Institute for Energy Economics and Financial Analysis

VPPs in Australia

Using Distributed Energy Resources (DER) as flexible resources in the Australian Electricity Market

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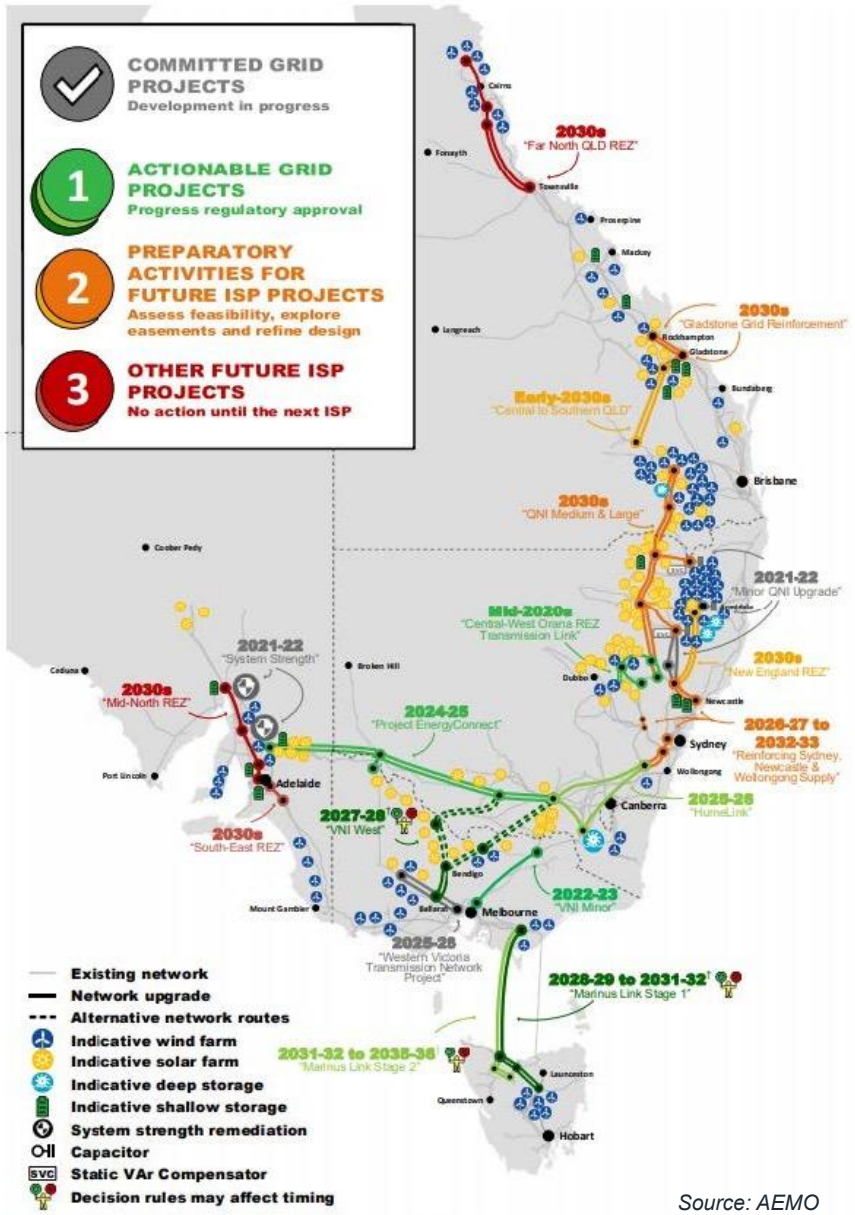
Australia's National Electricity Market (NEM)

Figure 1 The optimal development path for the NEM



Source: AEMO

† The timing of these actionable projects is dependent on decision rules.
All dates are indicative, and on a financial year basis. For example, 2023-24 represents the financial year ending June 2024.

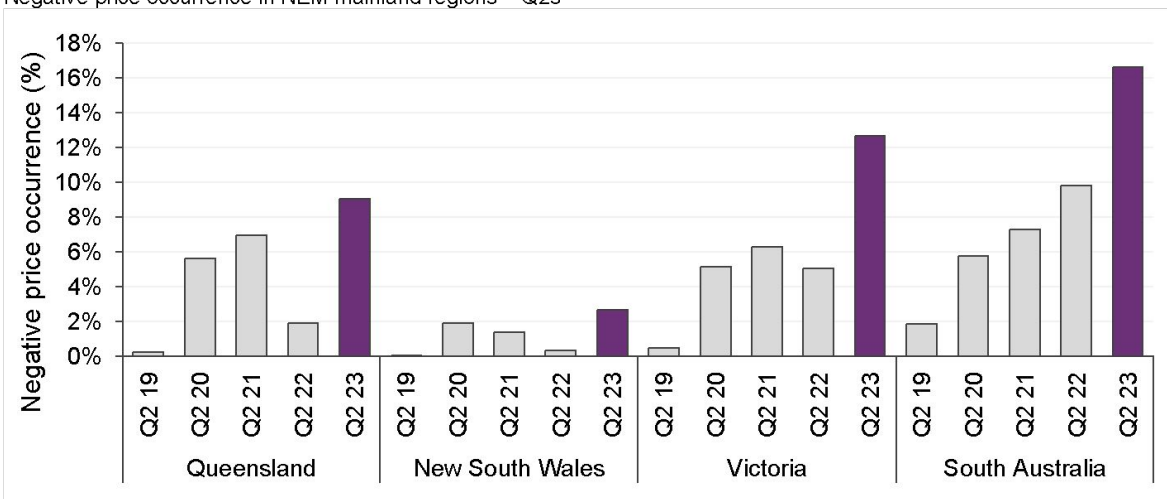
- **Wholesale** energy-only market
- **Market price cap:** $AUD16,600/MWh. Price floor: -$AUD1,000/MWh
- **Negative prices:** *9% of all trading intervals across the NEM Q2 2023 South Australia 17% and Victoria 13% in the same period* Source: AEMO

- Deregulated market, typical bill 2022:
  - **Wholesale** costs (35% of bill)
  - **Network** costs (46% of bill) –| revenue-caped Transmission and Distribution
  - **Environmental** costs (8%)
  - **Retailer and residual** costs (11%)

Source: AEMC Residential electricity price trends report 2021

Figure 17 Record high Q2 negative price occurrence in all NEM mainland regions

Negative price occurrence in NEM mainland regions – Q2s



Source: AEMO

DER has already changed Australia's energy system

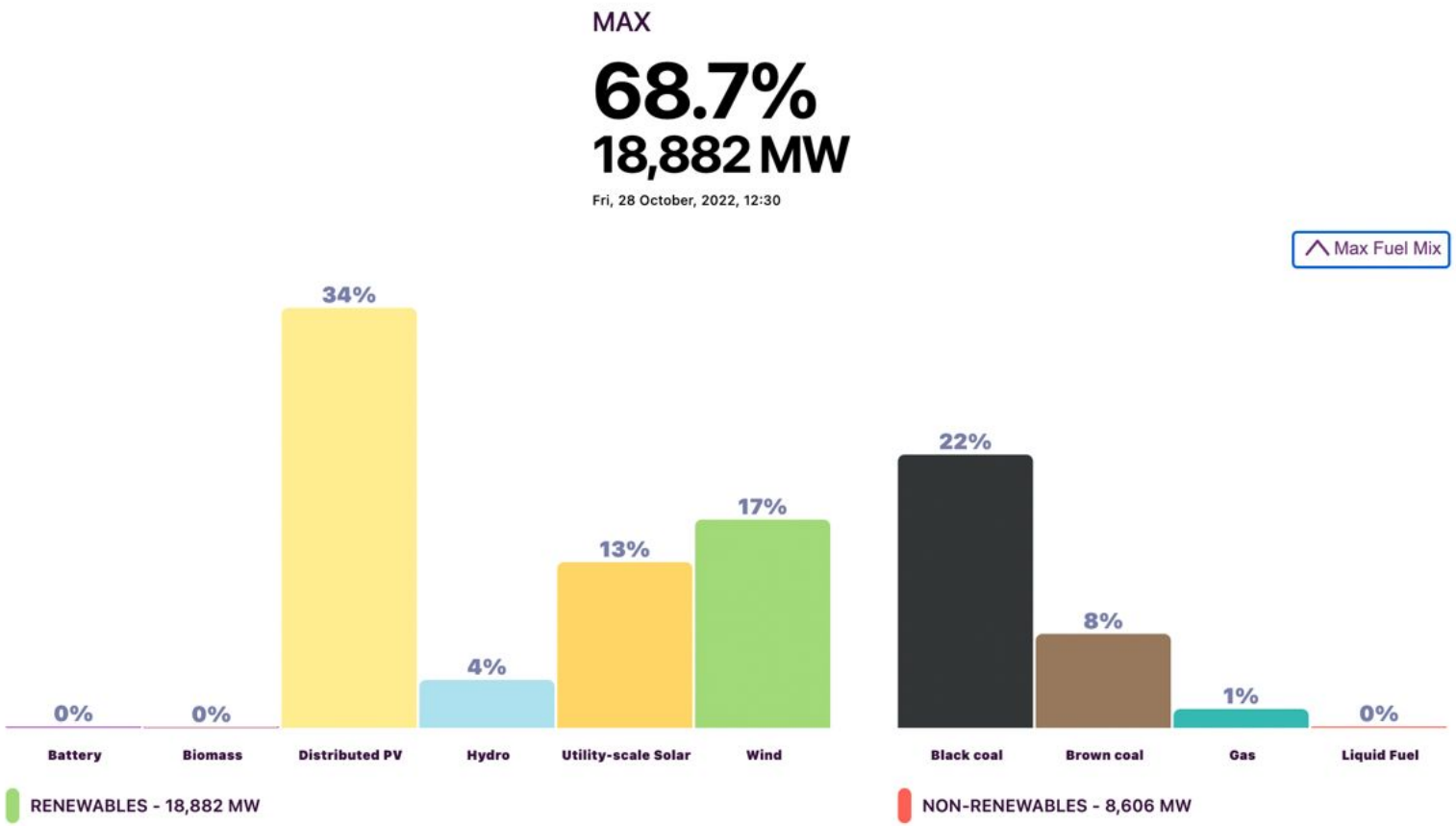
So far:

- $15+ billion of household investment in rooftop solar alone
- Over 3.5 million household rooftop PV systems, 17+GW on rooftops
- C&I rooftop PV accelerating (large potential)
- Over 110,000 small batteries
- Demand response underutilised

Source: IEEFA

But the benefits of DER are still underestimated

Maximum instantaneous renewable penetration in the NEM: 28 Oct 2022



Source: AEMO

Source: AEMO

Heading for 100% instantaneous renewables by 2025

South Australia:
74% over the last year
(wind and solar August 2022 –August 2023)

National Electricity Market (NEM):
37.5% over the last year

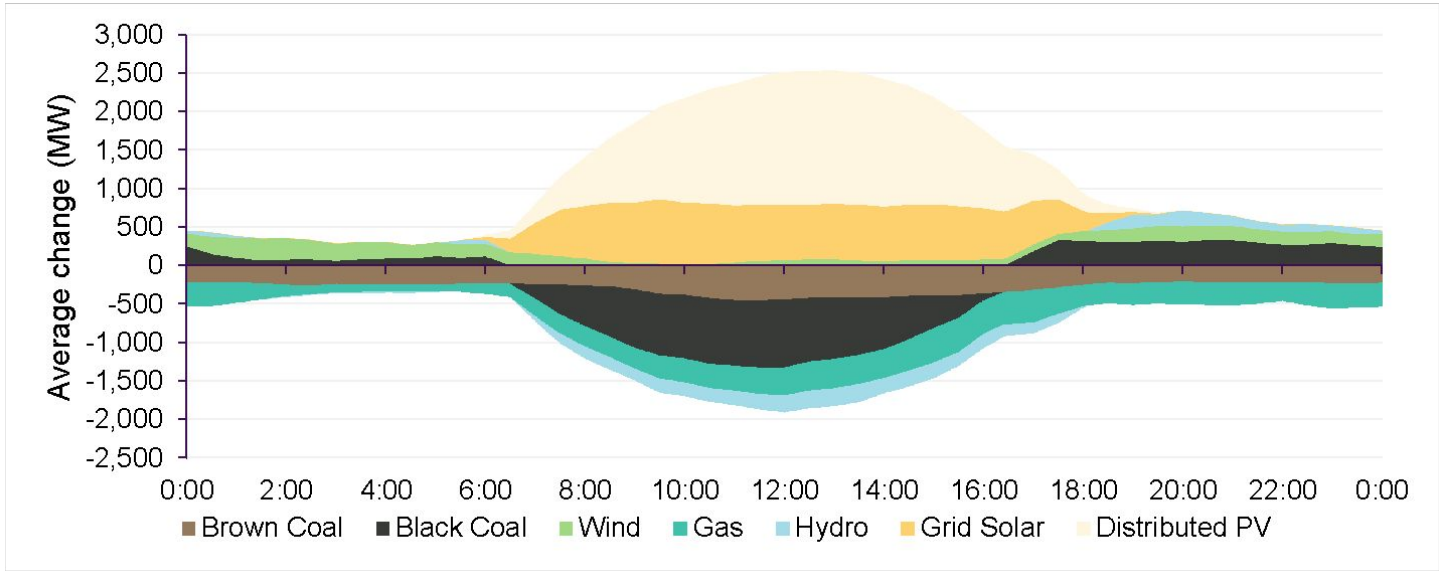
Source: OpenNEM

With variable renewable generation, demand must become more flexible to match supply

Current middle-of-the-day solar abundance

Figure 25 Large daytime drops in thermal and hydro generation as solar output increases

NEM generation changes by time of day – Q1 2023 vs Q1 2022



Source: AEMO 2022 | Quarterly Energy Dynamics Q4 2021

Dynamic operating envelopes: a necessary first step

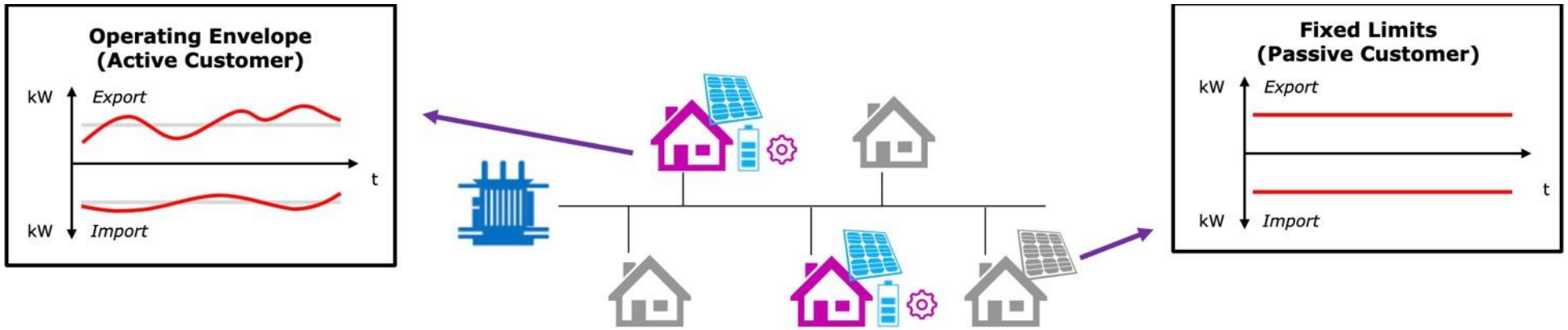
Set dynamically:
1-5-minute intervals,
24 hours in advance

Needs regulatory support:
including through consistency in APIs for information sharing – still a work in progress

Needs some funding:
but relatively small e.g. <1% revenue for SA Power Networks - $32m cf $3.9b 5-year revenue

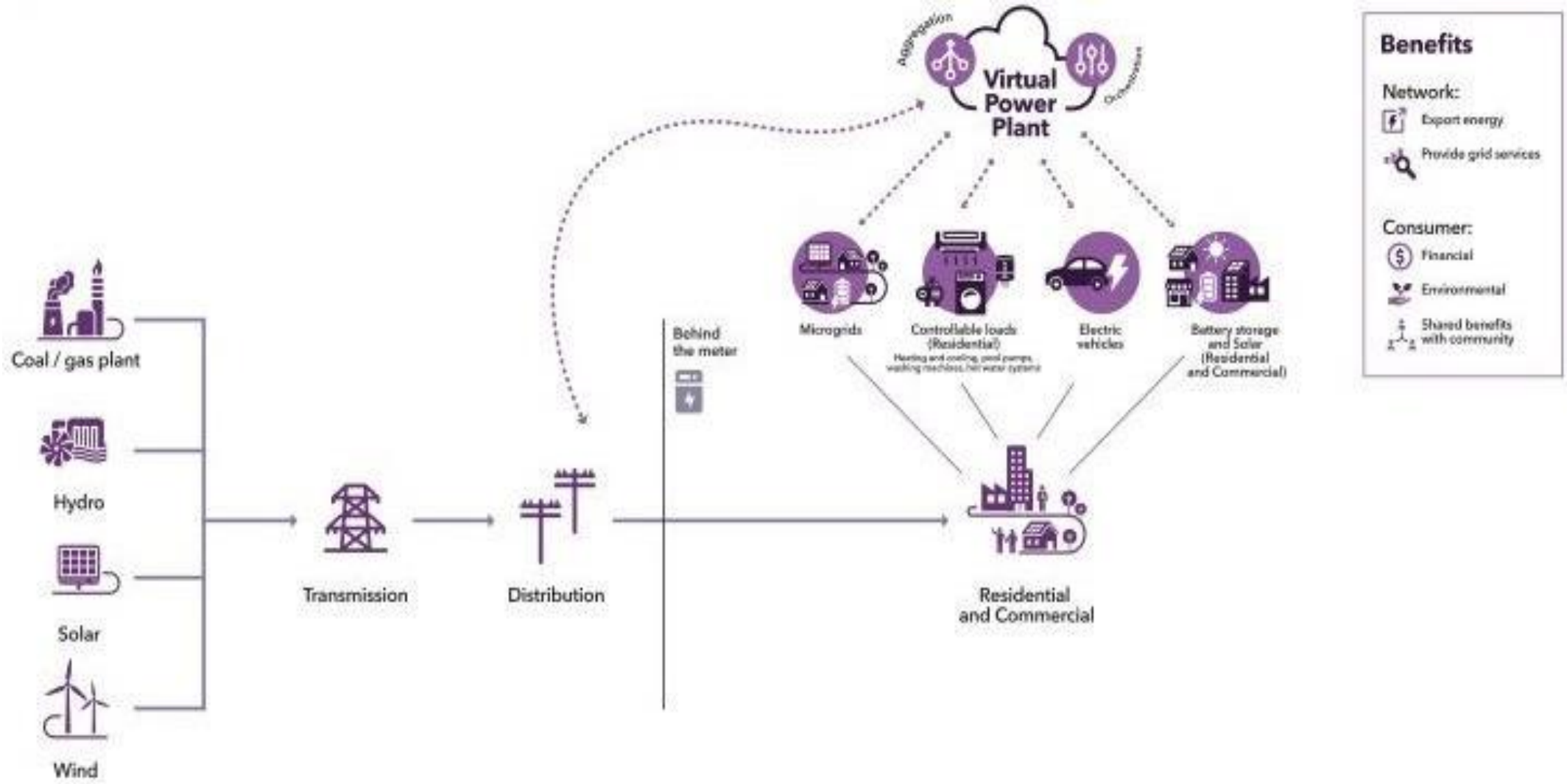
Source: IEEFA

Allowing DER to play a greater role in energy markets and the grid



Source: Melbourne Energy Institute

What is a Virtual Power Plant?

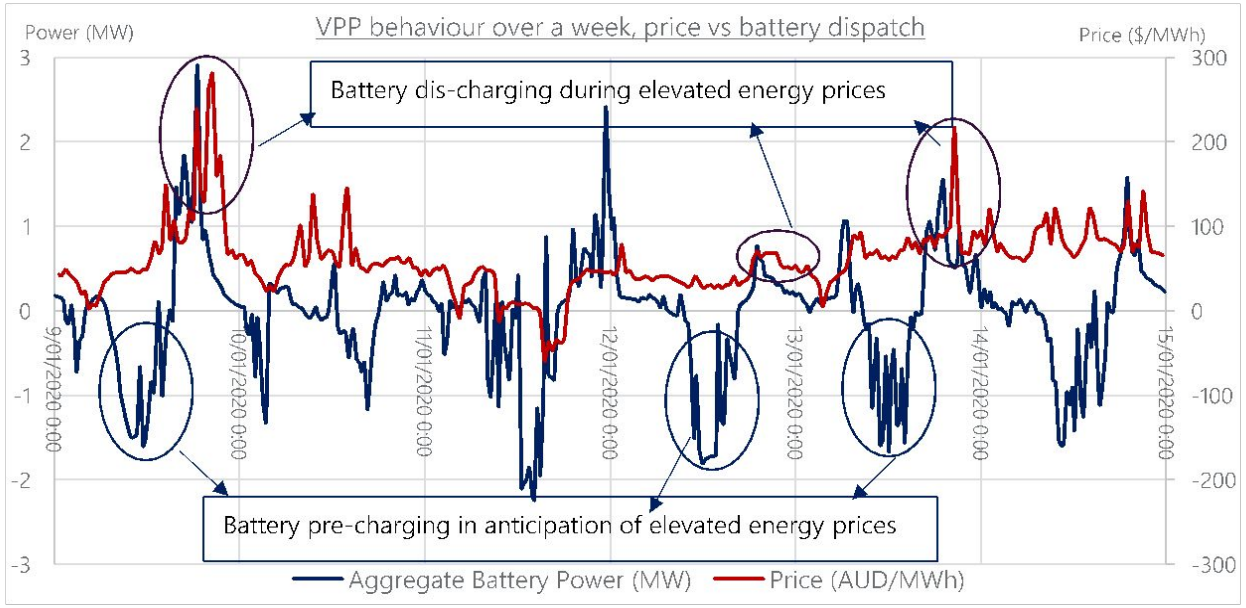


Source: AEMO

Findings of AEMO Virtual Power Plant trials

- Can provide FCAS, energy and assist with minimum system load
- Only battery participants at this stage (not other DER)
- Forecasting challenges (up to 42% different from actual on an hour ahead)
- AEMO needs for visibility, forecast-ability, dispatchability – system security challenges if VPPs scale
- *Participants view: too many requirements, too costly*
- Consumers: overall satisfaction to date is high, but some value opaque
- Need for consumer protections – especially for switching

Figure 5 Energy response for SA VPP – 9-15 January 2020, behaviour over a week



Source: AEMO

IEEFA VPP report: Findings

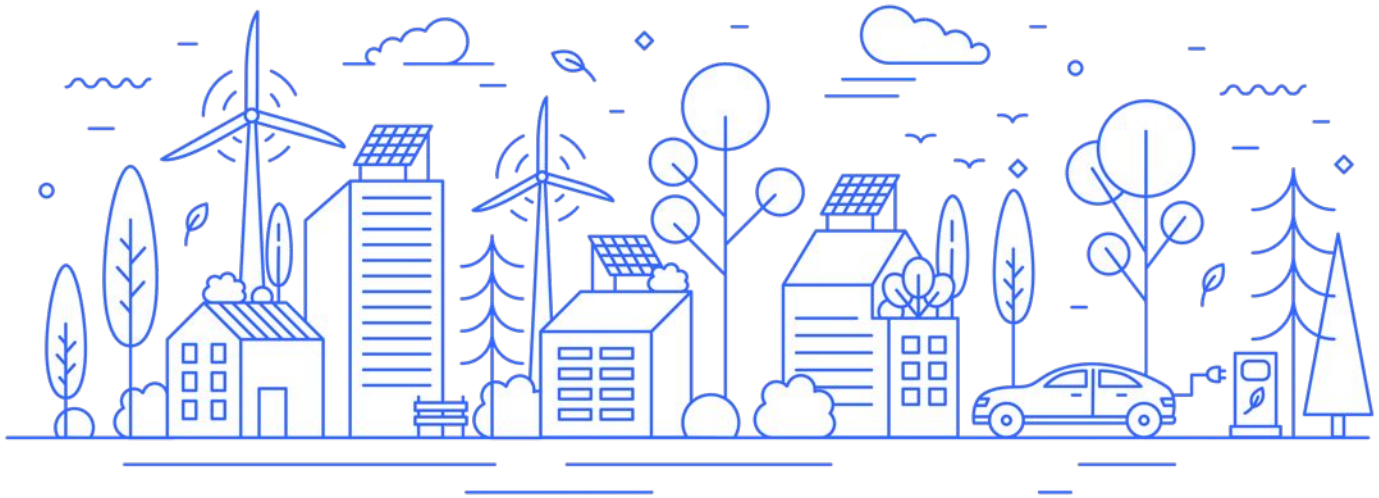
Margins are currently thin

But:

- Retailers will need to harness fleets of DER to be profitable
- The future is harnessed VPP and DER-centred retailing
- Endorsed by Origin Energy's announcement in February 2022 of a 10x increase in VPP – 205MW to 2000MW in 4 years

New sources of revenue needed

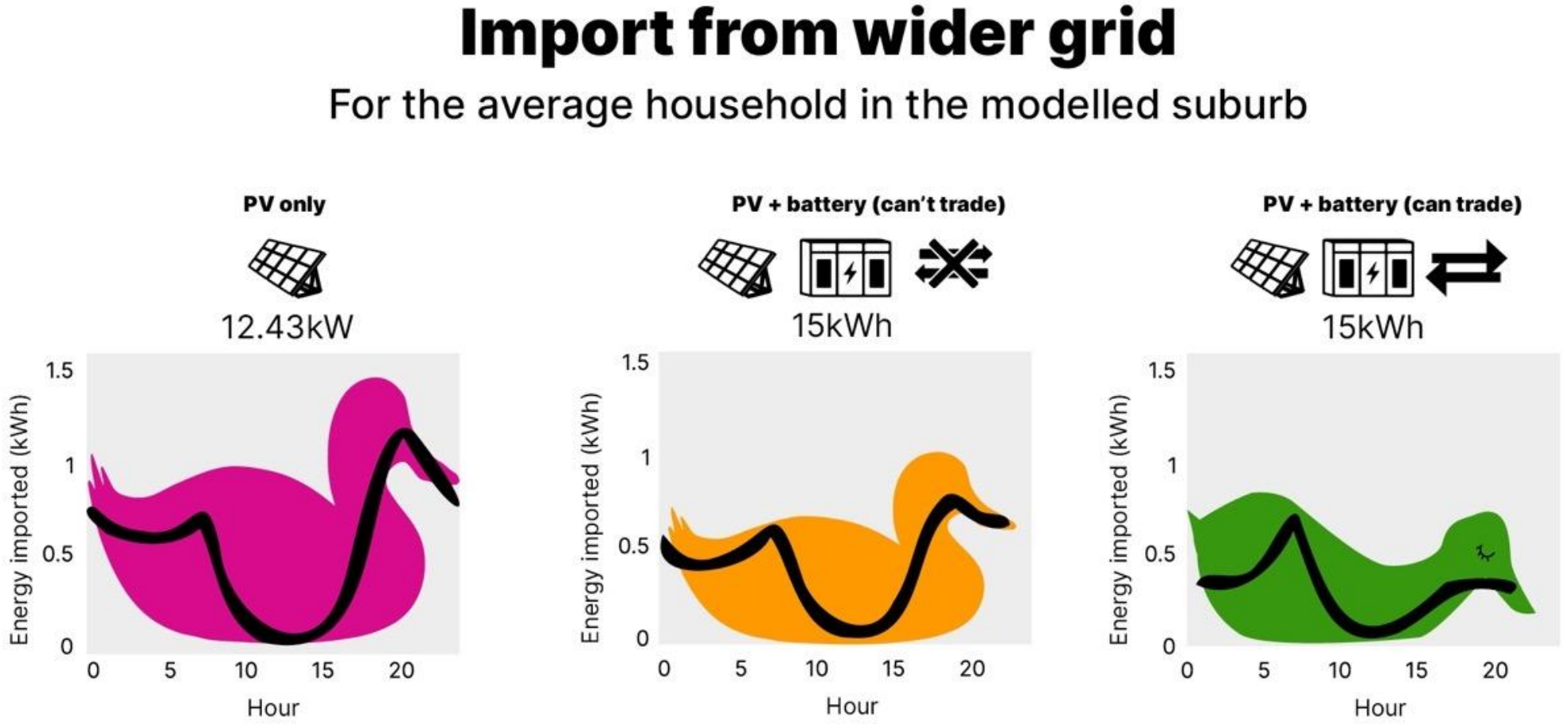
- e.g. allowing aggregated residential participation in the Demand Response Mechanism
- Payments for distribution network services



https://ieefa.org/resources/what-state-virtual-power-plants-australia

Possible Future:

Rooftop PV + batteries puts the duck to sleep



https://ieefa.org/resources/saturation-der-modelling-shows-distributed-energy-and-storage-could-lower-costs-all

VPPs can have multiple benefits

- Reduce wholesale market peaks and price volatility
- Reduce network peaks – more efficient utilization
- Alleviate minimum demand challenges
- Alleviate ramping issues

But need smart regulation and market design

- Put dynamic operating envelopes in place
- Provide open and transparent information on network constraints
- Support managed EV charging and then V2H and V2G
- Make it easy for VPPs to participate in wholesale, demand response and FCAS markets
- Allow DER to provide network services – through real-time pricing or auctions or other methods

Thank you

IEEFA Guest Contributor

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