

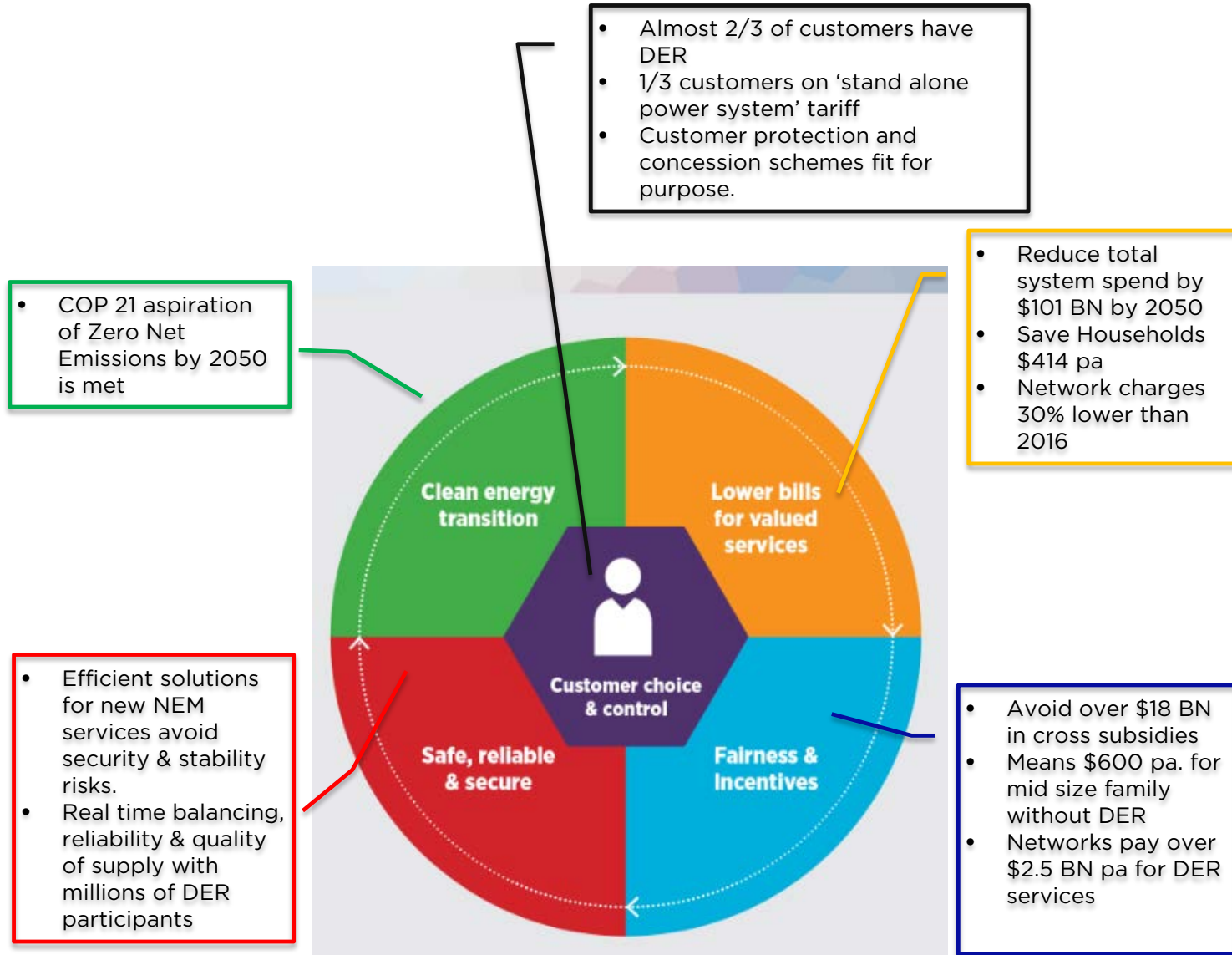
Electricity Network Transformation Roadmap Unlocking the Full Value of DER

CIDER 2017

John Bradley, Chief Executive Officer

15 August 2017

ENTR - a pathway to a better future



ENTR - Implementation

ENTR - 45 Milestones/158 Actions

Overview of the Electricity Network Transformation Roadmap

	FOUNDATION						IMPLEMENTATION					
	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2027+
CUSTOMER ORIENTED ELECTRICITY	Improve Trust with Customers <ul style="list-style-type: none"> » Enhanced customer engagement and collaboration » Customised choices, better information on services and new connection and advisory services » Demonstrate investment reflects customer value while improving service performance and response times » Review of Consumer Protection and concessions 						Networks provide a service platform <ul style="list-style-type: none"> » Open network platforms embrace diverse customer needs and aspirations » Collaborate with customers and market actors to create new value with streamlined connections » Leverage network information and digital services for personalised innovation in a dynamic market 					
POWER SYSTEM SECURITY	New systems to support diverse generation <ul style="list-style-type: none"> » Update Transmission Interconnection test » Review frameworks for protection systems, efficient capacity and balancing services » New market frameworks for ancillary services » Develop new power system forecasting and planning approaches to anticipate system constraints » Enhanced intelligence and decision making tools » Close focus on physical & cyber security 						Harmonised System Operations at all levels <ul style="list-style-type: none"> » Transmission networks support system stability with new services. » Distribution networks provide visibility of DER and potentially Frequency Control Ancillary Services (FCAS) and delegated balancing services. » Real-time communication and controls 					
CARBON ABATEMENT	A stable Carbon Policy for higher targets <ul style="list-style-type: none"> » Develop nationally integrated carbon policy framework » Implement emissions Baseline & Credit Scheme » Set Light Vehicle emissions standard policy to provide incentives for electric vehicle uptake, supporting climate goals » Review Australia's emissions reduction target » Agile network connections and integration of large and small scale renewable technologies 						Reviewing scope for greater efficiency <ul style="list-style-type: none"> » Review technology specific incentive schemes to focus on least cost abatement » Review scope for more efficient economy wide carbon pricing where consensus » Review Australia's emissions reduction target (2027) 					
INCENTIVES & NETWORK REGULATION	Incentivising efficiency and innovation <ul style="list-style-type: none"> » Ensure extensive smart meter penetration » Assign customers to new range of fairer demand-based network tariffs, with a choice to Opt Out » Enable standalone systems and micro-grids as a substitute for traditional delivery models » New innovation incentives in Regulation and Competition frameworks 						Unlocking value of distributed energy resource orchestration <ul style="list-style-type: none"> » Networks pay for distributed energy resource orchestration to provide system support in the 'right place at right time' » New network tariffs that provide beneficial incentives for standalone systems and micro-grids to stay connected to the grid » New and more adaptive regulatory approaches that are customer focused 					
INTELLIGENT NETWORKS & MARKETS	Essential information for an integrated grid <ul style="list-style-type: none"> » Establish open standards and protocols to enable secure system operation, management and exchange of information and interoperability with distributed energy resources » Networks enhance current system monitoring and models to inform advanced system planning » Build distributed energy resource maps and feeder hosting analysis to support locational valuation of distributed energy based services 						Networks optimised with distributed energy resources <ul style="list-style-type: none"> » Active network management for technical stability, enabling distributed energy resource markets and efficient optimisation. » Networks provide a suite of grid intelligence and control architectures to animate distributed energy resource markets, as well as providing system security. » Establish a new network optimisation market to procure DER services for network support. » A flexible and agile workforce to support the new optimised energy system. 					

Overall Customer outcomes by	
2027	2050
CUSTOMER CHOICE AND CONTROL	
<ul style="list-style-type: none"> » Over 40% customers use onsite resources: 29 GW solar and 34 GWh of batteries. » Concessions to support those who need it most. 	<ul style="list-style-type: none"> » Almost 2/3 customers use onsite resources, including 1/3 customers on a new stand alone system tariff.
LOWER BILLS FOR VALUED SERVICES	
<ul style="list-style-type: none"> » Avoid over \$1.4 BN in network investment. » Average network bills 10% lower than 2016. 	<ul style="list-style-type: none"> » Total system spend is \$101BN lower to 2050. » Save households \$414 pa by 2050. » Network charges 30% lower than 2016.
FAIRNESS & INCENTIVES	
<ul style="list-style-type: none"> » Networks pay over \$1.1 BN pa for DER services. » Over \$1.4 BN in cross subsidies avoided, saving \$350 pa for med size family without DER. 	<ul style="list-style-type: none"> » Networks pay over \$2.5 BN pa for DER services. » Over \$18 BN in cross subsidies avoided, saving \$600 pa for med size family without DER.
SAFETY, SECURITY, RELIABILITY	
<ul style="list-style-type: none"> » Planned and efficient market response avoids security & stability risks. » Robust physical & cyber security management. 	<ul style="list-style-type: none"> » Real time balancing, reliability and quality of supply at small and large scale, with millions of market participants.
CLEAN ENERGY TRANSITION	
<ul style="list-style-type: none"> » Electricity sector carbon abatement to reach 40% by 2030 - greater than current national target of 26-28%. 	<ul style="list-style-type: none"> » Electricity sector achieves Zero Net Emissions by 2050.

ENTR - Implementation

ENTR - 45 Milestones/158 Actions

ENTR Implementation Framework

Coordinated Implementation

- ENTR Flagship Programs
- ENTR Demonstration Projects
- Long Term R&D and Innovation Framework
- Energy Transformation Council
- ENTR Progress Monitoring & Reporting

Business Implementation

- Customer Engagement
- Regulatory Proposals & TSS
- Innovation Strategy
- Systems & Processes
- Planning & Investment
- Risk Management
- Corporate Planning, etc,

Influenced Implementation

- COAG Energy Council Policy
- NEL, NGL, NER, NGR
- Jurisdiction Regulation
- Australian Standards
- AEMO systems
- Retailer Cooperation, etc,

ENTR - Implementation

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11 Flagship Programs

Second Wave
Incentives

DER visibility

Valuation and
hosting
capacity

Advanced
Grid
Architecture

NSP capacity
to support
system
security

DER
Connection
Guideline

Standards
Development

Advanced
Customer
engagement

Tariff
Implementation
Plan

Alternative
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Metering
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Grid Orchestration: Architecture
and Procurement Models

Enablers

Policy Priorities

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Enablers

Policy Priorities

1. Establish Governance and working groups
2. Establish Reporting Framework
3. A-lab process
4. Outcomes Report and recommendations for further work
5. Outputs consistent with milestone/actions
6. Recurring activity

CSIRO

AEMO

ARENA

Greensync

Retailers

Network
Partners

AER

ECA

Other
Stakeholders

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Grid Orchestration: Architecture and Procurement Models

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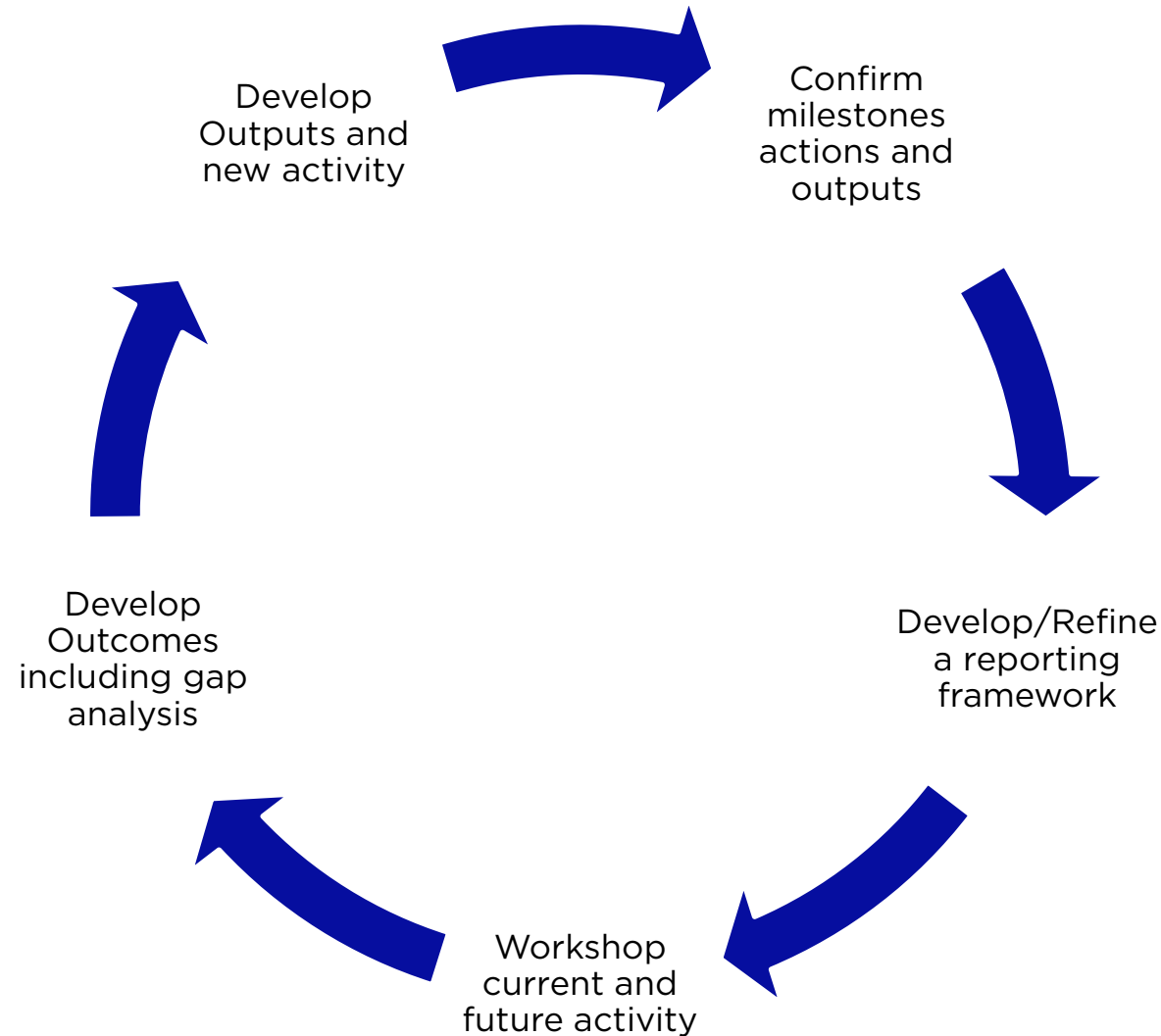
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Commonality and interdependency of “spine” projects



Unlocking NSP capacity for System Security

Milestones	Actions	Process 17/18	Outputs	Stakeholders and budget
<ul style="list-style-type: none"> By 2018, the central and transformed role for the transmission system to support power system security has been defined By 2018, market based approaches for providing efficient capacity, and balancing and ancillary services, have been established, including a set of fully tested options that would cater for a very low emission generation mix 	<ul style="list-style-type: none"> By 2017, review, and if appropriate, establish augmented market frameworks supporting timely and efficient capacity investment By 2017, Revise the regulatory test for transmission investment including interconnectors 	<ol style="list-style-type: none"> Establish Governance and working groups Establish Reporting Framework A-lab process Outcomes Report and recommendations for further work Outputs consistent with milestone/actions Recurring activity 	<ul style="list-style-type: none"> Reporting Framework for market and physical frameworks for efficient capacity Stocktake of trials: <ul style="list-style-type: none"> Forecasting renewables power system pricing approaches Synthetic inertia Gap Analysis Options for system security markets and frameworks 	<ul style="list-style-type: none"> Business Case owners of existing trials AEMO ARENA AEMO/ARENA process* ECA* AER* Budget \$135k for logistics and consultancy for reporting framework, gap analysis, outcomes and options framework \$10k budgeted \$125k additional budget required

Second Wave Incentives

Milestones	Actions	Process 17/18	Outputs	Stakeholders and budget
<ul style="list-style-type: none"> By 2018, networks with high DER are implementing basic NOM functions By 2027, 1/3 customers 'selling DER' on a dynamic/locational basis 	<ul style="list-style-type: none"> 2017 - Identify key locations of DER 2018 - Framework options for procuring DER 2019 - simple procurement mechanisms developed 2020 - Initial utilisation DER using procurement mechanism 2018-21 - Networks develop frameworks 2019-2021 - Incorporate into TSS 	<ol style="list-style-type: none"> 1. Establish Governance and working groups 2. Establish Reporting Framework 3. A-lab process 4. Outcomes Report and recommendations for further work 5. Outputs consistent with milestone/actions 6. Recurring activity 	<ul style="list-style-type: none"> Stocktake of trials: Frameworks for procuring DER Process for enrolling customers and locations Gap Analysis Framework for identifying key locations Options for procuring DER for Network Optimisation 	<ul style="list-style-type: none"> Business Case owners of existing trials AEMO ARENA ECA* AER* Budget for logistics and consultancy for reporting framework, gap analysis, outcomes and options framework \$10k budgeted through existing PRC budget

DER Visibility for AEMO*

Milestones	Actions	Process 17/18	Outputs	Stakeholders and budget
<ul style="list-style-type: none"> By 2019, approach developed for coordinating and optimising decisions across the power system incl interfacing between IMO and DNOs 	<ul style="list-style-type: none"> 2018 - Specifications for scope/access to information at interface IMO/TNO/DNO 2019 - Real-time capability for communication / controls between IMO/DNO 2019 - Enhanced intelligence / decision making at interface IMO/TNO/DNO 	<ol style="list-style-type: none"> 1. Establish Governance and working groups 2. Establish Reporting Framework 3. A-lab process 4. Outcomes Report and recommendations for further work 5. Outputs consistent with milestone/actions 6. nsistent with milestone/actions 7. Recurring activity 	<ul style="list-style-type: none"> Frameworks for operational interface and coordination between AEMO, transmission and distribution networks Evaluate appropriate DER adoption forecasting tools and techniques Determine what data is required about DER, and at what level of detail, for AEMO's operational needs spanning real time operation, short-term planning and forecasting, and long-term planning and forecasting Evaluate tools to incorporate DER forecasts into network planning processes identifying localised grid issues likely to emerge due to DER population and operation 	<ul style="list-style-type: none"> Business Case owners of existing trials AEMO ARENA ECA* AER* TBA AMC budget

Advanced Grid Architecture*

Milestones	Actions	Process 17/18	Outputs	Stakeholders and budget
<ul style="list-style-type: none"> By 2019, integrated suite of distributed grid intelligence & control architecture / tools for high DER By 2020, integrated suite of advanced network operation mechanisms & tools 	<ul style="list-style-type: none"> 2018 - identify technical priorities for distributed grid intelligence / control 2018 - develop framework to facilitate DR & monitoring 2019 - Min tech standards for LV sensing & measurement 2019 - Min tech requirements for DER / Microgrid interoperability 2020 - min tech requirements for real-time identification / communication Network support requirements 2020 - min tech requirements for visibility communication and coordination between IMO/DNO 	<ol style="list-style-type: none"> 1. Establish Governance and working groups 2. Establish Reporting Framework 3. A-lab process 4. Outcomes Report and recommendations for further work 5. Outputs consistent with milestone/actions 6. Recurring activity 	<ul style="list-style-type: none"> Shared view on the efficient, fit for purpose functional, technical and operational requirements for enhanced distributed grid intelligence, monitoring and control Quantify adoption and penetration requirements of new monitoring and control technology required to provide required functionality Processes and criteria for creating a sufficiently documented distributed grid architecture and system specifications to deliver functional requirements 	<ul style="list-style-type: none"> Business Case owners of existing trials AEMO ARENA ECA* AER* TBA AMC budget

Hosting Capacity and DER Valuation

Milestones	Actions	Process 17/18	Outputs	Stakeholders and budget
<ul style="list-style-type: none"> By 2019, integrated planning, forecasting and valuation techniques mainstream for DER as NNA By 2020, new tools and models developed to provide forecasting to anticipate where system constraints could lead to system security issues 	<ul style="list-style-type: none"> 2017 - Techniques for reliable forecasts of DER & VRE 2018 - Tools to evaluate cost/benefits of a range of technological / commercial solutions for: <ul style="list-style-type: none"> Forecasting DER & Demand/Supply Forecasting grid impacts Hosting capacity Value of DER 2019 - Develop and run tools 	<ol style="list-style-type: none"> 1. Establish Governance and working groups 2. Establish Reporting Framework 3. A-lab process 4. Outcomes Report and recommendations for further work 5. Outputs consistent with milestone/actions 6. Recurring activity 	<ul style="list-style-type: none"> Reporting Framework Stocktake of trials: <ul style="list-style-type: none"> Forecasting DER Forecasting Grid impacts Forecasting future costs Hosting capacity Gap Analysis Evaluation Framework Options for forecasting, hosting, costing and procuring DER for Grid Orchestration 	<ul style="list-style-type: none"> Business Case owners of existing trials AEMO ARENA ECA* AER* Budget for logistics and consultancy for reporting framework, gap analysis, outcomes and options framework \$10k budgeted through PRC

Next steps

- Working Group Reviews
- PRC AMC Endorsement
- ENA Board update
- Partner engagement
 - AEMO
 - ARENA
 - CSIRO
 - AER*
- Key player engagement
 - CEC
 - Greensync
 - Retailers
- Stakeholder engagement
 - ECA
 - AER
 - AEMC
 - COAG