



Distributed Energy Resources (DER) Integration Workplan
October 2019

1. Introduction

On 14-15 August 2019, the Energy Security Board (ESB) convened an invitation-only workshop facilitated by the Rocky Mountain Institute (RMI) to get input from a cross-section of stakeholders and experts across the electricity industry on key design questions Australia faces in successfully integrating Distributed Energy Resources (DER) in its electricity system. The ESB is considering these issues particularly noting the role of DER in the future and within the context of the ESB's broader post-2025 review of energy markets.

For the purposes of this paper, DER are 'resources located on the distribution system that generate, manage demand, or manage the network.' This is inclusive of, but not limited to:

- Rooftop solar
- Battery storage
- Electric vehicles and vehicle to grid services
- Solar hot water
- Other generators
- Smart appliances (e.g. air conditioning, pool pumps)
- Energy efficiency
- Small diesel
- Building electrification (e.g. heat pumps)
- Energy management systems (e.g. microgrid controllers)
- Standalone Power Systems (SAPS).

This paper presents a high-level overview of the outcomes of the August workshop and next steps. The ESB would like to thank those who contributed their time and input into the workshop. The ESB acknowledges there is substantial work currently underway in the DER space and looks forward to working with all stakeholders, in partnership with the market bodies, to take these reforms forward in a coordinated fashion.

2. Turning DER challenges into opportunities

The recently released [AEMO/ENA Open Energy Network Interim capability report](#) together with AEMO's report of April 2019 outlines challenges the [Technical Integration of Distributed Energy Resources presents](#) system operation and the distribution network management challenges that may eventuate if we do not fully optimise DER.

As outlined in those reports, DER creates two-way flows in the distribution network which can feed into the bulk system, and these new devices need to be able to 'ride through' faults on the system so as to not contribute to supply disruptions. DER can also support the management of peak demand, minimum demand, and facilitate the maintenance of power quality, should the appropriate reforms be put in place.

DER has the potential to provide several kinds of value to consumers, the distribution system, the bulk power system, and society (see Figure 1). The RMI discussed these values with some workshop participants. The values highlighted in yellow are the values that those experts agreed are being captured today. The values highlighted in green are those people interviewed expressed are important to capture in the future, including through introducing appropriate mechanisms that can enable prosumers to be compensated for the use of their DER when it is cost-effective to do so. This increases the value of DER to owners, spurring further deployment, while also lowering overall system costs.

Figure 1: DER values collated with the stakeholder extracting those values (RMI)

Customer values	Distribution system values	Bulk system values
Reduce bills	Increase hosting capacity	Provide low-cost energy
Provide energy choice	Increase planning flexibility	Provide low-cost capacity
Provide backup generation	Support voltage and frequency	Provide low-cost ancillary services
		Relieve transmission congestion
	Defer or obviate infrastructure investment needs	
	Reduce system losses	
	Provide system security and resilience	
Societal values		
Decarbonize the electric grid		
Provide jobs and workforce training		
Improve system security and resilience		

3. The ESB's objective and vision for DER integration in Australia

Working Objective

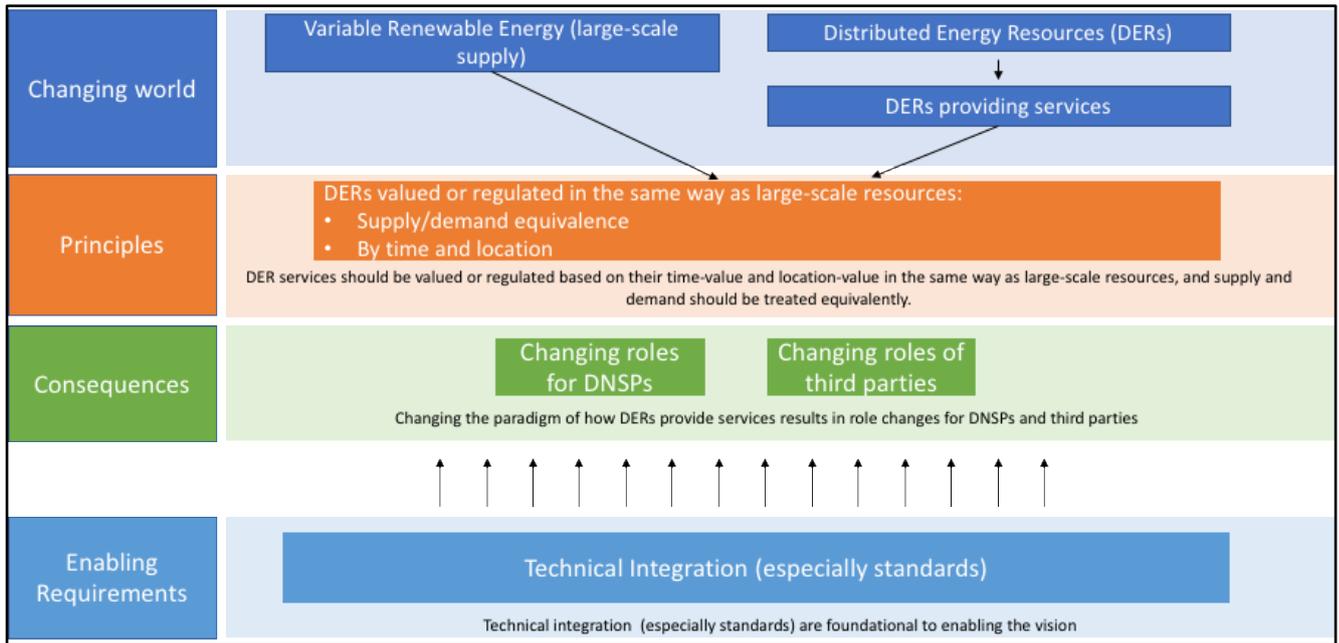
From discussion at the ESB's DER workshop, it was agreed that the overarching objective of DER integration is to **'optimise the benefits of DER investment for all Australians'**.

Note that this objective does not distinguish between benefits of DER owners (such as those with air conditioning or solar panels) or other consumers. Rather, the objective is to optimise both public and private investment in DER for the benefit of the whole electricity system and everyone who uses it.

Vision for DER integration

Figure 2 presents the ESB's vision for DER integration. Changes in the electricity system are occurring as a result of increasing support of variable renewable energy (large-scale supply) and DER. Additionally, there is the potential and opportunity for DER to provide services beyond energy (kWh) to consumers and to the grid. DER integration should be supported by the principle that services should be valued and regulated in the same way, independent of whether supply-side or demand-side resources are providing the service. Value and regulation of services should also account for their variance in time and location. As a result of changes in the principles behind the value of services, the roles of DNSPs and third parties will change. Finally, none of these changes would be possible without enabling requirements.

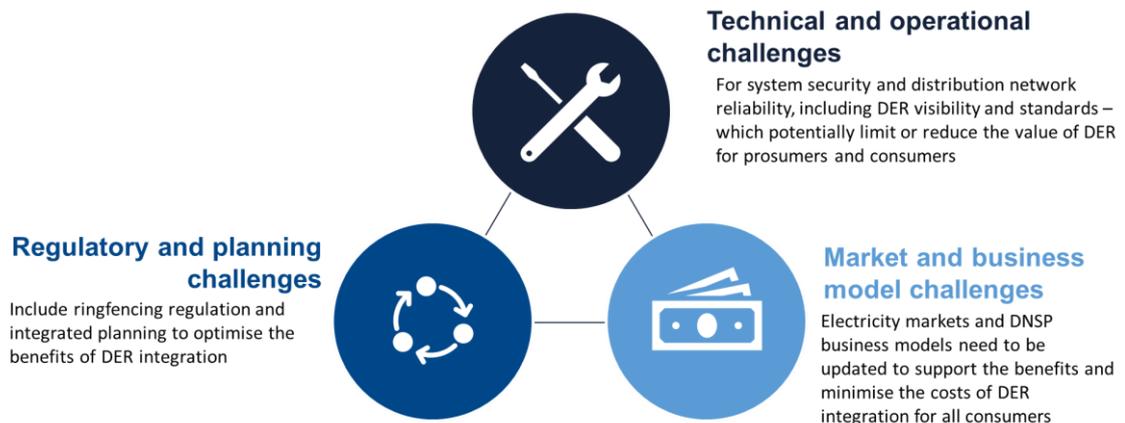
Figure 2: ESB Vision for DER integration



Defining DER integration

DER integration can be categorised into ‘technical and operational’, ‘market and business model’, and ‘regulatory and planning’ challenges and their potential solutions (as below).

Figure 3: Dimensions of DER integration



4. The ESB’s priorities for DER Integration

About this workplan

Stakeholders who attended the August workshop noted the extensive work currently underway in DER integration by various organisations. The ESB acknowledges the work to date, and notes there is a strong role for the ESB in partnership with the market bodies to take forward these important reforms. The ESB also supports the work of the Distributed Energy Integration Program (DEIP) and notes that work as part of this workplan.

The enclosed plan outlines the major activities to be progressed. The plan covers the work that the ESB will seek to coordinate and track progress on across the following areas:

Technical integration

Technical DER integration is the foundation for DER integration more broadly. The need for data for visibility of DER on a timeframe appropriate for efficient operation of the network and for planning is vital. AEMO leading much of the DER technical integration work but other organisations also have significant work programs in this area e.g. jurisdictions' battery subsidy programs are setting device requirements.

Priority activities for technical integration are:

- T1. Defining and updating device standards – especially for inverters - to support power quality, interoperability, enable system support and prosumers to access value if they choose to.
- T2. Defining and updating communication standards and protocols – as with device standards.
- T3. Connection standards - considering the need to mandate the adoption of nationally consistent connection standards to support efficient and effective integration of DER by distribution businesses.
- T4. Data requirements for DER integration – to be scoped supporting transparency in planning, markets and operations. Once this is done, methods for the collection and procurement of these services will need to be identified and pursued through rule changes.

Regulatory integration

Several areas of network regulation need amendment with the growth in the deployment of DER. There's a need to enhance planning across the Transmission-Distribution interface. As well as service provision potentially changing through the greater use of SAPS (including microgrids) to supply regional and remote consumers. Sandboxing and innovation funding are both important to support transitions to more efficient and effective service provision by distribution businesses and third parties.

Priority activities for regulatory integration are:

- R1. Planning - reviewing the National Electricity Rules (NER) for Distribution Annual Planning Reports and proposing enhancements to assist in integrating planning across the transmission/distribution interface. AEMO will also review the need to enhance the Integrated System Plan to support distribution planning, including by standardising scenarios and inputs for network planning.
- R2. Ringfencing - distribution ring-fencing guideline update to reduce uncertainty over the application of the guideline and improve the enforceability of the guideline.
- R3. Storage – review current and evolving business models for storage in distribution networks, including barriers to good economic outcomes for consumers.
- R4. Non-network alternatives - monitor distribution businesses uptake of non-network alternatives and consider further changes as needed as part of the post-2025 market design project.
- R5. Sandboxing – completed review of regulatory framework for sandboxing.

- R6. SAPS and microgrids – complete advice on third party SAPS and progress rule changes as required.
- R7 Innovation Funding – support ongoing government funding for DER integration research and development (including trials) which requires collaboration, knowledge sharing and capacity building across energy market institutions, distribution businesses, third parties and other stakeholders.

Market integration

The starting points for DER market integration are enabling a demand response mechanism and reviewing distribution network access, pricing and tariff reform which were identified by the AEMC in its 2019 Electricity network economic regulatory framework review.

Broader market design – including the potential for distribution-level markets - needs significant consideration. The AEMO/ENA Open Energy Networks process has already begun to investigate possible roles for a distribution system operator (DSO) and a distribution market operator (DMO). The post-2025 market design process will consider this and overall market design options.

Priority activities for market integration are:

- M1. Demand response mechanism – rule change determination to be completed and implemented.
- M2. Distribution network access and pricing – examine options to reform distribution access, connections and charging arrangements. Guidelines to be prepared on distribution businesses DER integration expenditure in revenue proposals.
- M3. Network tariff reform – ongoing engagement with distribution businesses on Tariff Structure Statements.
- M4. Open Energy Networks – decide on and implement a preferred approach to creating DSOs and a DMO.
- M5. Post-2025 market design – ensure DER services are incorporated into the post-2025 market design, including pricing outside markets as needed, where efficient to do so.

Other relevant DER integration reforms:

- Trials – AEMO and others are planning or undertaking a number of relevant trials, including of Virtual Power Plants (VPPs) and a distributed market place. Note: many trials are ARENA funded and some are being facilitated through the DEIP.
- Electric vehicles roadmap – this is in development through the DEIP.
- System reliability and security – rule change requests published in AEMC’s Black System Event review will be assessed to better manage the effects of increased DER.
- Consumer protection – AEMC will investigate the need to update the National Energy Consumer Framework (NECF), especially with respect to DER.

Governance and communication

The ESB’s priorities for DER Integration set out in this workplan doesn’t cover all the related work underway through energy market institutions but focuses on the most important work ESB will seek to coordinate and track progress on.

The ESB will seek to coordinate with external organisations on parts of this workplan, in particular, through the Distributed Energy Integration Program (DEIP). The energy market

institutions are working through the DEIP to deliver on a number of initiatives within the workplan. At present DEIP work packages are being refined and any additional DEIP activities will be included in future workplan updates. Given the role of the market institutions across both the DEIP and the ESB, we will look to ensure coordination and no duplication of effort.

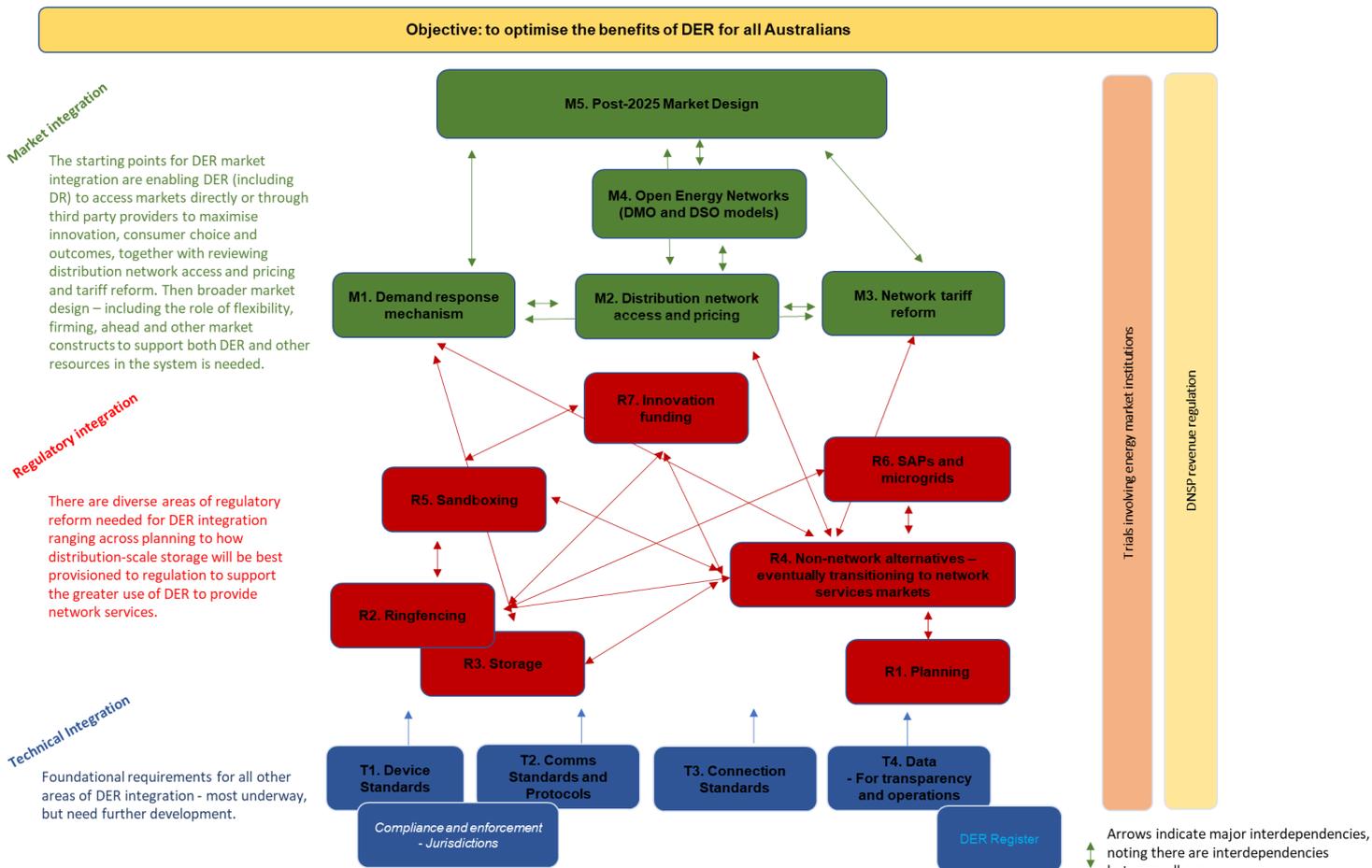
The longer-term DER market integration work will be largely undertaken through the ESB's post-2025 market design project.

The ESB will issue progress reports on the items in this workplan once every four months outlining what has been achieved against the plan, upcoming events and next steps. We will also update the workplan to include changes to existing priorities or new priorities as they emerge.

The plan on a page



DER Integration Priorities



Glossary

AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
ARENA	Australian Renewable Energy Agency
AS/NZS	A jointly developed Australian and New Zealand Standard
CEC	Clean Energy Council
DER	distributed energy resource(s)
DMO	distribution market operator
DNO	distribution network operator
DNSP	distribution network service provider
DRSP	demand response service provider
DR	demand response
DSO	distribution system operator
ENA	Energy Networks Australia
EV	electric vehicle
LV	low voltage
NEM	National Electricity Market
NER	National Electricity Rules
SAPS	stand-alone power system
VPP	virtual power plant

ESB - DER Integration Workplan – October 2019

Objective: optimising the benefits of distributed energy resources for the benefit of all Australians

Priority workstream	Workstream goal	Milestones				Progress tracking	
		2019 (Q4)	2020	2021	2022	Traffic light	Remaining work
Technical integration							
T1. Device standards	<ul style="list-style-type: none"> Appropriate DER capabilities to enable grid support, interoperability, and to enable system support and customers to exchange value with the grid, should they choose to. Ensure appropriate compliance arrangements in place. 	<ul style="list-style-type: none"> AEMO: in consultation with industry submit changes to AS 4777 (inverter standard). (complete). AEMO: in consultation with industry and through Standards Australia, finalise AS4755 (dispatchability standard). AEMO: work with COAG EC (SCO) to establish cross jurisdictional working group on compliance. Work with CER on scope of compliance audit. 	<ul style="list-style-type: none"> AEMO/Standards Australia: AS 4777 (inverter standards) finalised – subject to Standards Australian process. Compliance with new standards mandated by industry. AEMO: submit cyber standard requirements. AEMO: in consultation with industry, review and progress any gaps in standards identified. (for additional standards). Compliance: AEMO work with jurisdictional working group to review compliance arrangement. Work with CER on compliance audit and follow-up. Potential links to DER register. 	<ul style="list-style-type: none"> AEMO: in consultation with Standards Australia and other relevant regulatory body, finalise cyber standards requirements. Compliance with standard mandated. 			
T2. Comms standards and protocols		<ul style="list-style-type: none"> AEMO: through the API working group, establish comms standards (ie adoption of IEEE 2030.5). Take into account other API work through CDR, DER register and other relevant projects. 	<ul style="list-style-type: none"> AEMO: submit changes to put in place API interoperability standards. Including establishing interim guideline until formalised arrangements in place. 	<ul style="list-style-type: none"> AEMO: API interoperability standard finalised and in place. 			
T3. Connection standards	<ul style="list-style-type: none"> DER and related equipment is installed in a way that works best for customers and the system eg through technical standards. DER equipment is checked for compliance with required standards and any problems are fixed. 	<ul style="list-style-type: none"> AEMO/AER: to consider the need to mandate the adoption of nationally consistent connection standards through rule changes. 			•		
T4. Data – for transparency and operations	<ul style="list-style-type: none"> Appropriate level of data and information access to enable appropriate decision making at various levels of the system. i.e. AEMO to run the power system and market, networks to monitor and operate their network, thirds parties to officer services to consumers, consumers to make better /informed decisions around energy use and services. 	<ul style="list-style-type: none"> AEMO (DER register): implement DER register. AEMO (DER data requirements): scope data requirement to enable DER integration. AEMO (CDR): in consultation with ACCC a and standards body, develop timeline for delivery of CDR. AEMC (competition in metering): Identified (with industry) barriers to the roll out and use of smart meters, and commenced quarterly data collection on status of roll-out (prepare for Review of Competitive Metering Arrangements). 	<ul style="list-style-type: none"> AEMO (DER data requirements): in consultation with industry, develop key data requirement enable DER integration to support planning, operational, market functions (mid-2020). Progress necessary regulatory and process changes. (note, linked to API protocols). AEMO (CDR): complete regulatory changes (NEL/NER through COAG, ACCC rules, and data standards through Standards Body). Commence system changes, and industry readiness activities. AEMC: Commence review of competitive metering arrangements. 	<ul style="list-style-type: none"> AEMO (DER data requirements): implement as required. AEMO (CDR): in consultation with industry, implement CDR in energy. AEMC: Recommendations published to address barriers to the competitive roll out and use of smart meters (Review of Competitive Metering Arrangements) 			

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Regulatory Integration							
R1. Planning	<ul style="list-style-type: none"> Efficient investment across the system to deliver reliable, secure and affordable services to consumers. 	<ul style="list-style-type: none"> AEMO: ISP includes DER scenarios. 	<ul style="list-style-type: none"> AER/AEMO: Review the National Electricity Rules (NER) for Distribution Annual Planning Reports and propose enhancements to assist in integrating planning across the transmission/distribution interface. AEMO: review the need to enhance the Integrated System Plan to support distribution planning, including by standardising scenarios and inputs for network planning. 	<ul style="list-style-type: none"> AEMO: ongoing update of ISP as per regulatory and agreed arrangements. 			
R2. Ringfencing	<ul style="list-style-type: none"> Ensure distribution ring-fencing requirements remain fit for purpose and that DNSPs comply with their obligations 	<ul style="list-style-type: none"> AER Publish draft guideline update. Purpose of distribution ring-fencing guideline update is to reduce uncertainty over the application of the guideline and improve the enforceability of the guideline. 	<ul style="list-style-type: none"> AER Publish final guideline. 				
R3. Storage	<ul style="list-style-type: none"> The regulatory arrangement supports various business models for the delivery of storage into energy market. 	<ul style="list-style-type: none"> ESB: Contract a consultant to review current and evolving business models for storage in distribution networks, including barriers to good economic outcomes for consumers – by March 2020. 	<ul style="list-style-type: none"> ESB: consultation report delivered. ESB: following consultation with industry, outline recommended approach. ESB: as required, progress any regulatory changes. 				
R4. Non-networks alternatives (eventually transitioning to network services models)	<ul style="list-style-type: none"> To ensure distribution businesses are making effective use of DER to provide network services. 	<ul style="list-style-type: none"> ESB/AER: monitor distribution businesses uptake of non-network alternatives and consider further changes if needed, including through the post-2025 market design project if appropriate. 	<ul style="list-style-type: none"> 				
R5. Sandboxing	<ul style="list-style-type: none"> The regulatory arrangements provide a framework for trialling of new concepts and ideas (Minimum Viable Product, MVP) prior to full scale roll out. 	<ul style="list-style-type: none"> AEMC: review of regulatory framework for sandboxing. (complete). AER: : Submit New Policy Proposal for sandboxing to Treasury/Finance to seek resourcing. 	<ul style="list-style-type: none"> COAG EC: progress NEL changes to enable trial waiver and trial rule change mechanisms for sandboxing. AER: Commence innovation enquiry service (subject to resourcing). 	<ul style="list-style-type: none"> AER: Develop Trial Projects (Sandbox) Guideline (subject to law and rule changes) 			
R6. SAPS and Microgrids	<ul style="list-style-type: none"> The regulatory arrangement supports and create appropriate incentives around the establishment of standalone systems where it is more cost efficient to do so. 	<ul style="list-style-type: none"> AEMC: release final report on distributor lead SAPS. (complete). AEMC: release final report on embedded networks. (complete) AEMC: release draft advice on third party SAPS framework in the NEM. 	<ul style="list-style-type: none"> AEMC: release final advice on third party SAPS framework in the NEM (March 2020) COAG EC: response to AEMC recommendation and progress rule changes as required. AER: Guideline updates following DNSP-led SAPS law and rule changes. AER: Guideline updates following embedded networks law and rule changes 				
R7. Innovation funding	<ul style="list-style-type: none"> Appropriate funds are allocated to enable investment in R&D to support delivery of value add frameworks to the regulatory regime, business operations, and consumer service delivery. 	<ul style="list-style-type: none"> ESB: support ongoing government funding for DER integration research and development (including trials) which requires collaboration, knowledge sharing and capacity building across energy market institutions, distribution businesses, third parties and other stakeholders. 					

ESB - DER Integration Workplan – October 2019

Market Integration							
M1. Demand response mechanism	<ul style="list-style-type: none"> Encourage the effective participation of the demand side in the wholesale market by enabling third parties to access and aggregate DR resources and exchange value with the grid at times of peak. 	<ul style="list-style-type: none"> AEMC: Final determination published introducing a wholesale demand response mechanism (DRM rule change). 	<ul style="list-style-type: none"> AEMO: complete detailed design of wholesale demand services, including baseline methodology AEMC: complete review of customer protections framework for small customers. This will inform extension of DR and DER framework (refer to last item) 	<ul style="list-style-type: none"> AEMO: complete procedure changes and guides. 	<ul style="list-style-type: none"> AEMO: 1 Jan 2022 - Demand response services providers able to register and classify loads with AEMO (DRM rule change) AEMO: 1 July 2022 - Demand response mechanism operational for C&I customers (DRM rule change) 		
M2. Distribution network access and pricing	<ul style="list-style-type: none"> An efficient amount of both DER and network capacity is made available for exporting. Consumer choice is maintained, and consumer-led investments that support lower total energy costs are rewarded. 	<ul style="list-style-type: none"> AEMC: In collaboration with stakeholders intending to submit a rule change, develop and examine options to reform distribution access, connections and charging arrangements. AER: Develop network guidelines on how the AER will consider distributor DER integration expenditure in revenue proposals, and prudent approaches to integrating DER. 	<ul style="list-style-type: none"> AEMC: Assessment of rule change on network access, connection and charging arrangements (or AEMC commences work if no rule change submitted by mid-year) 	<ul style="list-style-type: none"> AEMC: Finalise network access, connection and charging arrangements, and transitional period to new framework. 	<ul style="list-style-type: none"> AEMC: Final network access, connection and charging arrangements in place 		
M3. Network tariff reform	<ul style="list-style-type: none"> To promote efficient demand response from end users, including investment and use of DER, to reduce network costs for the benefit of all end users. To send cost reflective network prices to retailers, to promote more innovation and choice in retail market offers. 	<ul style="list-style-type: none"> AER: Draft decisions on initial Tariff Structure Statement proposals from SA and QLD distributors. AER: Pre-lodgement engagement on initial Tariff Structure Statement proposals from VIC distributors. 	<ul style="list-style-type: none"> AER: Final decisions on revised Tariff Structure Statement proposals from SA and QLD distributors. AER: Draft decisions on initial Tariff Structure Statement proposals from VIC distributors. AER: Tariff Roundtable. 	<ul style="list-style-type: none"> AER: Final decisions on revised Tariff Structure Statement proposals from VIC distributors AER: Establishing AER's expectations on the future direction of tariff reform for the third round of Tariff Structure Statement proposals (which commences with NSW, ACT, TAS and NT distributors). 	<ul style="list-style-type: none"> AER: Pre-lodgement engagement on initial Tariff Structure Statement proposals from NSW, ACT, TAS and NT distributors. 		
M4. Open Energy Networks (DMO and DSO models)	<ul style="list-style-type: none"> Cross collaboration between AEMO and ENA to outline approaches and models to integrate DER into the network, whole of system, and market. 	<ul style="list-style-type: none"> AEMO: release final report outlining preferred model for DSO/DMO arrangements including a series of activities (roadmap) to deliver against the preferred models.) AEMO: outline plan and activities to deliver against OPEN recommendations. 	<ul style="list-style-type: none"> AEMO: Implement as per plan. Activities ranging from guides, regulatory change, trials, etc. 				
M5. Post-2025 market design	<ul style="list-style-type: none"> Market design, including valuing DER services to ensure efficient investment and operation of the energy market to deliver a secure, reliable, and affordable energy services that supports consumer choice. i.e granular pricing signals, firming markets, ahead markets, etc. 	<ul style="list-style-type: none"> ESB: Ongoing consultation with stakeholders and developing market design options. 	<ul style="list-style-type: none"> ESB: To test options for future market design and finalise a preferred model for recommendation to the COAG Energy Council. 	<ul style="list-style-type: none"> ESB/COAG Energy Council – NEL and NER changes as needed. 			

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Relevant work linked to DER							
Pilots	<ul style="list-style-type: none"> Undertake demonstrations to evaluate DER integration activities to ensure operational, market and consumer value leveraged. Evidence based approach to regulatory change. 	<ul style="list-style-type: none"> AEMO (VPP trial): launch trial (complete). Establish consumer insight working group to work through consumer experiences through the trial. This is being done in partnership with consumer groups. AEMO (distributed marketplace): scope trial for testing DSO/DMO model from OPEN with partners. Like the VPP trial, this will have a consumer insight stream. 	<ul style="list-style-type: none"> AEMO (VPP trial): share trial learnings. Progress regulatory changes to formalise arrangements. AEMO (distributed marketplace): implement in line with plan. 	<ul style="list-style-type: none"> AEMO (distributed marketplace): implement in line with plan. Working groups will be established to progress. Communicate learnings, and submit regulatory changes as required. 	<ul style="list-style-type: none"> AEMO (distributed marketplace): implement in line with plan. Working groups will be established to progress. Communicate learnings, and submit regulatory changes as required. 		
EV roadmap	<ul style="list-style-type: none"> Integration of EV to support consumer choice and adequacy of grid requirements. 	<ul style="list-style-type: none"> AEMO/ARENA: establish cross industry group to identify key EV activities required. (complete) AEMO/ARENA: seek stakeholder feedback on priority areas. Formalise priority actions. 	<ul style="list-style-type: none"> AEMO/ARENA: in consultation with industry and market institutions, progress priority actions. 				
System reliability and security	<ul style="list-style-type: none"> The power system continues to be managed in a stable and reliable manner, given changes in risk profiles, including the effects of increased DER. 	<ul style="list-style-type: none"> AEMC: Draft rule change requests published in AEMC's Black System Event review. 	<ul style="list-style-type: none"> AEMC: assesses rule changes to better manage the effects of increased DER (via AEMO's risk review and operational processes) 	<ul style="list-style-type: none"> AEMO: As a result of AEMC rule change, AEMO conducts their first risk review that incorporates DER-related risks to the power system. AEMC: AEMC Reliability Panel reviews any AEMO request for new protected event/operation 	<ul style="list-style-type: none"> AEMO: As a result of AEMC rule change, AEMO's system security parameters more flexible to account for DER impacts. 		
Consumer protection	<ul style="list-style-type: none"> Appropriate consumer protections are in place regarding DER technologies 	<ul style="list-style-type: none"> AEMC: Stakeholder consultation on whether the consumer protections in the NECF need to be updated. 	<ul style="list-style-type: none"> AEMC: Proposed framework published on consumer protections and DER (via the Retail Competition Review) 				