

# ENERGY SECURITY BOARD

## POST 2025 FUTURE MARKET PROGRAM

DER INTEGRATION – ‘OPEN MIC’ SESSION

28 JULY 2020





## IMPORTANT NOTES

These slides are solely for workshop purposes only. The content provides general information to support informed stakeholder engagement and feedback.

The presentation does not represent the official position of the Energy Security Board or any related body.

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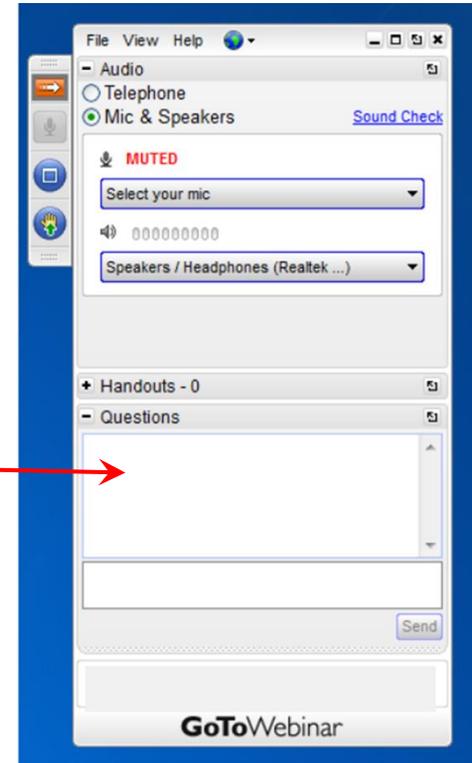
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## WEBINAR-WORKSHOP LOGISTICS

- All participants are currently in listen-only mode
- We will pause periodically for discussion. Please use the **Raised Hand** to signal that you would like to speak. 
- If you would like to record a comment without discussion, feel free to type it into this field. 

The webinar is being recorded and a link to the recording will be provided after the webinar.





## AGENDA / FORMAT

1. Recap and open discussion of KPMG/ITP final report
2. Recap and open discussion of DER Strategy
3. Other discussion



## KPMG/ITP FINAL REPORT – DER INTEGRATION RECOMMENDATIONS AND ISSUES

- KPMG/ITP final report makes recommendations to each MDI on DER integration:
  - Two-sided Markets & Essential System Services most relevant to DER
  - Scheduling & Ahead Markets next most relevant (although instances when DER is very relevant e.g. TGE)

### MARKET DESIGN INITIATIVES

A. Resource Adequacy Mechanisms

B. Aging Thermal Generation Exit Strategy

C. Essential System Services

D. Scheduling & Ahead Markets

E. Two-sided Markets

**F. DER Integration**

G. CoGaTI



## KPMG/ITP FINAL REPORT – DER INTEGRATION RECOMMENDATIONS AND ISSUES

- Key Issues Identified:
  1. DER Uptake and Functionality
  2. Technical requirements (off-market) v. Market incentives (on-market)
  3. Optimisation DER Participation
  4. Co-optimisation (Customer, Aggregator, DNSP, AEMO)
  5. Alignment of Financial Incentive
  6. Appropriate Sequencing of changes required for efficient DER integration (attached PDF)
  7. Distribution Level Markets



## DER INTEGRATION STRATEGY: ESB DER STEERING COMMITTEE

Objective	Outcomes	Dimensions	Priority work areas	
To optimise the benefits of DER for all electricity system users	To support a secure and reliable electricity system	Technical integration	Device, comms, cyber and data standards	
			New governance arrangements for DER standards	
			Improving DNSP systems to integrate DER	Improve LV network/connection point visibility
				Implement dynamic operating envelopes
	To support improved distribution network management	Regulatory integration	Incorporate DER into T&D planning	
			Consider modular networks	
			Enhance DNSP requirements for DER integration and network revenue regulation to optimise use of DER	
			Accelerate tariff reform and consider future pricing	
	To unlock the value of DER services	Market integration	Incorporate DER in p2025 market design	Define aggregators and market participants, consider MTR
				Enable value-stacking of DER services
				Consider non-financial motivations
			Pilot DER for network services, wholesale, FCAS/ESS and via local markets	

- DER Steerco have drafted a DER strategy
- This document will be published to accompany P2025 August report
- Focus on Technical and Regulatory changes in parallel to Market integration
- Customer Engagement is vital (all system users)



RENEWABLES  
**Implications of Distributed Energy  
Resources for the post-2025 market  
design project**

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**MDI Focus Group meeting**

**Tues 21 July 2020**



# POINTS FOR DISCUSSION



- Scope of engagement
- Approach and deliverables
- Relative importance of MDIs/DER
- Key Issues

- The Energy Security Board (ESB) DER Integration DMI is evaluating the implications of the uptake and operation of DER for the different Market Design Initiatives (MDIs) under the Post-2025 work plan.
- ITP/KPMG have been asked to provide perspectives on how DER is being considered by the MDIs and the possible implications for DER operation and integration under the reform options being considered.
- Our scope is considering:
  - How will the uptake of DER impact on the Post 2025 reforms?
  - Will the Post 2025 reforms better enable or put up barriers to DER uptake and value creation?
  - Are there any interdependencies related to DER across the initiatives?
- The implications for DER will depend on the detail design of this reform initiatives –which is currently being developed. Hence our observations are based more on the conceptual level and are subject to change

- 1. Briefing Paper** – provided a summary of current landscape for DER including activities, trials and changes being progressed to support DER integration plus initial thoughts on how the DER relates to each of the Post 2025 MDI
- 2. Interviews** with each MDI teams
- 3. Interim Report** on our observations and our initial advice to the ESB DER Steering Committee
  - 1.** Included a section circulated to the MDIs that summarised the outcomes from the meetings
- 4. Final Report** built on the Interim Report with
  - 1.** A summary of the relative importance of DER to each of the MDIs and vice versa
  - 2.** A prioritisation framework to identify particular DER issues most relevant to P2025
  - 3.** A discussion of key considerations identified using the prioritisation framework

# RELATIVE IMPORTANCE



MDI	Consumers		LV network		Technologies		Commercial		Regulatory	
Resource Adequacy Mechanisms	0	2	0	1	2	3	2	2	0	2
Thermal Generation Exit Strategy	0	2	0	1	2	4	2	3	0	2
Essential System Services	0	4	2	4	3	4	3	4	1	4
Scheduling & Ahead Markets	0	3	1	2	3	2	3	2	1	2
Two-sided markets	0	5	2	4	3	5	3	5	3	3
COGATI	0	2	0	1	1	2	1	2	0	2

# RELATIVE IMPORTANCE - 2



- 2SM and ESS most relevant to DER, followed by SAM, although particular instances when DER is very relevant e.g. TGE
- The first column for Consumers does not mean that the MDIs are not important for consumers, it means that they don't affect the fundamental drivers that influence consumers' decisions
- In general, DER is more important to the MDIs than the MDIs are to DER's uptake and operation, although fairly similar in the technical and commercial categories
- The technical and commercial categories are most to the MDIs, although the actions of consumers and the fact that DER is located on the LV network are important determinants of how DER engages with the MDIs, particularly the 2SM, ESS and SAMs

- DER uptake will continue irrespective of any market reforms. How much of DER capability can be accessed by markets (“active/able to be scheduled DER”)?
  - Depends on rate of uptake of different technologies, their capabilities, and the degree to which customers are both able and willing to participate. Only a small proportion of customers currently could be considered really responsive DER and, based on AEMO projections, only around 8% will be by 2030.
  - However, there is some circularity: in that the MDI outcomes and the development of aggregators could help drive more DER uptake, as could step changes in costs (batteries, EVs), favourable government policy etc
- Has implications for:
  - The timeline of progression of the MDIs, especially the progression of stages within SAM, ESS and 2SM
  - Has implications for the financial viability of aggregators forming around what may be a relatively small market, especially if value stacking is required
  - The degree to which retailers are left ‘carrying the can’ (if aggregators are sparse)

- The balance between ‘off-market’ and ‘on-market’ actions is crucial. Improved technical capabilities of, and requirements placed on, DER will (i) better enable it to participate in MDI mechanisms, and (ii) better enable it to provide power quality support independent on any such on-market drivers
- On-market approaches should be used where possible as they should be least-cost
- However, some functionalities will be mandated from a power quality/safety perspective
- Competition
  - Advanced inverters could provide frequency control (competes with ESS)
  - Batteries in load-following mode could reduce spot process
  - Increased visibility and forecastability could reduce the need for Ahead markets
  - Operational envelopes could be used to address minimum demand issues
- Consequences
  - This results in an interesting dynamic that could create uncertainty for market players such as aggregators who may not want to enter the market. Particularly relevant where value stacking is required for financial viability.
  - Should off-market provision of power quality services be financially compensated, achievable in practice?

- Need an appropriate framework for DER participation in P2025 markets i.e. the rules regarding eligibility to participate, calculation of payments and compliance
  - Need to ensure consistency of treatment for DER in these arrangements across the MDIs
  - What is the appropriate approach to define compliance arrangements for DER under the market design
  - The technical ability to respond to real time market-based signals may be more limited for DER than for other resources,
  - DER aggregators would need to contract with more DER capacity than necessary to manage diversity and availability issues, including any network constraints,
  - There could be merit in having DER operate under different time-frames for bidding and re-nominations under the ahead markets, and
  - Any financial penalty regime may unfavourably impact on DER participation more so than centralised generation

- Multiple layers of co-optimisation: customer, DNSP, aggregator and wholesale
- Is critical and is more complicated for local resources than for centralised generation
  - Who is ultimately responsible from the P2025 point of view?
  - The aggregator that solves and deploys its resources in response to price signals?
  - The system operator deciding how best to deploy the capability across the multiple markets in each time interval?
- Is dependent on
  - the contractual framework under-pinning the various compensation channels,
  - the congruency of the financial incentives,
  - customers' willingness and understanding,
  - information flows to enable correct and immediate evaluation of trade-offs, and
  - investment in IT systems to enable co-optimisation at the customer level
- Three key areas
  - Will the market designs provide customers/aggregators with sufficient information to facilitate co-optimisation?
  - Are there any barriers to the other enablers of optimisation?
  - Is there is merit in establishing a formal ability for the system operator to take a more active in solving the co-optimisation for customers?

- Consistency and alignment of financial incentives across the P2025 designs is critical
- However, the design of the financial incentive – either by price signal or other procurement mechanisms – will likely differ across markets
- This will be important to foster the investment in the supporting architecture
- Need to consider
  - how different designs impact on DER participation both from the consumer and aggregator perspectives
  - how collectively all the different price signals under the various markets would work together and reinforce each other in a manner which promotes market efficiency
- Compensation payments can differ according to:
  - Time period, in advance, in real time or ex-post
  - Resource value calculated: on a market clearing approach or an administrative approach
- Other issues:
  - There may be a need for multiple back to back contracts
  - Ex-ante payment could disadvantage DER give the dependency on multiple consumer decisions

- Appropriate sequencing of P2025 reforms from DER's perspective
- Needs to consider how the MDI reform affects DER and vice versa
- DER least relevant to COGATI, TGE, RAM and SAM
  - DER can affect the aggregated load profiles as seen by these MDIs but wouldn't materially impact on their sequencing
  - DER unlikely to be able to materially offer services to these MDIs for some time
- DER more relevant to 2SM and ESS
  - Important that the progression of stages within these MDIs takes into account the likely rate of uptake, functionality and participation on DER in market reforms
  - This includes the flexibility to allow for possible game changers such as step changes in costs (batteries, EVs), favourable government policy etc.
- Important to signal the sequencing of the full spectrum of value propositions for DER across multiple markets
  - Is required for aggregators to see a credible pathway of market reform

- Potential Impact of distribution-level markets and dependencies at the local level for market participation – increases complexity for DER integration into markets
- What are distribution level markets???
  - LET between customers or with a community battery?
  - A VPP with the DNDSP to provide local network support?
  - Trading of excess network capacities?
  - Nested markets, which feed into wholesale markets?
- A clear need to have a generally agreed working definition, as this affects questions like
  - Will they result in local settlement of transactions outside the wholesale markets, or will they feed transactions into the wholesale markets?
  - Will they increase or decrease visibility for AEMO and its ability to influence the operation of distribution-level assets to achieve system-wide goals?
  - Will they decrease or increase overall complexity of market design, and how will they interface with the outcomes of the MDIs?

- P2025 August consultation paper
  - Observations from interviews conducted by ITP/KPMG has been circulated to all other MDIs – it is expected that the advice/observations will be incorporated in the MDIs drafting of the consultation paper
- DER integration issues prioritisation framework
  - ITP/KPMG are preparing a prioritisation framework – for assessing issues that came out of MDI interviews
  - Issues will be assessed against a set of criteria to determine their importance to P2025 reforms
  - For issues that need attention, a timeframe for action will be assigned
- ESB DER integration strategy
  - The ESB DER Integration Steering Committee will prepare a separate paper that will accompany the P2025 August consultation paper
  - The paper will cover the ESB's integration strategy and future workplan – across all aspects of integration
- Open mic Q&A
  - Next Tuesday – 28 July 3.30pm – 5.00pm

# DER Integration

Technical Focus Group

JULY MEETING





# Agenda: Draft DER strategy paper outline

- Vision and objectives
- Technical integration
- Regulatory integration
- Market integration
- Resulting priority work areas
- ‘Critical path’ activities and timeline

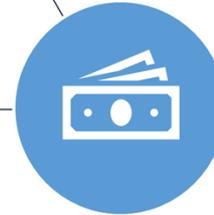
## Regulatory and planning challenges

Include ringfencing regulation and integrated planning to optimise the benefits of DER integration



## Technical and operational challenges

For system security and distribution network reliability, including DER visibility and standards – which potentially limit or reduce the value of DER for prosumers and consumers



## Market and business model challenges

Electricity markets and DNSP business models need to be updated to support the benefits and minimise the costs of DER integration for all consumers



# Objective, outcomes and dimensions of DER integration

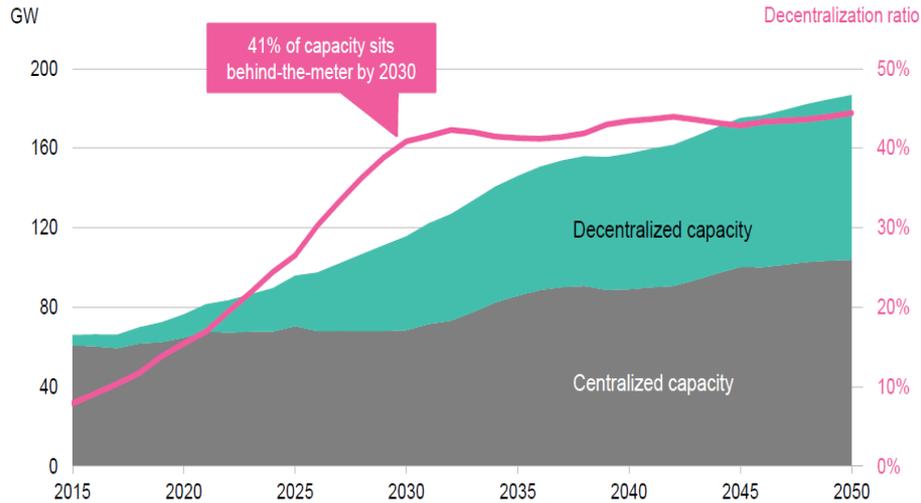
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			New governance arrangements for DER standards	
			Improving DNSP systems to integrate DER	Improve LV network/connection point visibility
				Implement dynamic operating envelopes
	To support improved <b>distribution network management</b>	<b>Regulatory integration</b>	Incorporate DER into T&D planning	
			Consider modular networks	
			Enhance DNSP requirements for DER integration and network revenue regulation to optimise use of DER	
	To unlock the <b>value of DER services</b>	<b>Market integration</b>	Accelerate tariff reform and consider future pricing	
			Incorporate DER in p2025 market design	Define aggregators and market participants, consider MTR
				Enable value-stacking of DER services
		Consider non-financial motivations		
		Pilot DER for network services, wholesale, FCAS/ESS and via local markets		

DER capability can offer value throughout the electricity supply chain. DER benefits should flow to all consumers, both those with and without DER.

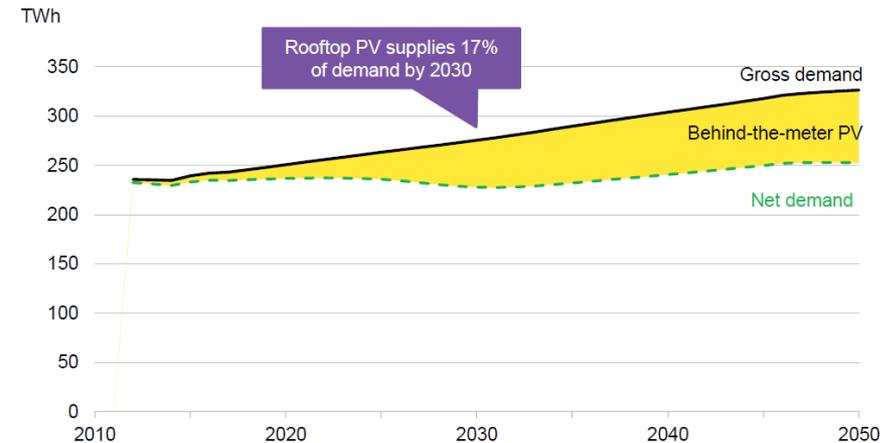


# DER will fundamentally change the electricity system

Installed capacity in Australia, centralized vs decentralized



Electricity demand in Australia



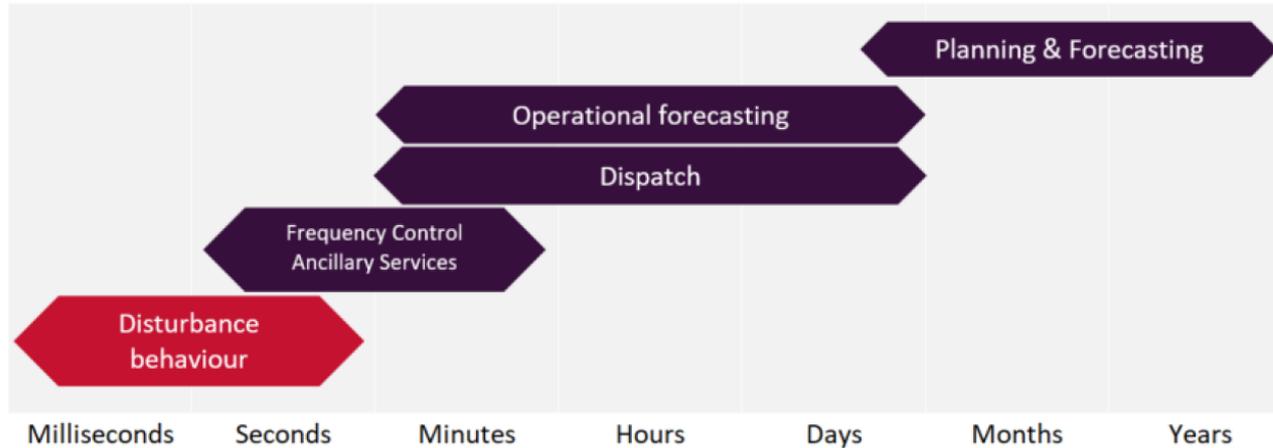
Source: BloombergNEF, [2018 Australia Behind-the-Meter PV and Storage Forecast](#), May 2018.



# Technical integration

AEMO's priority is ensuring DER responds appropriately to disturbances but technical integration will be needed at all timescales:

Figure 4 Timescales of power system operating elements, applicable to DER





# Technical challenges to system security and operations

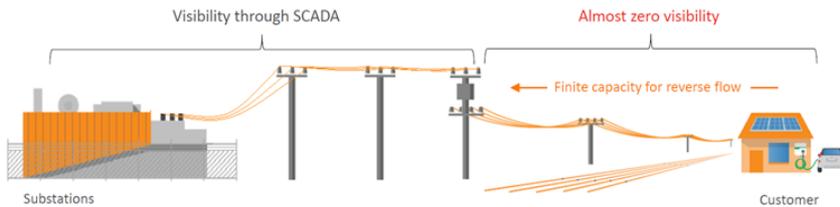
- The most immediate challenge is DER response during system disturbances, especially voltage disturbance ride-through
- Updates to AS4777 for inverters in 2020 – and inclusion in Rules
- Governance of Technical Standards:
  - Current arrangements not fit-for-purpose
  - Need leadership and coordination, greater speed and flexibility given the pace of change

Standards, Data and Interoperability Working Group		
DER and Performance Standards	APIs and Data Standards	Cyber Security
- Updates to device standards incl. AS4777 and AS4755. Review minimum performance standards for DER and Compliance methods. Liaise with Standards Australia.	- Develop a set of common methods for the use of APIs (incl IEEE 1547 and 2030) and data communication for trials and recommend new standards.	- Work with the Australia Cyber Centre and stakeholders to determine set of cyber security standards and compliance frameworks for DER devices and communication



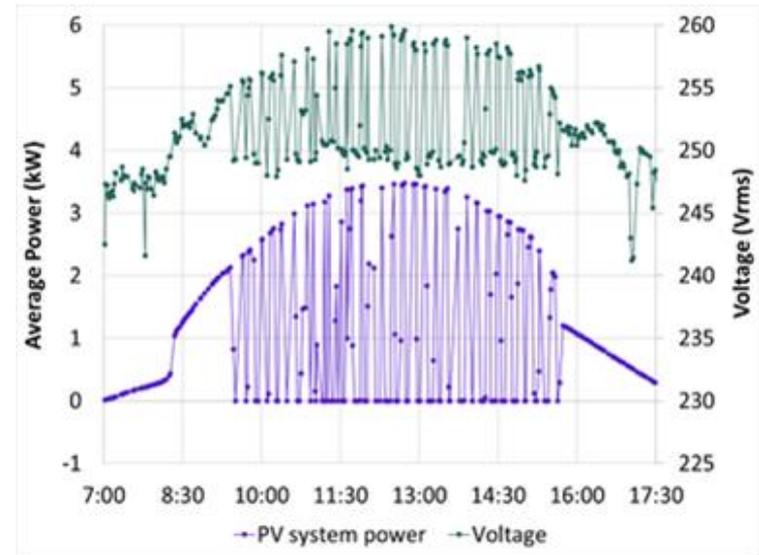
# Technical challenges to distribution network operations

- Need greater levels of network visibility
- Need communication/interoperability standards and protocols
- Together with the development of dynamic 'operating envelopes' providing signals as to when DER can't feed into the grid due to technical constraints



Source: SA Power Networks (2019)

Example site indicating link between PV curtailment and voltage



Source: UNSW LV Voltage report for ESB



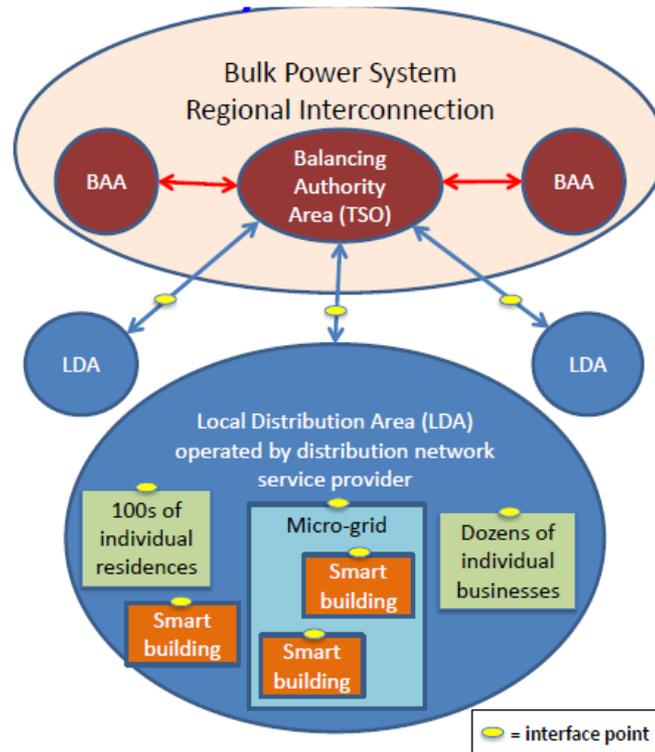
# Technical integration priorities

- Device, comms, cyber and data standards
- New governance arrangements for DER standards
- Improving LV network visibility
- Improving DNSP systems to integrate DER
- Dynamic operating envelopes
- Incorporation of DER into T&D planning



# Regulatory and pricing challenges

The need for 'grid architecture' and clear functional responsibilities

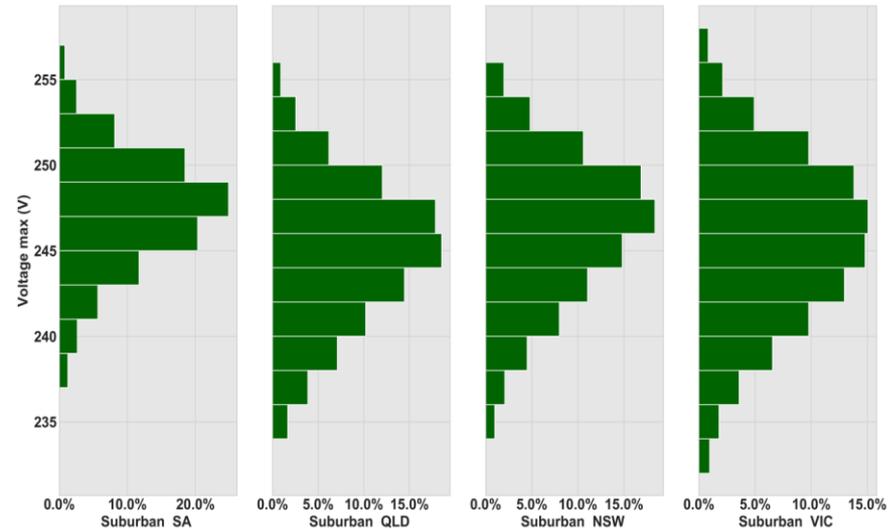


Source: Lorenzo Kristov



# Location changes to the supply/demand curve

- Note important existing technical challenge to DER exports: Across the NEM LV network voltage is currently sitting at high average levels and with a broad range of minimum to maximum voltage at many points
- DER exports can exacerbate this existing issue
- Need visibility and more dynamic ‘smarter’ network management
- However, DNSPs currently don’t have clear responsibilities or clear remuneration for DER integration under the rules



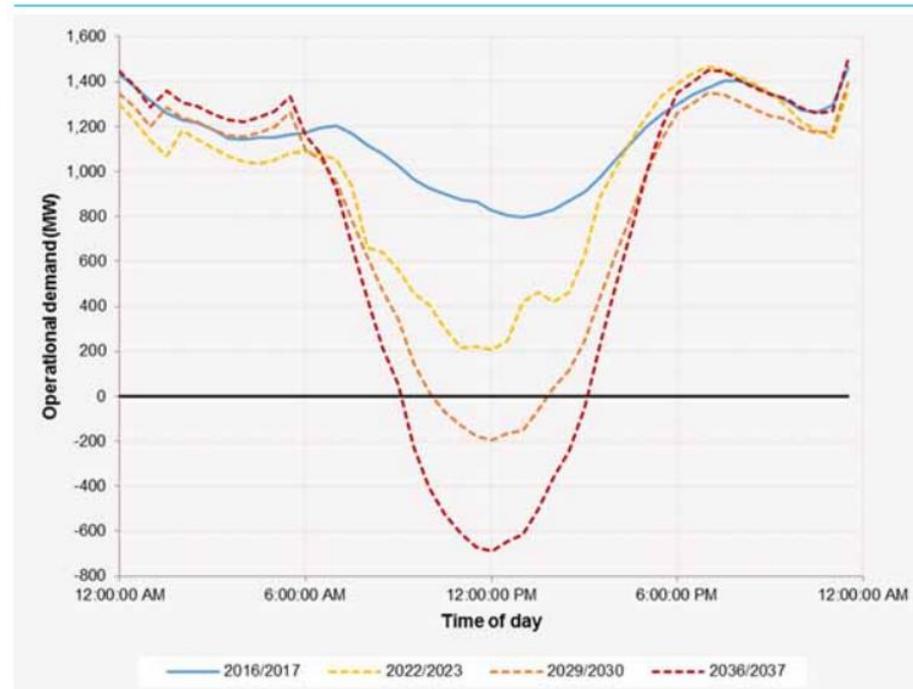
Source: UNSW LV Voltage report for ESB



# Time of day changes to the supply/demand curve

Technical, regulatory and market challenges:

- Negative minimum demand – impacts system security and pricing  
(SA in particular)
- Increased ramp rates  
(due to large and small scale PV)



Source: AEMO.



# DER can provide network services

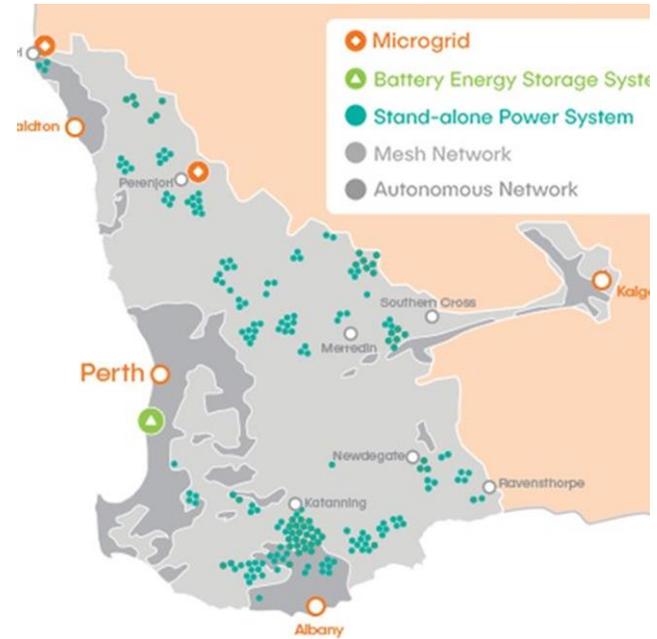
- DER can provide 'non-network alternatives' including:
- Network extension
  - Network augmentation
  - Network replacement
  - Network operation – especially voltage management, also thermal constraint/reverse flows management – some of which may be exacerbated by DER itself
  - Managing bushfire risk from lines (including allowing areas to stay powered even if a line has to be de-energised)
- Potential to move from static to dynamic 'network services markets' – will require significant changes to DNSP planning, operation and revenue
  - Need to consider potential within the Economic Regulatory Framework (ENERF review)



# DER can support a move to modular networks?

Contested future in the NEM but

Western Power is moving to a 'modular network':  
underground in high density areas, above ground  
in suburban settings and SAPs/microgrids in low  
density areas





# Regulatory integration priorities

- Enhance DNSP requirements for DER integration and network revenue regulation to optimise use of DER, including for network services where appropriate
- Accelerate tariff reforms and consider future pricing changes
- Consider modular networks and implications on revenue regulation
- Ensure integrated T&D planning

## Reform Package Components

### COMPONENT 1: UPDATE FRAMEWORK

#### No regrets foundations for future reforms

- Regulatory framework should reflect changing use of grid and consumer expectations
- Promote role of distribution networks as a trading platform for multiple services
- Update regulatory framework and re-align network incentives and obligations
- Strengthen access rights, greater transparency of network constraints to inform DER investments
- Foundational for considering how costs should be allocated and whether cost reflective pricing would promote NEO - now and for future models

### COMPONENT 2: EFFICIENT INVESTMENT SIGNALS

#### Flexibility to adapt to changing preferences

- Consumption only pricing arrangements may not provide sufficient flexibility for the future system
- Support customer choice and provide regulatory tools to meet different circumstances
- Export charges potentially useful tool to promote efficiency and equity objectives, but contentious
- Implementation could be complicated, trade-offs need to be considered
- AEMC can undertake targeted consultation on these more contentious issues, building on DEIP process

### COMPONENT 3: FUTURE PRICING MODELS

#### Full integration of DER into energy system

- Future energy services bought and sold in more dynamic way, responding to consumer preferences and price signals
- Networks facilitate customers' access to different energy markets and services
- Future pricing arrangements should send efficient signals so DER services deliver the most value to energy system at any point in time, and reward supportive behaviours
- Moving towards a 'two-way pricing' model is a significant transition, possibly requiring initial network investments
- These reform considerations need to be staged, and outcomes of ESB Post-2025 market design program will need to be taken into consideration

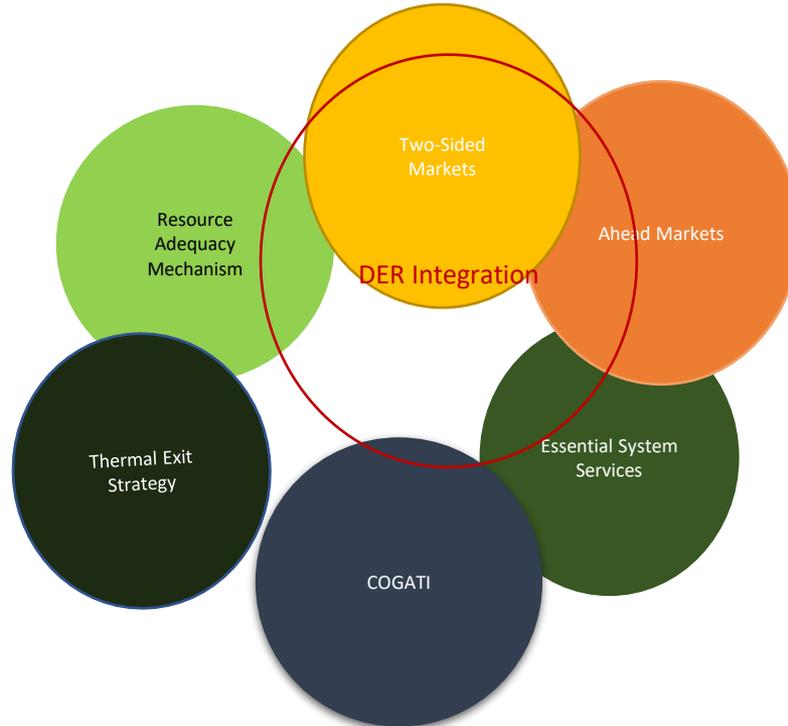
DEIP

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# Market integration

The need for integration across post-2025 workstreams – including the market infrastructure





# DER market integration: system and infrastructure considerations

Major changes needed to AEMO market design and operations:

- Forecasting, Metering, Scheduling, Dispatch, SCADA (etc) requirements to enable DER to become active in the wholesale and ESS markets

Major infrastructure requirements to enable market participation:

- Clear communications, data and interoperability standards and protocols
- Network monitoring, SCADA, constraint development and communication
- Visibility at the consumer connection point for aggregators/retailers
- Aggregator and retailer comms and changes to billing systems
- 'Platform' infrastructure for bidding (VPPs already being trialled on a small scale but will need work to scale and trade across multiple markets/procurement)



# Consumer considerations in market integration

Need to incentivise each DER owner to stay on-market (not to leave the grid), so that the benefits of their investment can be shared with the broader market

Need participation models that make it simple for DER to provide services into all markets, and simple for customers to understand the value of making their DER available to the market

Expose DER to price signals to encourage the optimal DER operation

Align risks to those who are best able to manage them

Even with infrastructure and price signals, consumers may not participate:

- Social science research shows that DER owners will be more likely to respond to non-financial incentives to provide DER services - for social good reasons – but this has not been tested in practice
- Commercial offers will require value (above self-consumption) and trust
- Consumer experience will be critical to participation – need for robust consumer protections



# Other challenges for DER integration into existing and new markets

- Aggregators for DER participation in the wholesale market are not currently defined in the rules
- As the possible functionalities for Market Participants become more varied, there is likely to be a need for greater functional flexibility
- The role of the DNSP in facilitating DER integration into these markets will need further consideration and definition
- The challenge of creating a contractual model where the DER proponent can sell various DER services across multi-parties (i.e. to achieve value stacking) has not been progressed significantly to date but there is opportunity to do so in the post-2025 project

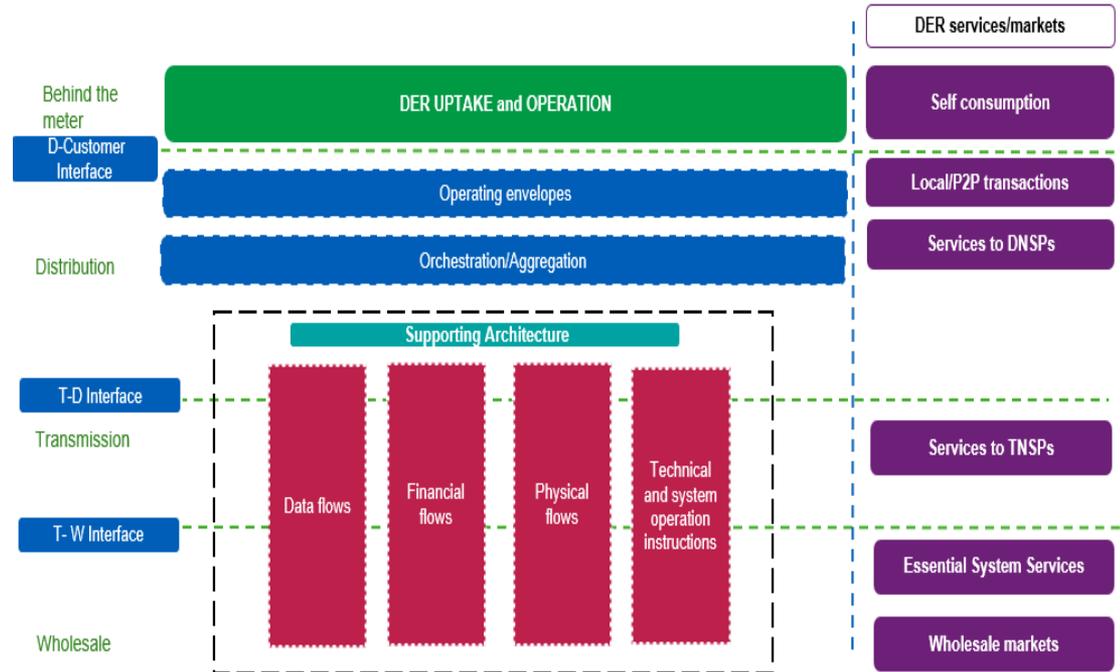
## Nested or distribution-level markets:

- The Open Energy Networks projects has left unresolved the issue of distribution-level markets and these require further exploration and definition
- Best way to resolve this is through trials



# Market integration priorities

- Incorporate DER into p2025 market design
- Define DER products and services, aggregators and market participation
- Consider MTR
- Pilot DER for wholesale, FCAS/ESS (and network services), and via distribution-level markets





# 'Critical path' actions for DER Integration

1. Technical standards rule change and new governance structure and processes
2. Reviewing network responsibilities for DER integration, revenue regulation to optimise the use of DER in distribution networks and network pricing
3. DER integration into Post2025 Market Design Initiatives, including defining DER aggregators in the Rules, MTR, understanding non-financial incentives for household DER owners
4. Design a suite of effective price signals, regulations and incentives to integrate DER into the wholesale, ESS, network services and (where appropriate) local markets/procurement mechanisms.

The aim by 2025 is:

- enable DER owners to sell DER services into wholesale, ESS and network services markets
- for DER to not cause any technical system or network operation challenges
- to have integrated transmission and distribution planning.



# DER Integration pathway

