Design and Implementation of a Demand Response Program

Date: 20 November 2023

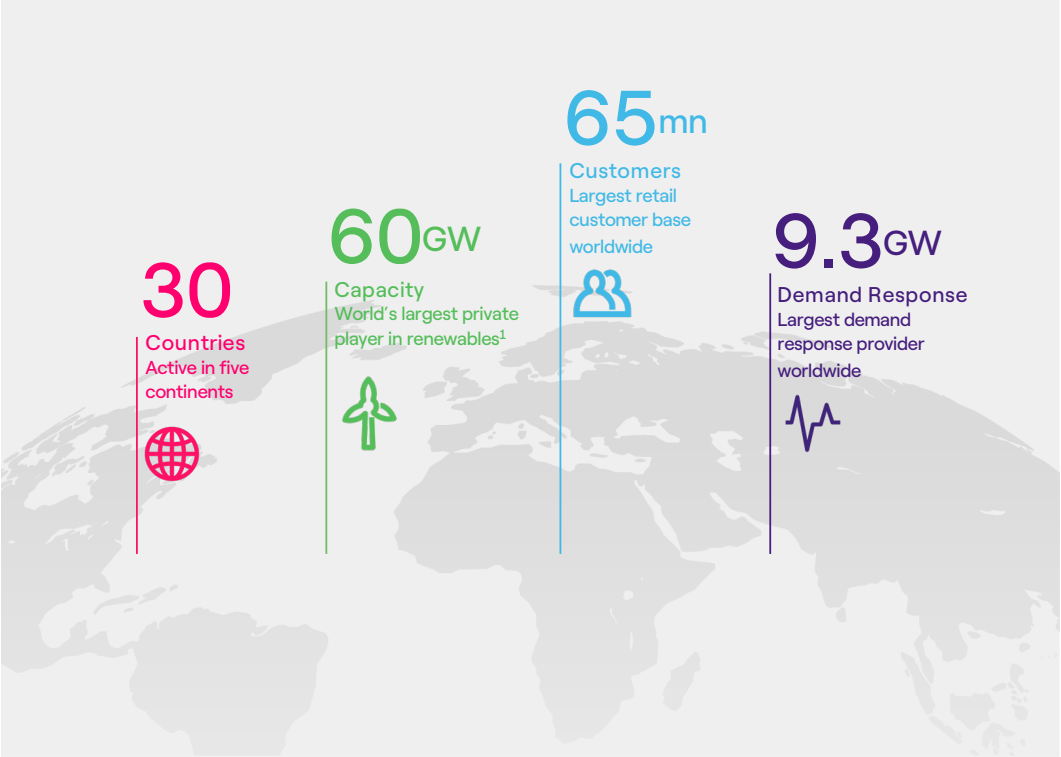
Summary

- Demand response a meaningful contributor[1] to solving energy trilemma
- With correct incentives, demand response can be brought to bear regardless of regulatory construct. I will focus on the designs required for successful service level and participation requirements, though acknowledge questions exist on incentives for discoms and other existing players
- Variety of roles demand response can play in grid support. Design for that end in mind, not just encouraging demand flexibility of any variety
- All types of demand response available – with varying degrees of success – in Australia
- Key to success and participations from desired players is across ten program design measures to make the program investible while achieving aims for electricity grid

1: Offering 5-10% of peak demand as capacity in mature North American open market programs

Enel

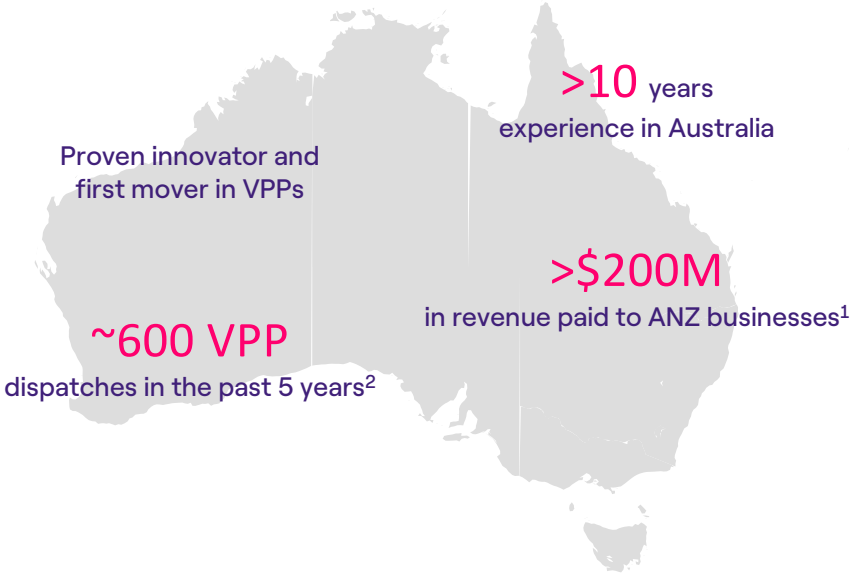
The global power company changing the face of energy

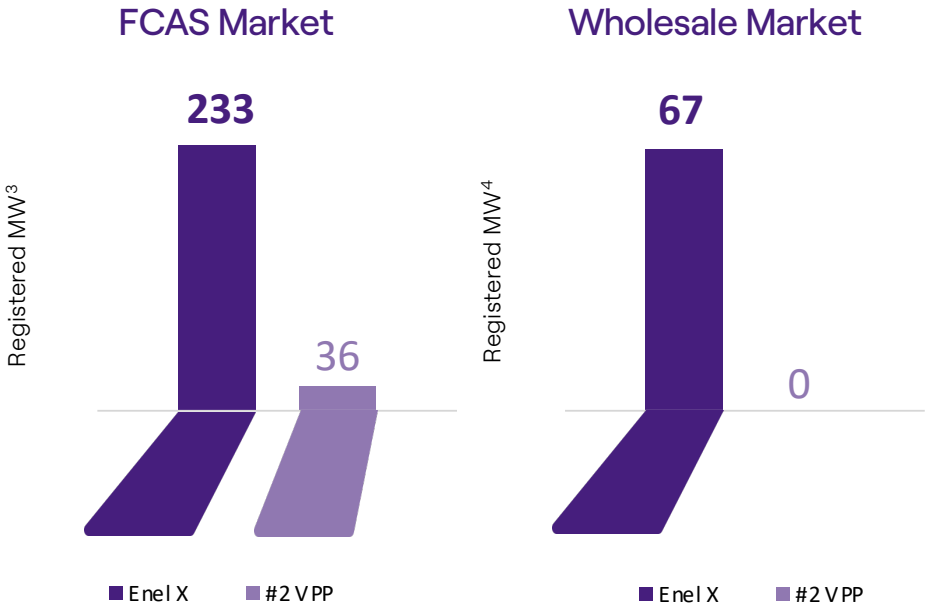


Our purpose is clear

- The world's largest private player in renewable power generation.
- Innovative platforms to help customers navigate the energy transition.
- Largest GHG emissions reduction of any company over the past decade.

Enel X Australia



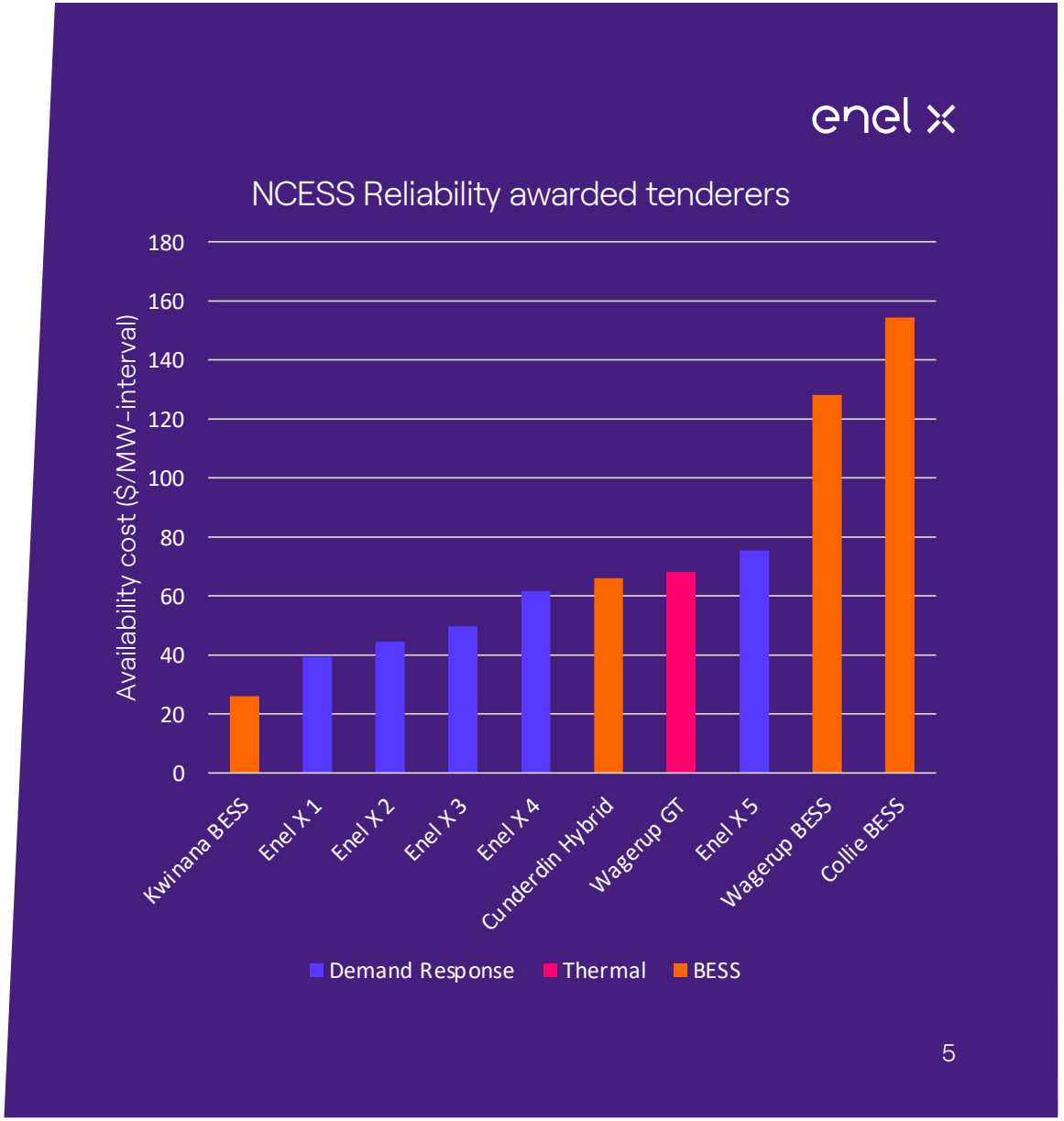


1. Enel X Australia & New Zealand payments to customers.
2. Enel X Australia & New Zealand dispatch events across eight market programs.
3. Based on FCAS market registered capacity data as at Nov 2023.
4. Based on Enel X Wholesale market registered capacity as at Nov 2023.

DR solves the energy trilemma

Reliability-Affordability-Sustainability

- Reliable source of energy to support the grid, e.g. findings of ARENA RERT trial[1]
- Cost-effective as compared to other sources of firming and generation, e.g. recent WA Non-Cooptimised Essential System Services tender (at right)
- Demand reduction carbon-efficient as compared to thermal generation



1: ARENA Demand Response Short Notice RERT Trial Year 3 Report, October 2021

Types of demand response

Value stream	Description	Australian programs
Emergency grid support	Employed as a reserve lever during supply emergencies, to avoid involuntary load shedding and rolling blackouts.	• Reserve Capacity Market • Reliability and Emergency Reserve Trader
Ancillary services / frequency support	Employed to respond very quickly to brief, unexpected imbalances in grid supply and demand.	• Frequency Control Ancillary Services (FCAS)
Critical peaking support / economic DR	Employed to generate during times when wholesale spot prices are high and earn revenue.	• Wholesale Demand Response Mechanism (WDRM)
Network support	Employed to manage the electricity peak within a geographically distinct transmission or distribution network area, deferring expensive network upgrades.	• Transmission / distribution operator specific programs
Site peak shaving	Reduce network costs by managing site or system maximum demand.	• AusNet GoodGrid • Individual Reserve Capacity Requirement programs

Three players to support and provide Demand Response

Residences

- Require automation to be successful at scale (e.g. hot water DR via controlled load in AUS, ripple control in NZ)
- Less proven at scale, but possible with technology consistency and advance of smart-homes

C&I Users

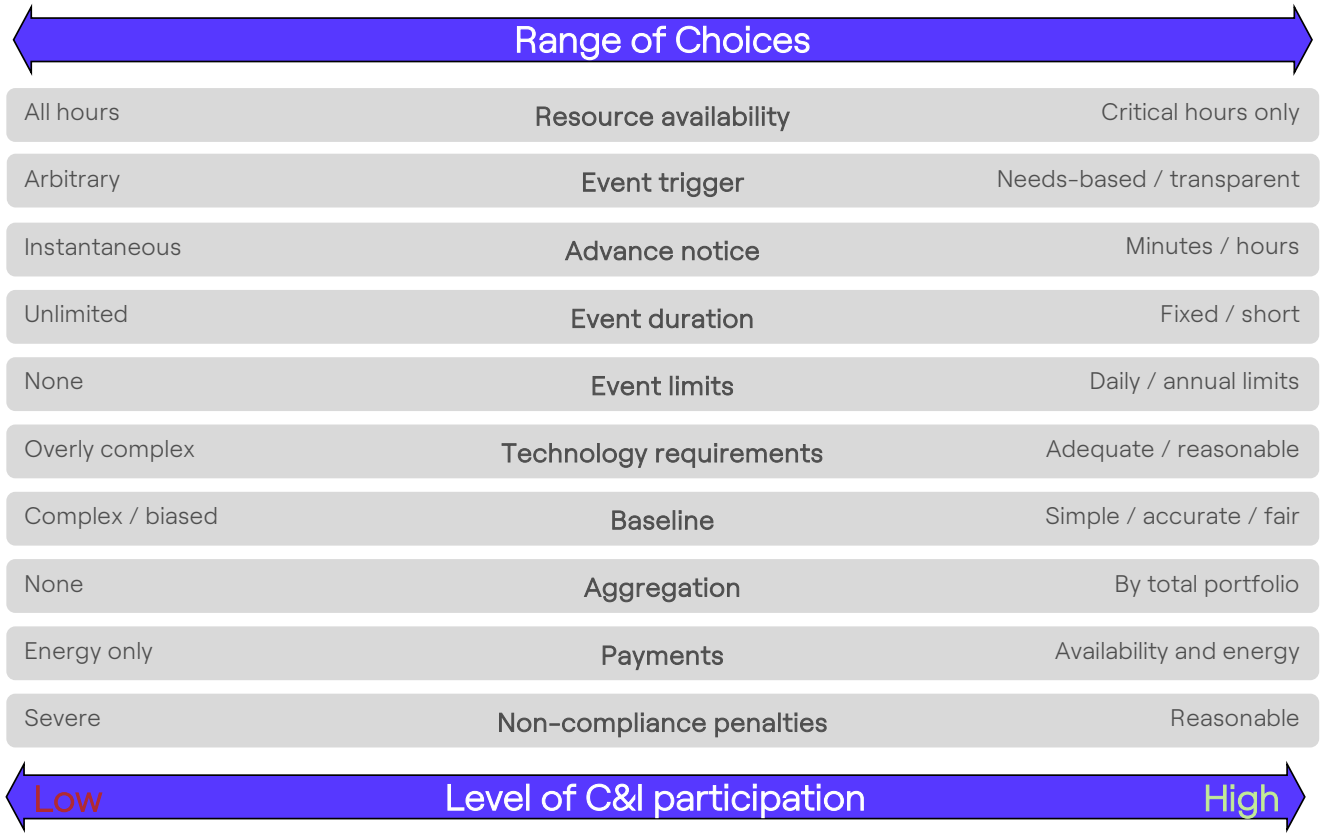
- Many equipment types and business types have flexible demand and can provide DR
- Often enter market directly or via aggregator
  - Major energy users often have energy-market sophistication on par with aggregators
- DR is an investment (even if no CAPEX); make it "investable" for users

Aggregators

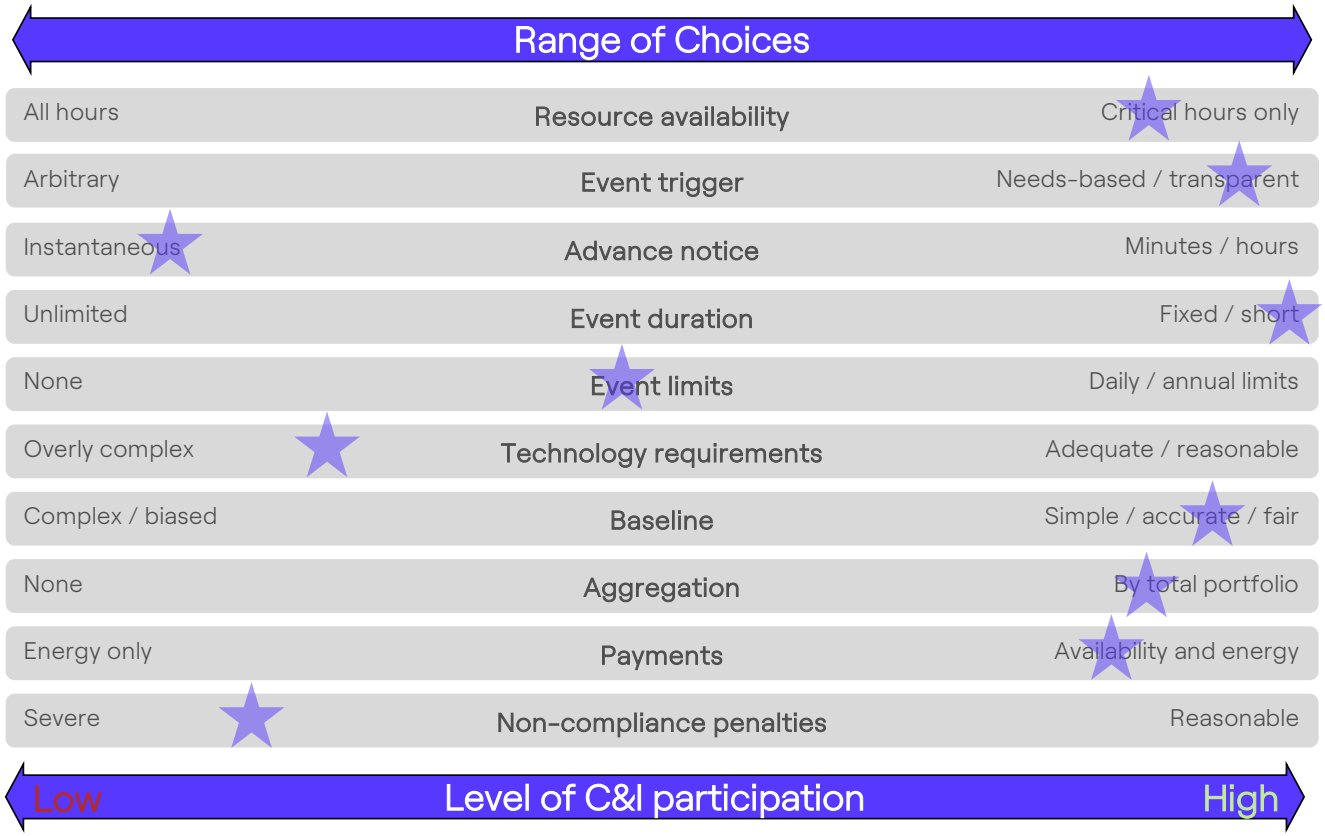
- Generally more necessary in markets where technology or compliance burden is higher
- Allows broader participation of residential and C&I users
- Largest cost is customer acquisition
- Successful models exist with both independent or retailers as aggregators

Examples exist of successful demand response across fully integrated markets (e.g. TVA), highly regulated markets, deregulated markets, capacity or energy-only markets (e.g. Australia NEM and WEM)

Dimensions of program design to balance for participation



Dimensions of design: FCAS example

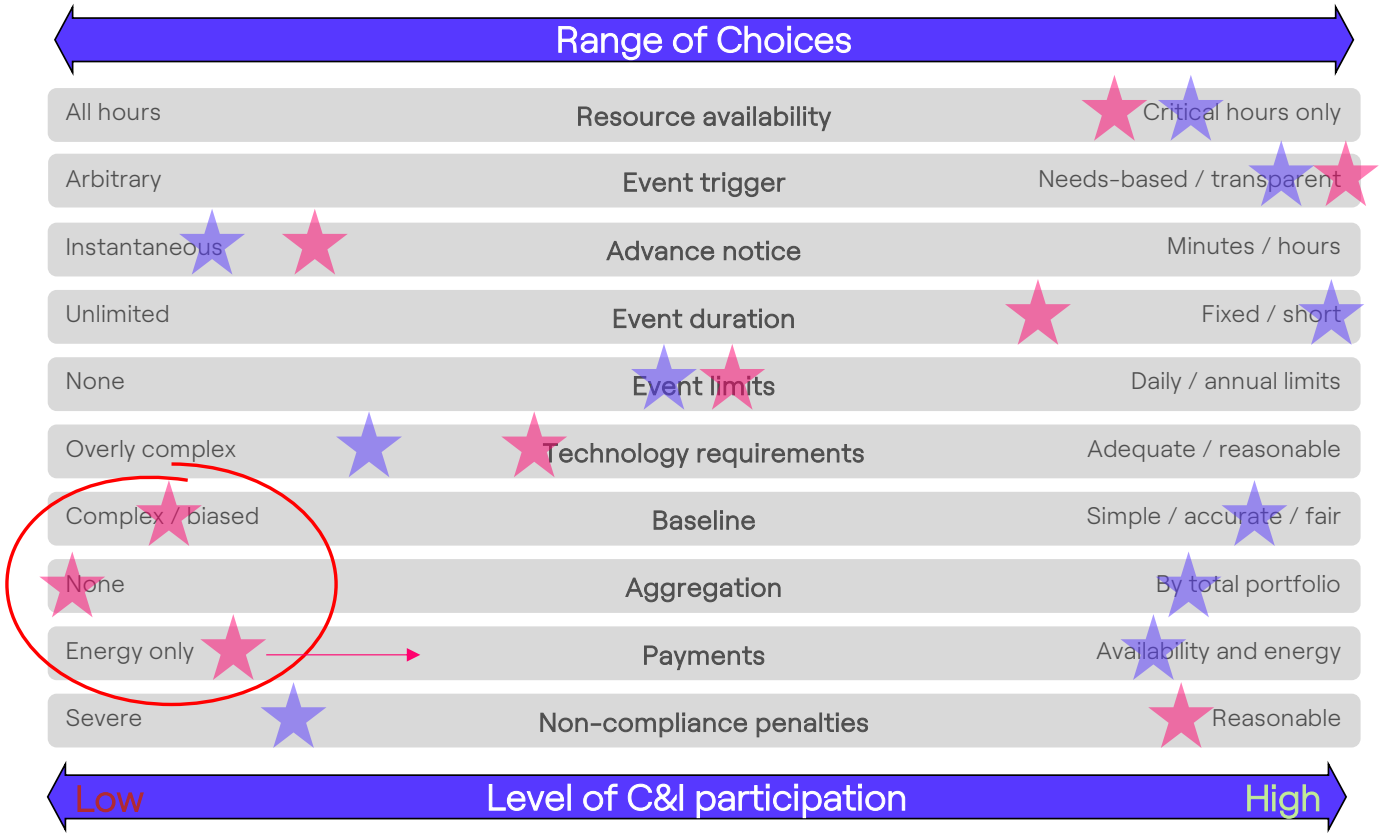


- FCAS market allowed demand response from 2017
- Entry had an immediate and long-standing effect to reduce consumer prices[1]
- Demanding technological and compliance requirements balanced by fair rules on measurement, aggregation and availability payments
- Results is sufficient registration (>1 GW registered[2] in shallow market)

1: AEMO, Quarterly Energy Dynamics Q1 2018;
AER, Wholesale Electricity Market Performance Report 2022

2: AEMO NEM Registration and Exemption List

Dimensions of design: WDRM example



- WDRM (pink) has had low uptake since commencement in 2021 (67MW registered[1])
- Complex and restrictive rules have resulted in low investment by aggregators and C&I participants
- NSW initiatives[2] will improve payments dimension for this state
- Small tweaks from AEMO and AEMC could support baseline and aggregation dimensions to improve uptake

1: AEMO NEM Registration and Exemption List

2: OECC's Peak Demand Reduction Scheme and AEMO Services' Firming Tender

Other lessons learned from implementation

- Incentives and program design matter greatly, participation levels will vary greatly based on this
- Prove out market attractiveness as part of the initial work; easier to build on positive momentum
- Feast-to-famine can play out (e.g. WEM 2017 reforms); examples of famine-to-feast theoretically possible too

- Markets evolve and consistent stewardship required to evolve with needs of the market
- FCAS compliance enforcement by AER; introduction of new Very Fast markets to support low-inertia grid
- NSW Government initiatives to support uptake of demand response to support reliability (e.g. Peak Demand Reduction Scheme)

- Good quality demand response programs harder in energy-only markets; creativity may be needed to make investible for users and aggregators (e.g. NSW Long Term Energy Services Agreements are most novel, but availability payments or certificate schemes can suffice)

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