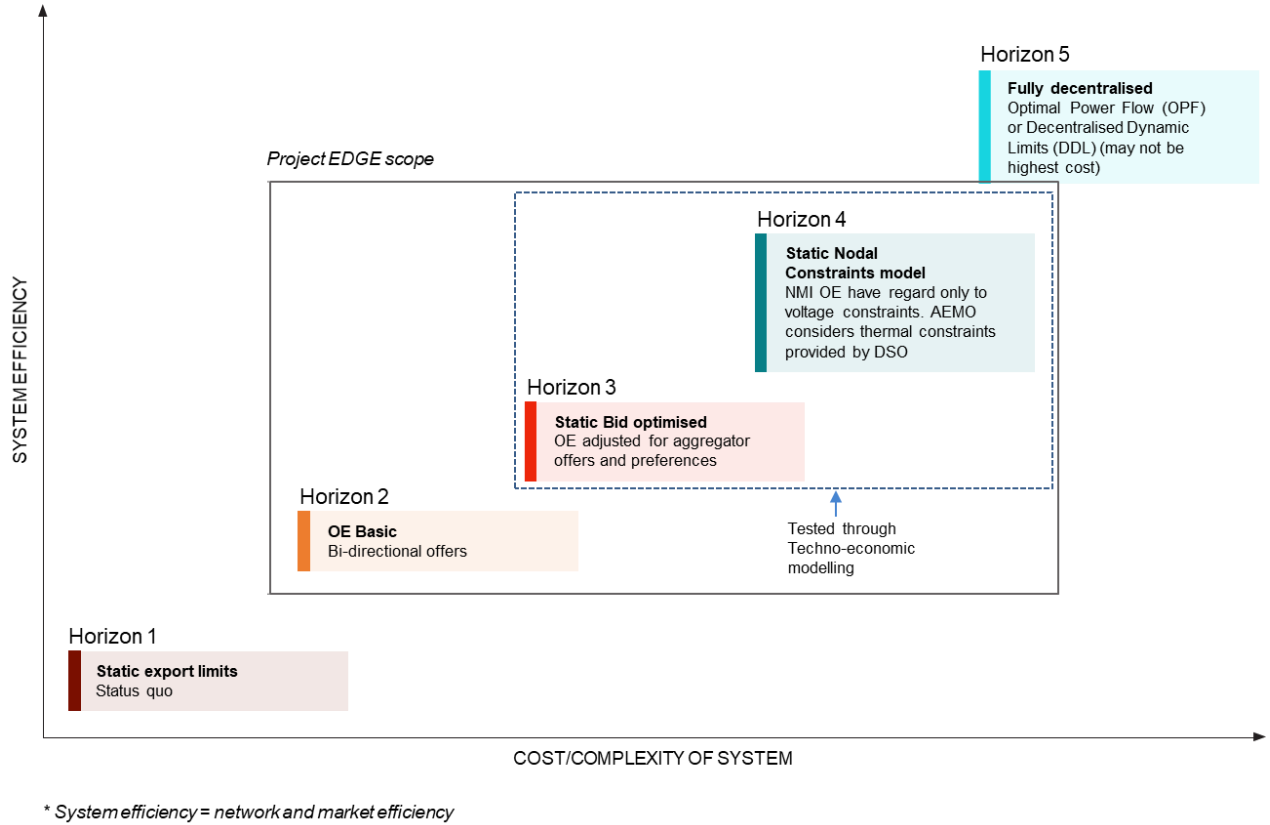
Research outputs will provide an evidence base to inform stakeholder decision-making



Project EDGE Function Sets

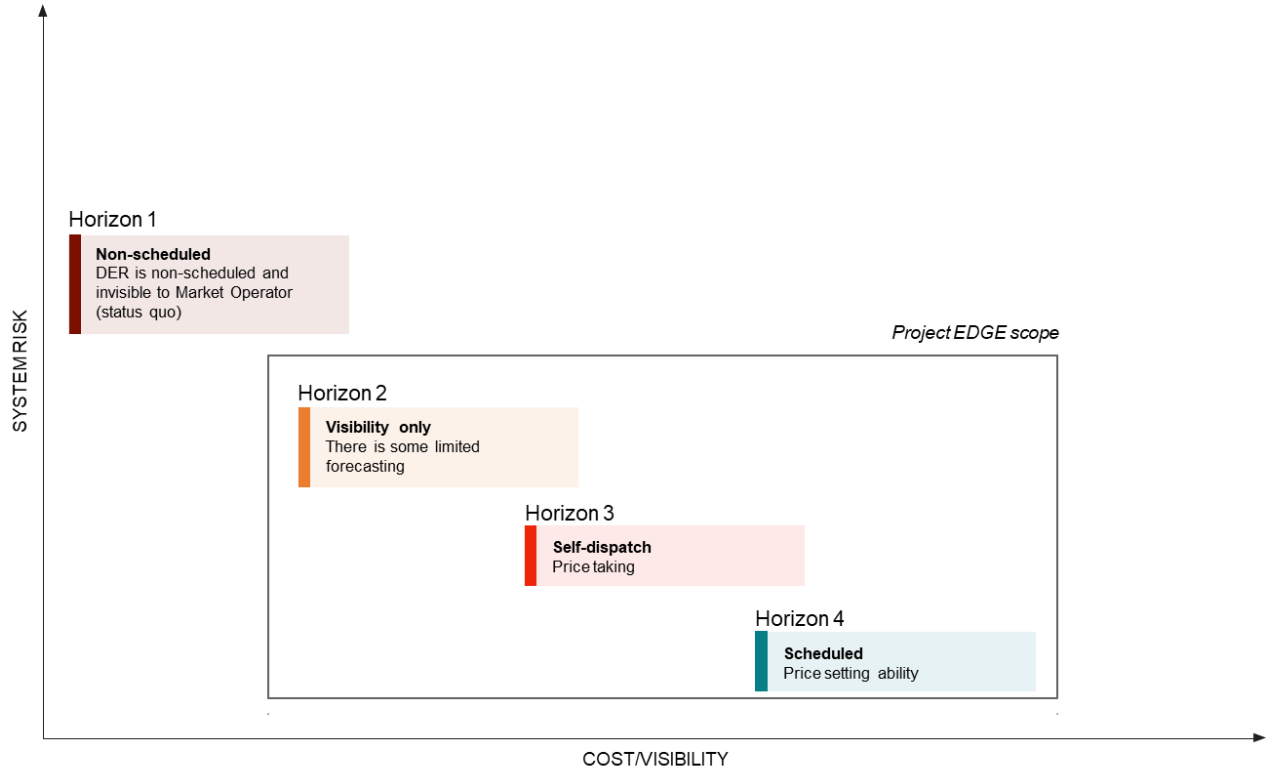
Wholesale Integration Function

Target Operating Model progression



* *System efficiency = network and market efficiency*

Aggregator bidding progression



** 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

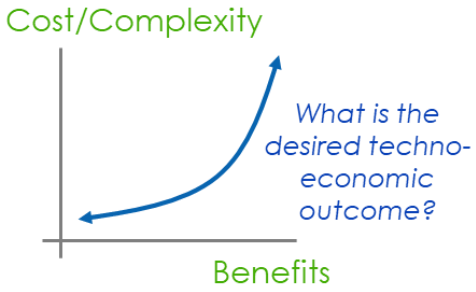
Static, governed at aggregate level, inherently conservative, limited visibility for DER opportunities

EDGE

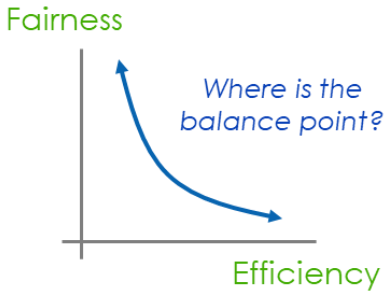
Progressive shift to dynamic, network connection based governance, increased network access availability

Every network connection "node" has a published network capacity access opportunity

Calculation and Cadence



Allocation Methods



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)

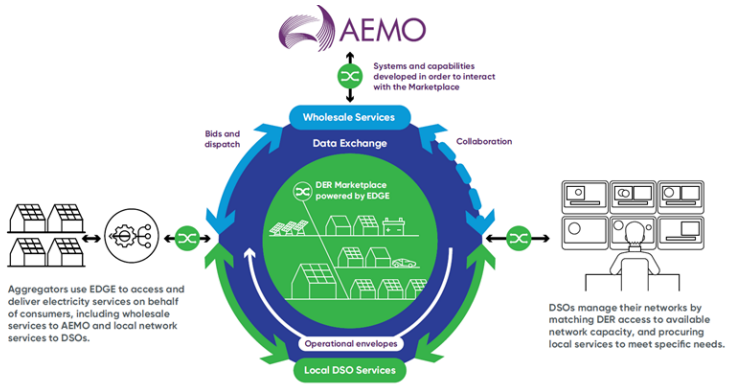
Weighted Allocation

(Treat each active DER in accordance with a weighting factor – could be technical or economic)

THE UNIVERSITY OF MELBOURNE

Local Services Exchange Function Set

Local Services Exchange – Proposed process/roles



Aggregator		Distribution System Operator
View service and assess whether to enrol	Define	Define service characteristics and contractual terms
Submit enrolment information and performance test data	Enrol	Assess performance test data and pre-approve to participate
Submit offer - if accepted, exchange contracts per pre-agreed terms	Engage	Post service opportunity, assess offers from pre-approved participants, exchange contracts
Respond to dispatch signal to deliver service	Deliver	Schedule service delivery or trigger dispatch via EDGE
Submit service verification data	Verify	Download/view data on EDGE Assess data to verify performance
Set up standard queries for reporting	Report	Set up standard queries for reporting

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 (>1year), 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

High Firmness

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

- **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 (>1year), hence suited to a longer-term contract with *guaranteed availability, agreed pricing and autonomous operation*

Medium Firmness

*(typically linked to a **forecast market need** use-case, high price related, funding to be clarified)*

- **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*

Low Firmness

*(typically linked to a **spontaneous market need** use-case trigger, event related, funding to be clarified)*

- **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*

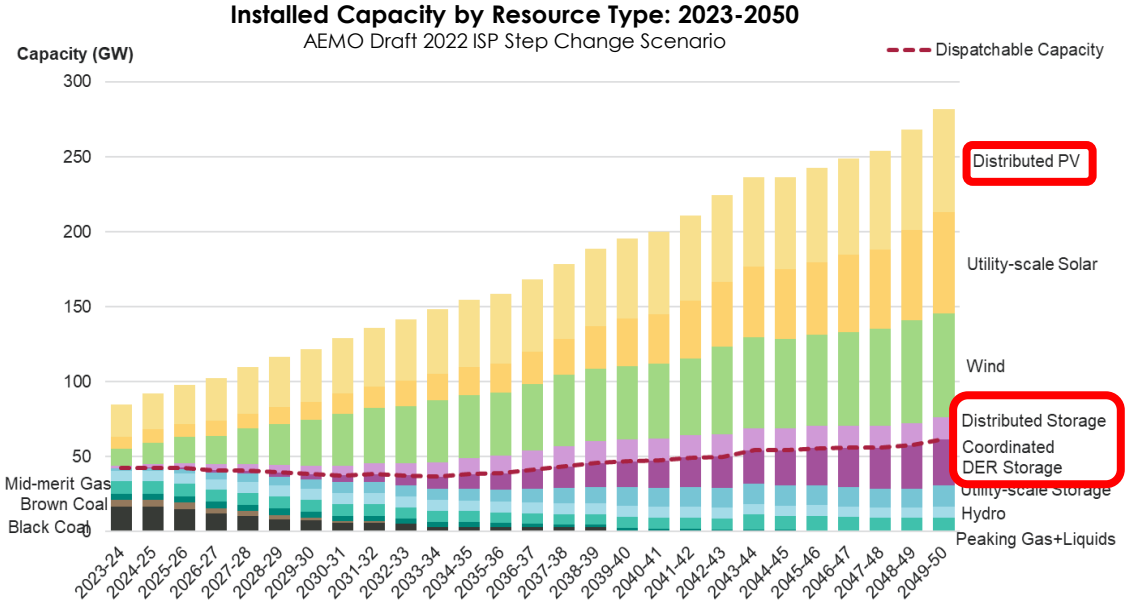
Market service oriented

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 network**[1]

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")

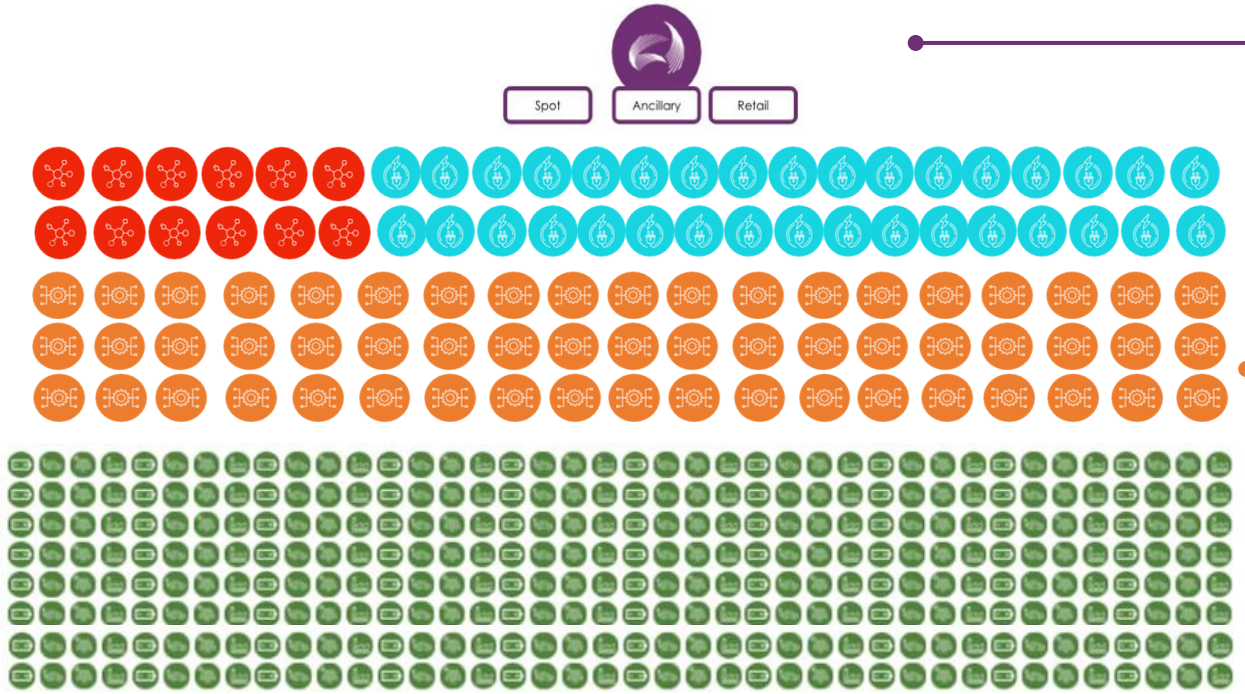


114 GW

40% of total installed capacity is connected to the distribution network

1 At https://aemo.com.au/en/energy-systems/major-publications/integrated-system-plan-isp/2022-integrated-system-plan-isp
2 At https://www.cleanenergycouncil.org.au/resources/technologies/grid

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



Multiple wholesale markets

Many local services & needs

Hundreds (or more) aggregators & agents

Millions of customers & assets*

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

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)

DNSP

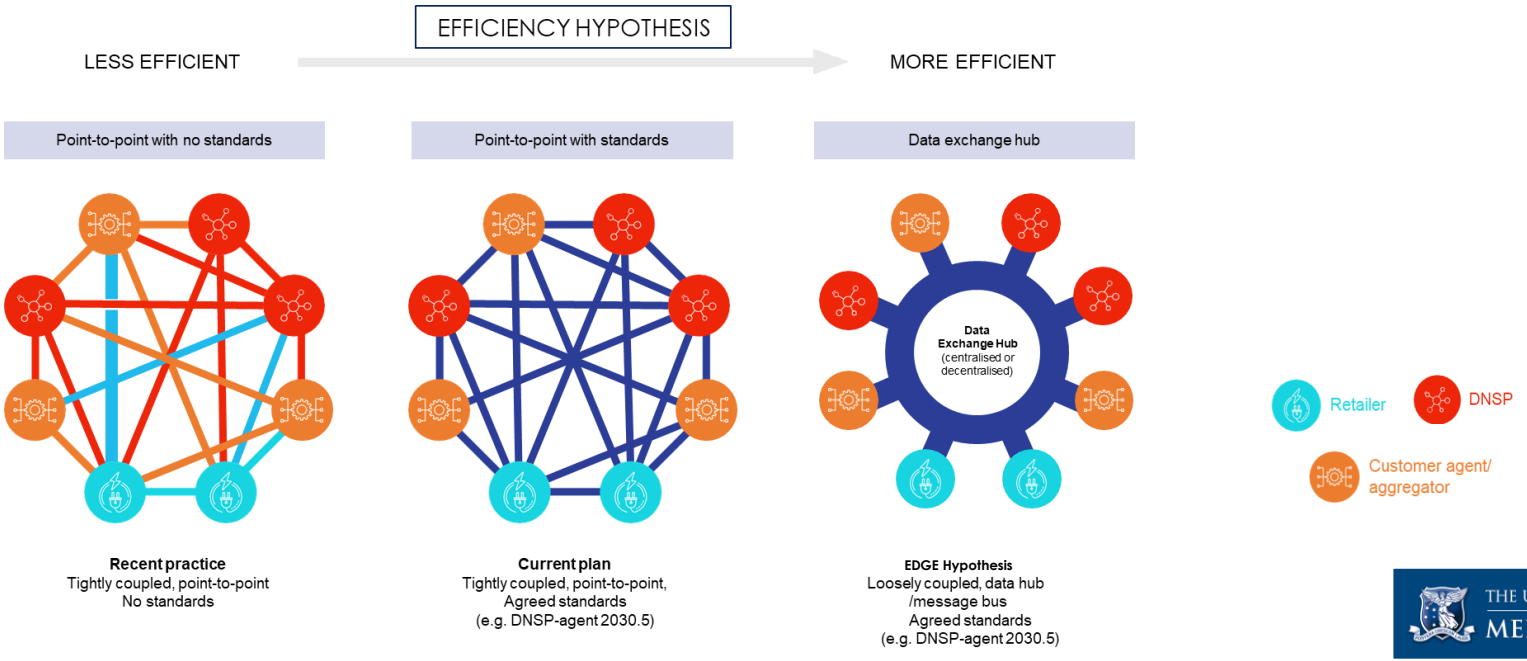
Customer agent/ aggregator

Retailer

Data Exchange Approaches

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

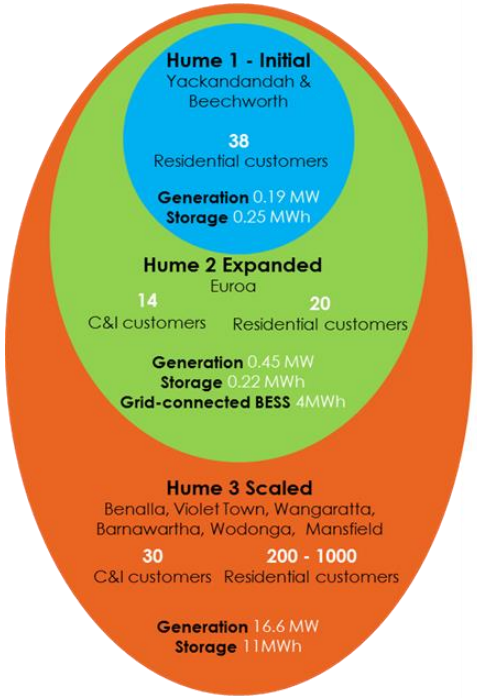
- **Heterogenous Point-to-point (no standards)** – individual connections to share data with no preferred methods/protocols
- **Point-to-point with standards** – individual connections to share data with agreed preferred methods/protocols
- **Hub** – connect once to a data exchange hub to share data with all parties. Project EDGE will consider both a centralised and a decentralised hub approach



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



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…

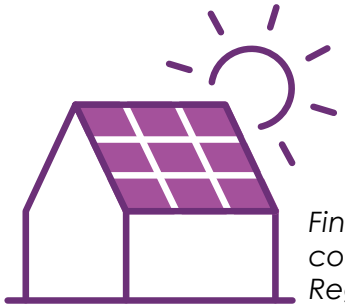
Research Components

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



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

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 10 in-depth interviews conducted with staff from 5 C&I and 5 LGAs from regional Victoria

Q&A

Want to know more?

- AEMO's Project EDGE Webpage: https://aemo.com.au/initiatives/major-programs/nem-distributed-energy-resources-der-program/der-demonstrations/project-edge
- 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