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8 May 2022

Chairman Peter Lake

Commissioner Lori Cobos

Commissioner Jimmy Glotfelt

Commissioner Will McAdams

Public Utility Commission of Texas (PUCT)

1701 N. Congress Avenue

PO Box 13326

Austin, TX 78711-3326

Re: Dispatchable generation in Australia's National Electricity Market

Dear Honorable Chairman and Commissioners:

We understand that at the Texas Senate Business & Commerce Committee hearing on March 9, 2022, there was discussion about whether the experience and design of Australia's National Electricity Market (NEM) could provide a useful example for the market redesign process currently underway in ERCOT.

Following the hearing, Eolian hired Marsden Jacob Associates to prepare a factual and objective analysis of the experience of Australia's current and proposed reforms to encourage investment in dispatchable capacity, to ensure Australia's market experience implementing load-serving entity capacity solutions are not misrepresented in discussions relating to the ERCOT market. Currently Australia is seeing the closure of large amounts of thermal (coal) capacity and their replacement by variable renewable energy of both utility and distributed scale. How to ensure the market has sufficient dispatchable capacity for this transition has been a major focus of market bodies and policymakers.

The goal of the analysis is to explain that the NEM, through the introduction of a load-serving entity capacity mechanism known as the Retailer Reliability Obligation (RRO), has not solved the problem of ensuring sufficient revenue for building the new dispatchable generation needed to firm the increasing volatility seen in the energy

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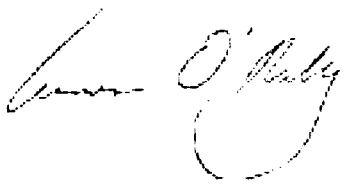
only market. As a result, there have been a range of non-market interventions, including direct government investment into the electricity sector.

The concept of the RRO is now being re-considered, with no clear model agreed for implementation of a replacement market solution. Stakeholders in other markets such as ERCOT that are considering a load-serving entity capacity market solution to create an incentive for new dispatchable generation should be aware of the limitations of the RRO that have been identified through its implementation in Australia's NEM since 2019.

Marsden Jacob was established in 1996 and has grown to be one of Australia's leading natural resource economics consultancies. Marsden Jacob has a professional staff of over 30 people and has offices in Melbourne (head office), Sydney, Adelaide, Brisbane, and Perth. The energy team brings proven and highly developed modelling expertise together with leading edge commercial and proprietary tools and models of the Australian electricity and gas markets.

As the principal author of this paper, I bring fifteen years of experience in the NEM as an energy official in the largest state of NSW, as Chief Executive of the national body for energy retailers and as a company director of two NEM retailers. I am also familiar with the ERCOT market having undertaken a Fulbright Professional Scholarship at the University of Texas at Austin in 2009.

Yours sincerely,



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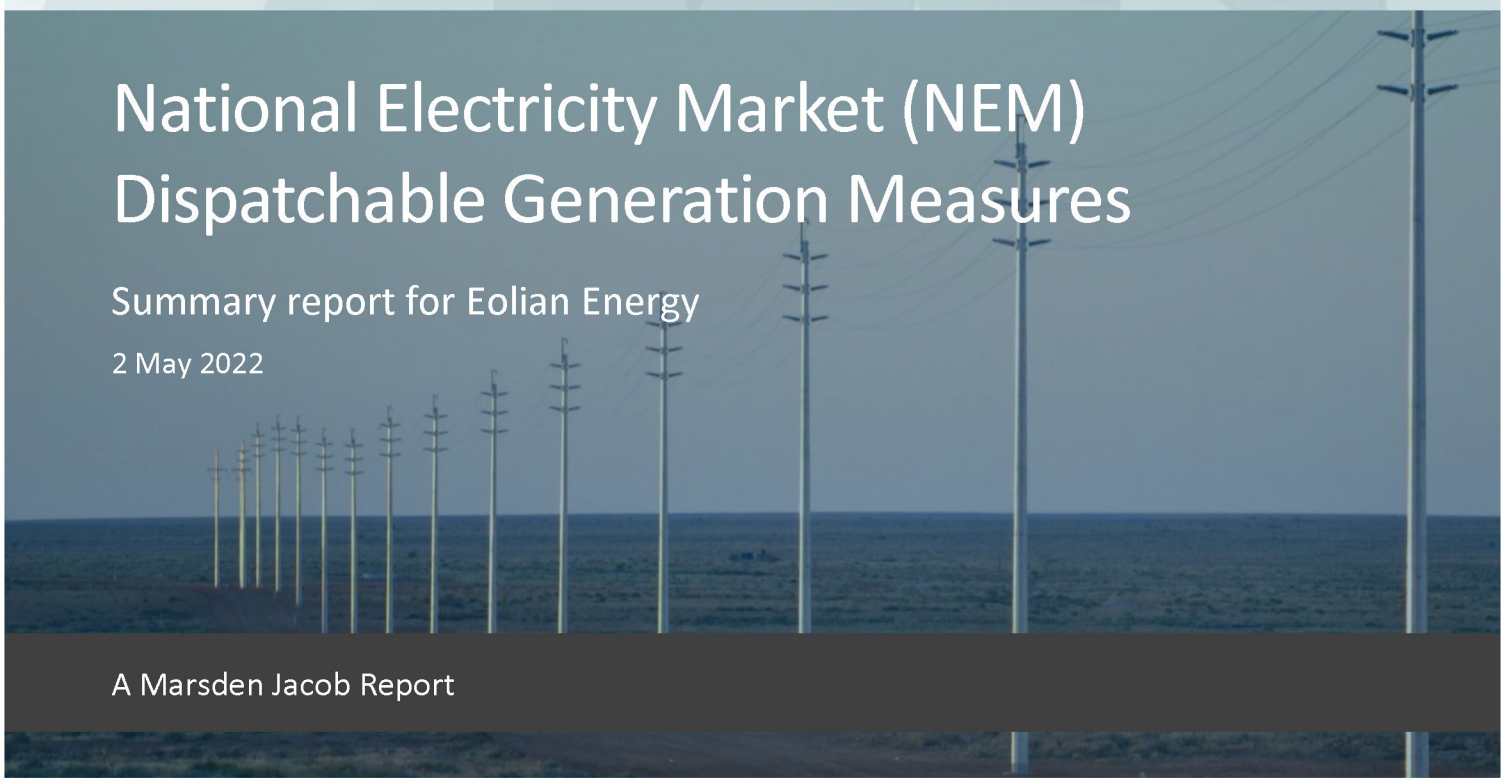
National Electricity Market (NEM) Dispatchable Generation Measures

Summary report for Eolian Energy

2 May 2022



A Marsden Jacob Report

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MARSDEN JACOB ASSOCIATES

Contents

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Acronyms and abbreviations

ACT	Australian Capital Territory
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
ASX	Australian Stock Exchange
BESS	Battery and Energy Storage System
CFD	contract for difference
DELWP	Department of Environment, Land, Water and Planning
DER	distributed energy sources
EIIA	Electricity Infrastructure Investment Act
ERCOT	The Electric Reliability Council of Texas
ESB	Energy Security Board
ESS	Essential System Services
ESOO	Electricity Statement of Opportunities
FCAS	Frequency Control & Ancillary Services
GW	gigawatt
GWh	gigawatt hour
IRS	Interim Reliability Standard
JSR	jurisdictional strategic reserve
kW	kilowatt
kWh	kilowatt hour
LTESA	Long Term Energy Services Agreement
MLO	market liquidity obligations
MW	megawatt
MWh	megawatt hour
NEM	National Electricity Market
OTC	Over the Counter
PRRO	Physical Retailer Reliability Obligation
PTP	Priority Transmission Projects
QRET	Queensland Renewable Energy Target
RERT	Reliability and Emergency Reserve Trader
REZ	renewable energy zone
RP	Reliability Panel
RRO	Retailer Reliability Obligation
USE	unserved energy
VRE	variable renewable energy
VRET	Victorian Renewable Energy Target
WEM	Wholesale Electricity Market

1. Executive Summary

Australia's National Electricity Market (NEM) and Texas' ERCOT market share a similar "energy only" design and face a common challenge in integrating increasing amounts of variable renewable energy (VRE) into the supply mix. When making comparisons, it should be remembered that the NEM is a smaller (in output) multi-state electricity market with flat load growth and a different generation mix.

In recent times, both the NEM and ERCOT have experienced VRE displacement of other forms of generation and a reduction in average wholesale prices. This has led to concerns about revenue sufficiency for "dispatchable" capacity required to meet reliability objectives and cover intraday, seasonal, and longer-term variations in VRE production.

The NEM market price cap of $15,000 a megawatt hour and market reliability standard (0.002 USE) have been the traditional instruments through which adequate capacity has been secured.

Australia's market bodies acknowledged in 2019 that these settings may not be sufficient and introduced a Retailer Reliability Obligation (RRO). The RRO required energy retailers and large industrial customers to contract with firm supply for their share of peak load, where it was projected that a breach of the reliability standard was likely to occur. Since its introduction, the RRO has not led to any significant change in the investment pipeline for the NEM, which remains dominated by new renewable capacity.

Owing to the earlier retirement of larger amounts of existing dispatchable capacity, the latest ten-year outlook released by the Australian Energy Market Operator (AEMO) is forecasting earlier breaches of the reliability standard than had been the case in 2019.

Market bodies have implicitly acknowledged design flaws in the RRO and are proposing changes as part of a broader redesign of the NEM from 2025. One of the changes under consideration is an RRO based on physical trading of certificates issued by eligible forms of dispatchable generation. This would introduce a decentralised capacity element into the NEM's energy only design.

There is no consensus amongst NEM market participants and stakeholders about whether this new physical capacity mechanism will address the shortage of dispatchable capacity.

Policymakers in the states that make up the NEM have shown a lack of faith in the current market settings by implementing state-based capacity mechanisms. In some cases, they have also engaged in direct investments in firm capacity and clouded the outlook for private investors.

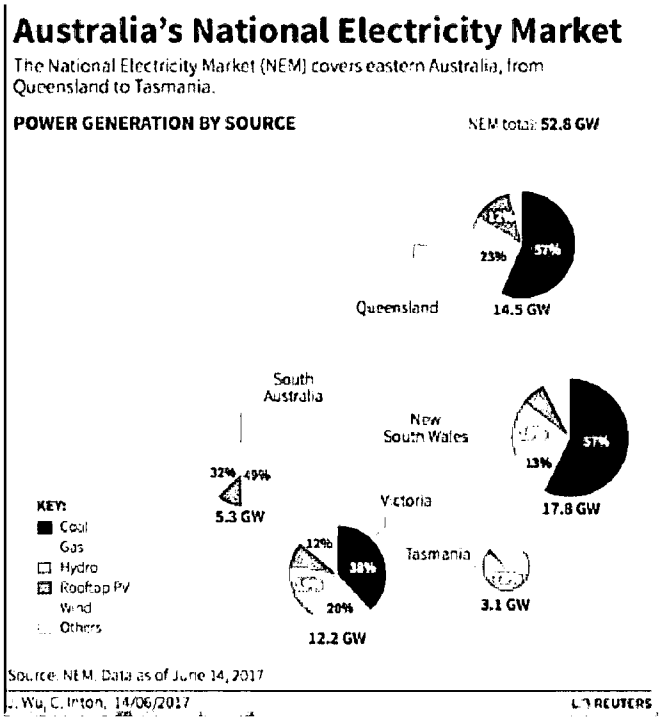
The combination of government interventions and a lack of willingness to allow the market price signals and volatility required for merchant investment in firm capacity, means that Australia is not in practice adopting a market approach to its future dispatchable needs.

Significant caution should, therefore, be applied by other markets if considering the adoption of NEM based measures to address their future reliability challenges in the face of a changing generation mix. The NEM has not solved the problem of ensuring sufficient revenue for dispatchable generation needed to firm the increasing amounts of VRE entering the energy only market.

2. Introduction to the NEM

Australia's National Electricity Market (NEM) is one of the longest, thinnest inter-connected wholesale electricity markets in the world. It stretches 5,000 kilometres from the north of Queensland to Tasmania and on to the west of South Australia as depicted in Figure 1. The NEM incorporates over 40,000 kilometres of transmission lines and cables, has a maximum generation capacity of 65 GW (includes an estimated 14 GW megawatts of DER), has a peak demand of around 35.8 GW and supplies 10.7 million customers.[1]

Figure 1: Map of Australia's National Electricity Market



The NEM began trading as a wholesale electricity spot market in 1998 and arose from intergovernmental agreements between the Australian states of New South Wales, Queensland, Victoria, Tasmania and South Australia, the Australian Capital Territory (ACT), and the Commonwealth (Federal Government) of Australia. Until the 1990's, the electricity industry operated within state borders and assets were developed by vertically integrated government utilities.

A cross jurisdictional governance model for the NEM was developed by the participating States and the Commonwealth, which involved a market operator, the Australian Energy Market Operator (AEMO), a national regulator, the Australian Energy Regulator (AER) and a national review and rules body, the Australian Energy Markets Commission (AEMC). These three entities report to a governance committee of Energy Ministers from the Federal Government, participating states, and the ACT.

[1] National Electricity Market Fact Sheet.pdf (aemo.com.au)

The NEM is a gross pool, "energy only" wholesale market where participating generators are only paid when dispatched to meet demand measured in five-minute increments (until recently, 30 minute). The market price is set by the marginal cost of the last generator on, and that price is paid to all generators operating in the trading interval. This establishes a merit order of generators based on marginal cost, and the higher the demand the more expensive the forms of generation.

The NEM operates to a market reliability standard of 0.002% unserved energy (USE) overseen by an independent Reliability Panel (RP) made up of market participants and AEMO. The panel is housed within the AEMC.[2] The reliability standard guides AEMO on its market decisions and projections for future capacity needs.

Energy only markets are less common than capacity markets for electricity which involve payments to generators for availability and centralised targets for supply. Australia also has a capacity market in Western Australia, the Wholesale Electricity Market (WEM).

Energy only markets are in place in Spain, Ireland, New Zealand, the Canadian province of Alberta and the US state of Texas (ERCOT). The ERCOT market is considered most like the NEM as it has mainly private ownership, disaggregated utilities, and contestable retail electricity markets.

2.1 Comparison of NEM & ERCOT

Unlike the NEM, ERCOT is a single state market, servicing 90% of Texas' electricity load. Its generation capacity of 86 GW, peak demand of 74.8 GW and 52,000 miles (~83,700km) of transmission lines also makes it significantly larger than the NEM in electricity output.[3]

The current generation mix of the NEM and ERCOT is also different. The NEM's main sources of generation dispatched in 2020-21 were coal 64%, wind 10.5%, utility and distributed solar 11%, hydro 7%, and gas 6%.

By contrast in 2020 the main sources of ERCOT supply were gas 45%, wind 23%, coal 18%, and nuclear 10%.

While the sources of generation differ, both the NEM and ERCOT are currently dealing with the impacts of nearly one quarter of generation being intermittent renewables that are not dispatchable or responsive to the price/demand signals of an energy only market. In the NEM, those generators are classified as semi-scheduled.[4]

In both markets, the variable renewable energy is reducing average market prices on a daily and seasonal basis and is impacting revenue for other forms of generation. In the case of the NEM, solar on both a utility and distributed scale is having greater market impact, although South Australia has very high installed wind power.

In the case of ERCOT, wind power is the second largest source of supply and Texas has the highest wind penetration of any US state.

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[2] https://www.aemc.gov.au/about-us/reliability-panel
[3] ERCOT Fact Sheet. March 2022.
[4] AEMO Application Guide for Registration as Generator in the NEM. 2021

Figure 2: Price of energy by time of day in ERCOT, Source: Potomac Economics. State of the Market Report for ERCOT (PUCT) May 2021

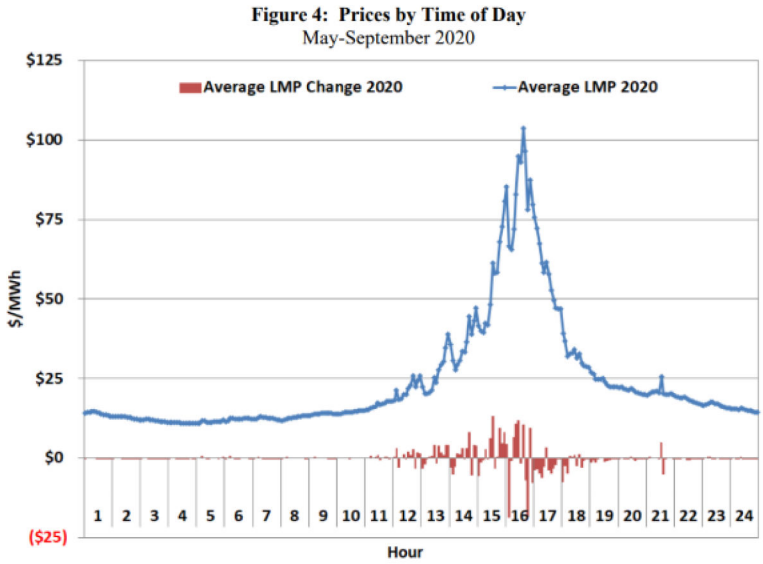
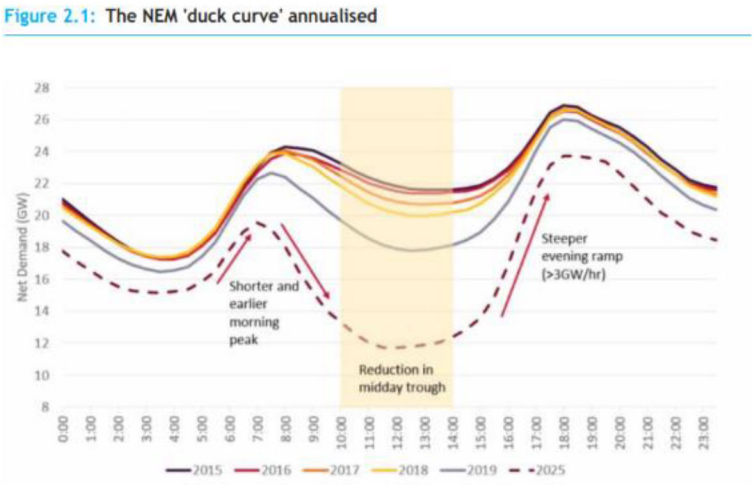


Figure 3: The NEM ' duck curve'



Source: AEMO, *Renewable Integration Study: Stage 1 report*, 2020, p. 58.

In both the NEM and ERCOT, the share of future electricity generated by renewables is projected to grow and impact the actual and forecast revenue of other generation sources.

This is creating concerns in both markets about the ability to attract investment in dispatchable sources required to address lengthy reductions in renewable energy production. These concerns were exacerbated by recent extended periods of lost load in Texas in February 2021 and South Australia in September 2016.[5]

[5] https://www.aemc.gov.au/markets-reviews-advice/review-of-the-system-black-event-in-south-australia

This is distinct from newer shorter-term forms of dispatchable generation, such as Battery and Energy Storage Systems (BESS) for which market opportunities are clearly emerging to address daily variations in renewable production and customer load. The opportunity to "arbitrage" these variations and provide market services such as Frequency Control & Ancillary Services (FCAS) has seen the NEM pipeline for BESS increase substantially in recent years.

Figure 4: NEM proposed new generation

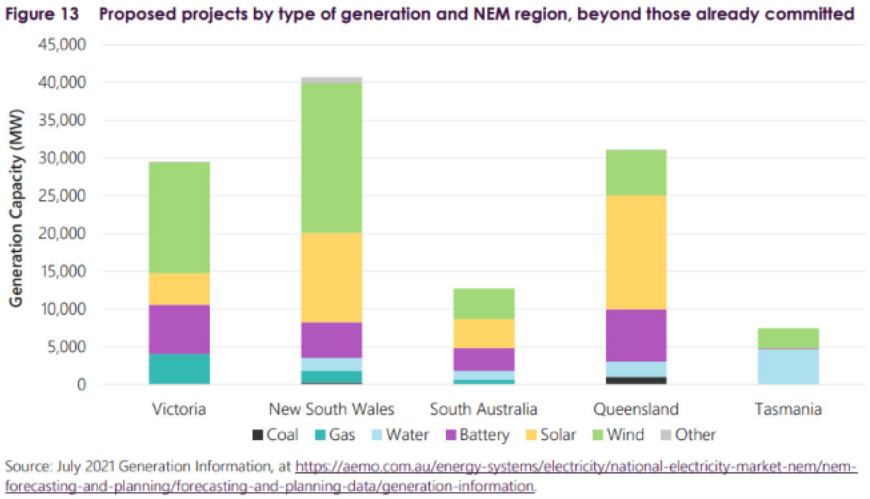
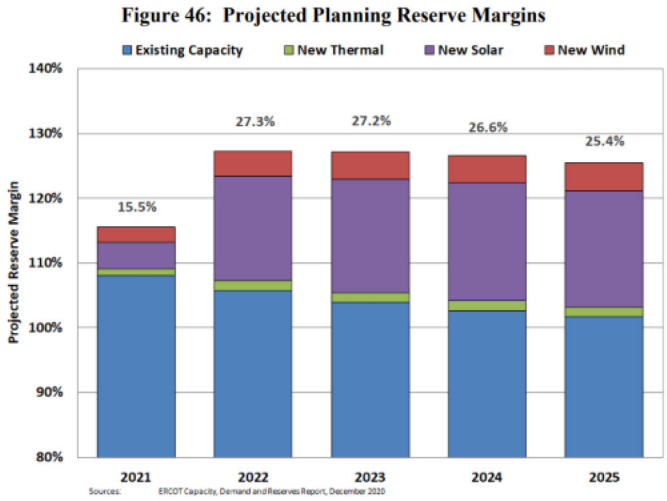


Figure 5: ERCOT proposed new capacity



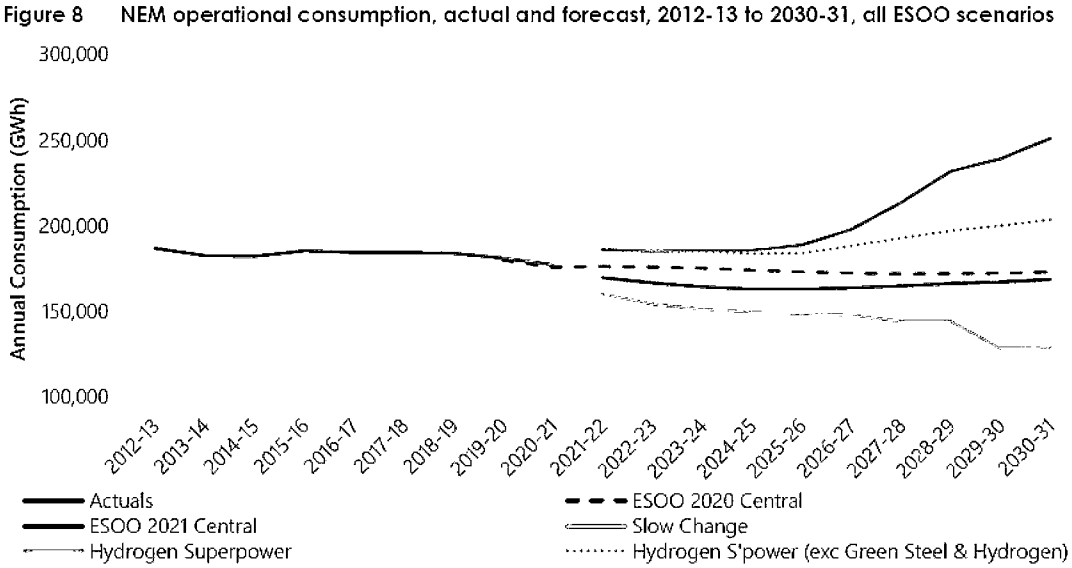
As can be seen from Figure 4 and Figure 5 respectively, the relative share of wind is expected to grow in the NEM, while the share of utility solar, from a low base, is expected to grow significantly in ERCOT. In both cases, the new generation pipeline is overwhelmingly renewable, while projected new thermal capacity is low. BESS proposals in the NEM are significant in all states except hydro dominated Tasmania.

In terms of its relevance to the situation in ERCOT, it should be noted that the NEM is a multi-state (region) market, is of a lesser scale than ERCOT, has experienced generally flat load for over a decade (partly caused by DER) and gets most of its current supply from large coal plants.

Those coal plants with a name plate capacity of 23 GW are all projected by AEMO to retire in the next two decades[6], creating a massive need for bulk energy just to meet current demand. This is on top of the challenge of developing forms of dispatchable generation that can respond quickly to variations in renewable energy generation and demand. The closure of the coal plants will also open opportunities to provide market services such as inertia that were hitherto provided for free by coal plants.

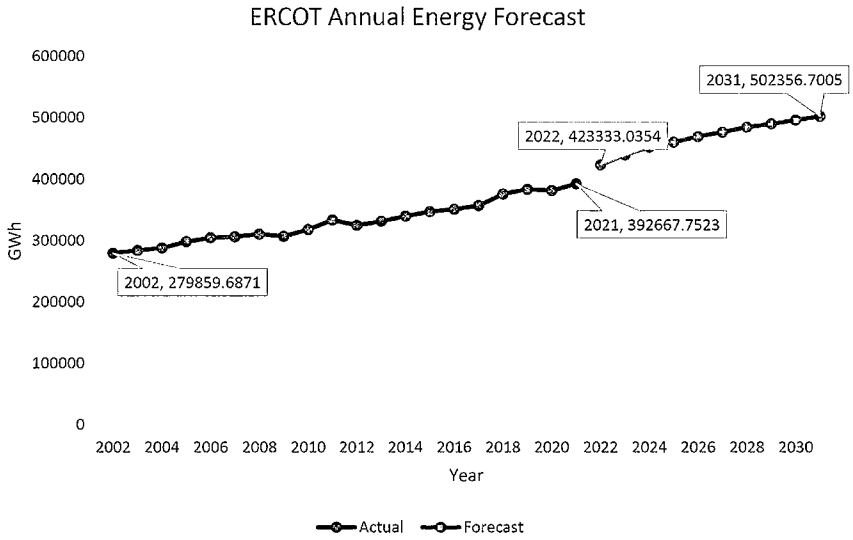
With the electrification of transport and other processes and potential growth of hydrogen, AEMO is projecting that NEM demand will grow significantly after 2030. As shown in Figure 6, NEM demand has been flat over the last decade, and it is expected to continue on that trajectory for at least the next five years. In contrast, ERCOT's demand has grown strongly and is expected to continue doing so in coming years as shown in Figure 7[7]. This makes ERCOT's need for new dispatchable generation more urgent than the NEM.

Figure 6: NEM operational consumption, actual and forecast



[6] AEMO Draft Integrated System Plan. December 2021.
[7] https://www.ercot.com/gridinfo/load/forecast

Figure 7: ERCOT annual energy forecast



In the NEM, the combination of retiring large thermal generation and growing demand after 2030 has meant that policymakers and regulators have become highly focused on resource adequacy requirements. It has also meant that governments, State and Federal, have increasingly become involved in direct investment in generation/storage or in implementing state-based policies aimed at attracting new capacity.

This array of interventions by governments, State and Federal, has dramatically impacted new private sector generation investment in the NEM. It has also undermined attempts by the national market bodies to create frameworks to support dispatchable generation.

3. Current outlook for the NEM

Australia's market operator, AEMO, each year produces annual outlook reports for the electricity sector called the Electricity Statement of Opportunities (ESOO). These reports project forward 10 years and indicate whether, based on current committed generation proposals, it believes there is adequate capacity to meet the market reliability standard in future years on a region-by-region basis.[8]

Where there are projected breaches in the reliability standard in a region, the reports are meant to be a signal to the market that new investment is required. If the projected breach is in the earlier years of the 10-year outlook, they can also trigger a range of regulatory and market operator responses.

[8] Note a region of the NEM corresponds to the borders of each state, with the exception that the ACT is part of the NSW region.

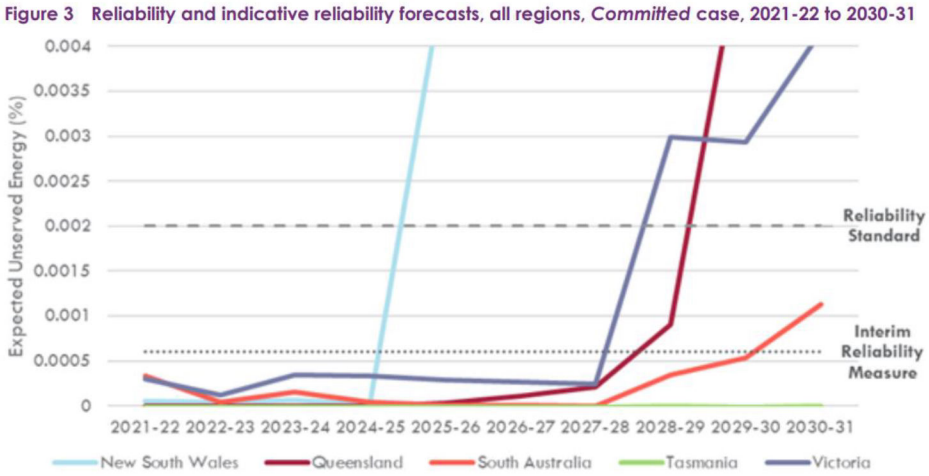
The most recent ESOO was for 2021, but in April 2022, AEMO released an update to the 2021 report in response to market developments, the most significant of which was the announced closure of the largest coal generator in the NSW region seven years earlier than forecasted.[9]

In its 2022 ESOO update, AEMO is now projecting a supply gap and breaches of the reliability standard in NSW as early as 2025.[10]

AEMO had been projecting a supply gap in NSW later in the decade along with other states, but the significance of the new warning is that it is too soon for most forms of generation to be built in the required time frame.

See the latest projections by AEMO from the 2022 ESOO below (Figure 8).

Figure 8: AEMO reliability and indicative reliability forecast



The 2022 update is likely to add further urgency to the need to support new dispatchable generation in the NEM. It also indicates that measures already adopted have not addressed this challenge. This can be seen below in the movements in committed generation in the ESOO update (Table 1).

Table 1: ESOO update - changes in committed nameplate capacity

Table 1 Changes in committed nameplate capacity in the Update to the 2021 ESOO (April 2022) compared to the 2021 ESOO (August 2021), for the 2025-26 forecast year (MW)

	New South Wales	Queensland	South Australia	Tasmania	Victoria
Wind capacity	396	172	210	0	0
Solar capacity	421	245	151	0	0
Gas capacity	266	0	-123	0	0
Coal capacity	-2,880	0	0	0	0

The one open cycle gas project included in the update in NSW called Tallawarra B, received over $90 million in government support from the NSW and Federal Governments.[11]

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[9] On 17 February 2022 Origin Energy announced during its half year results it intended to bring forward the closure of the 2880 mw Eraring black coal generator in NSW from 2032 to 2025.

[10] https://aemo.com.au/-/media/files/electricity/nem/planning_and_forecasting/nem_esoo/2022/update-to-2021-electricity-statement-of-opportunities.pdf?la=en

[11] https://www.nsw.gov.au/media-releases/australias-first-green-hydrogen-and-gas-power-plant

AEMO's definition of committed generation is based on a project passing five criteria relating to land access, planning approvals, contracts, finance, and construction.[12]

A review of the full list of projects in this category from the 2021 ESOO shows that the dispatchable generation pipeline is limited. Moreover, many of the projects in this category are either being built by government or financially supported by government. Battery proposals are strong but, again, those that have been built or committed all received some form of government assistance.

Table 2: Summary of NEM generation

Summary Table: NEM Scheduled, Semi-scheduled & Non-scheduled Generation (MW) - Existing and New Developments by Fuel-Technology Category

		Fuel - Technology Category										
	Summary Status	Coal	CCGT	OCGT	Gas other	Solar*	Wind	Water	Biomass	Battery Storage	Other	Total
	Existing	23,201	2,985	6,809	2,050	5,825	9,346	7,992	617	611	204	59,641
	Announced Withdrawal	4,880	388	-	120	-	-	-	-	-	-	5,388
	Existing less Announced Withdrawal	18,321	2,597	6,809	1,930	5,825	9,346	7,992	617	611	204	54,253
	Upgrade / Expansion	90	-	15	-	-	-	-	-	-	-	105
	Committed	-	-	1,220	-	2,849	1,367	2,290	-	139	24	7,890
	Anticipated	-	-	123	-	1,249	458	-	-	268	-	2,098
	Proposed	1,141	207	4,352	1,607	36,726	56,038	10,195	41	26,790	887	137,984
	Withdrawn	-	-	238	120	-	-	-	-	-	-	358

Notes:

"Existing" summary status includes "Announced Withdrawal".

"Committed" summary status includes "Committed*".

"Solar*" Fuel-Technology category excludes Rooftop PV installations.

Projects with "TBA" Dispatch Type are not included in the Summary Table.

Projects with "Confidential" FuelBucketSummary are not included in the Summary Table.

4. National policies relevant to dispatchable generation

The NEM institutions have already implemented measures aimed at ensuring the availability of sufficient firm supply to meet high demand periods. The main initiative has been a contracting mechanism called the Retailer Reliability Obligation (RRO).

It should be noted that the RRO is subject to a broader whole of market review conducted by the Energy Security Board (ESB). The ESB is a new NEM institution introduced in 2017 to bring together the heads of AEMO, AER and AEMC to discuss the challenges to the market arising from decarbonisation and the changing generation mix. It originally had an independent chair but is now chaired by the AEMC.

[12] https://aemo.com.au/energy-systems/electricity/national-electricity-market-nem/nem-forecasting-and-planning/forecasting-and-planning-data/generation-information

4.1 Retailer Reliability Obligation

The Retailer Reliability Obligation (RRO) commenced in the NEM on 1 July 2019 and was developed and implemented by the ESB with the support of Energy Ministers. It can be imposed in just one region of the NEM, where a projected reliability gap, meaning a breach of the market reliability standard, is identified.

If the RRO is triggered, 'liable entities' may or will (depending on how imminent the forecast gap is) be required to demonstrate that they have adequate contracts in place to meet their share of peak demand.

4.1.1 Retailer Reliability Obligation Process

AEMO Reliability Forecast

As part of their annual Electricity Statement of Opportunities (ESOO) report, AEMO produce the ten year "Reliability Forecast" (the last five years being indicative). They can update the forecast for any material changes in assumptions through the year, as they have in 2022.

Triggering the Retailer Reliability Obligation

If AEMO identifies a 'material reliability gap' from the reliability standards three years from the period in which it is forecast to occur (**T-3**), it must request that the Australian Energy Regulator (AER) publish a reliability instrument. A reliability gap will be considered 'material' if the forecast exceeds the reliability standard.

If, one year out from a forecast material gap an expected material reliability gap remains (**T-1**), AEMO must, again, request that the AER issue a reliability instrument. Note a T-1 instrument can only be issued if a T-3 instrument has been issued for that period.

For both T-3 and T-1 the RRO will be triggered if the AER determines the AEMO's assessment was appropriate and issues a reliability instrument.

Market Liquidity Obligations (MLO)

Where a T-3 Reliability Instrument has been issued, an obligation is placed on portfolio generators to provide contract liquidity by making buy and sell offers in the market within a specified buy-sell price spread. This is to ensure all retailers can access contracts, if they choose to, in a tight market.

Reliability Gap

A forecast reliability gap occurs in a region if it exceeds an Interim Reliability Standard (IRS). The IRS is set at 0.0006% unserved energy (USE). The IRS was introduced in 2020 by Energy Ministers in response to increased concern about reliability as large NEM generators retire.

The IRS is meant to be a temporary measure that allows AEMO to develop an out of market reserve to achieve the new standard on top of the obligations on market participants to contract to meet the market reliability standard under the RRO.

The IRS translates to AEMO requiring enough capacity to meet a one in 10-year demand peak with the two largest units in the region being out of service.

It should be noted this is a higher standard than the market RS[13] (USE 0.002%) used by the NEM Reliability Panel (RP) for setting the market pricing mechanisms. The market RS translates to requiring enough capacity to meet a one in year two-year demand peak with the largest unit in the region being out of service.

The RS set by the RP is meant to set market prices at a level that ensures that the market will deliver the required reliability level (USE 0.002%). Consequently, there is a mismatch between the IRS and what that market should, theoretically, deliver in terms of reliability.

Liable Entities

Liable entities include all entities registered as market customers (mostly retailers) with an annual energy consumption greater than 10GWh pa (~1MW). Large customers may choose to 'opt-in' to the RRO to manage the obligation associated with their load.

Responsibilities once the Retailer Reliability Obligation is triggered

The RRO being triggered at T-3 provides liable entities the opportunity to enter 'qualifying contracts' to meet their share of forecast in a one-in-two-year peak demand during the gap.

If T-1 reliability gap is triggered, liable entities will be required to disclose their net contract position for the periods where a reliability gap has been identified.

The AER publishes a default methodology for calculating the firmness of standard contracts. For bespoke contracts, entities can use their own methodology provided it has been independently audited.

Qualifying contracts must be:

- directly related to the purchase or sale, or price for the purchase or sale of electricity from the wholesale exchange during the stated period, and
- entered voluntarily by the liable entity to manage its exposure in relation to the volatility of the spot price.

Compliance

At T-1, AEMO may commence purchasing emergency reserves through the Reliability and Emergency Reserve Trader (RERT) process.

RERT is an additional security measure that allows AEMO to directly contract with an additional supply or demand response that is not presently available in the market.

RERT contracts can be negotiated between 12 months and 3 hours before a projected supply gap and are generally high cost. If RERT is triggered, it is paid by all customers in the relevant region.

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[13] https://www.aemc.gov.au/sites/default/files/2020-03/Reliability%20Standard%20Factsheet.pdf

However, under the RRO, part of the cost of RERT will be charged to any liable entity found to be under-contracted under the RRO based on its proportionate contribution to the RERT costs. The amount is capped at $100 million.

The process flow for the Retail Reliability Obligation is shown in Table 3 below.

Table 3 - Retail Reliability Obligation Process Flow

Retail Reliability Obligation (RRO)		
AEMO	Reliability Forecast	
	Reliability Gap 3 Years Out	Reliability Gap 1 Year Out
	Reliability Instrument Requested	
AER	Reliability Instrument Issued	
	RRO Triggered	
Liable Entities	Demonstrate future compliance by entering sufficient 'qualifying contracts'	Disclose their net contract positions for the gap period to the AER
AEMO		RERT mechanism to address the remaining gap
Liable Entities		Non-compliant entities pay for RERT

4.1.2 Issues with the current RRO

While the RRO and the higher standard for triggering it was introduced in 2019, the IRS was introduced in 2020, and they have not addressed the reliability gaps that had been identified in earlier ESOO reports. On the contrary, the updated 2022 ESOO now forecasts reliability gaps in the largest region of the NEM much earlier than had been forecast.

The fundamental failing is that the Reliability Forecast uses a one in ten-year demand forecast to predict a reliability gap, yet the contracting requirement on the retailers is for them to contract to a one in two-year demand forecast i.e., all retailers can be fully compliant, yet there is still a reliability gap. It would be unusual for a retailer not to contract to a one in two-year level under normal risk management practices. Hence, the RRO does little to change contacting behaviours or to encourage retailers to contract for the forecast supply gap.

A second significant problem is with the process for assessing the firmness of a retailer's contract position. The AER has produced a methodology for calculating the firmness of contracts held by the retailer.

Hedging contracts bought off the market, either bilateral Over the Counter (OTC) or through the Australian Stock Exchange (ASX), are treated as firm. Generation is not treated as firm.

This creates an incentive for vertically integrated retailers to sell their generation into the contracts market and for their retail arm to buy it back out of the market. This makes their contract position firm. Whilst this increases liquidity and brokers fees, it does little to support the aims of the scheme.

The RRO has also been criticised by some industry groups, including the Australian Energy Council (AEC) for favouring larger retailers with an ability to contract quickly with their own generation at the expense of small stand-alone retailers.[14]

For these reasons, the RRO is being reviewed as part of a broader future market design study by the Energy Security Board (ESB).

5. Energy Security Board (ESB) – NEM post 2025 market reforms

5.1 Overview of reforms and proposed changes to RRO

In 2019, the newly created ESB was directed by Energy Ministers to develop a post 2025 market design for the NEM to address the challenges of the energy transition. It had a very strong focus on the transformation in the generation sector driven by decarbonisation.

The reforms it recommended are centred around four core areas. These are:

1. Resource adequacy mechanisms and aging thermal retirement
2. Essential system services, scheduling, and ahead mechanisms
3. Integration of distributed energy resources (DER) and flexible demand
4. Transmission and transmission access

The ESB's final recommendations on the post 2025 market were handed to NEM Energy Ministers in August 2021 and are now under consideration. The recommendations relevant to ensuring sufficient dispatchable generation will be summarised but should only be considered proposals at this stage.

The ESB advice recommended changes to the RRO under the work stream of resource adequacy and aging thermal retirement. The ESB stated that the objective was to provide the right signals which will drive investment in an efficient mix of new resources which will minimise cost and maintain reliability[15].

The ESB is investigating changes to investment signals that ensure a more orderly exit of old thermal plants and timely investment in new assets that can maintain reliability. The ESB notes that the arrangements must "operate effectively in the presence of substantial government investment schemes". This was a reference to market interventions in participating NEM states aimed at attracting new capacity.

The ESB's stated intent of modifying the RRO in an issues paper was to:

- Manage investment in reliability without government needing to underwrite reliability risks
- Reduce the likelihood of a generator unexpectedly exiting the system, and

[14] Australian Energy Council submission on RRO to Chair of the ESB, Dr Kerry Schott, 21 November, 2018.
[15] https://esb-post2025-market-design.aemc.gov.au/options-paper

- Ensure there is a minimum amount of liquidity and contracting in the derivative market to support transparency of future price expectations.

The ESB has set out six measures of success for a modified RRO. These are:

- Seek to support longer term investment signals
- Encourage commercial risk-taking for investment (and to minimise the need on reliability grounds for government underwriting dispatchable resources)
- Seek to avoid disrupting price signals in the real time market as much as possible
- Ensure market participants bear risk for wholesale reliability gaps experienced by customers
- Capacity commitments sufficient to deliver the physical needs of the power system
- Help ensure new resources are operating in the market when they are needed.

Two options were considered in the options paper: the removal of the T-3 trigger under the RRO and/or changing the definition of qualifying contracts to physical certificates.

In the final advice given to Energy Ministers, the ESB proposes to modify the RRO with reforms split into Immediate Reform and 2022 Reform. The proposed immediate reforms are:

- Implementation of a NEM-wide jurisdictional strategic reserve (JSR) mechanism to allow states to procure reserves above the national market reliability standard where this is considered necessary (e.g., on the occurrence of unforeseen reliability events). The JSR would become part of AEMO's RERT portfolio and would be activated as needed.
- Mechanisms to improve the transparency around future generator availability, mothballing, and seasonal shutdowns to deal with uncertainties in relation to the timing of retirement for coal-fired power generation.
- Adoption of a common set of guiding principles to apply when developing future government investment schemes and achieve alignment between the physical needs of the electricity system and the financial interests of generators.
- Introduction of a Ministerial power in all states to trigger the current Retailer Reliability Obligation (RRO) and to give jurisdictions the ability to strengthen the RRO.

5.2 Physical RRO

The signature reform the ESB proposed was a Physical RRO (PRRO). The ESB sees a PRRO providing a revenue stream to dispatchable resources. This revenue stream should meet the gap between the revenue the energy only market provides and what is required to deliver the required reliability standard.

The ESB is proposing that the retail sector would need to demonstrate that they had procured physical certificates from 'dispatchable' resources to meet their customer's load.

Physical certificates would be issued to assets in the market that could provide dispatchable capacity. Physical resources would be assessed and certified by AEMO in advance.

The certificates would not provide insurance against the spot market. Hence, the sale of physical certificates should not impact the ability to sell electricity derivatives.

Retailers would need to procure these certificates to meet their liabilities, hence, the certificates would represent an additional revenue stream for dispatchable supply. A retailer's liability would be measured ex-post based on a retailer's actual demand.

An assessment of a retailer's position would only occur once a reliability shortfall occurred, either unserved energy and/or RERT activation. The shortfall would need to occur during a predefined period. A retailer would need to demonstrate they had procured enough certificates to meet their actual demand during a shortfall event.

The scheme would operate as an ongoing obligation without the reliability triggers that exist in the current design.

5.3 ESB proposed reforms to Essential System Services

Essential System Services (ESS) and how they are provided is another key element of the ESB's final advice to Energy Ministers. ESS also present new revenue opportunities beyond energy and FCAS for dispatchable generation sources as coal retires in the NEM.

The ESB identified four ESS markets for future development being frequency, inertia, system strength and operating reserves. It acknowledged that with the retirement of coal generators services like inertia that had previously been provided free of charge, would need to be remunerated.

The ESB also sought to distinguish what services could be provided through the spot market and which were better suited to direct procurement. In the case of inertia and system strength, it is believed that a spot market was possible over time and recommended further work on how this could be achieved.

The changing nature of generation would require the establishment of additional markets according to the ESB and a contestable environment would be the best way to open the market to new technologies, like BESS and synchronous condensers.

The ESB noted that with growing penetration of intermittent renewable energy in the NEM, the number of system security driven market directions was increasing. These are most pronounced in the region with the highest penetration of renewables, South Australia.

The cost of these directions was adding to the burden on consumers and provided a strong argument for the delivery of ESS by market mechanisms. Changes to the NEM were needed in time for the forecast closure of thermal generation in the largest regions of NSW and Victoria.

The ESB has stated it will work with stakeholders and jurisdictions over the next 12-18 months to progress detailed design of the PRRO and other proposed measures with Ministerial agreement targeted for mid-2023. It should be noted that there is no consensus around the PRRO, so its prospects of being implemented are uncertain, but there is general acceptance of the need for the market to procure remunerated ESS.

6. State Government Capacity Mechanisms

In view of the ongoing concerns about sufficient capacity replacement in the NEM, many of the State Governments responsible for regions of the NEM have implemented their own generation capacity mechanisms. This has indicated a lack of faith in the market's response to the changing generation mix, although the motivation has been faster decarbonisation of the electricity sector than under the Federal Government's binding emissions reduction targets for Australia.

The interventions by the state governments, particularly in Victoria and NSW, has had a significant impact on their privately owned generation sectors. It could be argued the market interventions become a self-fulfilling prophecy by deterring private investment under the NEM framework.

6.1 Victoria Renewable Energy Target scheme (VRET Scheme)

The state of Victoria has a 50% by 2030 renewable energy target that has been passed by both houses of the state parliament. The relevant legislation is the Renewable Energy (Jobs and Investment) Act 2017 (Vic). The renewable share of Victorian electricity was estimated at 24.3% in mid-2020.[16]

VRET targets are implemented through periodic reverse auctions conducted by the Victorian Department of Environment, Land, Water and Planning (DELWP), with the successful bidders receiving underwriting from the state through a contract for difference (CFD).

Projects are selected based on the following criteria:[17]

- Technical capability and viability
- Economic development
- Community engagement and shared benefits
- Impact on existing electrical infrastructure

Aside from the last criteria, VRET projects have not been supported by a plan to ensure development of dispatchable generation.

However, the Victorian Government has directly intervened in the timing of the exit of a major generator, the Yallourn brown coal generator in the La Trobe valley. A bilateral agreement was negotiated between the owners of Yallourn, Energy Australia, and the State Government to ensure the plant continued operating until a mutually agreed closure date in 2028.[18]

The terms of that agreement announced on 10 March 2021 have not been made publicly available, but it is clear payments from the Government to the company to stay open until that date are included in the arrangement.

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[16] Victorian Government. VRET Progress Report 2019-20.
[17] VRET 2017 Auctions. Q and A document. Victorian Government.
[18] https://www.energycouncil.com.au/analysis/end-of-era-with-yallourn-closure/

The Victorian Government justified the arrangement on the basis it would provide more time for replacement capacity to be put in place.

6.2 Queensland Renewable Energy Target (QRET)

The Government of Queensland has also set a state based renewable energy target of 50% by 2030. The target is not legislated but is pursued through a fully government owned energy generation company, Clean Co Queensland ("Clean Co"), who either develops or signs an offtake agreement with new renewable projects.[19]

Most existing generation in Queensland is owned by the state government, so they are likely to have more control over the entry and exit of capacity.

As a state, Queensland has enormous solar generation potential and the largest pipeline of new solar projects according to AEMO.[20] As with Victoria, there is presently no plan to ensure that any of the new generation is dispatchable generation.

6.3 NSW Electricity Infrastructure Roadmap

The NSW Government's Electricity Infrastructure Roadmap (Roadmap) is the most comprehensive market intervention by a jurisdictional government since the NEM was created. The Roadmap legislation, the Electricity Infrastructure Investment Act (EIIA), was passed in the State Parliament in November 2020 with bipartisan support.[21] NSW has the largest load in the NEM and the most retiring generation capacity over the next ten to fifteen years.

The Roadmap provides a framework for the state to underwrite up to 15 GW in new private sector generation in the state.

While most underwriting is targeted at renewable generation, unlike VRET and QRET, the Roadmap offers support to long duration (8 hours +) storage and, if required, firming infrastructure. It also includes a framework to enable investment in new transmission infrastructure.

The Roadmap legislation includes targets of 12 GW of new renewable generation in five identified renewable energy zones (REZ's), and 2 GW of long duration storage by 2030.

The key to these targets is Long Term Energy Services Agreements (LTESAs). LTESAs provide access price guarantees for eligible generation, long duration storage and firming projects.

LTESAs are to be awarded periodically through competitive tender. The amount of generation and long duration storage capacity that is tendered, and the timing of those tenders, is a decision for the independent Consumer Trustee, a newly established agency that is part of AEMO.

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[19] Cleancoqueensland.com.au
[20] AEMO Electricity Statement of Opportunities (ESOO) 2021
[21] https://legislation.nsw.gov.au/view/pdf/asmade/act-2020-44

Long duration storage is defined by the NSW Government as 8-hours of energy storage or greater and, therefore, favours pumped hydro over utility batteries. The government is also offering refundable grants for pumped hydro projects.

6.3.1 NSW Energy Supply Target

Aside from the targets for new generation to 2030, the EIIA also establishes legislative underpinning for a state specific reserve target, or NSW Energy Supply Target ("Target") out to 2030. This target that is to be set each year by an independent monitor (AEMO) requires sufficient megawatts to meet a one in ten-year demand scenario for the State (P-10), with a reserve equal to two units of the largest generator in the state.[22]

The target is, therefore, equivalent to the Interim Reliability Standard (IRS). A failure to achieve the forecast target in any one year requires the NSW Minister to outline what steps they intend to take to rectify the breach.

Options open to the Minister under the EIIA, include underwriting up to 1 gigawatt of investment in firming projects. Those projects can include Priority Transmission Projects (PTP) as well as new firming generation.

7. Direct investments in dispatchable generation by NEM Governments

With the growing concerns about generation capacity replacement in the NEM, some governments have gone further than underwriting new generation and have directly invested using their own balance sheets. The NEM has a mixed generation ownership structure, with the Queensland and Tasmanian assets mostly owned by the respective state governments.

Assets in the states of South Australia, NSW and Victoria are privately owned. In practice, as NSW and Victoria have the largest population and loads, this means NEM generation mostly comes from the private sector. As such, government investment in competition with the private sector is damaging to investor confidence.

A recent development in the NEM has been the increasing role of the Federal Government as a market player. Since the NEM began, outside Queensland and Tasmania there was a major government owned generator called Snowy Hydro Ltd. It was jointly owned by the NSW, Victorian and Federal Governments.

In 2018, the Federal Government bought out the state government shares and took 100% control of Snowy Hydro.[23] It did so to build a proposed new $6 billion pumped hydro project, Snowy 2, which would add 2,000 additional megawatts of firming capacity in the NEM.

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[22] https://www.energy.nsw.gov.au/energy-security-target-monitor-report-released
[23] Government announces $6b purchase of states' Snowy Hydro shares - ABC News

The Federal Government has increasingly been at odds with the state governments of the NEM about its decarbonisation targets, and the states responded by implementing their own renewable targets.

The Federal Government has claimed that state targets are driving out thermal capacity from the market faster than it can be replaced, and not bringing in sufficient dispatchable energy.

Consequently, as well as the Snowy 2 project, Snowy Hydro also announced new investment in a $600 million 660 MW open cycle gas project in the NSW region in 2021.[24]

While state governments have been critical of these interventions by the Federal Government, they have themselves directly procured new Battery and Energy Storage Systems (BESS) in recent years. Projects have included:

- The 100 MW Hornsdale battery project in South Australia in November 2017.
- The 300 MW Victorian big battery announced in 2019 and completed in 2021.
- A 700 MW Waratah battery project announced by the NSW Government in March 2022 and targeted for completion by 2025.

Hence, while state governments have been critical of the Federal direct investments, their actions belie their words that the private sector should be delivering new dispatchable capacity to the market.

8. Summary and Conclusions on NEM support measures for dispatchable generation

The NEM as a wholesale electricity market has design similarities to other "energy only" markets like ERCOT of Texas. Unlike ERCOT, the NEM is a multi-jurisdictional market with a much wider range of stakeholders and potential sources of market intervention.

While dealing with similar physical challenges in integrating increasing amounts of variable renewable energy (VRE) into an energy-only design, the energy capacity of ERCOT is nearly double the NEM, and the current generation mix is different.

The common challenge for the NEM and ERCOT is to ensure enough revenue for dispatchable forms of generation required to meet sometimes sudden demand shifts or reductions in VRE generation, as well as long term VRE droughts

The NEM seeks to address this with a capacity framework based on a market reliability standard which was recently tightened to address increasing reliability challenges.

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[24] https://www.abc.net.au/news/2021-05-18/federal-government-commits-600m-for-kurri-kurri-gas-plant/100147956

Current policy interventions put an onus on market players to ensure sufficient dispatchable capacity through their contracting, in particular, the Retailer Reliability Obligation (RRO). They also give powers to the market operator to contract with additional capacity for market security.

Based on recent updates to official market forecasts, these measures do not appear to be bringing forward the required dispatchable capacity.

As such, the RRO is subject to review as part of a broader process looking at the design of the NEM after 2025. The 2025 reforms are a work in progress.

One policy under consideration, the PRRO, is not yet accepted by Energy Ministers or energy industry stakeholders as a solution to ensuring requisite dispatchable capacity.

The speed of the energy transition in the NEM is seeing increasing reliability gaps emerge in the forward projections for the market. This is leading to more and more interventions by NEM governments in the market.

State based capacity schemes and direct government investments have clouded the outlook for investors in the NEM and contributed to a lack of market response to the need for new dispatchable generation. Recent capacity added to the market has not been merchant but supported by various government schemes or incentives.

The NEM, through the introduction of a demand-side capacity mechanism known as the RRO, has not solved the problem of ensuring sufficient revenue for dispatchable generation needed to firm the increasing amounts of VRE entering the energy only market.

As a result, there have been a range of non-market interventions, including direct government investment into the electricity sector, to avoid a crisis. The concept of the RRO is now being re-thought, with no clear model agreed for implementation.

Stakeholders in other markets considering a load-serving entity capacity market solution to create an incentive for new dispatchable generation, should be aware of the clear limitations of the RRO identified through its implementation in Australia's NEM.

9. About Marsden Jacob Associates

Marsden Jacob Associates (Marsden Jacob) is an economic consultancy company that provides economic, financial, strategic, and public policy advice and modelling in areas relating to energy, environment, natural resources, public policy, and transport. Marsden Jacob has a strong reputation that is based on consistent delivery of value to clients: pertinent market and strategic analysis and insightful assessments of the commercial and strategic implications of new developments.

Marsden Jacob was established in 1996 and has grown to be one of Australia's leading natural resource economics consultancies. Marsden Jacob has a professional staff of over 30 people and has offices in Melbourne (head office), Sydney, Adelaide, Brisbane, and Perth.

Marsden Jacob energy team was significantly expanded in 2012 and has continued to develop with senior experts who have a long history of providing respected advice on electricity and gas markets and associated environmental schemes and policies. The energy team brings also brings proven and highly developed modelling expertise together with leading edge commercial and proprietary tools and models of the Australian electricity and gas markets.

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