TRANSPOWER

# Developing Flexibility Markets in New Zealand

November 2021

# Agenda

1. Introduction
2. Flexibility markets are enabled by players across the supply chain
3. Internationally, cross industry working groups have helped guide regulation
4. Learning from others: Great Britain – Operational trials inform development
5. Learning from others: Australia – Innovation funding drives change
6. Discussion and next steps

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# DER uptake could reduce peaks by 2GW, saving between $3B and $6B across the supply chain

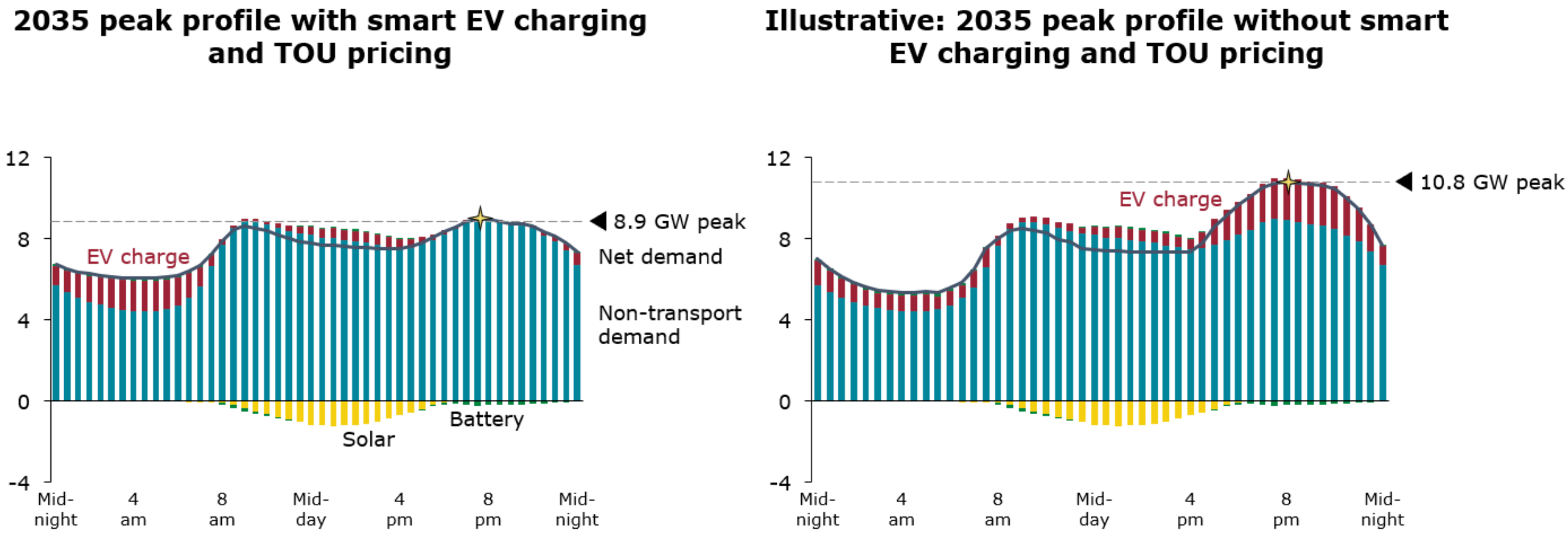


Figure: Comparison of New Zealand's peak demand for electricity both with, and without high uptake of DER (Source: Whakamana i Te Mauri Hiko)

# The majority of benefits are derived from avoiding the need to build new lines and generators

Table 6: Estimates of net economic surpluses by DER value streams, net present value 2021-2050

| | $ billion, NPV | % total |
|---|---|---|
| Resource adequacy – offset thermal peaking | $0.347 | 5.06% |
| Resource adequacy – offset new lines and generation | $5.9 | 85.86% |
| Hydrofirming | $0.624 | 9% |
| Instantaneous reserve | $0.0007 | 0.01% |
| Voltage management | $0.005 | 0.07% |
| **Total economic surplus** | **$6.9** | **100%** |

Source: Cost-benefit analysis of distributed energy resources in New Zealand (Sapere on behalf of the EA)

# To unlock this benefit DER owners need to ‘value stack’ - by offering services across the value chain to make it worth their while

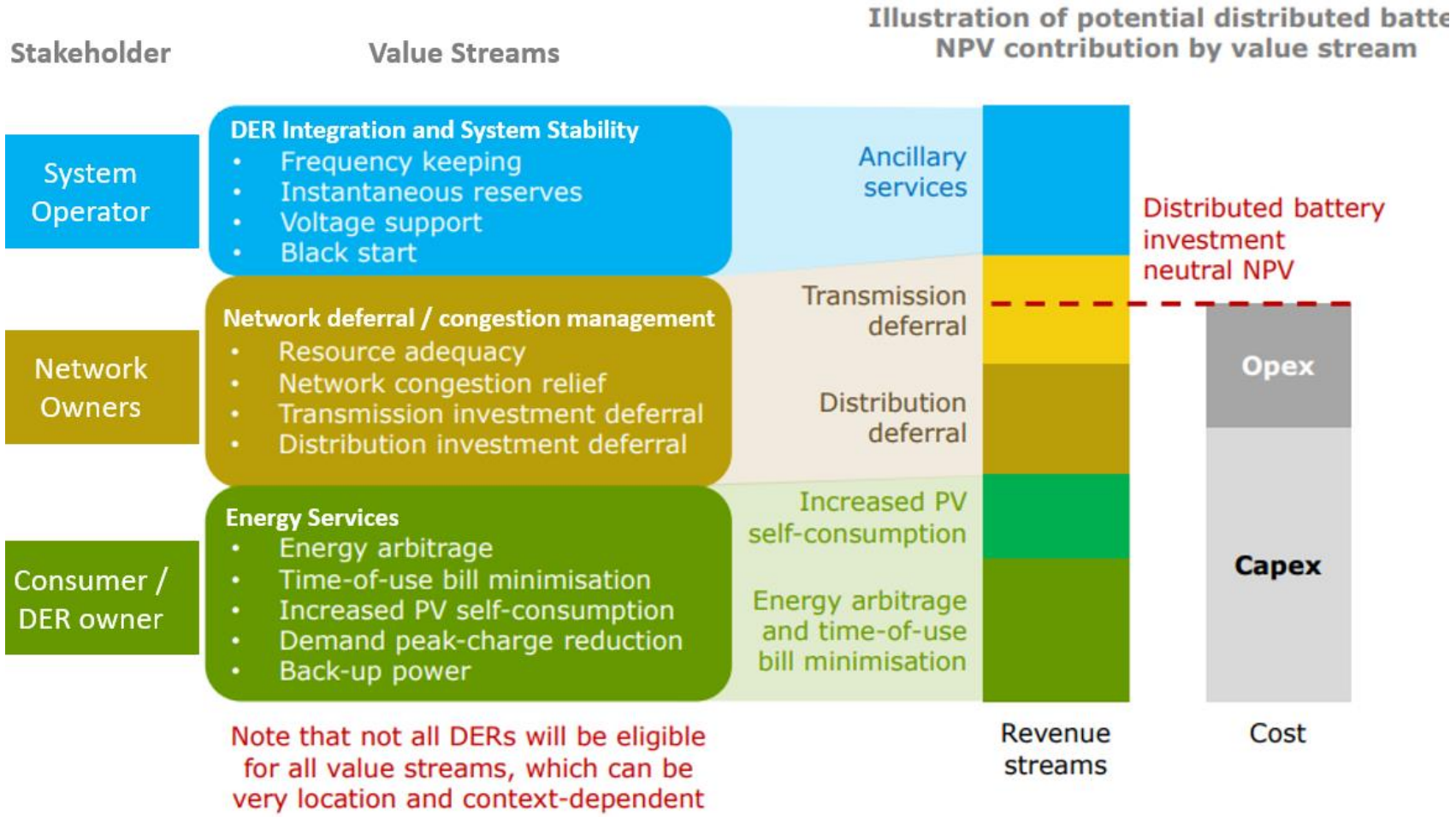


Figure: Illustrative example of revenue streams from across the supply chain ‘value stacking’ to exceed the cost of installing a new DER

# Unlocking the value stack – Providing DER with access to value

| Value Stream | # | Accessible through[1] | Value Stream Enabler |
|---|---|---|---|
| Ancillary services | 1 | Reserves market | EA / System Operator |
| | 2 | Frequency keeping market | EA / System Operator[2] |
| Transmission deferral and congestion management | 3 | Grid Owner flexibility procurement | Grid Owner |
| | 4 | Nodal pricing | EA / System Operator |
| | 5 | Transmission pricing | EA / Grid Owner |
| Distribution deferral and congestion management | 6 | Distribution Network Owner flexibility procurement | Distribution Network Owner |
| | 7 | Distribution tariffs | EA / Distribution Network Owner |
| Energy services | 8 | Direct wholesale participation | EA / System Operator |
| | 9 | Indirect wholesale participation | via Flexibility Trader |
| | 10 | Self consumption | Retail Provider[3] |



1,2,3: See notes in Appendix

# Value stacking is complex – flexibility traders can help flexibility owners assign their resources to the highest value application

To enable value stacking, markets must:

- Allow participation in multiple flexibility uses; while
- Providing confidence of DER availability where they are being procured for security

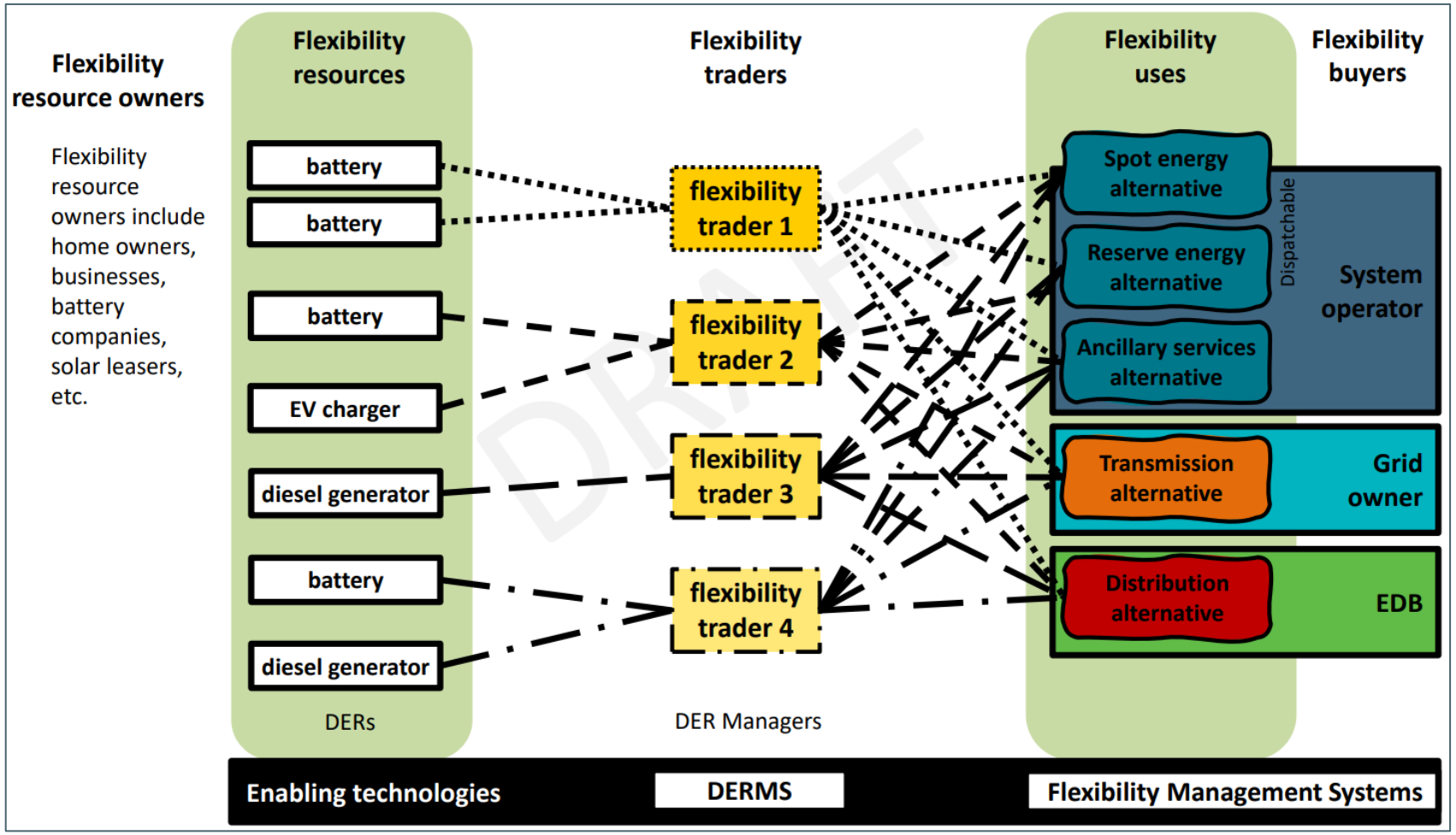


Figure: IPAG recommendation for flexibility market structure (Source: Draft advice on Review of Transpower Demand Response Programme and Meeting Papers)

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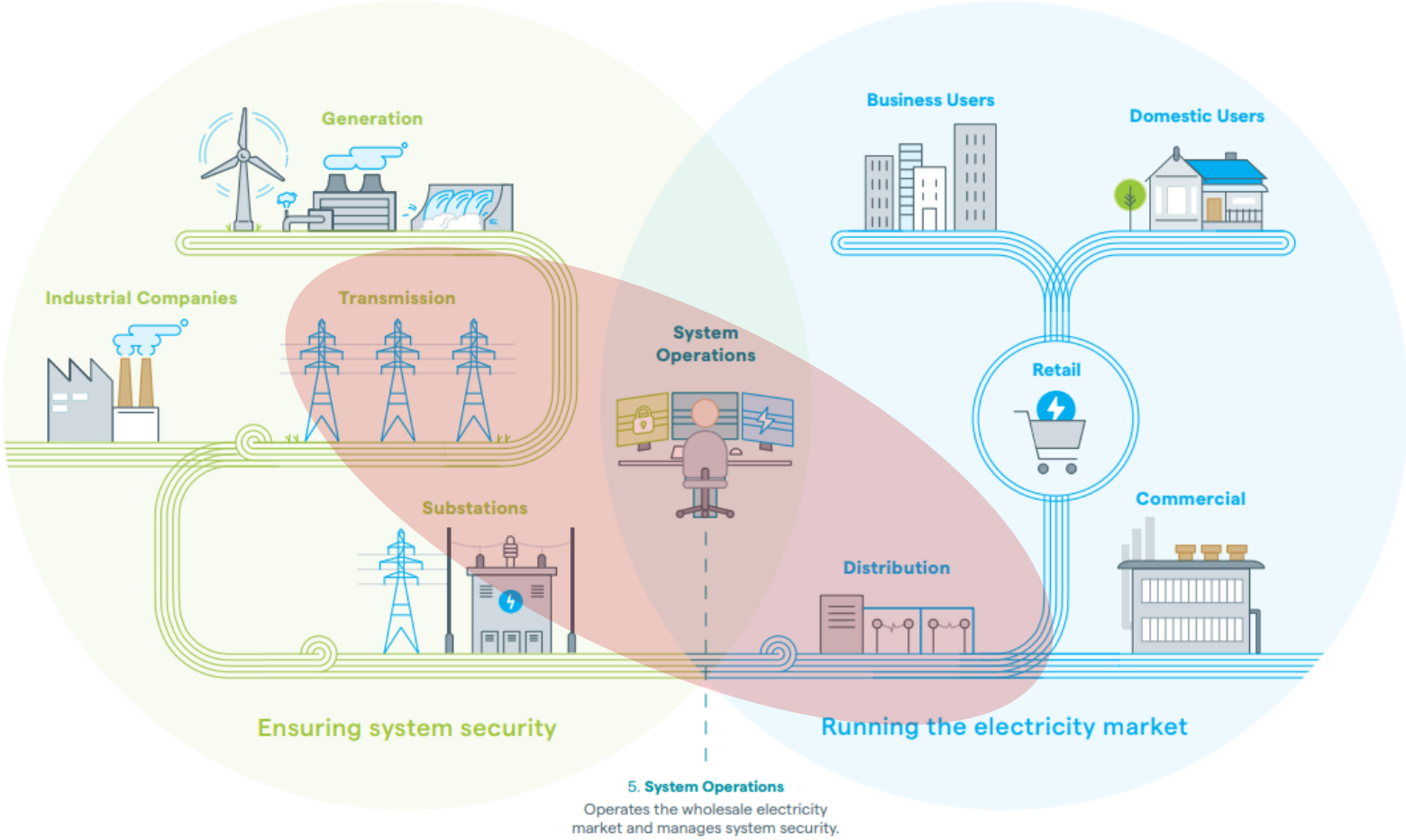
# Working groups in both GB and AUS included the System Operator, Transmission, Distribution, and Regulators




1. **Generation**
Generation companies generate power from wind, thermal, hydro and geothermal. They sell the power they generate on the electricity market. Emerging distributed generation includes electric vehicles, batteries and solar photovoltaic.

2. **Transmission**
Transpower transports high voltage electricity from where it is generated to distribution companies and some large directly connected customers.

3. **Industrial Companies**
A few major industrial companies receive their power directly from Transpower.

4. **Substations**
High voltage electricity is converted to lower voltage at substations before being passed to distribution companies.

5. **System Operations**
Operates the wholesale electricity market and manages system security.

9. **Domestic and Business Users**
Domestic and business users purchase their electricity directly from retail companies which is delivered to homes, businesses and commercial operations using distribution companies' lines.

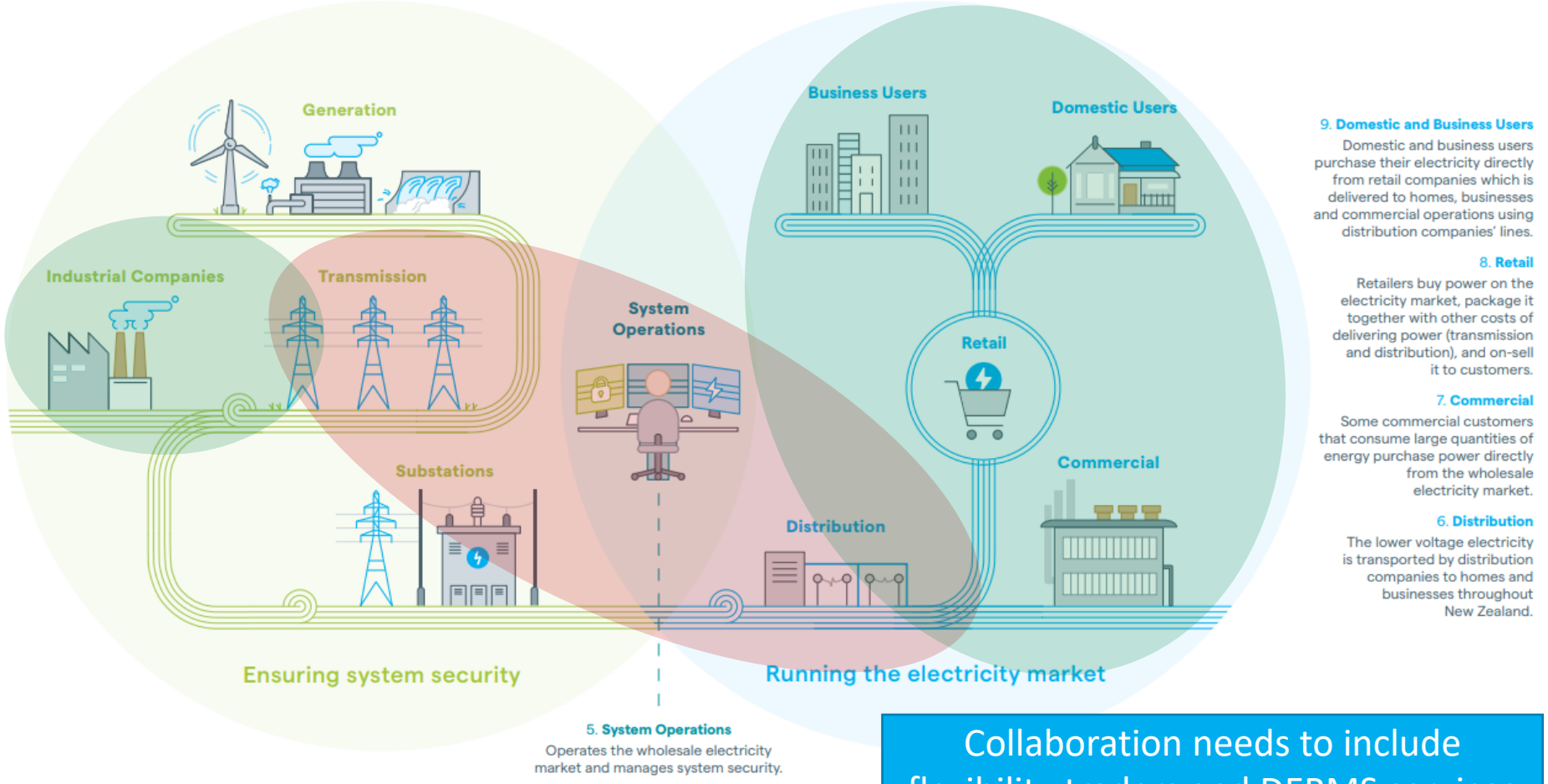
8. **Retail**
Retailers buy power on the electricity market, package it together with other costs of delivering power (transmission and distribution), and on-sell it to customers.

7. **Commercial**
Some commercial customers that consume large quantities of energy purchase power directly from the wholesale electricity market.

6. **Distribution**
The lower voltage electricity is transported by distribution companies to homes and businesses throughout New Zealand.

Figure: The electricity supply chain with GB / AUS working group participants highlighted (red)

# In addition to these players, New Zealand's development could be enhanced by including retailers, prosumers, and other third parties

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Collaboration needs to include flexibility traders and DERMS services providers

Figure: The electricity supply chain with GB / AUS working group participants highlighted (red) and potential other participants highlighted (green)

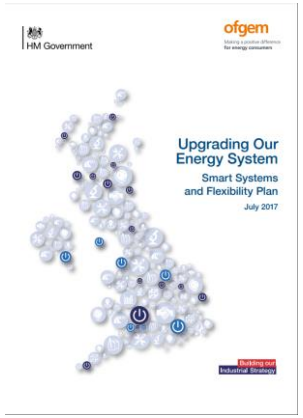
# Great Britain – DECC and Ofgem facilitated development of shared industry vision enabling EDBs to develop roadmaps and make flexibility commitments

**UK was in a similar position to where NZ is now**

- Could see the future coming and regulators and government wanted to be proactive to identify and achieve benefits

Department of Energy & Climate Change

Department of Energy & Climate Change + ofgem





## 2015

**Position Papers**

Education of industry and bringing them along the journey

## 2016

**Joint Call for Evidence**

Industry voice, alignment and buy-in

## 2017

**Joint Plan**

Future Vision and potential workstreams outlined to achieve future state

## 2018+

**Workstreams**

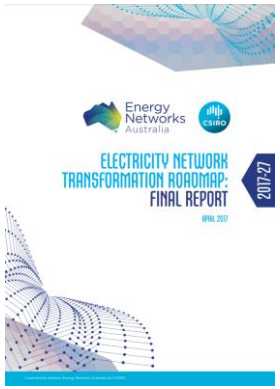
EDB aligned visons - DSO
DER Marketplace Trials - Piclo

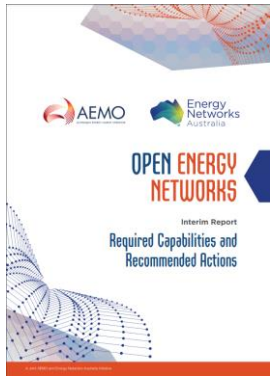
DER Uptake

# Australia – AEMO and the ENA partnered to develop shared vision before initiating operational trials to inform operations and regulation

**Australia was reactive in its vision due to the adverse effects of high level solar penetration**

- AEMO and ENA formed a White Paper to identify a preferred high-level market design framework for a Distribution System Operator (DSO) or Distribution Level Optimisation



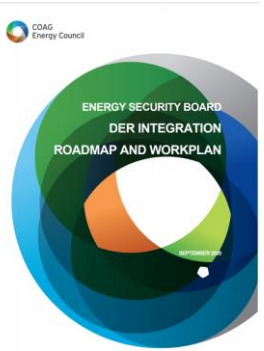



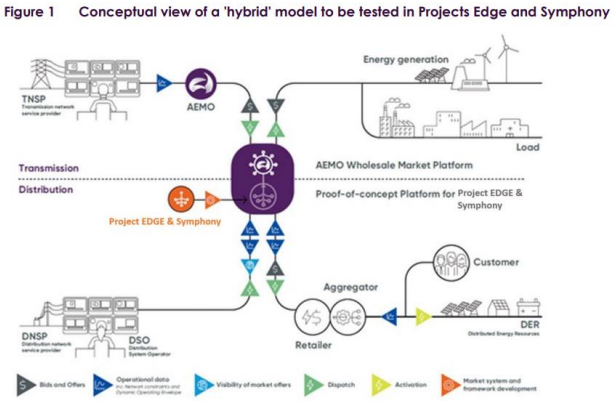

Australian Government
Australian Renewable Energy Agency

ARENA

Energy Networks Australia

AEMO




## 2017

**Position Papers and Consultation papers**

Shared understanding with industry

## 2018

**Joint Whitepaper**

Steering industry towards a preferred future model that is accepted and has the greatest whole-of-system benefit

## 2018+

**DER Projects**

Distributed Energy Integration Program launched in 2018
500m+ invested
Roadmap to the future

## 2020

**DER Integration Roadmap**

Government ownership of integrated DER vision.
1.62 billion of funding for next 10 years issued to ARENA by government.
Accelerating roadmap to realise benefits

## 2021

**Flagship DER Integration Pilot**

3-year trial of Hybrid Model (preferred target operating model)
DER Market Portal
Implementation of Flexibility future

DER Uptake

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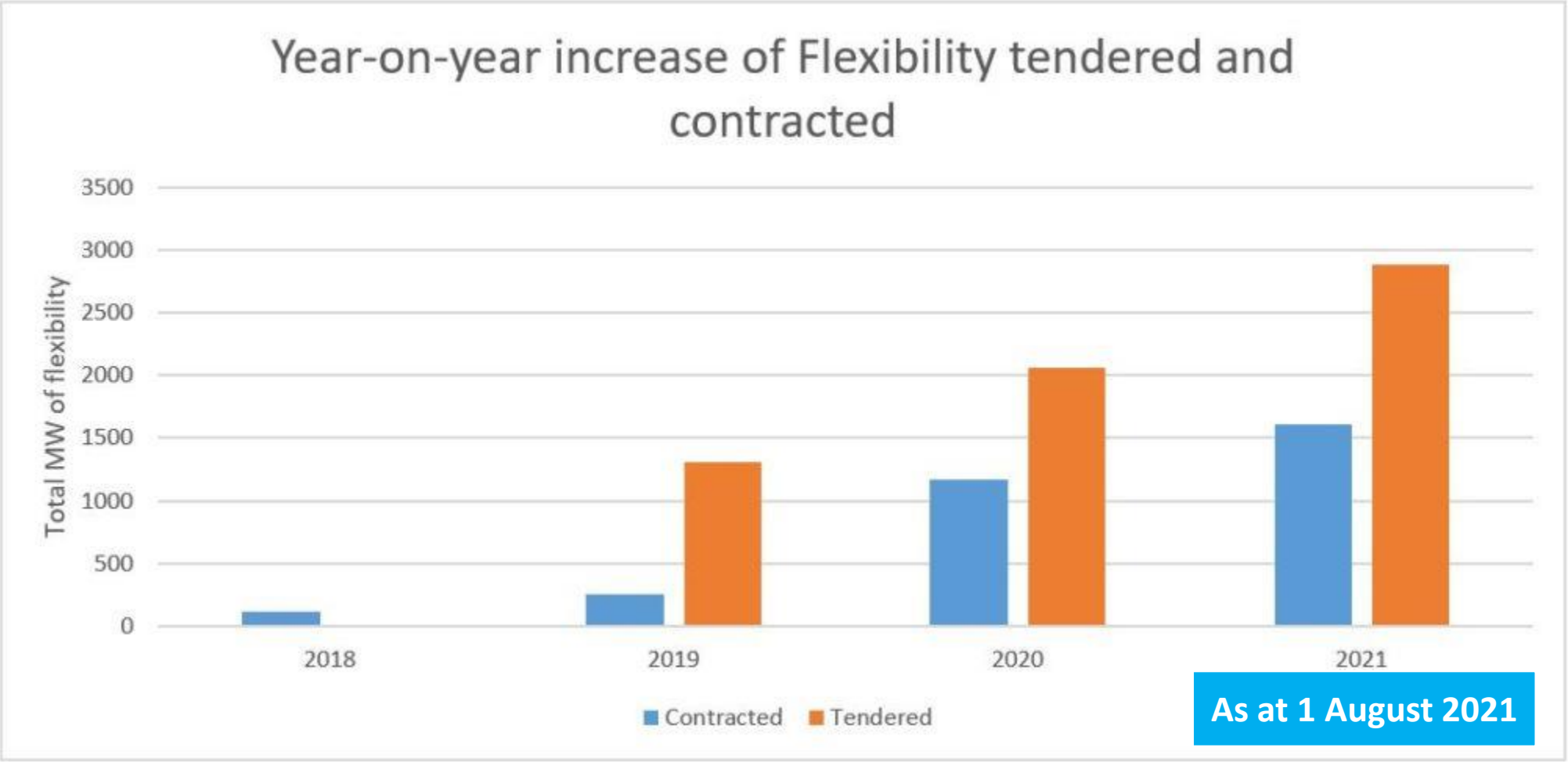
# UK flexibility markets have experienced significant growth (1/2)

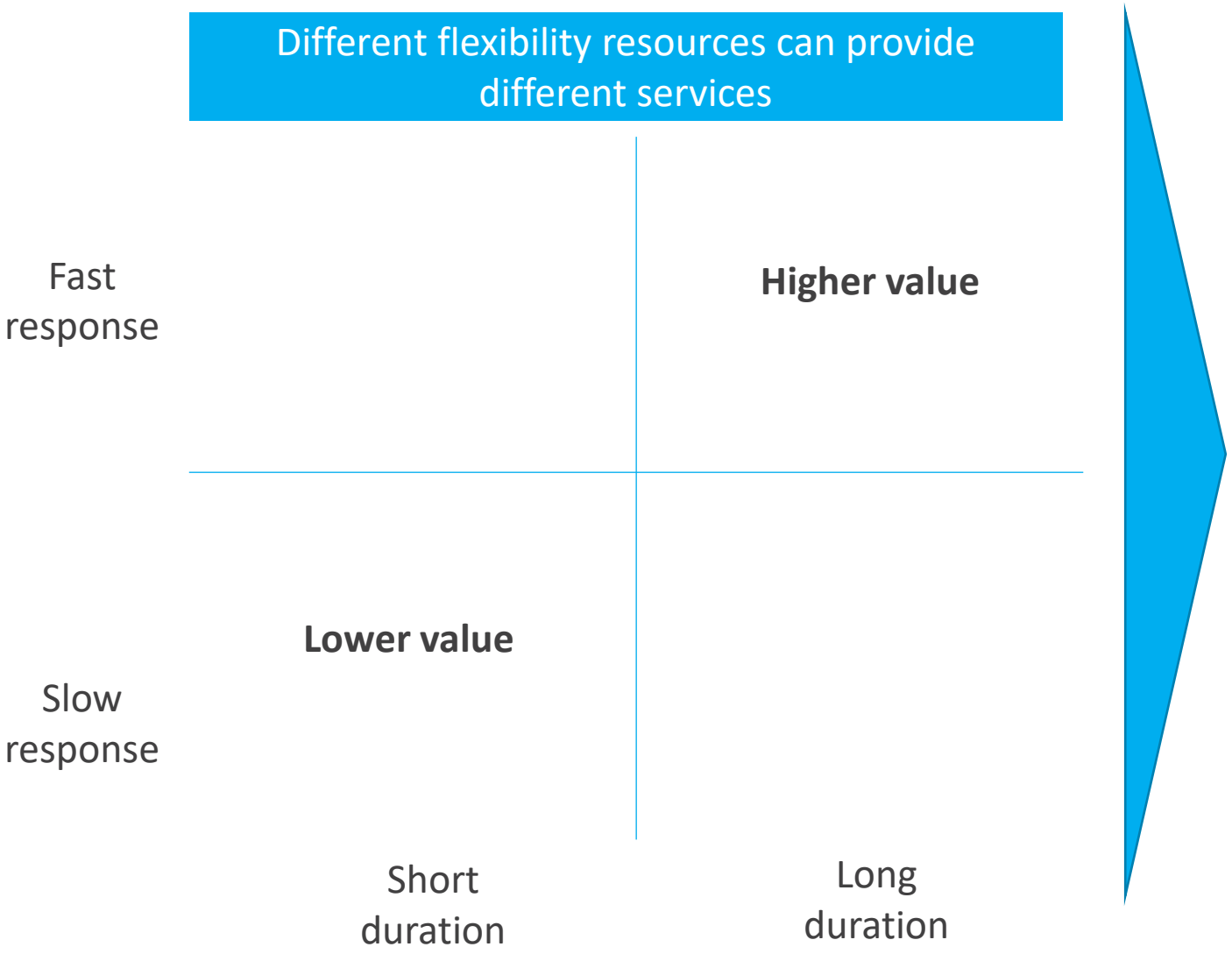


# UK flexibility markets have experienced significant growth (2/2)

| DSO Flexibility Tenders (Industry Total) | Sustain (MW) | Secure (MW) | Dynamic (MW) | Restore (MW) | Reactive Power (MVAr) (if applicable) |
|---|---|---|---|---|---|
| | Peak Capacity (MW) | Peak Capacity (MW) | Peak Capacity (MW) | Peak Capacity (MW) | Peak Capacity (MVAr) |
| Contracted for 2018 | 0 | 24 | 34 | 59 | 0 |
| Contracted for 2019 | 0 | 10 | 121 | 125 | 0 |
| Contracted for 2020 | 2 | 105 | 556 | 502 | 0 |
| Tendered for 2020 | 14 | 493 | 771 | 778 | 7 |
| Contracted for 2021 | 13 | 263 | 730 | 603 | 0 |
| Tendered for 2021 | 31 | 692 | 1203 | 955 | 9 |

**Sustain (scheduled):** The Sustain service is used to manage peak demand loading on the network and pre-emptively reduce network loading. The requirement windows for provision of these services will be scheduled and fixed at the point of contract.
**Secure (pre-fault constraint management):** The Secure service is used to manage peak demand loading on the network and pre-emptively reduce network loading. Secure requirements are declared a week-ahead each Thursday for the following week (commencing Monday). Payments consist of an Arming fee which is credited when the service is scheduled and a further utilisation payment awarded on delivery.
**Dynamic (post-fault constraint management):** The Dynamic service has been developed to support the network in the event of specific fault conditions, often during summer maintenance work. As the service is required following a network fault, it consists of an Availability and Utilisation fee. By accepting an Availability fee, participants are expected to be ready to respond to Utilisation calls within 15 minutes. Dynamic availability windows are declared a week-ahead each Thursday for the following week (commencing Monday).
**Restore (restoration support):** The Restore service is intended to help with restoration following rare fault conditions. Such events are rare and offer no warning as they depend on failure of equipment. Under such circumstances, response can be used to reduce the stress on the network. As the requirement is inherently unpredictable, Restore is based on a premium 'utilisation only' service. This will reward response that aids network restoration, but will pay no arming or availability fees. Participants declared available for the Restore service will be expected to respond to any utilisation calls within 15 minutes and will receive an associated utilisation fee.

# Difference types of response have different contracting mechanisms and values based on the services they provide




| | Secure | Dynamic | Restore |
|---|---|---|---|
| Use Case | Pre-fault mitigation | Post-fault recovery (often under planned outages) | Post-fault network restoration |
| Advanced Payment | Yes, an arming payment for the accepted availability time: £125/MW/h | Yes, an availability payment for the accepted availability time: £5/MW/h | No |
| Utilisation Payment | £175/MWh | £300/MWh | £600/MWh |
| Availability Declarations | By midnight every Wednesday for the following week (Mon-Sun) | | |
| Availability acceptance | By noon every Thursday for the following week (Mon-Sun) | | |
| Dispatch Notice | Week Ahead, on acceptance of availability | 15 minutes ahead of requirement | 15 Minutes ahead of requirement |

# Government and industry collaboration has enabled flexibility markets: The ENA's Open Networks Project has driven industry's approach

The EDBs in the UK have followed a rigorous process that ensures standardisation and best practice sharing across the sector

In 2019 the ENA developed "Our six steps for delivering flexibility services":

- We will champion a level playing field
- Ensure visibility and accessibility
- Conduct procurement in an open and transparent manner
- Provide clarity on the dispatch of services
- Provide regular, consistent and transparent reporting
- Work together towards whole energy system outcomes

# Government and industry collaboration has enabled flexibility markets: Government and the regulator have been proactive

In July 2021 the Department for Business, Energy and Industrial Strategy and Ofgem released "Transitioning to a net zero energy system: smart systems and flexibility plan 2021"

The Plan has 4 key areas of focus:

- Support flexibility from consumers
- Remove barriers to flexibility on the grid
- Reform markets to reward flexibility
- Monitor flexibility across the system

# Government and industry collaboration has enabled flexibility markets: The industry has also been proactive (1/2)

In July 2021 the ENA released its Open Networks Project Flexibility Consultation, outlining aims for:

- Delivering on the themes and expectations from the Ofgem/BEIS's Smart Systems and Flexibility Plan
- Standardising processes and methodologies for flexibility procurement across network and system operators
- Identifying and implementing actions to facilitate the development of flexibility marketplaces and the participation of flexibility providers, for example common product descriptions, etc
- Demonstrating transparent processes for evaluating flexibility tenders, ensuring outcomes are transparent, predictable and justified
- Raising appropriate change within electricity network companies and/or electricity Codes
- Facilitating markets outside the direct procurement of service by DSOs to allow third parties to develop effective and liquid market platforms for customers to realise value for flexibility

# Government and industry collaboration has enabled flexibility markets: The industry has also been proactive (2/2)

The ENA Open Networks Project has roadmap focus areas for each year. The below is for 2021:

- **Enhancements to the Common Evaluation Methodology and Tool used to evaluate flex and traditional intervention options**
- Alignment of procurement timescales
- **Review of the curtailment requirements specified in existing Flexible Connections (ANM)**
- **Improvements to existing Commercial arrangements - Standard Agreement**
- **Defining 'Primacy' rules for the ESO and the DNOs to manage service conflicts**
- Support non-DSO services and align their proliferation for grid resilience
- **Implementation of common Baseline Methodologies**
- Equalising the balance of curtailment risk for ANM connections
- Strategy for improving the availability of Curtailment Information

# All of this work has led to standardised best practice approaches

UK EDBs now have standardised processes which lower transaction costs for them and participation costs for flexibility traders:

- Common baseline methodologies
- Common Evaluation Methodology and Tool used to evaluate flex and traditional intervention options
- Procurement via the common Piclo platform
- Standard products and product definitions
- Standard commercial agreements
- Standard information reporting

Government policy and regulator support has also helped:

- Totex regime
- Innovation funding
- Focus on enablers like digitisation

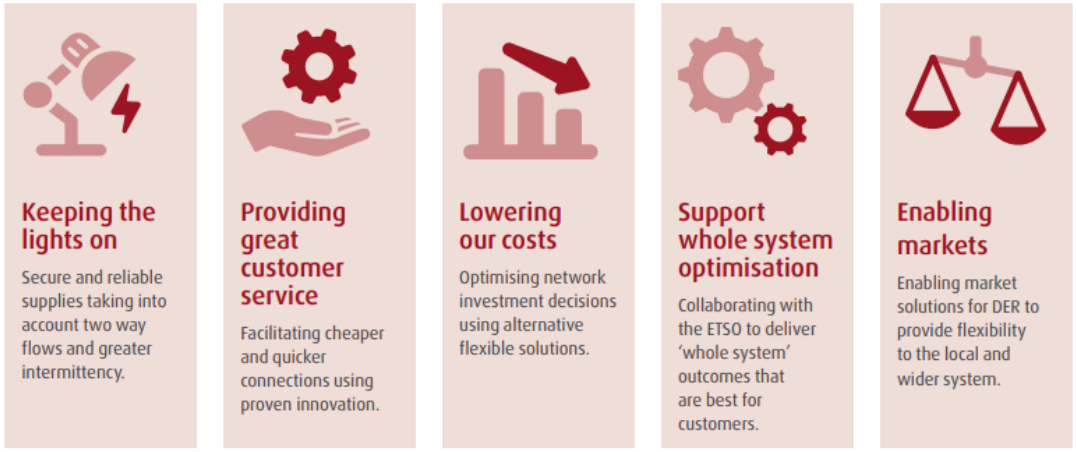
# Operational trials allowed distribution businesses to build knowledge and experience – enabling them to develop plans to enable their value streams (1/2)

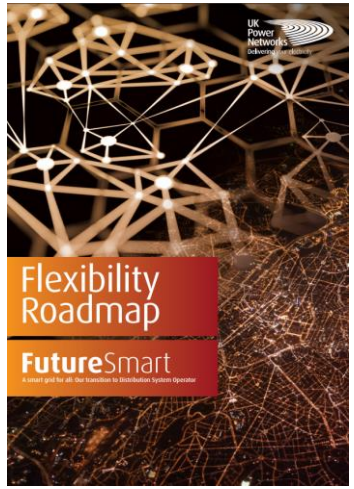
## UK Power Networks

### Our DSO Vision

Building on our successful innovation portfolio[6], we launched our consultation on our DSO vision and strategy – Future Smart[7] in July 2017. This document sets out how we will adapt our business over the coming years in order to continue to provide a high quality service to our customers, amid the changing energy landscape.

**Figure 3:** DSO role in a future energy system



# Operational trials allowed distribution businesses to build knowledge and experience – enabling them to develop plans to enable their value streams (2/2)

## UK Power Networks

### Our Process

We run two procurement processes per year and publish our flexibility requirement on Piclo Flex. The first tender is announced near the start of each year with the winners announced a few months later. Contracts generally begin at the end of that year. The second tender is published each autumn, with the winners announced a few months later. Contracts generally begin the following summer.

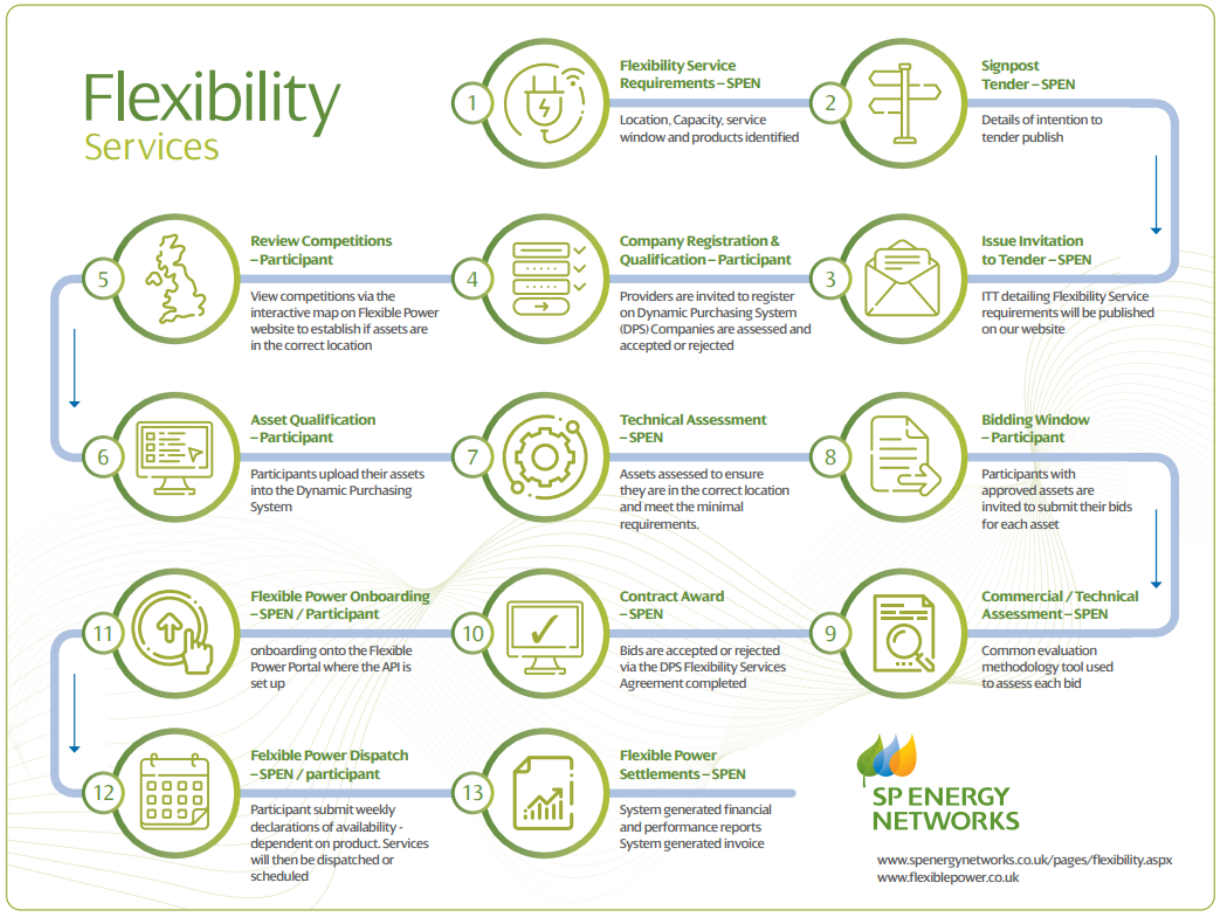
We announce our procurement process on this site, on social media and through our winter and summer flexibility forums. All our requirements – along with specific start dates – are available on Piclo Flex.

To bid in the tender, first register your assets on Piclo Flex. Join us at our events or contact our team directly to find out more.

Once they are published, view our 'Invitation to Tender' documents in the document hub below, and complete the relevant forms. You can get in touch with our dedicated team if you have any questions or need any help. Get updates through our social media pages of by joining our mailing list.

Pre-qualification for our February 2021 Tender closed on 21st December 2020. The tender competition ran from January 29th – February 22nd 2021. We'll be announcing results for the tender at our next Flexibility Forum and on our website.

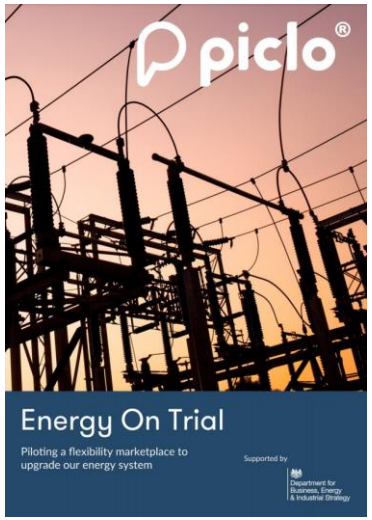
## SP Networks



# GBs centralised flexibility exchange platform was trialled in programme funded through Department of Energy & Climate Change innovation incentives

## Department of Energy & Climate Change (DECC)

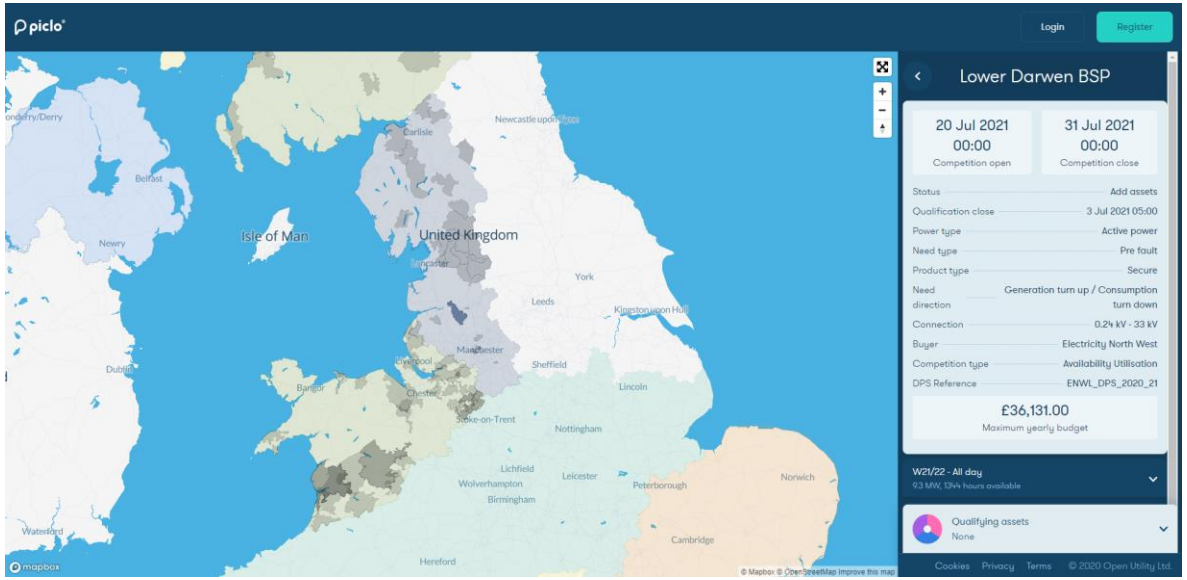
- **Innovation funds setup to deliver Vision:** Flexibility exchange demonstration competition (FleX)





## Open Utility Ltd (trading as Piclo)

- **Piclo Project:** Online exchange for multiple flexibility markets
- Project trialled in collaboration with UK Distribution Network Operators and National Grid ESO, and is open to the 250+ flex providers registered on the Piclo platform
- **Grant award:** £561,727



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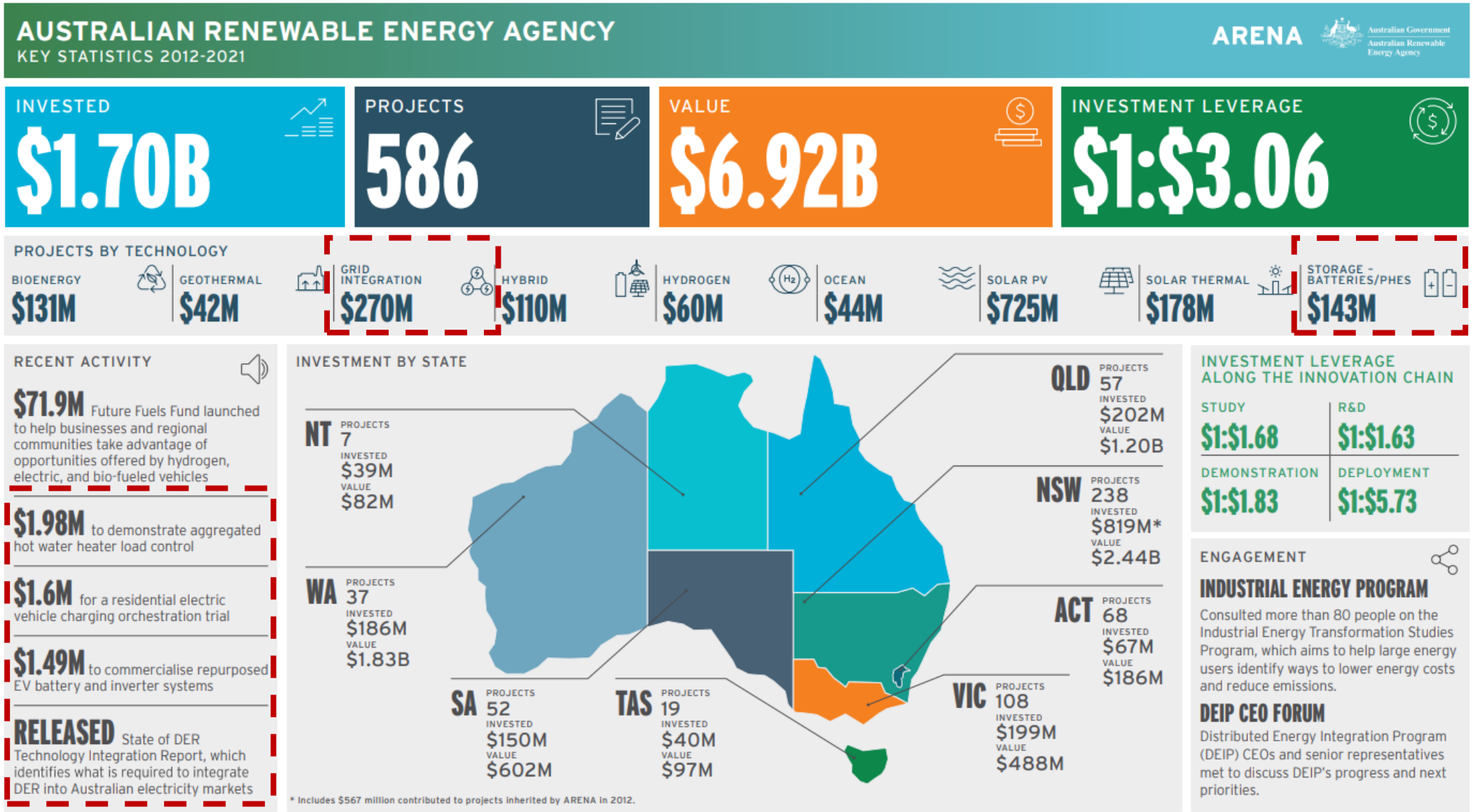
# Australian demonstration projects funded through ARENA funding creating 4x benefit on invested funds

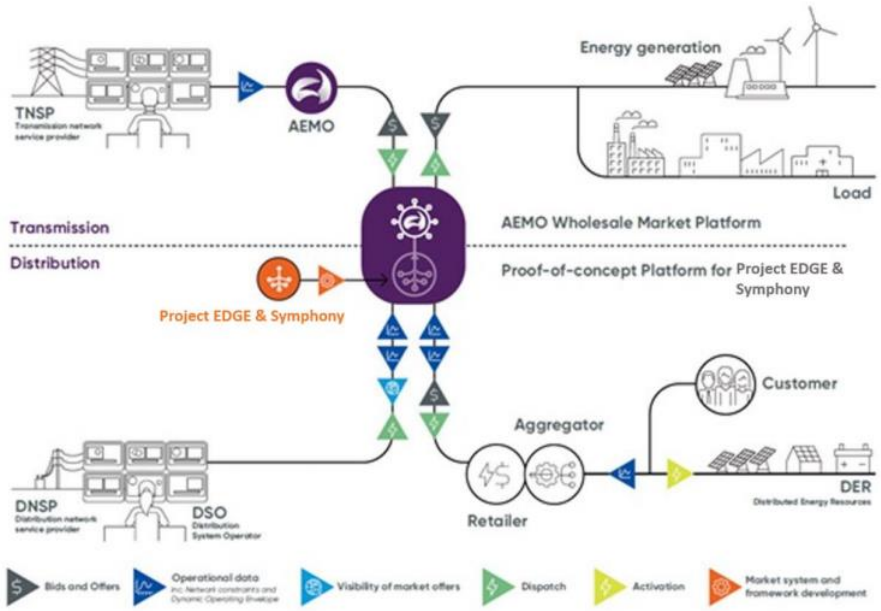


# Australia's proposed DSO model was developed through a series of operational trials and consultations

**Figure 22.** Key projects to test and deliver DSO capability

| | | | | | | |
|---|---|---|---|---|---|---|
| Aggregate DER fleet in VPP trials and learn from data | Wholesale Demand Response: assess rule change and implement | Visibility of LV network + modelling improvements | LV/MV dynamic constraint development | Market participation with dynamic operating envelopes | Add new market frameworks for wholesale participation | Add Distribution Services Market (DSM) |

**Figure 1** Conceptual view of a 'hybrid' model to be tested in Projects Edge and Symphony




## Project EDGE | Collaboration

Distribution System Operator (DSO): AusNet services

Aggregator: mondo

EDGE — Energy Demand & Generation Exchange

AEMO — Project Lead

Project EDGE is a jointly funded project with support from the Australian Renewable Energy Agency (ARENA).

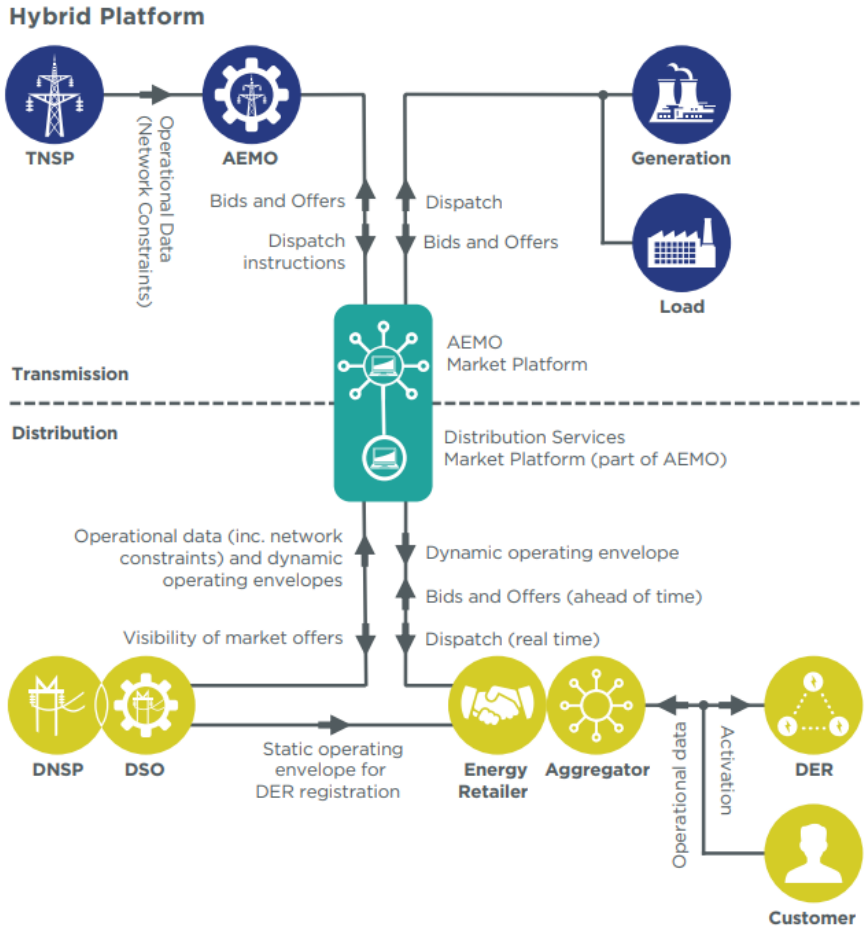
Australian Government, Australian Renewable Energy Agency — ARENA

Supporting Partners

- The University of Melbourne — Networks and Markets
- Deakin University — Customer Insights
- nous — Independent Project Manager

# Trials allowed iteration of DSO function designs and market arrangements – informing final market design

## Target model for AEMO and the ENA Open Networks project




| Key characteristics | |
|---|---|
| **Market arrangments** | » There is a two-sided market platform, comprised of wholesale and ancillary services that is organised and operated by AEMO<br>» Market participants, including DER via aggregators/retailers, submit bids and offers for system services to the market platform which in turn makes them available to AEMO for whole system optimisation |
| **AEMO** | » AEMO organises the operates the market<br>» AEMO assesses all bids and offers and optimises the dispatch of energy resources considering T-network and D-network constraints<br>» AEMO sends out dispatch instructions to energy resources, including DER via their respective Aggregator/Retailer |
| **DSO** | » DSO provided DER with static operating envelopes based upon the technical capability forecast of the D-network to accommodate DER dispatch<br>» The DSO assesses market bids and D-network constraints to generate dynamic operating envelopes for DER which respect distribution network constraints and inform their technical and commercial offering to the markets |
| **Aggregator / Retailer** | » Aggregator/Retailer combines different DER and offer their aggregated output as system services to the market platform |

# Learning From Others – Australia

## Wholesale Demand Response Mechanism

The Wholesale Demand Response Mechanism (WDRM) comes more than a decade after it was first proposed, and follows the success of ARENA and AEMO's three year $35 million trial to deliver 200 MW of demand response as emergency reserves, in partnership with the NSW Government.

The new rules created by the AEMC and the mechanism being run by AEMO is now live as of 24th October 2021.

The rule change follows shortly after the introduction of Five Minute Settlement (5MS) into the NEM wholesale market, which was described as a "massive" creator of opportunity for battery storage.
The WDRM lets a third-party aggregators sell demand response without being a customer's retailer. These aggregators are introduced as a new market participant - a demand response service provider (DRSP). DRSPs' obligations replicate those of other scheduled participants (such as generators).
DRSPs will be settled in the wholesale market for the demand response they provide at the prevailing spot price.

The mechanism was first designed for commercial and industrial energy users who are stuck on fixed price contracts and want to be able to do demand response. This is reflected in the rules and regulations that mean only customers who have no exposure to the wholesale price can participate.

It is planned to in future allow residential demand response to be aggregated and access the wholesale demand response mechanism.

**2011**

**AEMC Market Review**

Market Review titled 'Power of Choice' was published and one recommendation was to create a demand response mechanism

**2013**

**AEMO develop High Level Market Design**

High Level Market Design

**2018**

**AEMC received a rule change request**

Public Interest Advocacy Centre (PIAC), Total Environment Centre (TEC) and the Australia Institute (TAI) seeking to introduce a mechanism for wholesale demand response in the national electricity market (NEM)

**2020**

**Flagship DER Integration Pilot**

AEMC made its final determination and set new rules and delivery of the mechanism to be delivered by AEMO

**2021**

**Go-Live Wholesale Demand Response Mechanism**

On 24 October the new rules went live and Demand Response now offered and paid for in the wholesale market in 5-minute dispatch

# Learning From Others – Australia

## Wholesale Demand Response Mechanism

### Reconciliation

The WDRM sets out a process for having baseline methodologies determined and applied to wholesale demand response units (WDRU). This provides the DRSPs to be settled in the wholesale market for the wholesale demand response they have provided at the prevailing spot price.

The proposed Rule requires the retailer, at the WDRU to fund the demand response. During a demand response event (represented by a consumption target in dispatch less than maximum available demand responsive component of the aggregated WDRU), the retailer will be settled with respect to both the energy market settlements (based on metering data) and the baseline energy level. The baseline energy is the counterfactual to the actual metered energy if there had been no demand response.

- The DRSP will be paid based on the energy difference between the baseline and the metered energy. The metered energy amounts will be loss-adjusted as normal. Demand response settlement amounts will be determined for each trading interval at the regional reference price.

- To ensure that the retailer is compensated following a demand response event, there will be a wholesale demand regional reimbursement rate (WDRRR) calculated, which is charged to the DRSP based on the energy difference between the baseline and the metered energy. This amount will be paid to the retailer. The WDRRR is intended to reflect the cost of the electricity the Retailer is liable to purchase in the wholesale market which is not consumed by, and therefore not charged to, the customer

Figure 4 Wholesale demand response financial flows

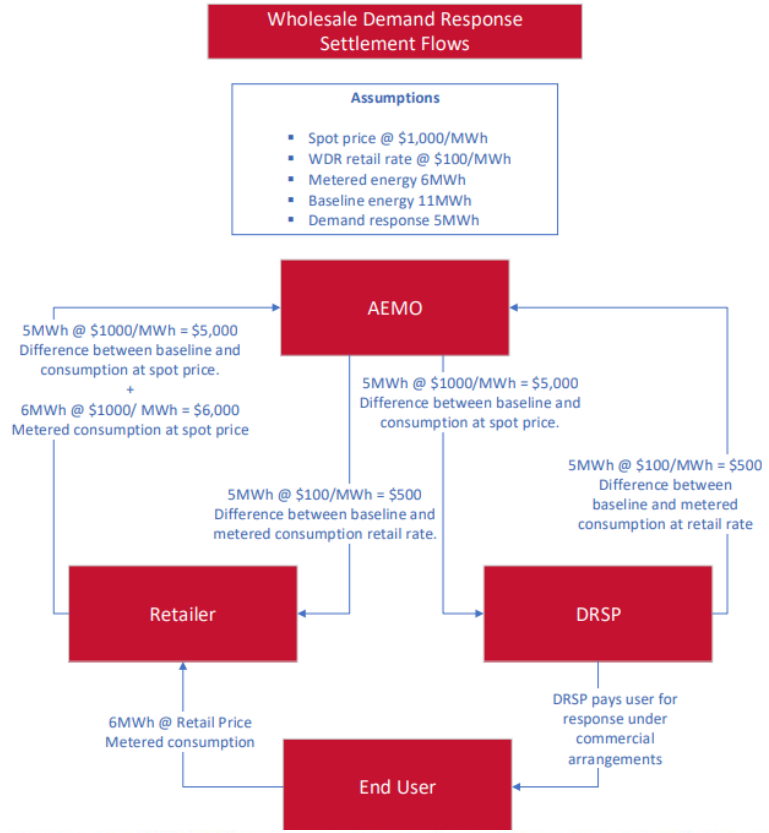
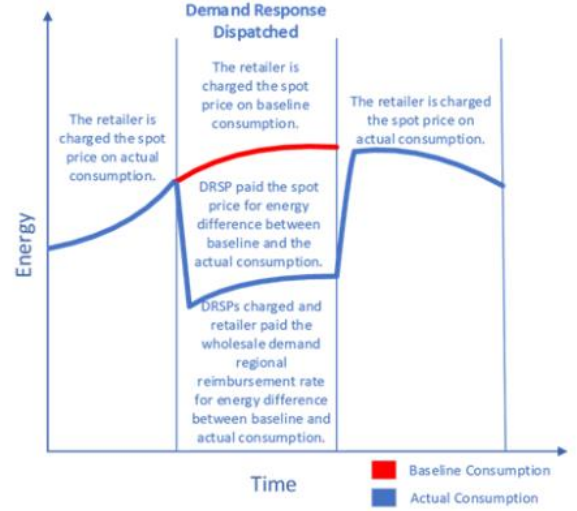



Figure 5 Illustration of demand response financial flows relative to baseline and actual consumption



# Thank you

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# Notes accompanying slides 8

- Value streams can be accessed via different markets through direct participation or via a flexibility trader who can value stack on the consumers' behalf.
- Indirect wholesale participation can occur when a DER is used for either demand response or generation but is not bid into the market. This can be achieved via a flexibility trader who can value stack on the consumers' behalf. The EA and the System Operator still enable the value stream as it is the wholesale market price signal that is being responded to.
- Where a consumer uses self-consumption, it is often to avoid retail charges. The Retail provider is considered the value stream enabler due to their tariff acting as the price signal which a direct participant or flexibility trader would respond to on the consumers' behalf. When this occurs, it can lead to access to components of the value stack beyond energy services (i.e. avoiding volumetric network charges).