Integrating distributed energy resources (DER)

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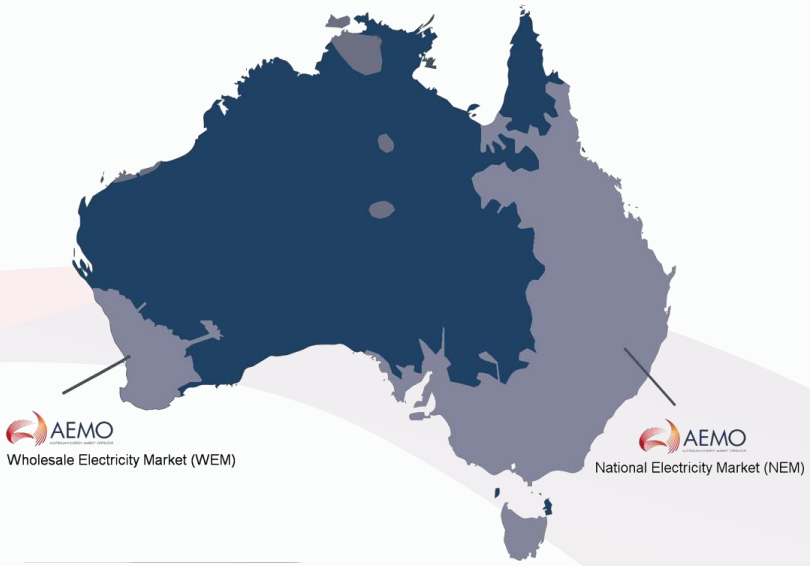
About AEMO



We operate Australia's National Electricity Market and power grid in Australia's eastern and south-eastern seaboard, and the Wholesale Electricity Market and power grid in south-west WA.

Both markets supply more than 220 terawatt hours of electricity each year.

We also operate retail and wholesale gas markets across south-eastern Australia and Victoria's gas pipeline grid.

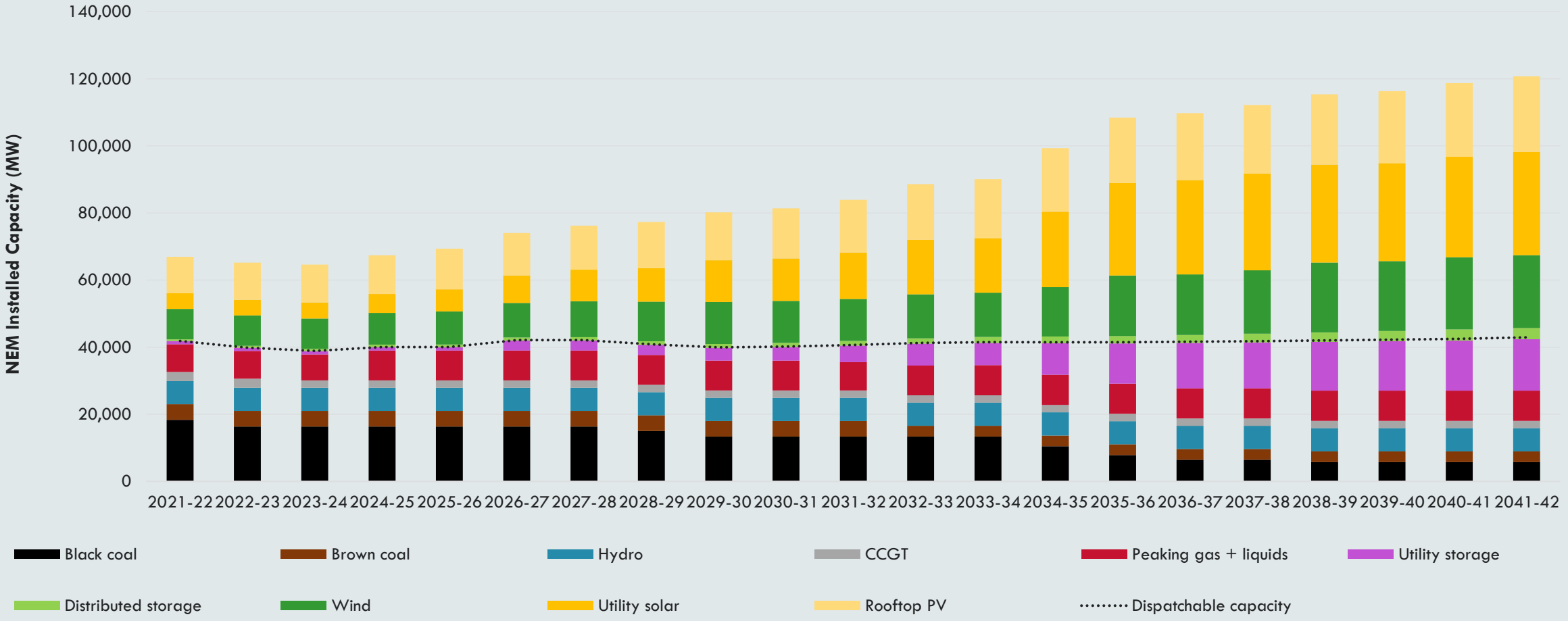
Collectively traded more than A$20 billion in the last financial year.

Ownership

40% Market participants

60% Governments of Australia

The growing level of consumer choice



Source: AEMO 2018 ISP

DER forecast to play an important role in the NEM by 2030

Rooftop PV generation capacity

9.6 GW to **22.4 GW**

Embedded battery storage capacity

0.8 GW to **15.9 GW**

Electric vehicle electricity consumption

66 GWH to **7,710 GWH**

Virtual power plant aggregate storage capacity

53 MW to **9,100 MW**

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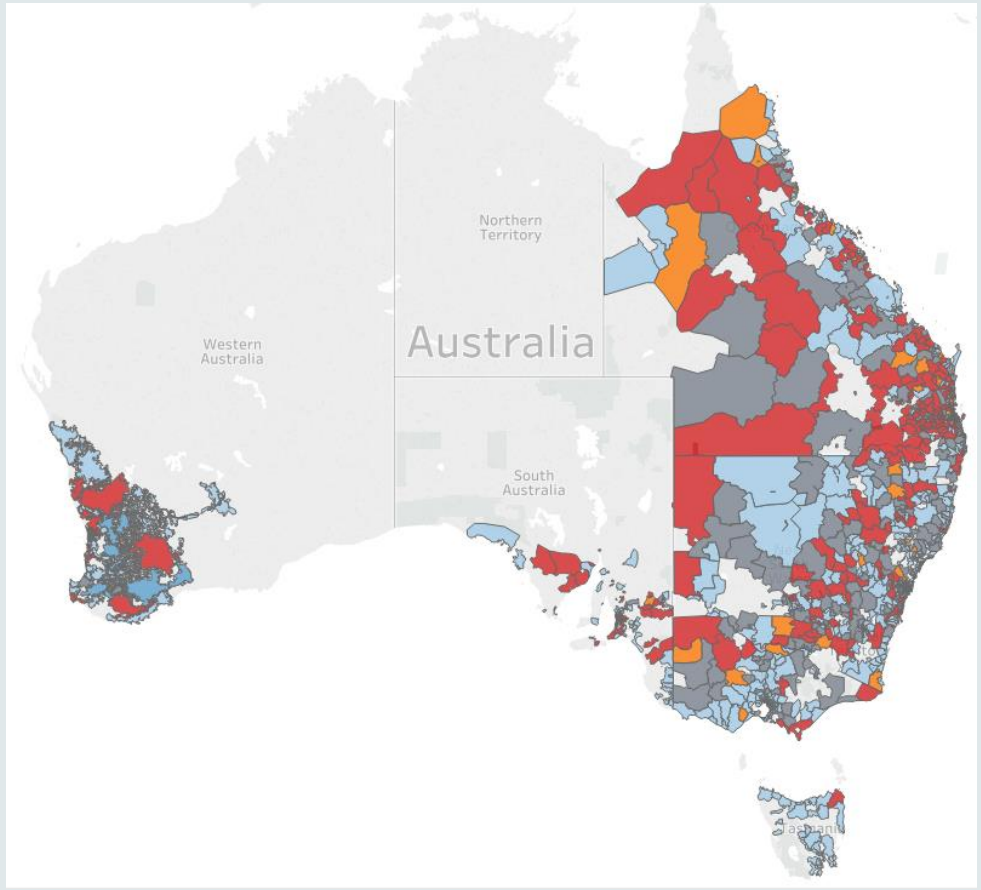
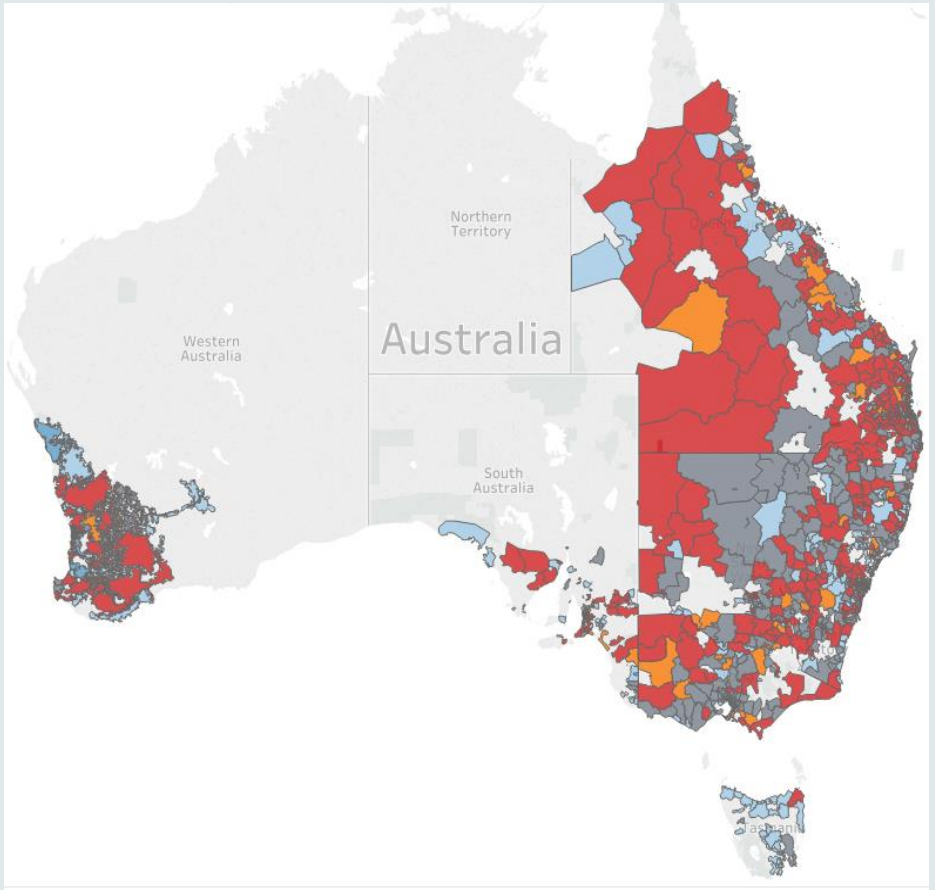
Source: AEMO 2018 ISP

Moving towards a two-sided system and the need for a two-sided marketplace

Forecast 'reverse electricity flows' in across Australia's distribution networks



Slow DER scenario



Fast DER scenario

Years
<=2025
<=2030
<=2040
<=2050
>2050

AEMO's DER Program – maximising value for consumers

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AEMO's DER vision

To integrate DER in the system and market to maximise customer value through price, greater choice, and the provision of a secure and reliable system.

We're on a journey that involves:

- Building a **two-way electricity system**
- Establishing a '**marketplace**' to trade services from consumers – flexibility markets
- Enabling **open access**

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DER Program overview

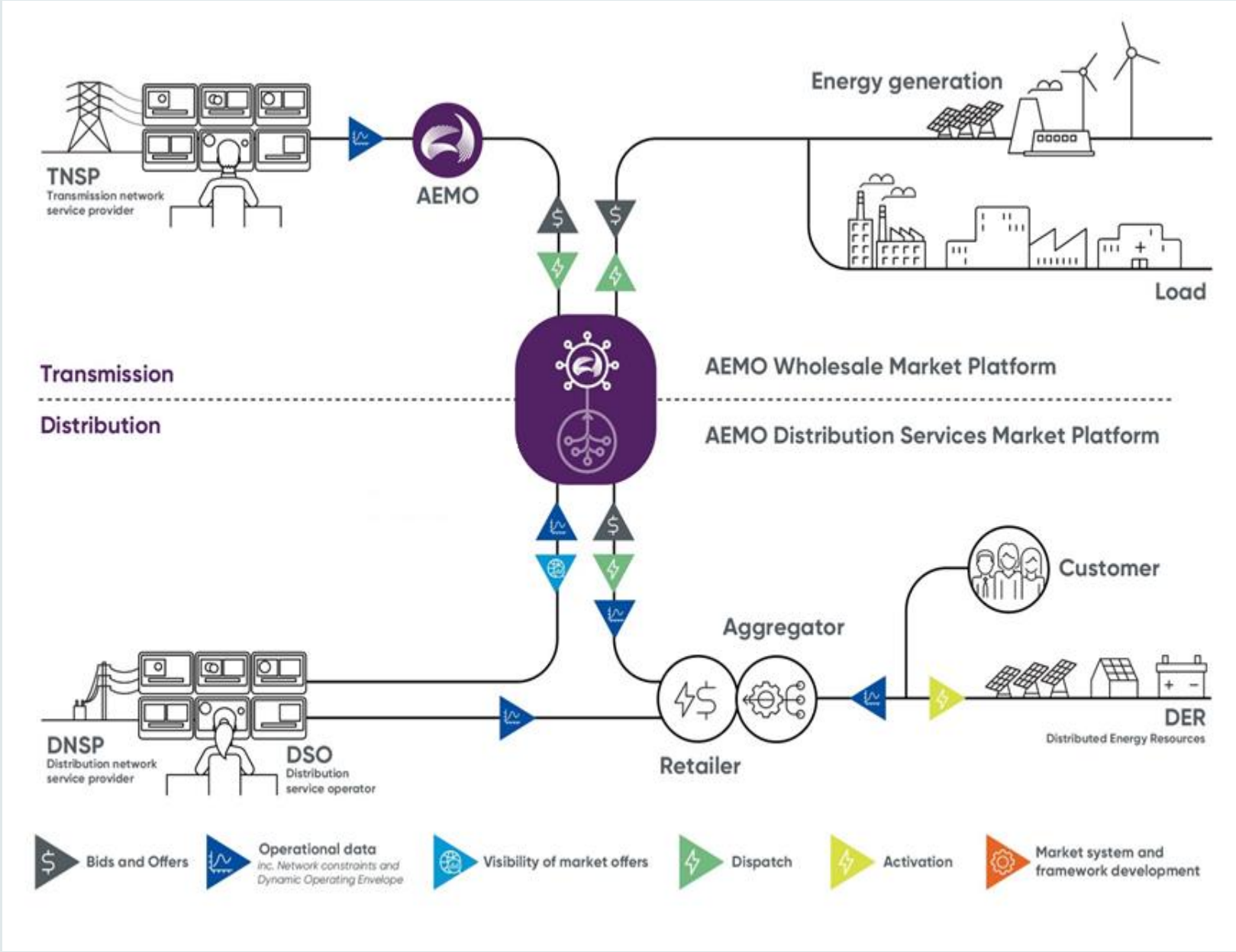
DER Workstream	Pilots	Data	Market and other arrangements	Standards and protocols	Operations	Communication & Education
Workstream objectives	Use pilots to inform change – partner with key stakeholders to inform operational and market design requirements	Visibility of DER for operational, forecasting, planning, and market (incl settlement) functions. Consumer and service provider access to data and services to enable better service offerings/choice for consumers	Integrate DER into energy, ancillary and reserve markets. Market arrangement recognise non-retailer models, including third-party/aggregator concepts. Evolve market arrangement to a distributed market model. Network regulation, planning & pricing facilitate DER and better customer service offerings.	Where appropriate, a nationally consistent approach to DER connections and develop DER technical standards.	To better understand operational challenges and DER capabilities to inform operational processes and tools. Better operational tools to operate in high DER world	Industry-wide collaboration (domestic and international) to deliver outcomes for consumers

Enablers

- Broader market redesign (AEMC and ESB broader design)
- Digitalisation
- Stakeholder engagement

Open Energy Networks

Partnership with ENA to unlock flexibility markets



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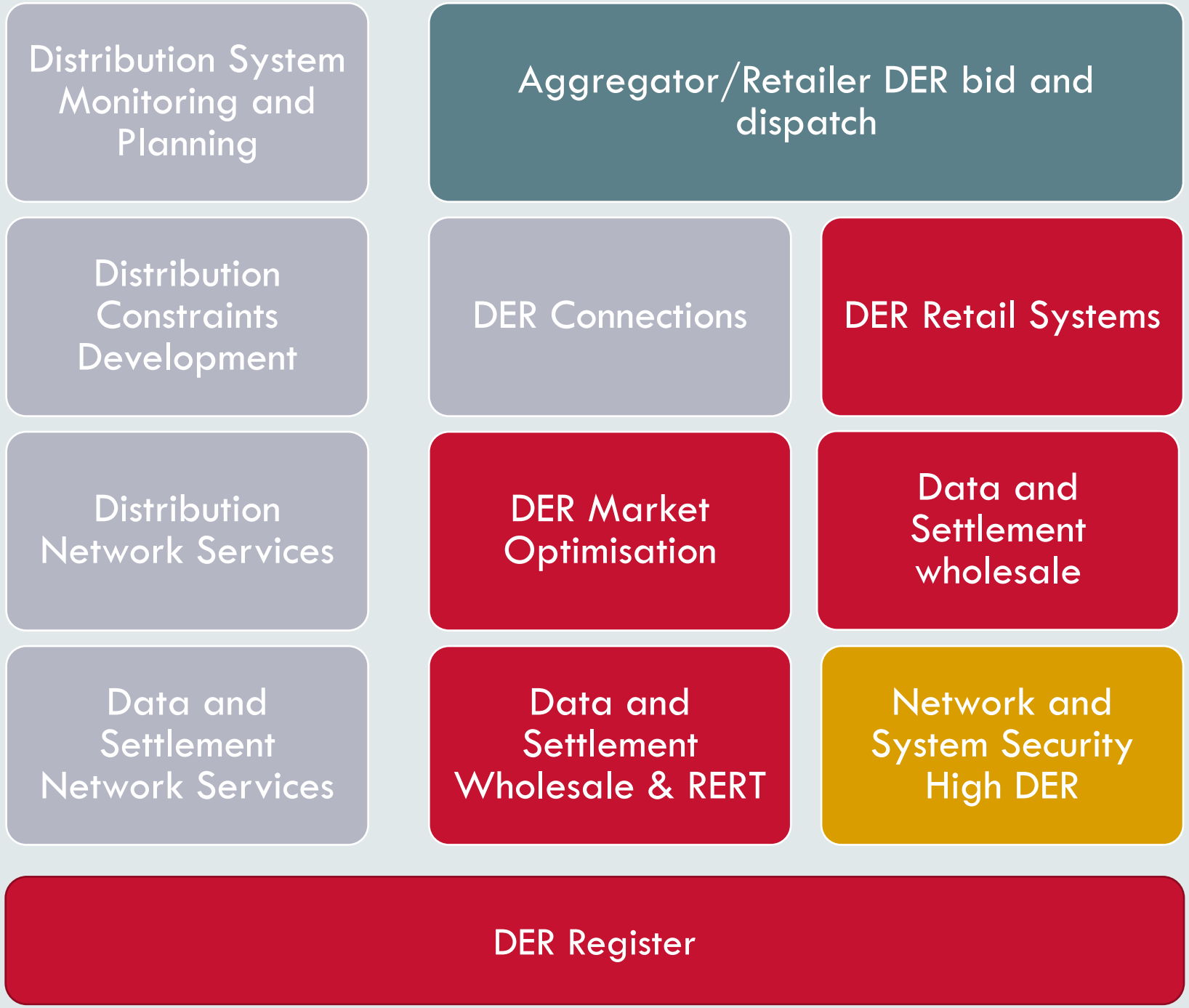
Open Energy Networks

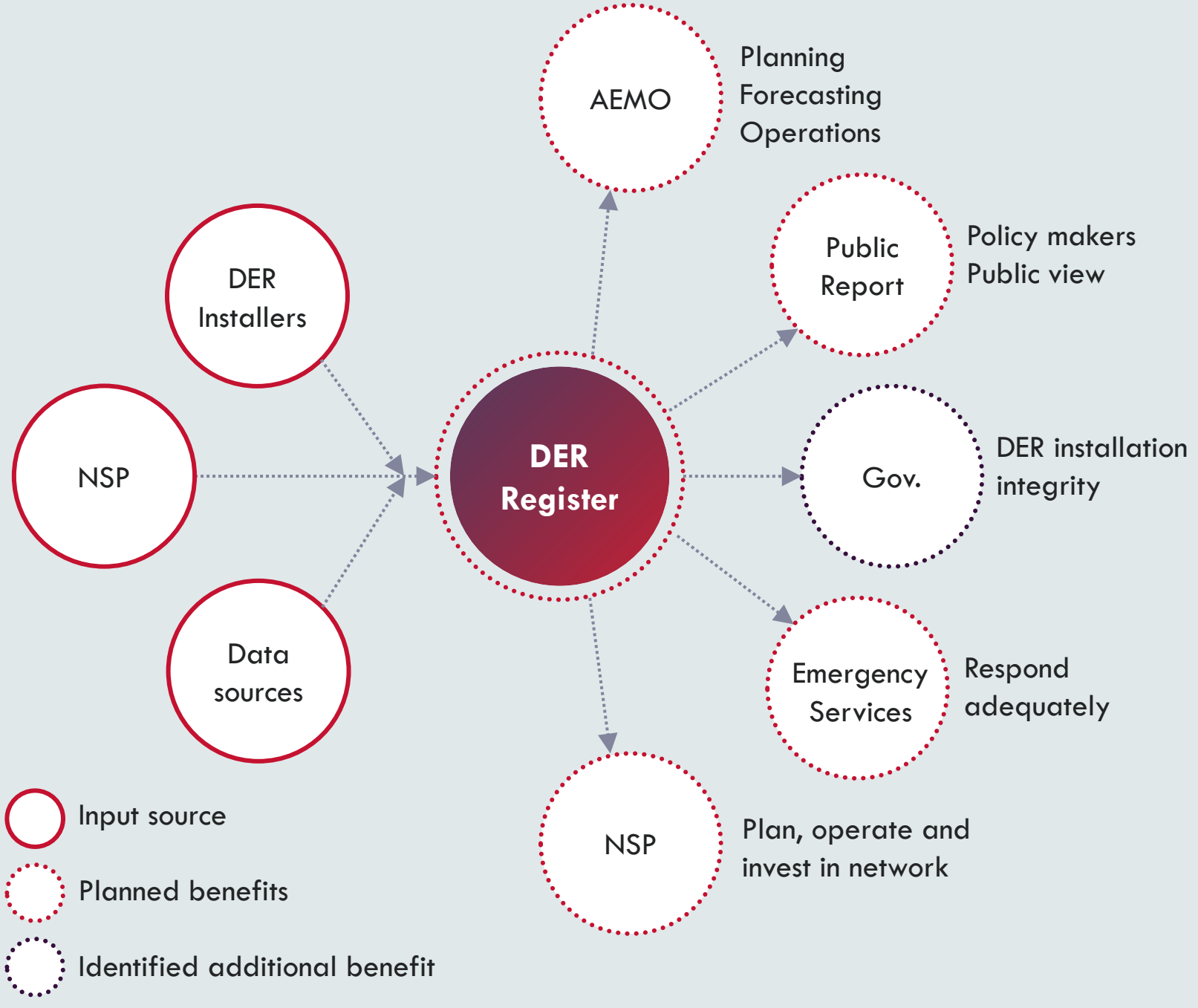
Distributed Energy Market Functions



DER Register

A national database of DER assets to enable the realisation of consumer value and enhance power system reliability via DER installed in homes and businesses across Australia

Implemented and operational from December 1 2019



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Technical integration: standards and protocols

DER Standards & APIs (ie data)

Stage 1 - 2020/21

- Advanced grid support modes (autonomous grid interaction)
- Disturbance ride-though
- Compliance

→ System Security

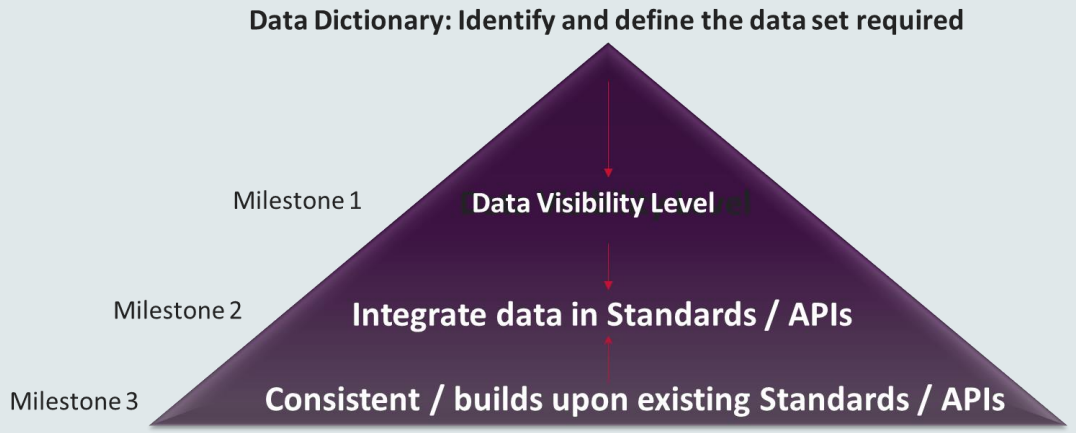
Stage 2 – Later 2020/21

- Cyber
- Interoperability = API Standard = data definition
- In-built demand response modes
- (dispatchability)
- Demand response capabilities defined
- EVs

→ DER FLEXIBILITY
- Dispatchability
- System Services
- VPPs

New markets Consumer services

Stages 1 & 2 Commenced in parallel: Delivery timeframes deliberately designed



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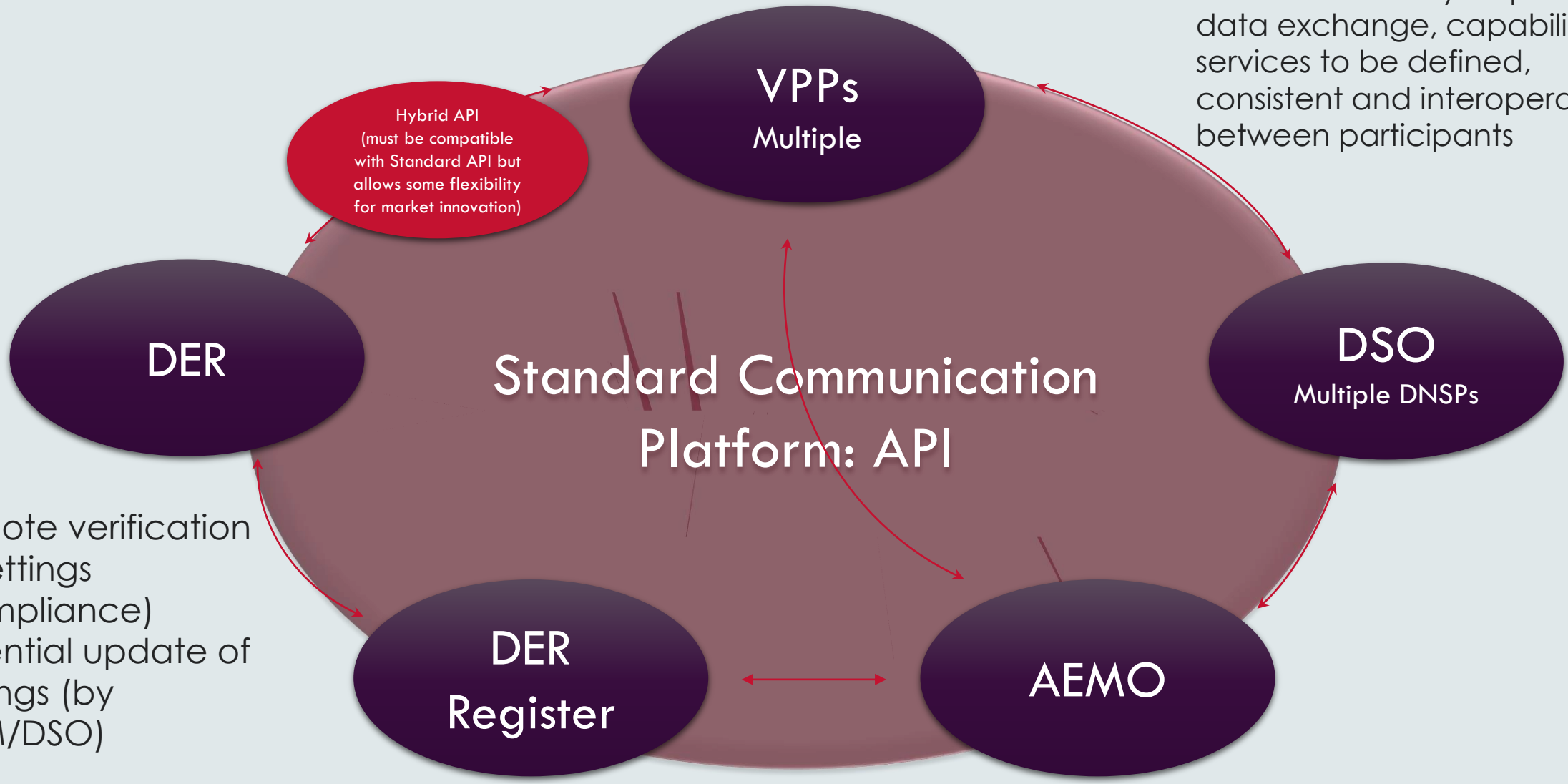
Technical integration: interoperability across the market

Such functionality requires DER data exchange, capabilities & services to be defined, consistent and interoperable between participants



Remote verification of settings (compliance)
Potential update of settings (by OEM/DSO)

Interoperability across the market

Business Layer eg. VPPs delivering consumer services

- Business models, energy services and regulatory requirements.

Capability Layer eg. AS 4777/55

- The capabilities required to deliver the **Business** needs, such as dispatchability and FCAS response. Software design.

Information / Data Layer – delivered via an API

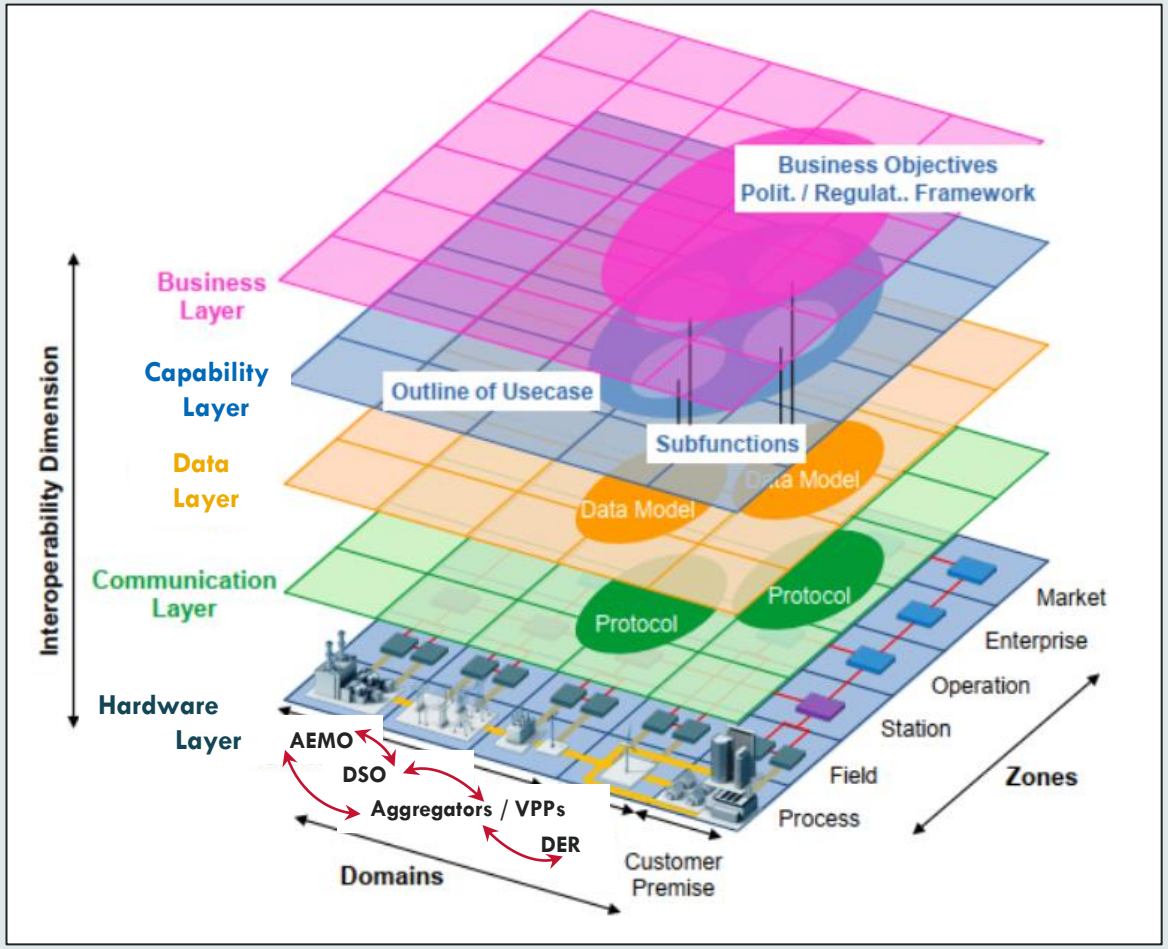
- *What* data is being exchanged to fulfil **Capabilities** and be exchanged by **Communication**. Software design.

Communication Layer

- Protocols and mechanisms, including cyber, for *how* data is being exchanged between **Hardware**. Software design.

Hardware Layer – Incl. comms. hardware

- Physical power system, market participant systems, DER and ICT hardware delivering **Capabilities**, hosting **Data** and the means of **Communication**.



Demand response mechanism – third party access

What demand response happens now in the wholesale market?

Big energy users are able to turn down, turn off or move their energy use to later. Consumers can change how much energy they demand in many ways including signing up for a time-of-use tariff that encourages lighter loads during peak times.

Providing wholesale demand response has been difficult to date because consumers need to be technically equipped to respond (e.g. advanced metering and control over consumption), as well as needing a 'signal' to respond to. Most consumers elect to not respond to wholesale prices themselves, and instead a retailer typically manages these price signals on their behalf. Not all consumers have access to demand response.

As the sector continues to transform, we are increasingly seeing more variability, not only on the supply side (with more weather dependent generation), but also on the demand side. Increases in solar PV, the uptake of batteries and electric vehicles, will increase the need for more information to be provided by the demand side.

What will change if the proposed rule is made?

Opening up the market

Consumers would be more easily rewarded for choosing to turn down or turn off their electricity at peak times. Consumers would negotiate what they get paid directly with their retailer or the third party.

Under the proposed mechanism these third parties, demand response service providers, could then sell demand reductions into the wholesale market as a supply-side resource. They would operate in a similar way to scheduled generators and be able to set lower wholesale prices.

Valuing wholesale demand response

The value of 'demand response' would be determined against a baseline quantity to be set by the market operator. Because it is impossible to know exactly what energy would have been used at any given time, the baseline quantity must be estimated.

The framework under the draft rule makes AEMO responsible for determining the baseline, which provides greater certainty while also allowing for innovative approaches to be developed over time.

In time, technology will allow us to outgrow the need for baselines and move to an authentic two-sided market.

Issues for consultation

The draft rule released for consultation seeks to minimise implementation costs

AIMS	Avoid increased costs associated with retailer billing systems	Avoid disruption to existing AEMO settlement systems (and associated costs)	Avoid imposing risks on retailers which may lead to increased charges	Maintain consumer protections for small customers (households and small business)	Recommending more to complement the mechanism
APPROACH	Allow retailers to continue billing customers based on actual consumption	Timing implementation to occur progressively until after changes to allow for 5-minute settlement are finalised	By establishing a centralised benchmark and associated compliance regimes	No change to retail rules until a comprehensive review of the appropriate energy-specific consumer protections	AEMC to review interaction between wholesale price settings and demand response. Retailers to facilitate demand response through Energy Charter. AER updating comparison website Energy Made Easy.

Next steps

NOW UNTIL 12 SEPTEMBER consultation › 14 NOVEMBER final rule › JUNE 2020 review of NECF complete › MARCH 2021 DSP portal › JULY 2021 five-minute settlement commences › JULY 2022 final implementation

Pilot program

Objectives:

Inform evidence-based policy, regulatory and operational process changes through innovative real-world trials

Phase 1
VPP Demonstrations

- Retailer led (current)
- Non-scheduled, but submit operational forecasts and actual performance data
- Operate for retail strategy only
- Consumers can only engage with retailers

Phase 2
AEMO/ARENA DR Trial

- NSW, VIC, SA
- All business models – C&I, aggregator
- Strategic reserve
- Consumers can also engage with aggregators

Phase 3 – Australian Distributed Market Trials

- Local & regional competition
- Much higher visibility of distribution networks & resources, through local market optimsation
- Max system efficiency through 2-stage optimisation - considers local network constraints, then co-optimises with NEMDE
- Multiple Trading Relationships

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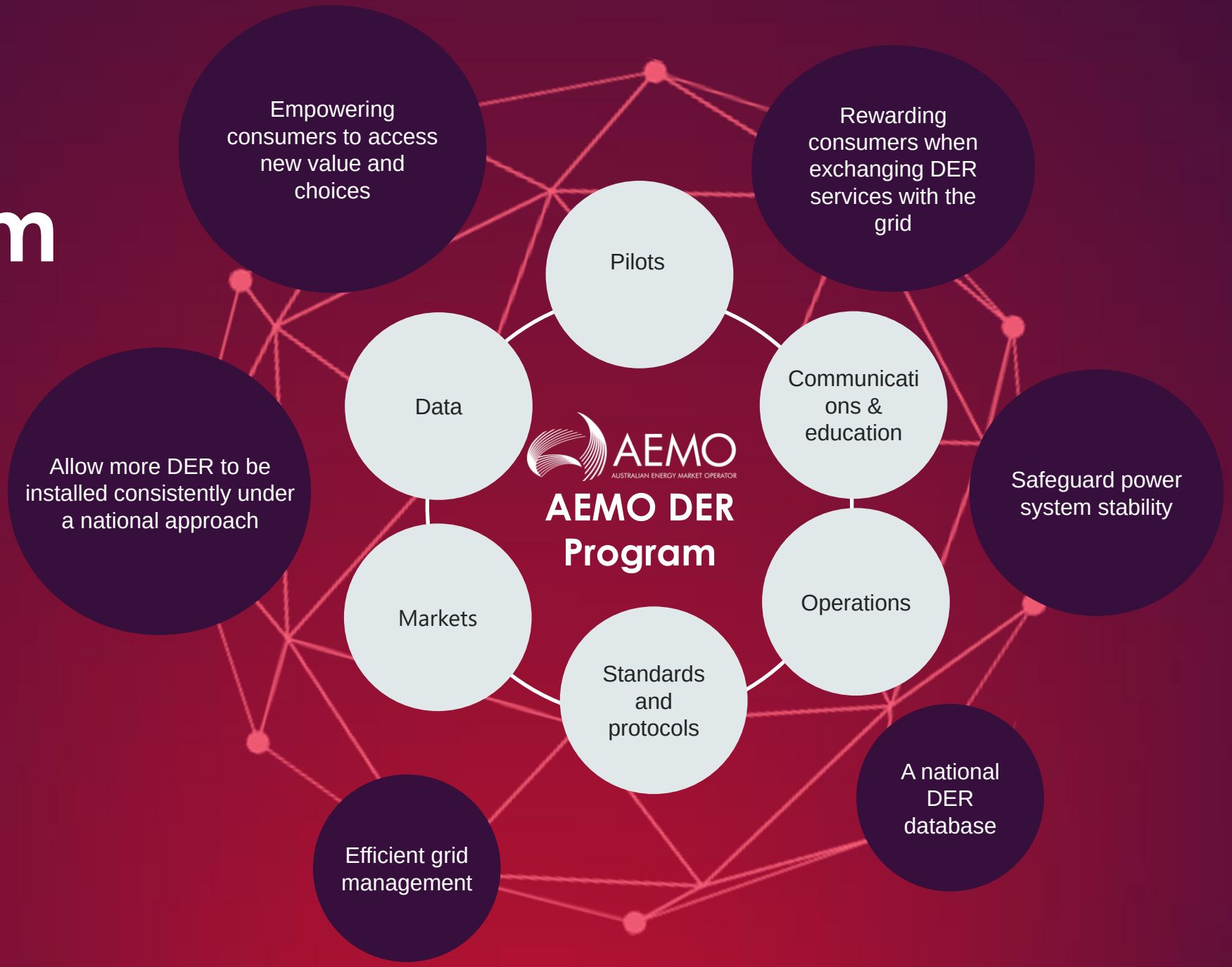
DER Program



Projects

Consumer benefits