ENERGY SECURITY BOARD

POST 2025 FUTURE MARKET PROGRAM

RESOURCE ADEQUACY MECHANISMS - PRESENTATION FOR TECHNICAL WEBINAR #1

8 MAY 2020

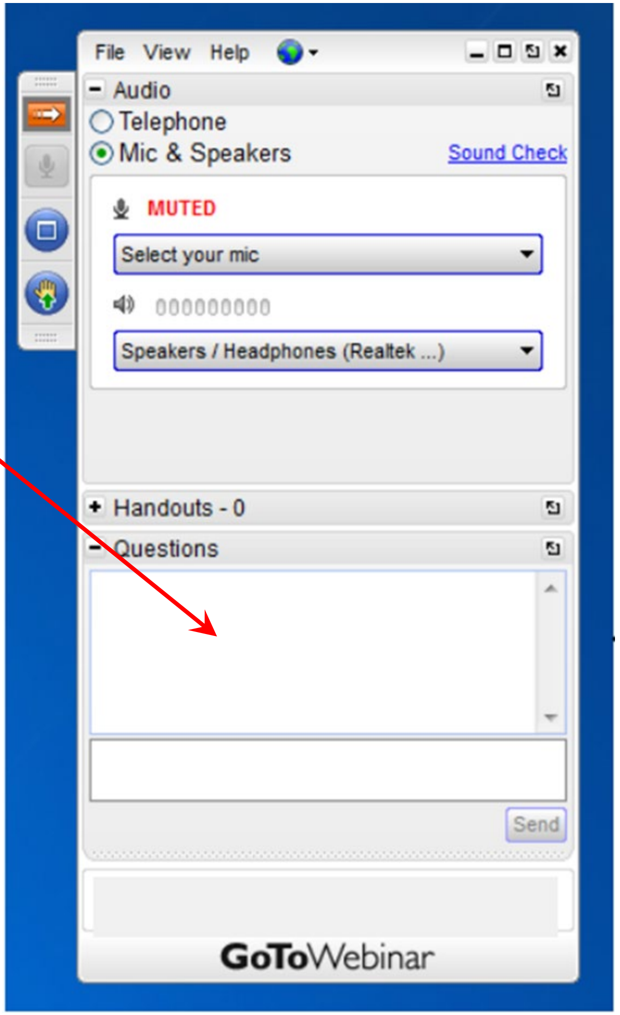
IMPORTANT NOTE

These slides are solely for workshop purposes only. The contents provide general information for the purpose of fostering a diversity of thinking and enabling stakeholder engagement and feedback.

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

WEBINAR-WORKSHOP LOGISTICS

- All participants are currently in listen-only mode
- We will pause at the end of each page where you see the  symbol to answer questions. Please:
  - Type your questions here as we proceed through the content (double-check before sending); and/or,
  - Use the *Raised Hand* to signal that you would like to speak when we open the audio.
- Today's webinar is being recorded and a link to the recording will be provided after the webinar



POST 2025 FUTURE MARKET PROGRAM (P2025)

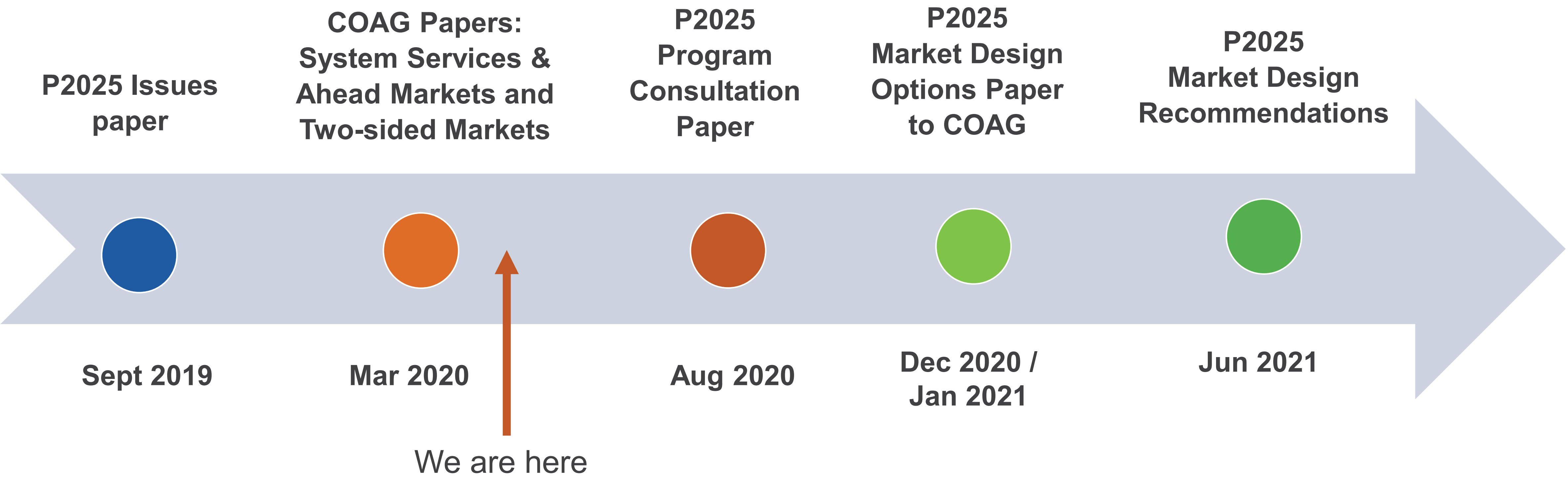
The COAG Energy Council tasked the ESB with developing advice on a

long-term, fit-for-purpose market framework

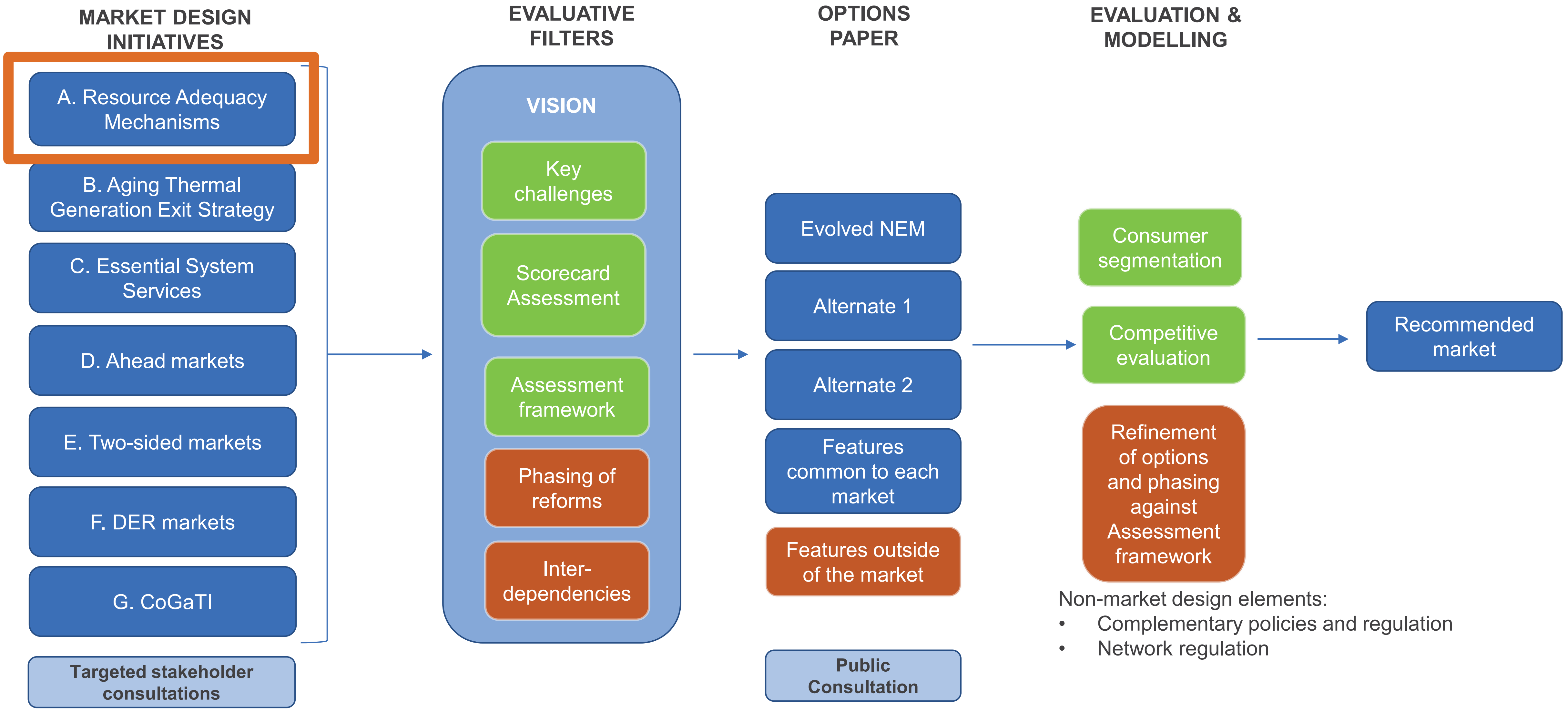
to support reliability that could apply from the mid-2020's.

The ESB needs to recommend any changes to the existing market design or recommend an alternative market design to enable the provision of the full range of services to customers necessary to deliver a secure, reliable and lower emissions electricity system at least-cost.

P2025 PROGRAM – KEY DELIVERABLES



P2025 PROGRAM ASSESSMENT FRAMEWORK



OBJECTIVE OF THIS MEETING AND ROLE OF TWG

- Outline the RAM workstream and how it fits with other reforms
- Provide context for why the ESB is considering resource adequacy mechanisms for the NEM
- FTI to present:
    - The objectives of well-functioning electricity market and the potential challenges in achieving these
    - Seven distinct RAM options for evaluation and seek feedback
    - The proposed evaluation approach and seek feedback
- Discuss engagement with the TWG – input and future sessions

SCOPE & OBJECTIVES

Scope and objectives for this meeting

AEMC PROJECTS RELATING TO ESB MDIS

The AEMC as statutory rule maker is currently progressing a number of projects relating to resource adequacy and system services in the changing NEM. The projects listed below are being coordinated with the work undertaken by the ESB, including the FTI work on system services which is an important input.

AEMC project	ESB work stream	Essential system services						Ahead market	Resource adequacy	Aging thermal plant
		Frequency	Operating reserves	Inertia	System strength	Voltage control	System restart			
System strength investigation				✓	✓			✓		
Incentives for primary frequency response (AEMO)		✓		✓	✓	✓				
Fast frequency response (Infigen)		✓		✓				✓		
Operating reserves (Infigen)			✓					✓	✓	✓
Synchronous services (HydroTas)				✓	✓	✓		✓		
Centralised management of synchronous services (TransGrid)				✓	✓	✓		✓		
System restart (AEMO) – –**complete**							✓			

INTEGRATED SYSTEM PLAN AND THE RENEWABLE INTEGRATION STUDY

Work on Resource adequacy mechanisms is being informed by AEMO technical studies that are being undertaken to understand the needs and inform the physical operation of the future power system. AEMO teams are coordinating with ESB to understand the implications of this work for related MDIs.

2020 Integrated System Plan

Draft: published December 2019
Consultation: Q1 2020
Final publication: Expected mid-2020

https://aemo.com.au/en/energy-systems/major-publications/integrated-system-plan-isp/2020-integrated-system-plan-isp

Renewable Integration Study

Stage 1 Published 30 April 2020

https://aemo.com.au/energy-systems/major-publications/renewable-integration-study-ris

Context for System Services and Ahead Markets in the March 2020 COAG paper
http://www.coagenergycouncil.gov.au/post-2025/system-service-and-ahead-markets

If you would like to be added to the distribution list for upcoming RIS stakeholder briefings, please email FutureEnergy@aemo.com.au
https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/system-operations/future-grid/renewable-integration-study

AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

CONTEXT

What is a resource adequacy mechanism?

The case for a resource adequacy mechanism in a post-2025 NEM.

WHAT IS A RESOURCE ADEQUACY MECHANISM?

- A resource adequacy mechanism provides specific incentives to bring on investment in supply or demand side resources needed to operate the power system in real time and over the long term.
- The NEM rules include reliability settings that expose market participants to very low and very high spot prices, which encourage them to buy or sell contracts in the financial market to manage risk and smooth cashflows. Expectations of future spot prices are reflected in contract market prices and contract premiums on spot prices encourage investment in new resources.
- Other regulatory arrangements and mechanisms support reliability, including ancillary service markets, the Retailer reliability obligation and, in emergencies, the Reliability and emergency reserve trader, directions and instructions.
- The ESB's interim reliability arrangements are currently being implemented to provide additional confidence in the NEM's ability to deliver reliable supply in the near term. In addition, new arrangements such as a wholesale demand response mechanisms are being developed to add to the framework of incentives in the future.

CONSIDERING THE NEED FOR A RESOURCE ADEQUACY MECHANISM

- One of the key questions posed in the post-2025 market design issues paper was if there were appropriate incentives within the NEM to bring on sufficient investment to maintain reliability (resource adequacy) where and when it is needed.

- In response to the ESB's post-2025 issues paper stakeholders had different views about whether the current or evolved NEM framework will provide sufficient incentive to bring on the resources needed for a post-2025 NEM.

- **KEY QUESTION FOR STAKEHOLDERS: What information or evidence should the ESB use to assess whether additional incentives are needed to bring on the amount and type of resources required in a post-2025 NEM?**

"alternative market mechanisms to deliver capacity investment should be considered. These designs should focus on providing the investment signals as leading, not lagging signals, that deliver efficient and timely investment without socially undesirable levels of price volatility and reliability risks."

- EnergyAustralia

in our view the NEM's fundamental wholesale market design – comprising the spot electricity market and forward derivatives market – remains strong."

- Infigen

OVERVIEW OF RESOURCE ADEQUACY MECHANISMS MDI

- The **Resource adequacy mechanisms (RAM)** workstream – previously referred to as *Investment signals for reliability (capacity mechanisms)* – is evaluating the case for introduction of a mechanism to incentivise investment in resources to meet the needs of a post-2025 NEM, and the pros and cons of specific mechanisms.
- ESB has engaged FTI consulting to provide advice on this.
- Electricity markets in other jurisdictions approach resource adequacy through a variety of mechanisms e.g. availability payments, strategic reserves, financial or capacity markets etc.
- While there are some features in common, each jurisdiction has implemented a scheme that is suited to their particular market requirements and the behaviours of those participating in the market.
- The ESB considers it appropriate to evaluate a range of resource adequacy mechanisms in the NEM context - specifically noting the already high and increasing penetration of DER in the NEM, and the expectation of increasing amounts of renewable energy generation in the future.
- **We would like early input from the TWG provide feedback on the evidence the ESB should use in assessing the need for additional incentives, the RAM options and the framework for assessing them.**

QUESTIONS ON CONTEXT?

Resource Adequacy Mechanisms webinar

Presentation to the Technical Working Group and Advisory Group

8 May 2020

CONFIDENTIAL

Introductions – FTI team presenting this webinar

Project Director

Jason Mann

Jason is a Senior Managing Director, based in FTI Consulting's London office.

Jason has been a leading global advisor to regulators and market participants on the design of different electricity markets and regulatory models since the mid-1990s. Throughout his career, Jason has worked on the design, implementation and operation of wholesale energy markets, and the regulation of energy networks.

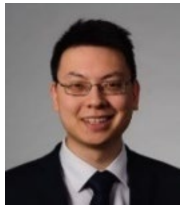
Project Manager

Martina Lindovska

Martina is a Senior Director, based in FTI Consulting's London office.

Martina is an energy economist and has worked as a consultant for over ten years across the energy and wider utilities sector. She has extensive experience in global electricity markets, having worked for Ofgem, MISO and AEMO in recent years on various aspects of electricity market design.

Project Support



Gregory Yap

Gregory is a Director, based in FTI Consulting's London office.

Greg is an energy economist with 7 years of experience in economic, financial and regulatory matters. His has worked with several regulators, system operators and network companies or market design matters, including Ofgem, AEMC, NG ESO, EirGrid / SONI, Statnett, Svenska Kraftnat, and AEMO

Subject matter expert – US specialist

Dr Susan Pope

Susan is a Managing Director, based in FTI Consulting's Boston office.

Susan specialises in the economic and public policy analysis of electricity markets and advises on the design, improvement and performance of electricity networks. She has particular expertise in US electricity markets, where she has worked with clients including NYSIO, PJM, CAISO, ERCOT and MISO.

Subject matter expert – European specialist

Dr Fabien Roques

Fabien is an Executive Vice President, based in the Paris office of FTI-CL Energy.

Fabien is an economist and an engineer with deep expertise in the energy sector. He is an authority on the regulation of utilities and electricity market design, and has extensive experience of European electricity networks. Fabien has led projects on the design and assessment of capacity mechanisms in more than 14 countries.

Subject matter expert – NEM specialist

Robert Prydon

Robert is FTI Consulting's Australian energy lead, based in Sydney.

Robert has extensive experience in market design in Australia, gained over 25 years working for regulators, energy businesses and in consulting on energy market issues. Prior to joining FTI, Rob worked with the AEMC as Senior Economist advising on the strategic framework for energy market development.

DRAFT FOR DISCUSSION

A well-functioning energy market seeks to achieve several key principles and objectives

These principles are similar to the ones previously discussed with the TWG on the ESS workshop

#	Principle	Description
1	**Efficient dispatch to drive efficient price signals**	• Facilitate an efficient real-time dispatch while observing technical constraints to maintain real-time reliability • Optimise based on voluntary bids and offers, subject to rules to mitigate the exercise of market power • Determine real-time market settlement prices from the dispatch model • Ideally co-optimises schedules for energy with the appropriate Essential System Service (ESS) in the dispatch model, and include the costs of targeted environmental externalities • This is linked to a secondary principle that **prices should reflect scarcity**
2	**Efficient price signals to drive efficient investments**	• Prices reflective of system reliability needs to provide incentives for efficient and timely investments, differing in technical characteristics such as ramping speed, start-up time and location • Price signals should be sufficiently transparent & predictable and that appropriate hedging tools are available
3	**No undue discrimination**	• No undue discrimination for or against any participant in the market (i.e. market participants able to respond to clear incentives with open access) • This should apply when designing renewables policy
4	**Minimum regulatory intervention**	• Markets used to deliver efficient outcomes rather than through government and regulatory interventions • This does not preclude the need for a centralised system operator to coordinate dispatch and maintain energy security. Ideally this role should be minimised
5	**Cost recovery / risks allocated appropriately**	• Participants who cause costs should be exposed to them • Risks should be borne by participants best able to manage them

FTI CONSULTING

While energy-only markets seek to achieve these principles, they may be hindered in achieving reliability objectives

Missing elements[1] of energy-only markets may hinder reliability objectives …

Lack of dispatchable demand	Incomplete markets	Unpriced products / services	Unpriced externalities
• Demand that is responsive within each dispatch period could clear the market when supply is exhausted • However, consumers may be prevented from expressing the value they attach (e.g. due to technical or economic reasons).[2] Therefore, more generating capacity is required	• Some plant that are needed to ensure reliability targets are met are required to run very infrequently • This means that investing in these plant is risky, even if prices are unfettered • Ideally, financial markets would provide investors more certainty, however may not be available in practice	• Essential security services are required to maintain system reliability. The value of some of these reserves can rise during certain real-time system conditions • An energy-only market design may not include a mechanism to enable energy prices to rise sufficiently to reflect this value	• Carbon emissions will not be reflected in price signals without an integrated decarbonisation policy (e.g. cap-and-trade or carbon price) • In absence of such policy, intervention to achieve social objectives may disrupt the price signals needed to achieve reliability objectives

… these are exacerbated by ongoing pressures in the sector

Policy interventions / uncertainty

- **Price caps are in place in the NEM**, potentially below the Value of Lost Load (VOLL)
- Further **direct subsidies to generation** are expected
- Some **intervention in dispatch** – i.e. out-of-market actions such as must run contracts and operator commitments
- **Decarbonisation policy** remains uncoordinated and varies by state
- Some “threats” of further intervention & perpetual policy changes may deter investors (potentially leading to self-fulfilling prophecies where discussing these policies could create the expectations of such interventions, and in turn, causing the actual need for them)

Changing generation mix

- Significant **closure of thermal generation and increase of renewables** are expected
- The combined effect of the transition away from synchronous generation is that there is still a need for dispatchable (typically thermal) generation, but the investment in **reliable generation** may not be forthcoming.

Note 1: *we define “missing elements” as elements that have not been developed or for which there has not been sufficient regulatory / industry commitment to implement, that may be needed to provide desired levels of reliability. Other missing elements may include lack of locational pricing (nodal), inefficient transmission pricing and disorderly bidding among others*

Note 2: *a two-sided market design could be a step-forward in addressing the lack of dispatchable demand. However, the potential impact is currently uncertain*

DRAFT FOR DISCUSSION

We consider seven distinct RAMs grouped into three broader categories which may address some of the "missing elements"

Adjustments to the existing NEM	Enhancements to the existing NEM	Mandatory capacity markets
Adjusting "existing levers" currently available within the NEM *(i.e. relying on the existing spot market price signal to drive investments)*	New mechanisms to "enhance" the existing functions of the NEM *(i.e. augmenting the spot market with an additional price signal)*	New markets for capacity that would "overlay" the NEM *(i.e. procuring a level of capacity which is driven by quantity defined, not price)*

#	RAM	Description
1	Reliability setting adjustments	Adjusting the wholesale price caps currently in place
2	Modified RRO obligation	Modifying the existing Retailer Reliability Obligation ("RRO") obligation
3	RERT adjustments	Adjusting the existing Reliability and Emergency Reserve Trader ("RERT") mechanism
4	Operating reserves mechanism	Introduce a new operating reserves mechanism (as an ESS)
5	Scarcity price adder	Adjusts the real-time price to reflect operating reserves requirements
6	Decentralised capacity market	A capacity market that places obligations to procure capacity on retailers
7	Centralised capacity market	A capacity market that is delivered and operated by a central body (typically the SO)

Note: *These RAMs would also apply to "two-sided markets" in addition to "energy-only markets". Two-sided markets would support the formation of efficient real-time prices (that in turn, facilitates investments), by enabling consumers of electricity to be more active participants. Additionally, two-sided markets may enable the demand-side participants to contribute to some of the RAMs.*

Note: *We consider each RAM individually, although they may not be mutually exclusive. Multiple RAMs may be implemented together with different effects. Each RAM may also consist of many distinct subvariants.*

DRAFT FOR DISCUSSION

We set out six dimensions to define the different Resource Adequacy Mechanisms

A — Product description

- What is the product being introduced to improve resource adequacy?
- How is it defined, e.g. as a MW or a % of load?
- What does the product intend to achieve?

B — Obligation

- Who is obliged to procure the product? Retailers / generators / central body (i.e. the SO)
- Does the obligation apply uniformly to all similarly-situated parties?
- Do obligations vary by location?
- Who determines the nature & level of obligation? How centralised is the decision-making?

C — Procurement approach

- How is the product procured? What is the term of the product? Is the product traded in forward markets or bilaterally?
- What is the term of each procurement round? How far in advance of the obligation to deliver does the procurement occur? How are locational requirements procured?

D — Enforcement

- How is compliance monitored?
- How is non-compliance penalised?

E — Pricing

- Is the price paid for the product a "market-clearing" price or a "pay-as-bid" price?
- Does the product procurement and pricing affect real-time energy prices or capacity prices?
- What is the relationship with energy and system service revenues?

F — Impact on risk allocation

- How does the mechanism affect the risk allocation between different participants?
- If the SO procures the product, how are the costs incurred recovered (e.g. from Retailers based on MW peak or MWh)?

Reliability setting adjustments

Overview	▪ Adjust the reliability settings – i.e. changing either the level of the market price cap (MPC), the cumulative price threshold (CPT) and/or the administered price cap (APC) ▪ The current level of the MPC is $14,700/MWh, the CPT is $212,800 (over 336 trading intervals) and the APC is $300/MWh
A Product description	▪ "Product" in this context means the value of energy-not-supplied… ▪ …and the mechanism seeks to enhance the definition of the price of unserved electricity
B Obligation	▪ Standard energy market incentive on all market participants to balance positions in real time or risk being exposed to changes in prices
C Procurement approach	▪ Appoint an appropriate body responsible for making adjustments that represent consumer reliability preferences – requires decisions on level of cap, frequency and method of amendments, and the level of long-term certainty provided to the market ▪ Ideally, the wholesale price cap should be set high enough to be above the VOLL of 50% of retail customers
D Enforcement	▪ Enforcement through standard electricity market mechanisms
E Pricing	▪ Real-time price change during periods of scarcity (an increase in the caps of the settings may result in sharper and more volatile prices). Changing the settings would also affect the prices of FCAS and other ESS that are co-optimised with energy ▪ The interactions between the reliability settings, particularly the CPT and the APC, are complex and still in consideration. For example, it has been observed that market response to high prices were reduced when the APC came into effect after the CPT was triggered.
F Impact on risk allocation	▪ Any participant that is not hedged would be exposed to the risk of higher real-time prices if the caps of the settings are increased and/or relaxed. These would place more risk on parties that are more likely to be short relative to the contract position at times of system stress

Modified RRO obligation

Overview

- Modify and/or adjust the levers of the current RRO mechanism to further incentivise retailers to contract / invest in dispatchable resources
- The RRO requires retailers to cover its share of expected peak elec demand, and is triggered when AEMO identifies a shortfall. A range of adjustments could be considered, for example, changing the definition and measurement of firmness, introducing closer monitoring and stricter enforcement before T-1, or changing the level of discretion that AEMO has on how and when trigger the RRO

A Product description

- Currently, the RRO has two “products” which are often bilateral and not market wide:
  - T-3: Retailers enter into “qualifying contracts”; financial contracts to cover peak demand. The definition of “qualifying contracts” is broad with different levels of “firmness” or how effective they might be.
  - T-1: Retailers disclose net contract positions
- The specific definitions of the products would change with any modifications, for example with a methodology of firmness

B Obligation

- Financial obligation on retailers (and large energy users) to enter into the qualifying contracts to meet the “one-in-two year” peak demand
- Obligation on AEMO to determine the shortfalls, the region and the duration. AER then issues the products. RERT is used by AEMO if shortfall not resolved

C Procurement approach

- RRO is applied to each state separately
- In addition to AEMO, state governments are able to trigger the RRO, irrespective of any expected shortfall in resource adequacy

D Enforcement

- Penalties for non-compliance (e.g. not procuring sufficient qualifying contracts)
- Penalties are based on the cost of the RERT required to cover the shortfall not met by the liable retailer

E Pricing

- The impact on pricing is currently unclear; uncertain if RRO mechanism is sufficient to bring on new capacity and the resultant impact on pricing

F Impact on risk allocation

- Retailers, especially those who are independent, would potentially take on some risk away from generators. Some risk can be passed on to consumers depending on link with retail prices
- If the RRO is successful, there may be an increase in the actual and/or perceived risk to gen investors that are not supported through a retailer contract

Reliability and Emergency Reserve Trader ("RERT") adjustments

Overview

- Modify and/or adjust the current levers of the RERT mechanism. The RERT is a mechanism used by AEMO to contract for additional resources in advance of a project shortfall (akin to a call contract). The RERT can be considered as a "strategic reserve", i.e. reserves that are procured out-of-market
- A range of adjustments could be considered, for example, on the conditions on when to activate these reserves, the level of discretion AEMO has on procuring and utilising the RERT, the applicability to existing resources and/or new build, or the applicability to only plants that are at risk of closure.
- These adjustments in effect define the applicability of the RERT as a "last resort"

A Product description

- Reserve contracts for MW of generation or demand reduction that can be sustained for at least 30 minutes. Specification of contracts may differ (e.g. response time and run-time of resources)
- These contracts provide AEMO the option to dispatch scheduled resources or activate unscheduled resources when required
- The RERT is intended to be used to maintain reliability, but can also be used to provide security if necessary

B Obligation

- Resources are obligated to provide energy when called, and to sustain for a time period
- AEMO has to make the following decisions in two stages
  - Whether to enter into reserve contracts, and the volume, duration and method of procurement
  - Whether to dispatch scheduled resources or activate unscheduled resources, and the conditions on when to do so

C Procurement approach

- AEMO procures RERT based on its projected shortfalls, and the length of time in advance of the period. Reserves contracted must not otherwise be available to the market
- There are currently three procurement approaches, although each of these could be changed with any modifications to the RERT:
  - Long-notice RERT – procured 10 weeks to 12 months from the projected shortfall through an invitation to tender
  - Medium-notice RERT – procured 10 weeks to 7 days from the projected shortfall. Prices negotiated separately each time
  - Short-notice RERT – procured 3 hours to 7 days from the projected shortfall. Prices pre-agreed with the panel

D Enforcement

- Resources may face penalties for failure to meet obligations
- AEMO may face a penalty for terminating a contract early

E Pricing

- The RERT, on its own, may create a distortionary effect as procuring and utilising resources require out-of-market actions (e.g. by crowding out market-based investments or distorting the merit order)
- However, intervention pricing is applied in the NEM which intends to minimise the RERT's distortionary effects

F Impact on risk allocation

- Consumers bear risk of over-procurement

Operating reserves mechanism

Overview	▪ Markets to schedule one or more types of operating reserves (ORs) and possibly other ESS. These markets are co-optimised with energy market dispatch (in real-time but can also be in ahead markets). ▪ In addition to functioning as a RAM, ORs are also an ESS. These resources can also be used to support system security, such as inertia and frequency response
A Product description	▪ One or more OR products defined could differ with respect to the lead time for activation, duration of running and other factors ▪ Required OR quantities would be specified to support set reliability goals and could vary by location and/or based on other measures of system operational status ▪ Requirements for new OR product(s) specified as a demand curve, with prices rising toward VOLL as lower quantities of operating reserves clear the market. These products monetise the real-time value of capacity during periods of scarcity
B Obligation	▪ Resource participation in the market could be mandatory or voluntary (i.e. retailers could be required to offer ORs in quantities related to their load obligations) ▪ The SO is responsible for procuring ORs in real-time (and ahead markets, if relevant). Market design specifies rules to guide centrally-made decisions about the required procurement quantities, locational requirements, shape of the demand curve(s); these rules implement the resource adequacy objective
C Procurement approach	▪ Resources do not need to be procured in advance; they submit offers for ORs in either the real-time or ahead markets and are scheduled in the co-optimised dispatch with energy ▪ An ahead market may be needed to create financial commitments (e.g. make-whole payments) to incentivise resources to provide OR in real-time. Without one, resources may not be able to recover the costs of unit commitment. Alternatively, there might be a day-ahead requirement for retailers to demonstrate their ability to meet a real-time offer obligation
D Enforcement	▪ Penalties for scheduled resources that do not activate set at real-time market price of replacement energy, which will likely be high under this alternative
E Pricing	▪ Market clearing prices for ORs and energy determined from real-time co-optimised dispatch. This is used for settlements of real-time energy and OR purchase and sales ▪ Pricing and compensation might occur in part through advance contracts between resources and retailers (depending on design choices) ▪ Both energy and reserve prices are likely to increase during scarcity periods. Reserve prices might increase independently of energy prices during low load conditions (if system is long on energy but short on dispatchable capacity)
F Impact on risk allocation	▪ Providers of ORs (i.e. mostly generators) bear investment risk ▪ Retailers that are not hedged would be exposed to risk of higher real-time prices

Scarcity price adder

Overview	▪ A mechanism which increases the real-time price during periods of scarcity to reflect requirements for responsive capacity such as operating reserves
A Product description	▪ The "product" in this context is the provision of incremental responsive capacity incentivised by a price adder to real-time markets (may also be applied in day-ahead markets). The price adder is typically based on an Operating Reserve Demand Curve (ORDC), whereby the value of responsive reserves rises toward the VOLL as lower levels of reserves are scheduled ▪ ORDC may vary locationally, seasonally, by time-of-day and/or based on other measures of operational status
B Obligation	▪ Mechanism intended to incentivise additional voluntary investment in capacity as a hedge for price increases when capacity scarcity arises, and in expectation of increased revenues to resource that is utilised ▪ Obligation on the SO to administer the adder
C Procurement approach	▪ Centralised determination of ORDCs (e.g. height and shape, which may differ across price zones) to meet reliability objectives. Key design issues are the value of VOLL and how quickly prices rise as responsive capacity falls ▪ Investment in capacity is triggered voluntarily in response to the higher energy prices at times of system scarcity
D Enforcement	▪ No formal enforcement is required. Any participant that is not hedged will be exposed to the higher real-time price
E Pricing	▪ Energy prices increase during scarcity periods, and may reach high levels ▪ Higher prices compensate all resources that are actually available ▪ Unhedged loads pay high real-time price during scarcity; resources with forward contracts may pay high price for failure to be available
F Impact on risk allocation	▪ Any participant that is not hedged would be exposed to the risk of higher real-time prices at times of system scarcity. Consumers may bear some risk if retail pricing linked to wholesale pricing

Decentralised capacity market

Overview	▪ A capacity market where an obligation to procure capacity is determined by a central body and placed on market participants. These participants can then trade on their obligations to meet reliability ▪ This market is driven by the quantity of capacity to be procured, and units traded are physically-backed ▪ Many subvariants exist, e.g. product definitions and timings, extent of rules set ex-ante, level of decentralisation
A Product description	▪ A volume-driven capacity market where tradeable units (or capacity certificates) of dispatchable resources are bought and sold ▪ Intended to ensure there is sufficient capacity available during defined periods
B Obligation	▪ Retailers (i.e. buyers of units or capacity certificates) have the obligation to procure these capacity certificates to meet their expected demand (which may be augmented by a certain margin) ▪ Resources (i.e. sellers of units) have the obligation to deliver resources during scarcity commensurate on units sold ▪ A central decision-maker, typically the SO, has to decide the nature and level of obligation to set

C Procurement approach	▪ The SO can set the obligation in different ways:
	  ▪ Product definitions – e.g. a MW amount, % of load or a margin over peak demand (the latter is more decentralised, reliant on the forecasts of each supplier which may or may not be sufficient)
	  ▪ Binding period – obligation could either be set for specific periods corresponding to scarcity or all year long, similar to a centralised CM
	  ▪ Nature of capacity markets – e.g. the use of auctions and reference prices
	  ▪ Timings of procuring the capacity ahead of delivery

D Enforcement	▪ Penalties for retailers on whether they have sufficient units to cover obligations and for sellers on non-delivery of resources (corresponding to the quantity of units sold)
E Pricing	▪ Distortionary effects on bidding and price dynamics in the energy market could be minimised if well designed. However, this will influence the generation mix, which in turn affects the market price (as it is intended to)
F Impact on risk allocation	▪ Retailers take on most risk (away from generators) but can pass this on to consumers

Centralised capacity market

Overview	▪ A capacity market where the central body procures capacity to a pre-determined volume, typically through a market-wide auction ▪ Successful bidders in the capacity market are obligated to deliver the capacity in line with the market rules ▪ Many subvariants, e.g. on how to determine mandated quantity, eligible tech and penalties
A Product description	▪ A volume-driven capacity product, procured through a market where capacity contracts are auctioned to resources in advance. Most commonly, this requires a certain volume of capacity to be procured
B Obligation	▪ Resources are able to bid in to the auction. Successful bidders have the obligation to be available during defined periods ▪ Capacity market is cleared and settled by the SO. Costs are typically recovered through network charges to load entities ▪ The nature and level of obligations are all set centrally

C Procurement approach	▪ Decision-makers would need to consider
	  ▪ Which technologies are eligible (e.g. inclusive of subsided resources / renewables, demand-side response), and the duration of the contract to successful bidders
	  ▪ The level of “firmness” or “capacity factor” to reflect expected availability
	  ▪ Auction mechanism, including the volume of capacity to procure and penalty mechanisms
	  ▪ When to run the auction ahead of the delivery year (a trade-off between reducing risk to investors and having more certainty on the system needs)

D Enforcement	▪ Penalties for non-delivery (referring to both being available to be scheduled and responding to instruction to activate).
E Pricing	▪ Real-time price likely to decrease depending on amount of capacity procured ▪ Value of capacity contracts not necessarily linked to expected real-time prices ▪ Clearing price of auctions affect all successful bidders
F Impact on risk allocation	▪ Consumers take on most risk (away from generators) ▪ Central body (e.g. the SO) may be incentivised to reduce forecast risk

We consider seven distinct RAMs grouped into three broader categories which may address some of the "missing elements"

Adjustments to the existing NEM	Enhancements to the existing NEM	Mandatory capacity markets
Adjusting "existing levers" currently available within the NEM *(i.e. relying on the existing spot market price signal to drive investments)*	New mechanisms to "enhance" the existing functions of the NEM *(i.e. augmenting the spot market with an additional price signal)*	New markets for capacity that would "overlay" the NEM *(i.e. procuring a level of capacity which is driven by quantity defined, not price)*

1 Reliability setting adjustments	2 Modified RRO obligation	3 RERT adjustments	4 Operating reserves mechanism	5 Scarcity price adder	6 Decentralised capacity market	7 Centralised capacity market
Adjusting the wholesale price caps currently in place	Modifying the existing Retailer Reliability Obligation ("RRO") obligation	Adjusting the existing Reliability and Emergency Reserve Trader ("RERT") mechanism	Introduce a new operating reserves mechanism (as an ESS)	Adjusts the real-time price to reflect operating reserves requirements	A capacity market that places obligations to procure capacity on retailers	A capacity market that is delivered and operated by a central body (typically the SO)

Note: *These RAMs would also apply to "two-sided markets" in addition to "energy-only markets". Two-sided markets would support the formation of efficient real-time prices (that in turn, facilitates investments), by enabling consumers of electricity to be more active participants. Additionally, two-sided markets may enable the demand-side participants to contribute to some of the RAMs.*

Note: *We consider each RAM individually, although they may not be mutually exclusive. Multiple RAMs may be implemented together with different effects. Each RAM may also consist of many distinct subvariants.*

Question for stakeholders: have we captured all the main RAM options?

DRAFT FOR DISCUSSION

We are planning to evaluate each RAM across the following categories relative to the "status quo" market design applied to future conditions

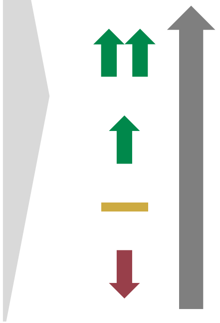
1 Description

Product description	• What is the product being introduced to improve resource adequacy? • How is it defined, e.g. as a MW or a % of load? • What does the product intend to achieve?
Obligation	• Who is obliged to procure the product? Retailers / generators / central body (i.e. the SO) • Does the obligation apply uniformly to all similarly-situated parties? • Do obligations vary by location? • Who determines the nature & level of obligation? How centralised is the decision-making?
Procurement approach	• How is the product procured? What is the term of the product? Is the product traded in forward markets or bilaterally? • What is the term of each procurement round? How far in advance of the obligation to deliver does the procurement occur? • How are locational requirements procured?
Enforcement	• How is compliance monitored? • How is non-compliance penalised?
Pricing	• Is the price paid for the product a "market-clearing" price or a "pay-as-bid" price? • Does the product procurement and pricing affect real-time energy prices or capacity prices? • What is the relationship with energy and system service revenues?
Risk allocation	• How does the mechanism affect the risk allocation between different participants? • If the SO procures the product, how are the costs incurred recovered?

2 How each RAM would deliver the objectives of a good market design

Efficient dispatch to drives efficient price signals	• How does the RAM affect real-time price signals relative to the status quo? • Would it change how prices reflect scarcity?
Efficient price signals to drive efficient investments	• How successful is the RAM in promoting efficient and timely investments, relative to the status quo?
No-undue discrimination	• How does the RAM treat different participants and technologies?
Minimum regulatory intervention	• How much reg. intervention and centralised decision-making is required relative to the status quo?
Cost recovery / risks allocated appropriately	• How would the cost of the RAM be recovered and allocated? • What is the impact on risk allocation?

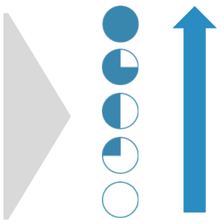
Relative rankings on the effect of the RAMs on each principle relative to the status quo market design



3 Benefits and disadvantages

Benefits and disadvantages

- Detailed description of the benefits and disadvantages.
  - Include discussion of potential subvariants / design parameters / alternatives
  - Consideration of other shortcomings, risk and unintended consequences
- Qualitative impact assessment on different participants: relative rankings on the different impacts and expected outcomes
  - Impact on resources
    - by generation technology
    - gentailers vs independents
    - distributed energy resources (incl. batteries, DSR))
  - Impact on network operators
  - Impact on retailers
  - Impact on consumers
  - Impact on policy-makers



Increasing level of expected benefits relative to the status quo market design

4 Implementation challenges

Implementation constraints and costs	• Economic and technical constraints (e.g. impact on existing investments) • Practical constraints (e.g. time required to implement, consultations) • Impact on governance (e.g. is there a clear articulation of roles / responsibilities and a pre-defined process to manage evolution / changes required) • Qualitative views on implementation costs and the impact of time-delays (e.g. modifications to rules, procurement processes, new central functions required)
Interaction with ESS	• Consideration of any interactions with ESS and the practical considerations required (e.g. how co-optimisation of energy and operating reserves would work)
Interaction with other areas of the energy market	• Additional mechanisms and policies that might be required (e.g. an ahead market might be required for an effective operating reserves mechanism) • Any intermediary actions required (e.g. changes to network codes and cost recovery approaches) • Other potential issues that may have an impact (e.g. lack of locational pricing within price zones, disorderly bidding)

Question for stakeholders: what other criteria should be considered when evaluating the RAMs?

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FINAL QUESTIONS?

NEXT STEPS OF ENGAGEMENT

HOW TO PROVIDE FEEDBACK

Please provide feedback to info@esb.org.au with email subject heading titled '*TWG resource adequacy mechanisms briefing*' by **Friday 15 May.**

Please get in contact if you have further questions.

The next TWG meeting on Resource adequacy mechanisms is expected to be in the week commencing 8 June 2020.

END OF PRESENTATION

BACKGROUND FROM PRE-READING PACK

What is a resource adequacy mechanism?

The case for a resource adequacy mechanism in a post-2025 NEM.

CHANGING GENERATION MIX

- Around 15GW (63%) of coal-capacity is expected to retire by 2038.
- As coal generation retires and the capacity of variable renewable energy (VRE) grows, new dispatchable resources will be required to firm up the variable resources.
- The ISP forecasts that most initial investment will be in utility-scale pumped hydro or battery storage.
- Over the long-term the firming of VRE will be supported by demand response, distributed batteries and new flexible gas generators.
- **QUESTION:** What expectations of the future generation mix would indicate a need for additional incentives to bring on new resources?

Announced retirements and corresponding builds in Central scenario to help firm VRE)

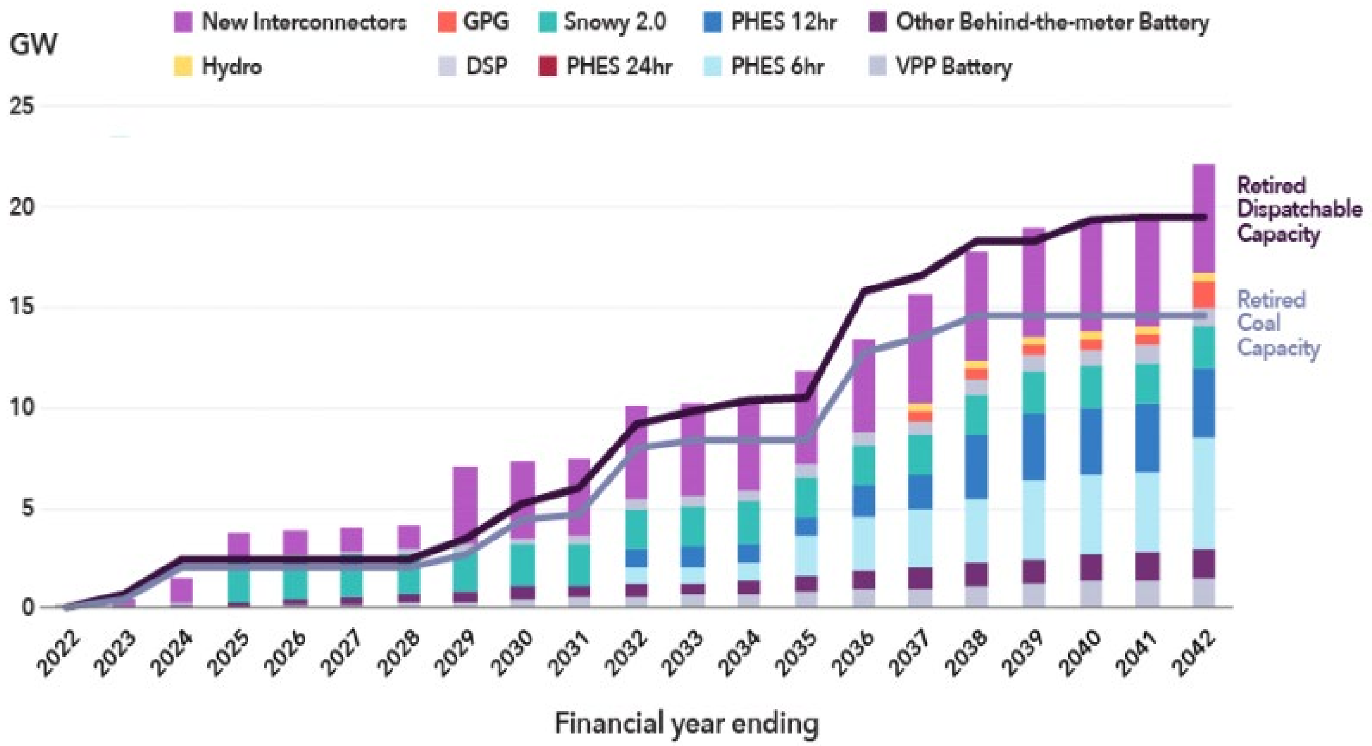

Figure 16, Draft 2020 Integrated system plan, AEMO

INVESTMENT IN DISPATCHABLE PLANT

- The dominant pattern in recent years has been the exit of large, dispatchable thermal generators and the entry of smaller variable, semi-scheduled or non-scheduled generation
- There has been a relatively small amount of new investment in dispatchable generation capacity despite an increasing portion of energy traded at higher spot prices and a reduction in reserves.
- Stakeholders have raised concern about the investment risk associated with government intervention and the potential closure of large loads.
- **Question:** What investment outcomes or expectations would indicate a need for additional incentives to bring on new resources? Are there other hurdles to investment in dispatchable resources?

Figure 2.5: Entry and exit of generation (installed megawatts) by fuel type - 2007/08-2018/19

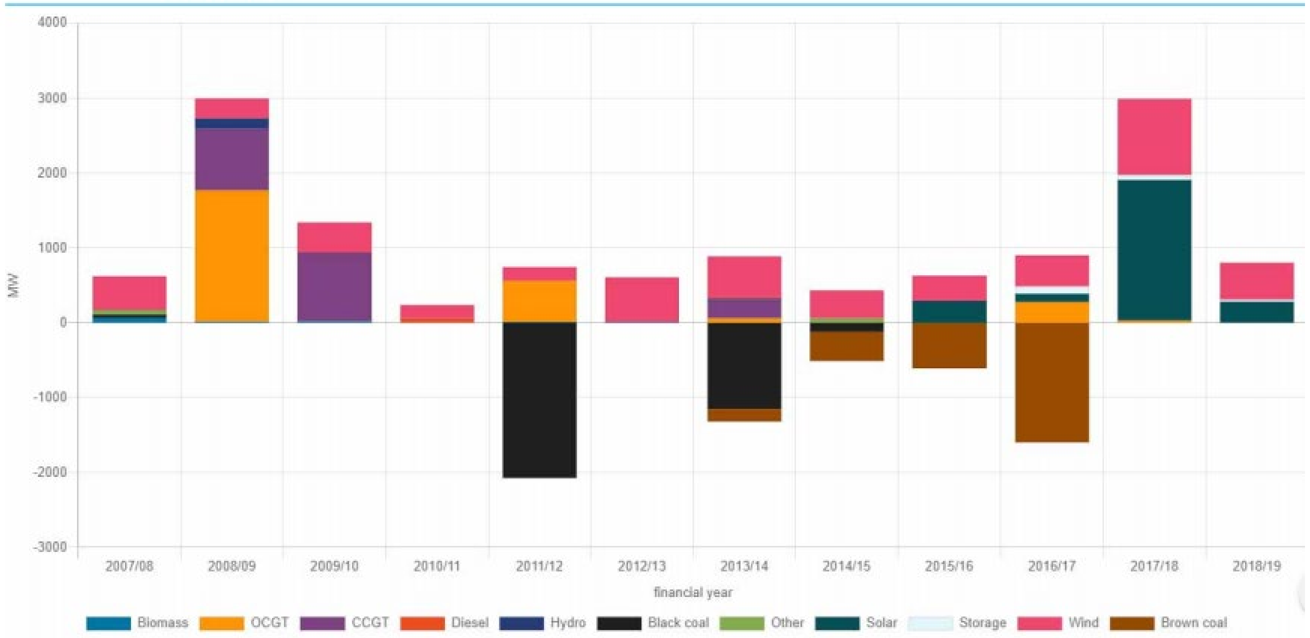

Figure 2.5, 2019 Annual market performance review, AEMC

PRICE SIGNALS IN THE NEM

- High spot and contract markets signal for resources that are available during those times.
- Over the last three years, an increasing proportion of energy has been traded at spot prices of more than $100.
- **QUESTION:** What price outcomes or expectations would indicate a need for additional incentives to bring on new resources?

PRICE BAND CONTRIBUTION TO SPOT PRICES (2000-2019)

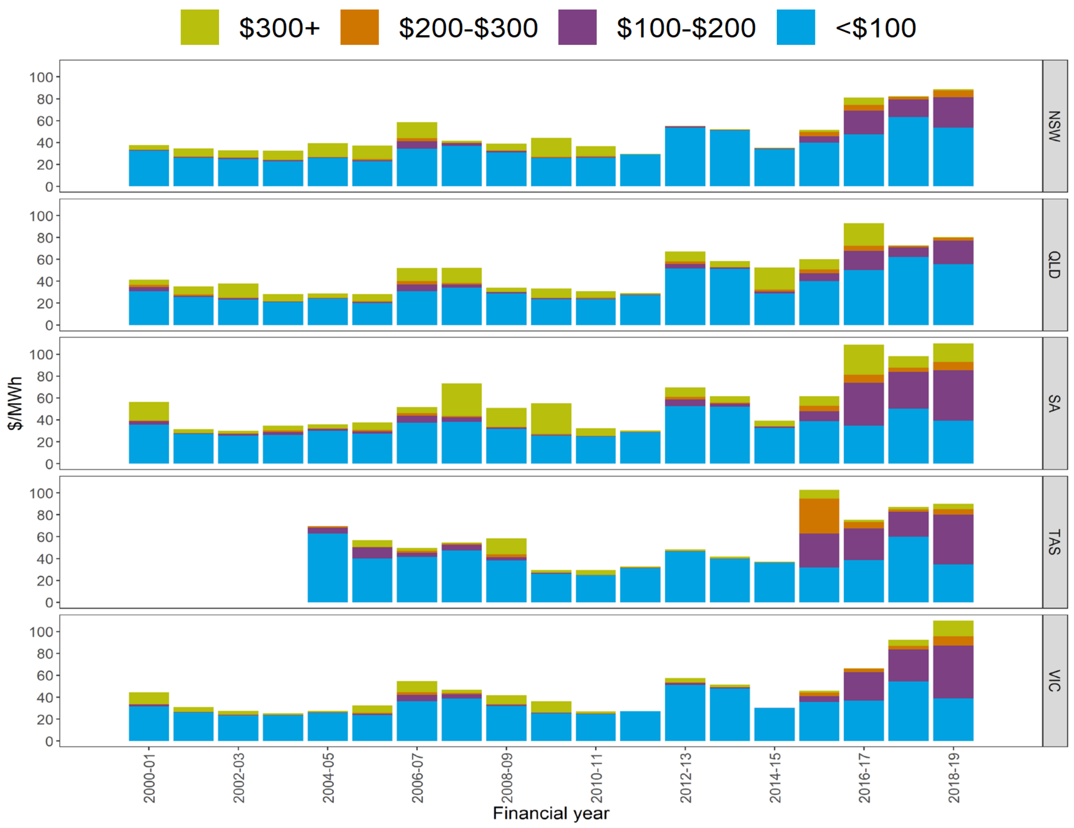

Figure 2.5, 2019 Annual market performance review, AEMC

UNSERVED ENERGY IN THE NEM

- Historically, the reliability standard has been met each year, in each region except in SA and VIC in 2008. There was also unserved energy in 2017 and 2019 though not breaching the Standard.
- Forecast unserved energy shows that in the absence of new investment, there risk of unserved energy in SA, NSW and VIC in mid-2020s, though not breaching the Standard.
- **QUESTION:** What unserved energy outcomes or expectations would indicate a need for additional incentives to bring on new resources?

Figure 3.2: Unserved energy in the NEM

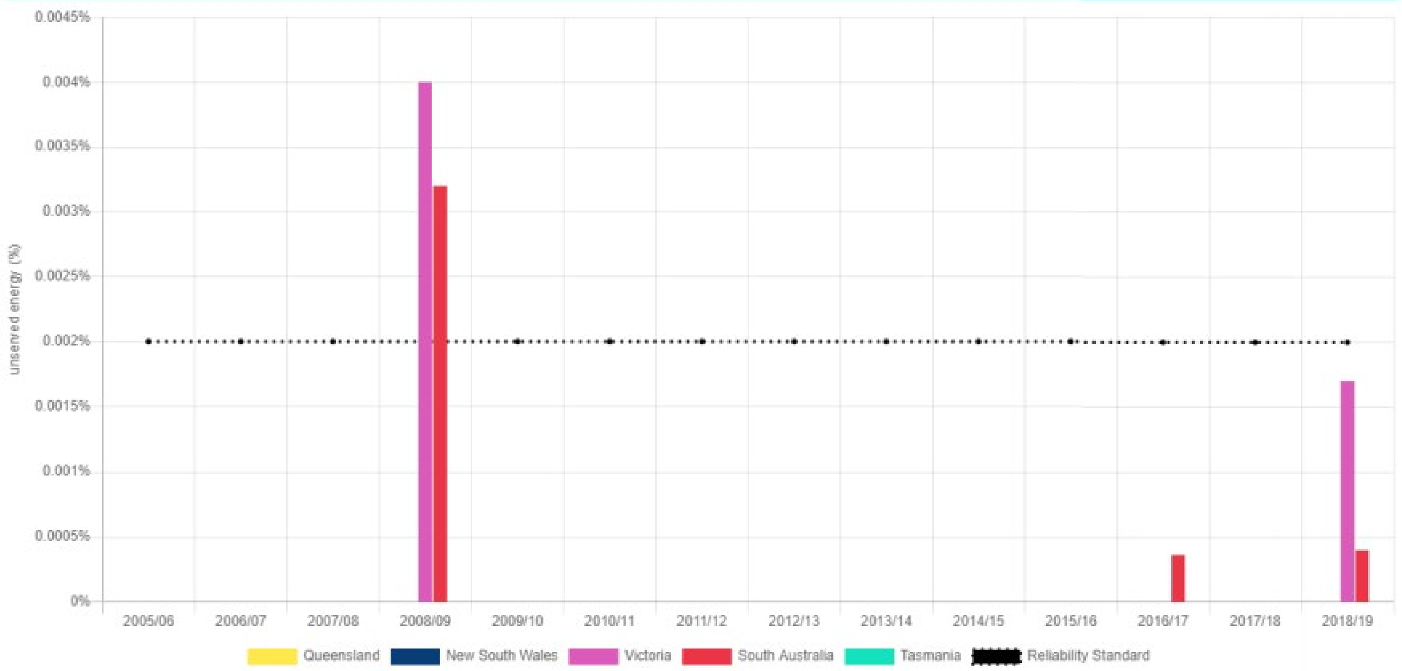

Figure 3.2, 2019 Annual market performance review, AEMC

LACK OF RESERVE & USE OF EMERGENCY RESERVES

- Recent years have seen an increase need for and use of emergency reserves through the RERT to be able to deliver reliable supply.
- This means there is an increasing number of times when the market is not delivering enough supply to meet demand. It indicates a broader issue with the level of investment in additional generation or demand response capacity to meet the supply gap.
- In addition, around half of all lack of reserve (LOR) levels and almost all LOR 2 levels were set by AEMO using the new forecasting uncertainty measure. This is consistent with increasing short term variability of intermittent generation output (and not the potential loss of large generating units) signalling a potential shortage in market reserves.
- **QUESTION**: What lack or reserve, RERT or other market intervention outcomes or expectations would indicate a need for additional incentives to bring on new resources?

Figure 3.9: RERT reserves delivered

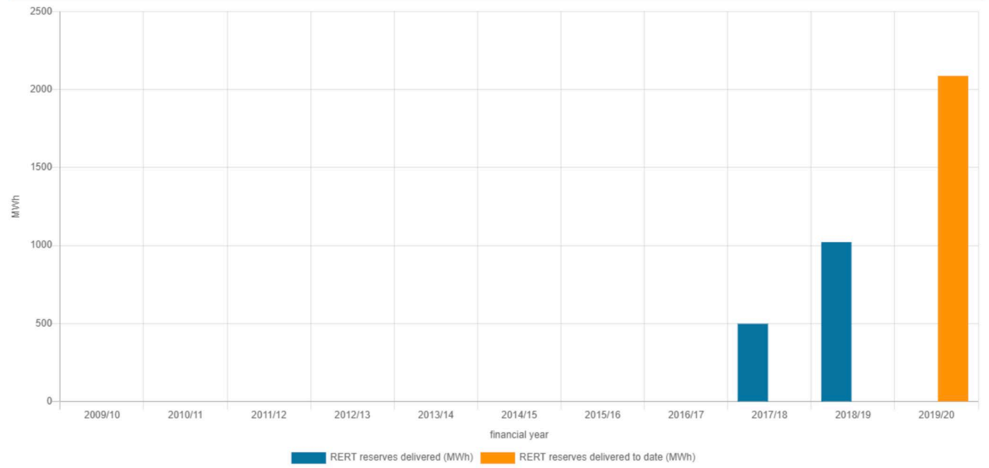

Figure 3.6: Forecast notices set by the deterministic method vs the Forecast Uncertainty Measure

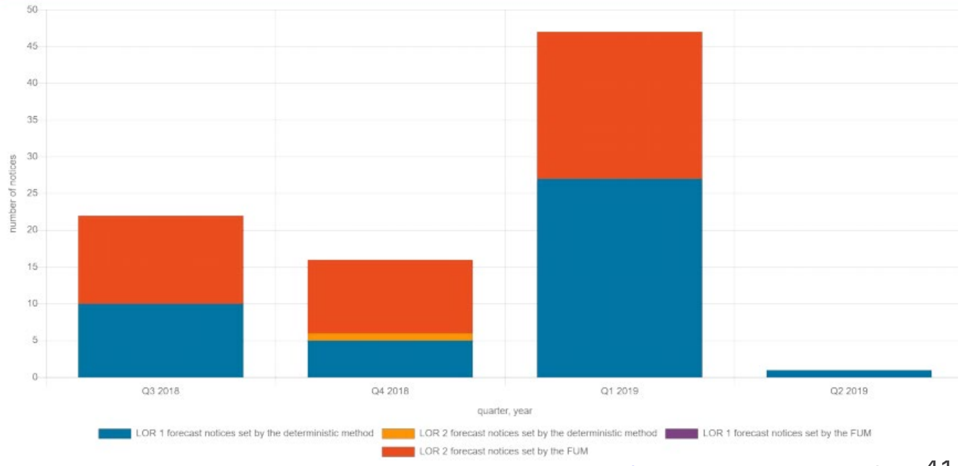

Figure 3.9 and 3.6, [2019 Annual market performance review](), AEMC

SPECIFIC QUESTIONS FOR TWG INPUT

Context:

- What key challenges is/will the NEM face/ing in bringing on investment in new energy resources to meet future needs? E.g. are there:
  - “missing” incentives in the NEM when it comes to signalling new investment?
  - other barriers to investment that a RAM may help overcome?

RAM options and evaluation:

- Do the options outlined today broadly “cover the field” of RAM options that should be evaluated for the NEM?
- Does the evaluation approach capture all the factors the ESB should be considering when assessing the need or otherwise for a RAM in the post-2025 NEM?

Note: Engagement for related MDI workstreams will continue in parallel

END OF PACK