



**Chief Scientist
& Engineer**

Assessment of Summer Preparedness of the NSW Energy Market: 2020/21

Supplementary Material

December 2020

Supplementary Material

This supplementary material document provides further explanation of specific sections in the 2020/21 Assessment of Summer Preparedness of NSW Energy Market (Main Report) in response to questions that have arisen from briefings to NSW Government stakeholders, as well as new information that has come to light by 12 December 2020 since the submission of the 2020/21 Assessment report on 30 October 2020.

Updates and additional information

2.2.1.1 Learnings from summer 2019/20

The 2020 ESOO (Section 8.1 Climate and resilience) notes the impact of heat and fire over the previous summer, this includes the *“impact on gas infrastructure (required for gas-fired electricity generation) of increasing temperature periods that are at or above the design tolerance of pipelines and plant”*. Gas pipelines have a maximum temperature rating of approximately 50 °C, above which prolonged heat can degrade plastic lining on the pipes. Additionally, it is difficult to maintain compression equipment below temperatures of 50 °C when the ambient temperature is in the mid-40 °Cs. New cooling options are being explored by industry, for example, misting for evaporative cooling instead of direct hosing of the pipes which is currently employed as a management tool during periods of extended heat.¹

2.3.3.1 4 January 2020 - Separation of NSW and Victoria

Chapter 8 of the Final Report on the NSW and Victoria Separation Event of January 4 2020² details the response of distributed photovoltaic generation to voltage and frequency disturbances caused by the separation. AEMO analysis showed a correlation between distance from the separation location and proportion of inverters disconnected or dropping to zero output, with a higher disconnection rate observed closer to the separation. Part of this was due to voltage disturbance and part due to the expected controlled response to over-frequency required for inverters installed under the AS/NZS4777:2015 standard. The report states:

“The over-frequency drop response of inverters on the 2015 standard is becoming an important contributor to power system security, assisting in minimising over-frequency excursions by reducing distributed PV generation by meaningful proportions. However, significant rates of non-compliance were observed, as shown in Table 7. The analysis found that 35% of distributed PV systems in South Australia and 46% of distributed PV systems in Victoria installed under the 2015 standard were observed to not respond as specified.”

Table 7 Responses of distributed PV systems on the 2015 standard

	Victoria (and New South Wales south of the separation)	South Australia
Response as specified	24%	35%
Did not deliver any response	46%	35%
Partially responded	14%	20%
Disconnected or dropped to zero	11%	7%
Offline prior to the incident	3%	4%

Source: AEMO 2020³

¹ AEMO, personal communication, 25 September 2020.

² AEMO (2020), *Final Report – New South Wales and Victoria Separation Event on 4 January 2020*.

³ AEMO (2020), *Final Report – New South Wales and Victoria Separation Event on 4 January 2020*.

In addition to the high non-compliance rate, the current AS/NZS 4777.2 standard does not capture all the performance requirements needed to optimise and support a secure power system under high levels of DER penetration.⁴ AEMO is currently participating in a revision of AS/NZS 4777.2 and is actively working with industry to improve compliance with standards. AEMO is also undertaking consultation on an initial DER minimum technical standard. This is being conducted alongside the AEMC rule change consultation on establishing DER technical standards in the National Electricity Rules (NER). The AEMC made a draft determination on 3 December 2020⁵ and the Final Determination is due to be released in March 2021.

Appendix 3 of the final report for the 4 January 2020 event contains a detailed analysis exploring the behaviour of distributed PV generation during the separation.

3.1 Reliability and Demand Forecasts - Figure 6 in the 2020/21 Assessment Report

The Medium-Term Projected Assessment of System Adequacy (MT-PASA) analysis provides probability-based indications for NSW's generation availability in meeting demand over a two-year horizon. The MT-PASA analysis is a mechanism to notify the market of any potential reliability issues and enable a market response that mitigates any required intervention or direction from AEMO. Unserved Energy (USE) is used for reliability forecasting as it considers energy flows across states. AEMO's 2020 ESOO suggests all regions remain below RS and IRM levels for the summer 2020/21.

The graph in Figure 6 from Section 3.1 of the 2020/21 Assessment Report is updated with data from AEMO current at 11 November 2020 (Figure 1). This shows AEMO's Medium Term Projected Assessment of System Adequacy (MT-PASA) forecast supply and demand for the NSW region from 15 November 2020 to 31 March 2021, and there is no material change compared to the original graph.

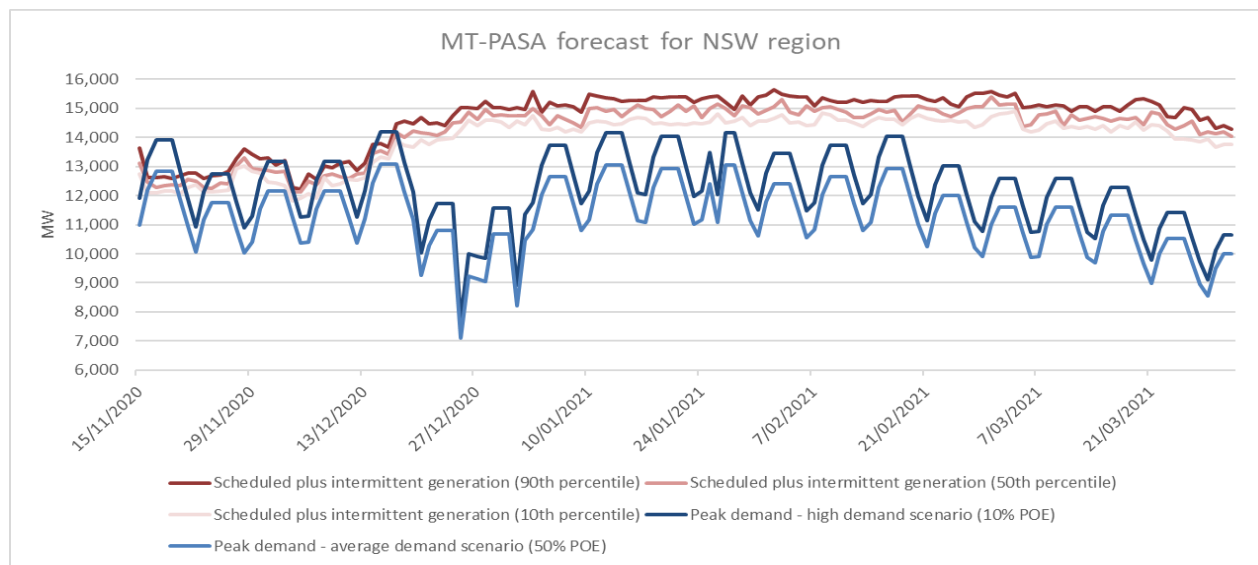


Figure 1: MT-PASA for the NSW region updated with data from 10 and 11 November 2020

Source: AEMO (2020)^{6,7}

⁴ AEMO, *AS/NZS 4777.2 – Inverter Requirements standard*, accessed 11 November 2020.

⁵ AEMC (2020), *Draft Rule Determination, National Electricity Amendment (Technical standards for distributed energy resources) Rule 2021*

⁶ AEMO (2020), *Market data – NEMWEB. Medium Term PASA*, 10 November 2020 (12:43 PM), accessed 11 November 2020.

⁷ AEMO (2020), *Market data – NEMWEB. Medium Term PASA Regional Availability*, 11 November 2020 (9:33AM), accessed 11 November 2020.

The supply forecasts (red, pink and light pink lines) include scheduled and intermittent generation availability in the NSW region only, noting that this does not take into account imported electricity via interconnectors from other states (that could potentially make up any shortfall):

- Scheduled generation is the aggregate of the offered PASA Availability for all Scheduled generators in the region.⁸
- Intermittent generation is the Variable Renewable Energy generation (comprised of semi-scheduled solar and wind generation, and large non-scheduled generation) across all iterations and reference years of the forecast process to the specified percentile level.
- Rooftop solar is not included in the MT-PASA supply forecast, however operational demand forecasts are net of demand that is met by behind the meter rooftop solar generation.

Forecasts for peak daily demand (light and dark blue lines) for the NSW region are shown for both high (10% POE) and average demand (50% POE) scenarios.

Figure 1 highlights the potential risk that electricity demand may not be met solely by NSW generation availability, particularly until mid-December. This is important in circumstances where NSW becomes ‘islanded’ from the rest of the NEM, or interconnector flows become disrupted or constrained in other regions of the NEM, particularly on high demand days. Such circumstances were observed in two key events in January 2020 which resulted in actual LOR2 conditions in NSW requiring RERT activation (Chapter 2 of 2020/21 Assessment).

The reduction in NSW generation availability until mid-December is due to shoulder period maintenance programs, including a major scheduled outage at Mt Piper for a turbine upgrade at Unit 1. Advice from EnergyAustralia indicate that the maintenance work, whilst complex, is progressing according to schedule, with the unit planned to be online by 20 December 2020 and available for full commercial operation by 24 December 2020.⁹

NSW is a net importer of electricity from other regions of the NEM¹⁰ and is forecast to continue this trend.¹¹ Import capabilities via interconnectors to NSW are outlined in Table 1. The maximum capacity is adequate to cover more than 2,000 MW of additional electricity when the interconnectors are unconstrained. Since interregional imports can cover generation shortfalls, as highlighted previously, the risk to NSW is primarily in situations where the region becomes islanded or impacted by constraints on interconnectors around the NEM (for example, in the 2018/19 and 2019/20 Assessments the example of the de-rating of the Queensland-NSW Interconnector, QNI, during thunderstorms in close proximity to the QNI was outlined, although the Panel notes that there is augmentation underway to mitigate this risk), or in situations where there is inadequate generation capacity to cover demand in both states (i.e. a multi-jurisdictional heatwave that causes high demands in multiple states). In addition to the NEM case studies presented, the 2020/21 Assessment also outlines such a situation that occurred in the Californian energy market on 14-15 August 2020 where state-wide rolling blackouts were caused by an interaction of factors including COVID-19, fire activity, a regional heatwave creating high demand, and constraints on interconnector flows from other states.

Table 1: NSW-linked interconnector import capacities

Interconnector	From	To	Nominal Capacity (MW)
Terranorra Interconnector (N-Q-MNSP1)	QLD	NSW	210
Queensland to New South Wales Interconnector (QNI)	QLD	NSW	1,078
Victoria to New South Wales (VIC1-NSW1)	VIC	NSW	700-1,600

Source: AEMO (2017)¹²

⁸ AEMO (2020), *Medium Term PASA Process Description*.

⁹ EnergyAustralia, personal communication, 10 December 2020

¹⁰ AER (2020), *State of the Energy Market 2020*.

¹¹ AEMO (2020), *2020 Integrated System Plan*.

¹² AEMO (2017), *Interconnector Capabilities for the National Electricity Market*.

3.1 Reliability standard

On 18 November 2020, the Energy Security Board (ESB) published a set of changes to the National Electricity Rules to amend the triggering of the Retailer Reliability Obligation (RRO). These Rules will align the declaration of a Forecast Reliability Gap with the new Interim Reliability Measure (0.0006% USE) that commenced in August 2020. These rules were recommended and approved by Energy Ministers in November 2020, following consultation undertaken by the ESB at the request of the (former) COAG Energy Council.

In addition, the Energy Ministers agreed to two interim measures to improve reliability, including¹³:

- The establishment of an out of market capacity reserve triggered to keep unserved energy to no more than 0.0006% in any region in any year that would apply for the 2020/2021 summer and beyond.
- Amending the triggering arrangements for the RRO to improve incentives on retailers to contract and support reliability.

3.4.3 Coronavirus (COVID-19)

The COVID-19 impacts continue with significant social and economic impacts to Australia and at a global level. Since 30 October 2020, there are updated COVID-19 restrictions for state borders and international movements.

- On 23 November 2020 the NSW Government announced the reopening of the border between NSW and Victoria at 12:01 am: this date was set as a two-week window from the Victoria Government removing the 'ring of steel' border around Melbourne and allowing regional travelling in Victoria.
- On 1 December 2020, Queensland opened its borders to all NSW and Victorian residents, noting that 32 NSW Local Government Areas were already able to travel to Queensland as of 12 November 2020 (noting that the major exclusion to this was the Greater Sydney region)¹⁴.
- Western Australia has announced the opening of borders to NSW and Victoria residents on 8 December 2020, removing the requirement for residents of these states to quarantine for 14 days.
- As at 30 November 2020, Australia's borders remain closed.¹⁵ There is a COVID-19 resurgence in Europe with outbreak hotspots in the United Kingdom, Spain, Italy and France. New daily COVID-19 cases in the United States remain high with more than 10 million total infections reported to date.¹⁶

The relaxation of interstate border rules within Australia means some of the risks identified in relation to interstate expertise being available for equipment care and maintenance and repair are mitigated.

¹³ Energy Security Board (2020), *ESB Decision Paper Interim Reliability Measure – RRO Trigger Final*.

¹⁴ [ABC News \(2020\) Coronavirus Live Blog](#)

¹⁵ [Australian Government \(2020\), COVID advice for international travellers, accessed 12 November 2020.](#)

¹⁶ [The Washington post, COVID live updates US, accessed 12 November 2020.](#)

New developments

AEMO Summer Readiness Plan 2020/21

AEMO released their Summer 2020-21 Readiness Plan in November 2020 and briefed stakeholders subsequent to the Plan's release. AEMO reiterates the same trend from the 2020 ESOO for summer 2020-21 and is in line with the findings from the OCSE 2020/21 Assessment Report, that the Central Scenario (most likely to occur) predicts a similar or reduced annual maximum demand outcome compared to last summer (2019/20) but that this comes with greater uncertainty due to COVID-19 impacts. AEMO forecasts within their modelling that the reliability standard and the Interim Reliability Measure (IRM) are not expected to be exceeded this summer.

The key risks identified by AEMO this summer within their Plan include:

- Climatic conditions that could impact both supply and demand: this includes an above normal fire risk for Queensland, warmer than average summer temperatures for regions in south-eastern Australia (including the risk of heatwaves), an increase activity in tropical cyclones and an increased likelihood of flooding (due to La Niña conditions, which are forecasted to persist until February 2021).
- Management of concurrent peak electricity demand across multiple NEM jurisdictions, which is a focus of AEMO's reserve management strategies. Peak demand is forecasted to occur at a similar or slightly later time of day in NEM regions compared to last year, with uptake in rooftop PV driving this trend.
- AEMO has identified additional reserves through the Reliability and Emergency Reserve Trader (RERT)

AEMO's Plan outlines their four-pillar plan for mitigating risks over summer 2020/21:

- **Preparation of resources:** working with generators and TNSPs to mitigate impacts of COVID-19 on operations, projects and maintenance; establishing short notice RERT panels; coordination with generators to identify and minimise potential fuel availability risks, and to minimise any potential planned outages and mitigate unplanned outage risks; and, coordination with TNSPs to maximise transmission capacity.
- **Operational improvements:** recent operational and system enhancements include continuing the self-forecasting joint initiative for renewable energy generation with ARENA; increasing forecasting accuracy and quantifying uncertainty with meteorological and third-party providers; ongoing assessment of potential COVID-19 impacts and trends.
- **Contingency planning:** AEMO has ongoing engagement with stakeholders (governments, TNSPs, etc.) to identify risk scenarios and test contingency plans, including briefings and emergency exercises. For summer 2020/21, AEMO will host weekly briefings with jurisdictional representatives and TNSPs regarding the conditions for the week (weather, power and gas systems, etc.).
- **Collaboration and communication:** AEMO identified improved communication with business and householders around risks via digital platforms (Energy Live, website material, social media) as an opportunity for coming summer.

NSW Electricity Infrastructure Roadmap¹⁷

On 7 November 2020, the NSW Government released the NSW Electricity Infrastructure Roadmap as a coordinated framework to develop a modern electricity system for NSW.

The Roadmap has five foundational pillars:

¹⁷ NSW Government (2020), *NSW Electricity Infrastructure Roadmap (Detailed Report)*.

1. *Driving investment in regional NSW: supporting our regions as the State's economic and energy powerhouse.*
2. *Delivering energy storage infrastructure: supporting stable, long-term energy storage in NSW.*
3. *Delivering Renewable Energy Zones: coordinating regional transmission and renewable generation in the right places for local communities.*
4. *Keeping the grid secure and reliable: backing the system with gas, batteries or other reliable sources as needed.*
5. *Harnessing opportunities for industry: empowering new and revitalised industries with cheap, reliable and low emissions electricity.¹⁸*

Key components of the strategy that have implications to energy reliability and security are summarised below:

- A new Electricity Infrastructure Investment Safeguard that will appoint a Consumer Trustee to set out development pathway that can deliver:
 - o generation capacity equivalent to the size of Central-West Orana (CWO) Renewable Energy Zone (REZ), the New England REZ and about 1 GW of outstanding projects by 2030;
 - o 2 GW long duration storage in addition to Snowy 2.0 by 2030; and
 - o Additional firming capacity if required.
- To support the delivery of those targets, the Consumer Trustee will run competitive process rounds to offer Long Term Energy Services Agreements for generation, long duration storage and firming capacity. Different types of contracts will be offered to the market for targeted services.
- A Scheme Financial Vehicle will be developed to recover costs for the Long-Term Energy Services Agreement through on-selling those energy services to the market or funding contributions from distribution network businesses.
- In terms of supporting long duration storage, a Pumped Hydro Recoverable Grants Program will be set up to offer open tender to 'shovel ready' pumped hydro projects that can make competitive bids for Term Energy Services Agreements. It will be implemented through the extending of NSW Emerging Energy Program with a second round of pre-investment studies with \$50 million budget. The Grant targets a total pumped hydro capacity of 3 GW, with a minimum storage duration of 8 hours (preference for 12 hours and greater) and minimum capacity of 30 MW per project.
- Firming capacity can enter Long Term Energy Services Agreements if there is a risk of breaching the NSW Energy Security Target¹⁹ and is in the public best interests to procure additional firming capacity. Contracts for firming capacity are expected to be technology neutral (e.g. include gas and storage) however gas peaking plants need to be hydrogen ready.
- Transmission regulatory investment reform for REZs that will establish a bespoke regime for NSW REZs similarly to NEM's Regulatory Investment Test for Transmission (RIT-T). The reform will introduce a Transmission Efficiency Test for REZ transmission projects to determine their costs and recovery. Generation and storage project will have to pay an ongoing fee for access to the REZ transmission networks.

In addition, the Electricity Infrastructure Roadmap is expected to unlock substantial economic opportunities and emission reductions through reliable and low-cost electricity. For example, hydrogen and other synthetic fuels, could provide energy storage, firming capacity and system

¹⁸ [DPIE \(2020\) NSW Electricity Infrastructure Roadmap, Building an Energy Superpower](#)

¹⁹ The Energy Security Target is set by the NSW Electricity Strategy which is a capacity target equivalent to NSW's peak demand over ten year plus two largest generation units. Refer to Section 4.2.4.1 of the Main Report for Energy Security Target forecasting.

services support in the medium to long term. This has been briefly discussed in the Section 4.3 of the 2020/21 Assessment.

The *NSW Electricity Infrastructure Investment Bill 2020* (Bill) has passed the NSW Parliament which enacted the NSW Electricity Infrastructure Roadmap. The Bill has legislated the NSW Energy Security Targets with monitoring system, reporting requirement and information gathering power.²⁰

NSW LOR events in November 2020

As shown above in Figure 1, there was a potential forecasted shortfall in supply to meet demand in NSW from mid-November to mid-December. On the weekend of 28-29 November 2020, NSW and SA experienced their hottest November days on record (46.9°C and 48°C respectively), just shy of the national record (Birdsville, Queensland, at 48.7°C in 1990), and a further 30 sites recorded night-time temperatures that exceeded the national record of 35°C²¹. Due to demand, an actual LOR1 was declared for the NSW region on the 28th and 29th, but both were subsequently cancelled (indicating that the market responded)²². There was also a non-credible contingency event declared for SA that had the potential to impact multiple transmission elements due to the abnormal conditions (extreme weather), which was also subsequently cancelled. This was a similar story to the weekend prior for NSW, where an actual LOR1 was declared then subsequently cancelled on the 16 November.

Erratum in the 2020/21 Assessment Report

Page	Error	Correction
10	'20 December 2020 : Extreme ambient temperatures (>40°C) led to wide-scale cut-out of wind turbine operation triggering a non-forecast LOR2 condition.'	20 December 2019
24	'The Panel notes that there is currently an application with the EPA to revise the hours of operation under elevated water discharge temperatures.'	NSW EPA has confirmed that there are no new EPL applications or changes to existing conditions, although notes that there is a pending review on seagrass condition. ²³

²⁰ NSW Government (2020), *Electricity Infrastructure Investment Bill 2020*.

²¹ Doyle, K (2020) *Weekend heatwave sent records tumbling in SA and NSW — and it isn't over yet*, *ABC News*

²² AEMO (2020) *Market notices*

²³ EPA, personal communication, November 2020.