TRANSPOWER

Distributed Energy Resource Management Briefing to IPAG #5

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Agenda

1. Introduction

2. Operationalising flexibility services

3. EVConnect submission

Transpower's proposals for DERM discussions with IPAG

22 July 2020	21 October	1 December	27 January 2021	February & March	August 2021
• Introduction • Transpower's RCP2 DR programme • Transpower's flexibility platform	• RCP2 outcomes • Mechanics of our flexibility platform • Operationalising flexibility: overview	• Value stack and pricing interactions • Operationalising Grid Owner flexibility • Flexibility market development issues	• Procurement of NTS • MCP Process • Terminology	• Cost allocation • NTS tenders • Auctions vs Tenders • Aggregator competition	• Grid Support Contracts • Operationalising flexibility • Long term market evolution

Transpower's intention is to lend our experience and analysis to the IPAG to assist you spark an effective flexibility work plan with the Authority, and so facilitate:

- Competition in provision of DER aggregation, DERM and DERMS services
- Incentives for flexibility investment
- An efficient, least cost transition to electrification and decarbonisation

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The Role of the System Operator and DER

- The System Operator must dispatch assets to avoid cascade failure arising from:
  - A frequency or voltage excursion, or
  - A supply and demand imbalance

- The System Operator must also:
  - Maintain frequency within the normal band
  - Restore frequency if a fluctuation occurs
  - Manage frequency time error
  - Identify and resolve problems arising from the Connection Code

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Potential for DER opportunities

What impacts could DER have on the SO's ability to fulfil its role

- Potential risk to System Operator's management of frequency and voltage
  - Mitigation via standards
- Challenges to power system security and resilience
  - Future Security and Resilience project initiated
- Challenges to demand forecasting:
  - Short term (scheduling) and longer term (security of supply)
- Challenges to outage management:
  - Outage planning, and
  - Outage restoration

Visibility and behavioural expectations

What features could a flexibility market(s) have to aid the SO in fulfilling its role?

- Enforcement of standards (technical and communications)
- Provision of visibility of DER
  - What is out there – central registry?
  - Volumes and locations for each flexibility service
  - Notification of calls outside of wholesale market
  - Confirmation of responses to calls – inside and outside of wholesale market
- Ability to interface with existing wholesale market e.g. WITS and dispatch
- Ability to add new products and services if needs arise

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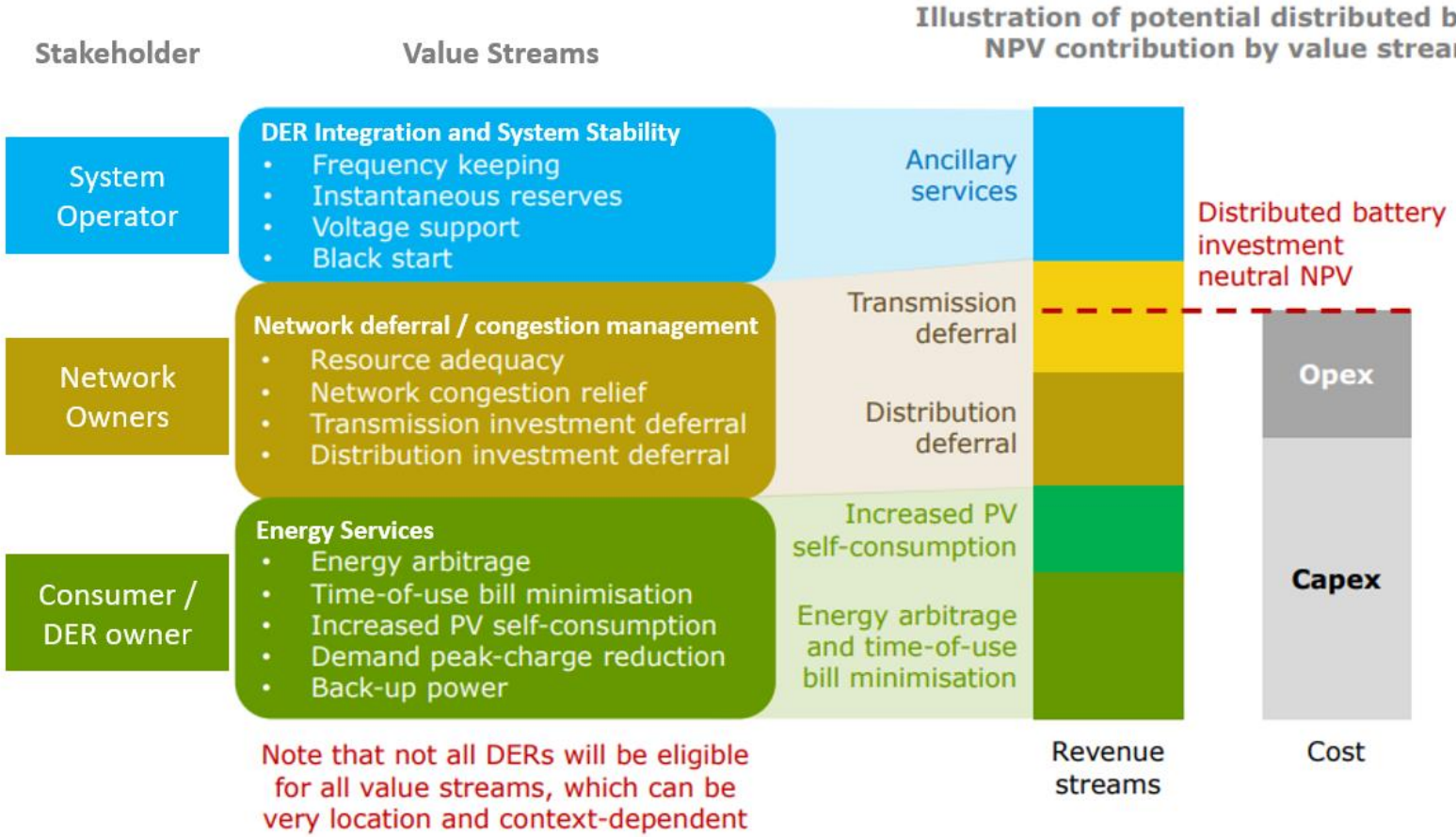
Summary: Industry Collaboration is Essential

- DER has the potential to significantly lower the cost of New Zealand's decarbonisation
- Value stacking is vital to DER uptake
- Unlocking different slices of the value stack requires different markets
  - DER integration and system stability
  - Energy services
  - Network deferral and congestion management
- International examples demonstrate different potential models for unlocking the value stack, each focuses on a different slice
  - California
  - Australia
  - UK
- In New Zealand we could learn from these examples to create the full value stack
- Industry collaboration is essential – all international examples resulted from collaborative work programme

Value stacking is vital to DER uptake



Success is when all value streams are available to flexibility owners

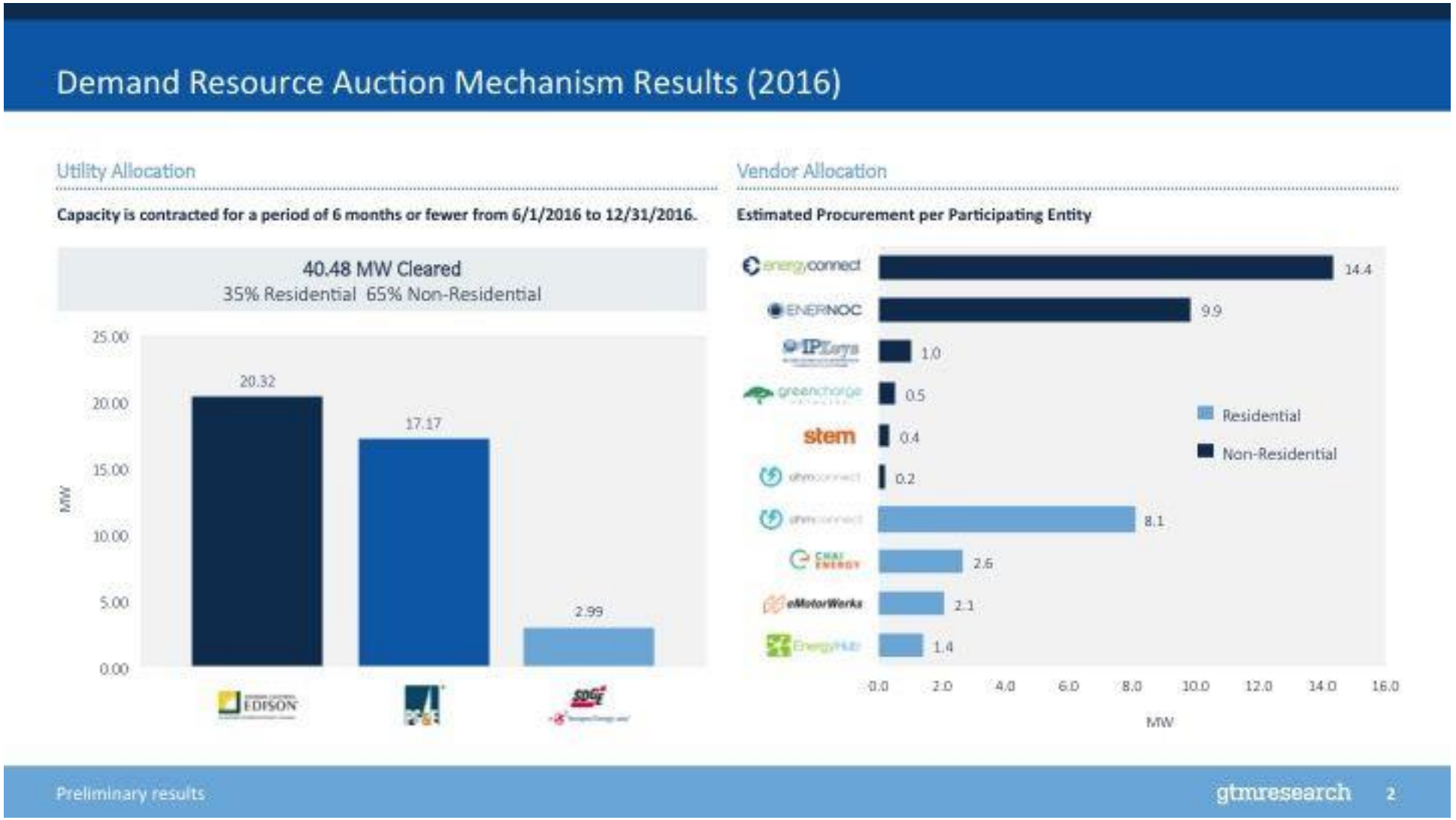
AND

Each value stream can stack together – i.e. Accessing one value stream does not preclude a flexibility owner from accessing other value streams

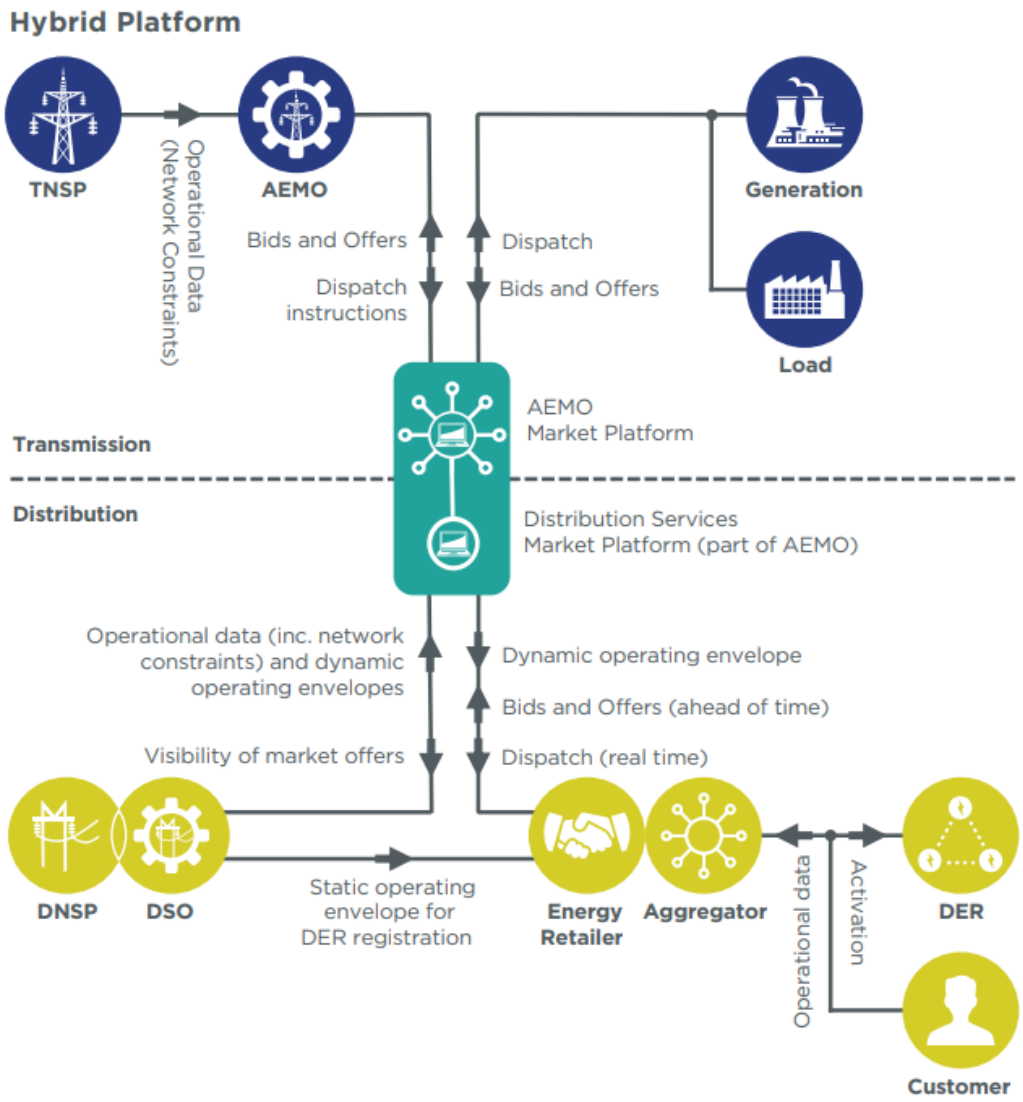
Unlocking the value stack – Providing DER with access to value

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

International examples demonstrate different potential models: California DRAM: Network deferral / congestion

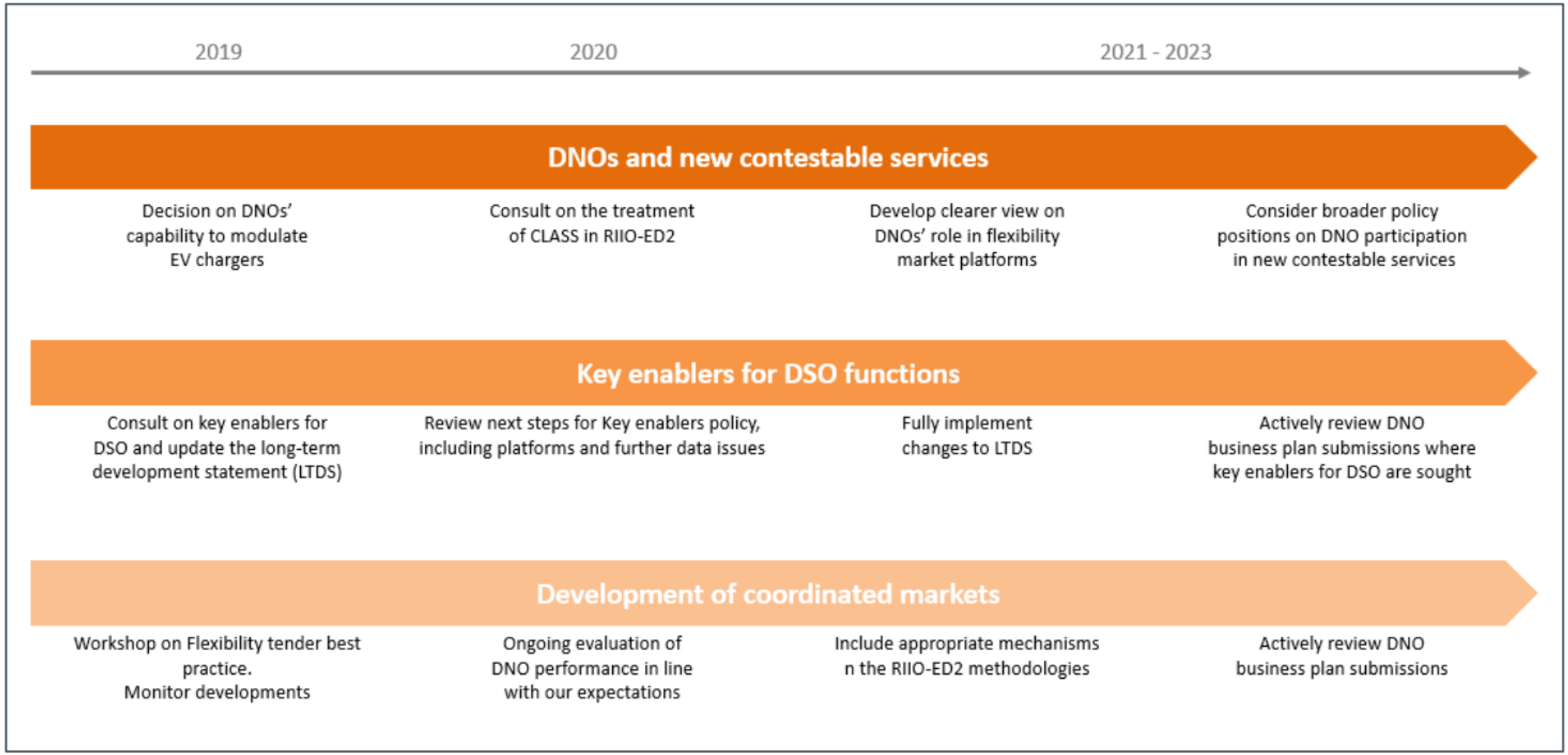


International examples demonstrate different potential models: Western Australia DERP: DER Integration and system stability



Key characteristics	
Market arrangments	» There is a two-sided market platform, comprised of wholesale and ancillary services that is organised and operated by AEMO » 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 » AEMO assesses all bids and offers and optimises the dispatch of energy resources considering T-network and D-network constraints » 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 » 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

International examples demonstrate different potential models: UK Flexibility Markets: DER integration, system stability, and congestion management



https://www.ofgem.gov.uk/publications/ofgem-position-paper-distribution-system-operation-our-approach-and-regulatory-priorities

Industry collaboration is essential

- Alongside the market architecture and high level design considerations outlined in the international examples, there are also lessons in the need for information sharing, standards, and market settings that enable open access for DER owners

- The introduction of models to realise the value stack in other jurisdictions has required collaboration across industry and regulators

- Processes followed in both Australia and the United Kingdom provide examples of how an industry working group, comprised of regulators, the System Operator, transmission grid owner/s, and representatives of the distribution sector provides the perspectives and expertise that are required to successfully enable DER to realise its full potential

Appendix

DERMS spot market issues by need

Key
Change
Maybe
No

Requirement			Needed for DER market participation?	
			Retail	Wholesale
1	Aggregation across retailers	Aggregators need access to DER irrespective of which retailer the owner is aligned with (sub-ICP metering)	Yes	Yes
2	Replace profiling with TOU data	Retailers need to apply half hour or five minute reconciliation where available	Desirable	
3	DER communications standards	Communications between DR platforms, DER and DER owners are critical for calls and verification		
4	DER technical standards	Benefits of common standards for DER connection and operation that do not cause unwarranted system issues		
5	DER information provision	Key system players (SO, EDBs, Grid owner) need information on connected and active DER	Yes	
6	DERM information provision	Need to incorporate planned and actual DR calls into SO's and EDBs' load and hence price forecasts		
7	Pass-through participation	If use DERMS as a market portal, its need to bid/offer into the wholesale market without owning energy	n/a	Yes for market portal only

Issue 1 – Aggregation across retailers

- To enable full DER product innovation, the DER energy usage needs to be netted off ICPs at reconciliation
- This need has been well canvassed in the EA's workstreams enabling mass participation in the electricity market and through IPAG Equal Access and Assess to input services
- A 'Connection Agent trader model' model canvassed with the industry is:
  - A single participant ("Connection Agent") deals with ICP-level responsibilities including engagement with the meter provider and distributor, and consumer obligations
  - Channel Traders can trade sub-ICP volumes in central processes, but they must be associated with a specific channel on the meter
  - The Connection Agent may also be a Channel Trader
- Alternative models could presumably allow approved alternative DER metering or profiling
- Likely to require changes to Code and reconciliation systems

Figure 2: Data flows for Connection Agent model

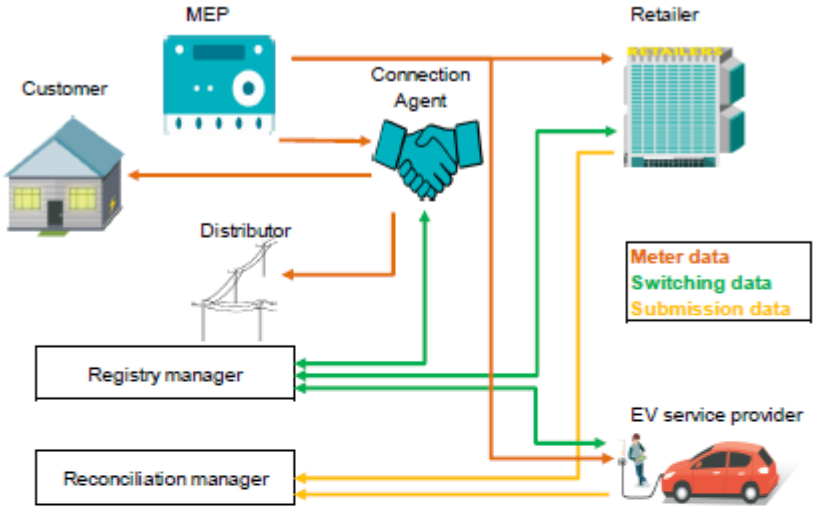
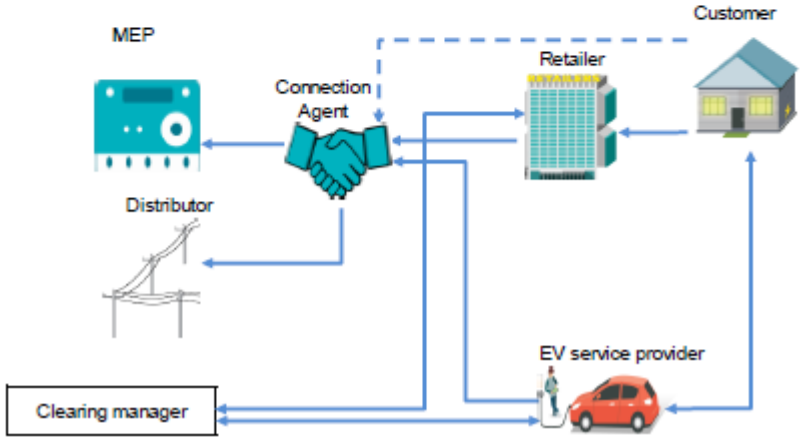


Figure 3: Financial flows for Connection Agent model[4]

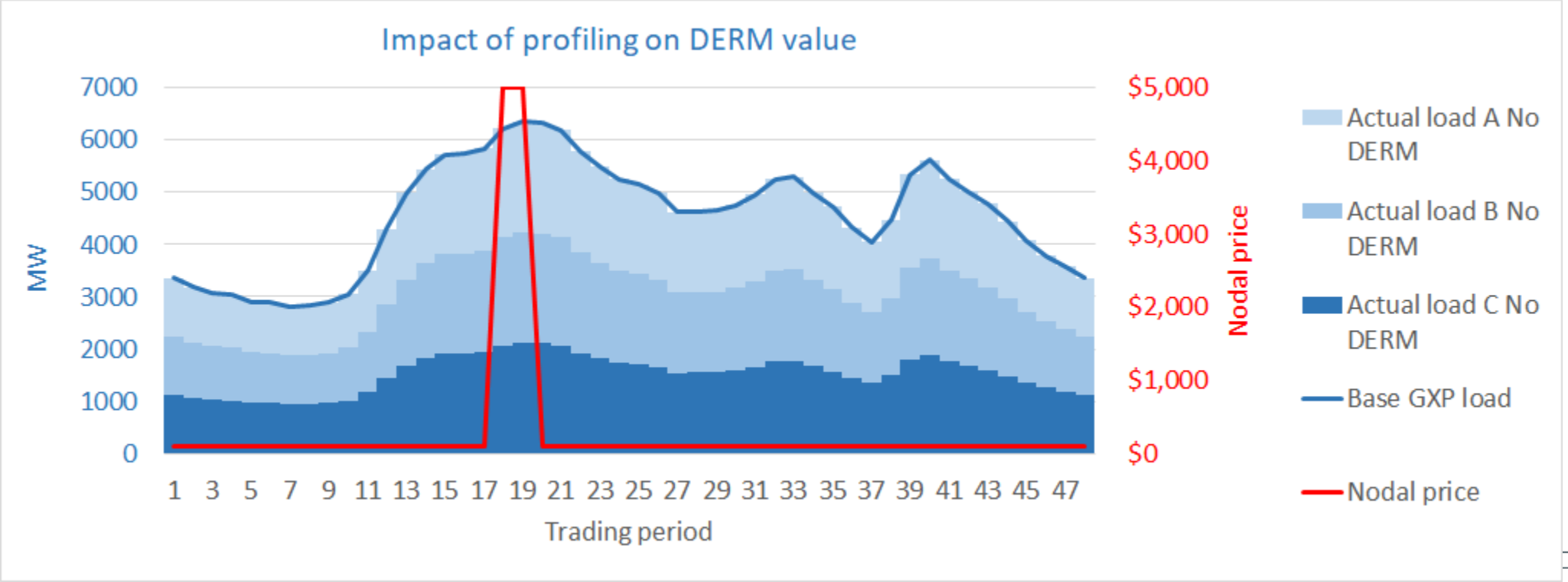


Source: EA's Additional Consumer Choice of Electricity Services Stakeholder Interviews Summary Information paper September 2019

Graph Indicative

Issue 2 - Replace profiling with TOU data

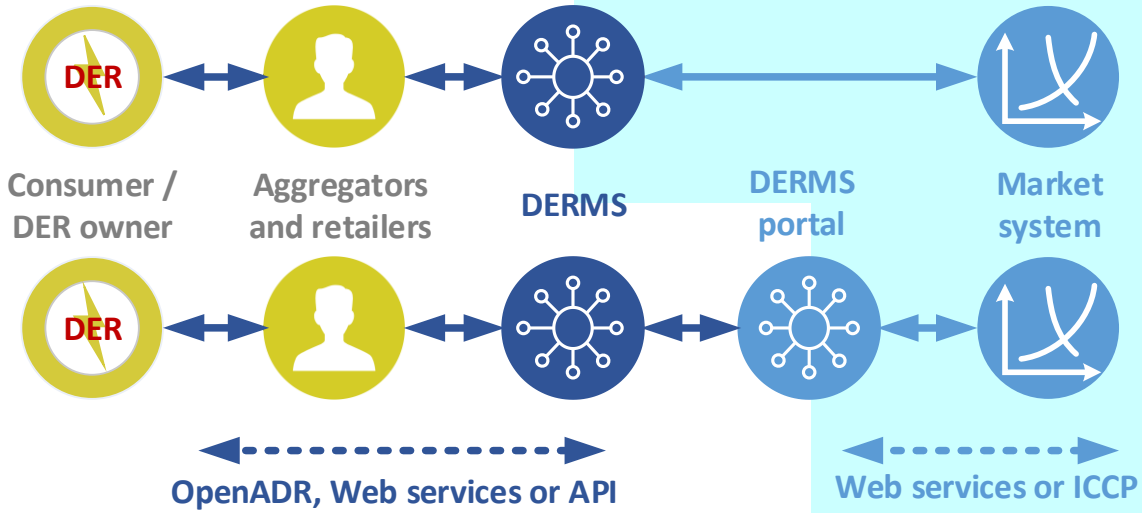
- Issue well known by IPAG: IPAG text here (slide 27) describes it qualitatively



Issue 3 – DER communications standards

- Communications between DER, DER owners and DERMS platforms are critical for registration, calls and verification
- International, open-source DR communications standards have emerged and continue to evolve:
  - OpenADR is the emerging international standard
- Modern DERMS platforms allow DER owners direct access using graphical user interface (GUI) via:
  - Web services
  - OpenADR, or
  - Application programming interfaces (APIs)

- DERMS portal needs to bid/offer into and be dispatched by the market system
- This currently requires:
  - Web services, or
  - ICCP (if real-time data required e.g. for source verification)



Issue 4 – DER technical standards

- DER has the potential to impose costs on system and network operation. Some technical standards are likely to be economic. The topical example is voltage standards for inverters.
- As DER penetration increases (preferably before!) then standards for other system impacts such as fault ride-through and harmonics may become critical
- Development and enforcement of standards not well managed in New Zealand. Options:
  - Worksafe (MBIE)
  - Code (EA)
  - Connection contracts (TP)
  - Connection contracts (distributor)
  - Requirement for DER registration (DERMS provider)
  - Requirement for aggregated Dispatch Notified participation (SO)
- Short term, get at least one of these working
- Long term, a centralised standards registry or hub referred to by all regulations?

Issue 5 – DER information provision

Information on connected DER

- SO needs to know what characteristics of load on the system, at least in aggregate, so that security issues such as transient response can be accurately modelled: without such information a sub-optimal conservative approach may be necessary
- Someone (the EDB?) needs to maintain and enforce system standards and network connection DER standards

Information on connected DER

- The registration process for active DER could be used to provide much of this information
- Ideally a consumer with a DER could register it once (e.g. in a central verified DER register) to access multiple markets, deciding who to offer any DER control to and under what conditions (e.g. price and required notice for response)

Information on active DER

- Aggregators would benefit from information about DER to offer products within its capabilities and to enable calls, verification and settlement
- SO's and distribution network operators' visibility of actual and planned DR activity could avoid creating security issues as DR markets take off
- SO is expected to authorise participation in Dispatch Notified, and may need DER information to support this decision
- Distributors in the North Island and Transpower in the South Island would benefit from visibility of active DER to maintain their AUFLS obligations
- SO needs to feedback planned and actual DER calls into its forecasts (Issue 6)

Issue 6 – DERM information provision for forecasting

- Market efficiently generally and demand response in particular will benefit from accurate price forecasts, for schedules (MTFL) and for dispatch (STLF). Poor forecasting can lead to over-reaction to system security issues too.
- We can expect – and should seek to encourage - increases in:
  - ↑ Quantum of DER on system
  - ↑ DER self-response against forecast price (schedules)
  - ↑ DER self-response against ex-ante RTP price (close to real-time)
  - ↑ DER dispatched response (Dispatch Notified and Dispatchable Demand)
  - ↑ DER calls by aggregators operating in distribution, transmission, spot and ancillary service markets
- These will all make current forecast models less accurate and so dampen efficient response
- Of the above, only dispatched response under RTP is modelled. Ideally, we should consider:
  - ↑ Allowing for price responsiveness in our forecasts
  - ↑ Feeding DER calls back into our forecasts (requiring information on planned and actual DER calls)
  - ↑ Improving our embedded wind/solar forecasting too, or it will limit possible net load forecast accuracy

Issue 7 - Pass-through participation

- If we have a DERMS market portal bidding into the spot market (as a practical alternative to embedding that gateway functionality within the market systems software), then who is responsible for the bid physically and financially?

X The portal owner/operator

- Presumably not
- As, the service could be offered by a market service provider that would not be buying and selling energy, but acting more like a clearing house

✓ The aggregator who bid into the portal

- Presumably so
- Requires a Code change to allow aggregation as a purchaser type
- Prevents the portal further aggregating bids

- The Code needs to allow a middleware DERMS portal to present bids and be dispatched by the market systems, with the financial and physical obligations remaining with the DER aggregators

DERM spot market issues by changes required

Key
Change
Maybe
No

Requirement			Regulation	Mkt Sys
1	Aggregation across retailers	Aggregators need access to DER irrespective of which retailer the owner is aligned with	Code change?	No change required
2	Replace profiling with TOU data	Retailers need to apply half hour or five minute reconciliation where available		
3	DER communications standards	Communications between DR platforms, DER and DER owners are critical for calls and verification	Ideally mandated by regulator?	Possible changes
4	DER technical standards	Benefits of common standards for DER connection and operation that do not cause unwarranted system issues		No change required
5	DER information provision	Key system players (SO, EDBs, Grid owner) need information on connected and active DER for system security studies		
6	DERM information provision	Need to incorporate planned and actual DER calls into SO's and EDBs load and hence price forecasts		SO's load forecasts
7	Pass-through participation	If use DERMS as a market portal, its need to bid/offer into the wholesale market without owning energy	Code change?	No change required