AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

Summer 2020-21 Readiness Plan

November 2020

A report for the National Electricity Market

Important notice

PURPOSE

AEMO has prepared this document to provide information about its preparations for summer 2020-21. These preparations are designed to minimise the risk of customer supply disruption in the National Electricity Market during the periods of highest demand for electricity from the grid. This report is based on information available at 4 November 2020.

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VERSION CONTROL

Version	Release date	Changes
1	26/11/2020	Initial release

Executive summary

AEMO operates the power system for the National Electricity Market (NEM) that serves the eastern and south-eastern regions of Australia, and the Western Australian South West Integrated System (SWIS). AEMO's key responsibility is to oversee the operations of the power system so electricity is supplied safely, securely, and reliably to Australian homes and businesses, and the power system operates in the long-term interests of consumers.

In summer, the power system must manage extra risk as it responds to increased consumer energy demand, in the face of high temperatures and climatic events, including bushfires and storms.

Annually, AEMO prepares a Summer Readiness Plan, collaborating with generation and transmission network providers, federal and state governments, and key agencies to actively manage heightened risks to power system operations.

The NEM Summer Readiness Plan to address risks and deliver reliable and secure power to consumers throughout summer 2020-21 builds on the strategies and actions which delivered reliable, secure supply during summer 2019-20, and is structured around these four pillars:

- Prepared resources.
- Continuing operational improvements.
- Contingency planning.
- Collaboration and communication.

Summer 2020-21 forecast

The Bureau of Meteorology (BoM) has advised that a La Niña has developed in the Pacific Ocean and is expected to persist until at least February 2021, which is likely to bring increased rainfall and longer duration, less intense heatwaves in the south-east of Australia. While La Niña conditions are associated with altered average conditions, the conditions do not necessarily have material implications for maximum demand forecasts, as conditions conducive to high maximum demand, such as high annual maximum temperatures, may not be affected.

AEMO's Central forecast scenario predicts similar or reduced annual maximum demand outcomes compared to summer 2019-20, but also greater uncertainty, due to the unprecedented impacts of COVID-19 on the summer demand profile.

Up to approximately 3,400 megawatts (MW) of new grid-scale wind and solar generation capacity is expected be available in the NEM for summer 2020-21 that was not operating last summer. Approximately 2,000 MW of additional distributed photovoltaic (PV) will further increase supply.

In the 2020 Electricity Statement of Opportunities (ESOO) for the NEM, AEMO's modelling identified that unserved energy was not expected to exceed the reliability standard nor exceed the Interim Reliability Measure (IRM) for any NEM region this summer under most normal conditions. The ESOO also identified

numerous climate hazards and other high impact lower probability (HILP) events that affect generation and transmission infrastructure, and consumer power system outcomes.

Heightened risks in summer

The key focus areas of risk for summer 2020-21 are:

- **Climatic conditions**, with potential impacts on both demand and supply.
  - The bushfire outlook from the Bushfire and Natural Hazard Cooperative Research Centre (CRC) for the months leading up to summer indicates above normal fire potential for parts of Queensland. Bushfires can directly impact generators and transmission networks and limit the transmission network's power transfer capability.
  - The BoM is forecasting warmer than average temperatures this summer in selected parts of south-eastern Australia. Extreme temperatures and extended heatwaves elevate the risk of extreme peak demands on the network and can limit generator capacity or lead to equipment failures.
  - Additional aspects of the BoM forecasts relevant to summer operations are:
    - A more active tropical cyclone season. In rare circumstances, cyclones can damage transmission or generator assets.
    - Increased likelihood of flooding. Flooding may affect coal supplies or disrupt power flow across the network by damaging infrastructure.
- **Peak electricity demand**.
  - AEMO's Central forecast scenario predicts similar or reduced annual maximum demand outcomes compared to summer 2019-20 across most NEM regions, but also greater uncertainty, due to the unprecedented impacts of COVID-19 on the summer demand profile. Management of concurrent peak demand across multiple NEM regions remains a key operational risk, and a focus of AEMO's reserve management strategies.
  - Maximum demand is expected to occur at a similar time or slightly later in the day in all regions than it did last year. This continues an existing trend, as growth in rooftop PV uptake sees consumers generating more of their own energy supply during daylight hours, before drawing on grid supply into the evening. The status of COVID-19 lockdown measures and subsequent transition back to workplaces may have an influence on this timing.
- **Resource availability**, with impacts on supply.
  - Extreme conditions can impact the adequacy and the availability of generation and network resources when they are needed for the power system to meet demand.
  - Downside risk exists to unserved energy projections if demand exceeds expectations, or supply is below expectations, or both.
  - The risk of unserved energy, particularly in Victoria, is more acute if there are multiple delays in commissioning of new generation or increases in forced outage rates amidst COVID-19 restrictions.
  - As part of its reserve management strategy and to manage supply shortfalls, AEMO has identified additional reserves which can be made available through AEMO's Reliability and Emergency Reserve Trader (RERT) panel function. These are used only if the market does not respond with enough supply or demand resources to ensure the NEM reliability standard is met[1], or to manage power system security incidents.

Managing system security is AEMO's focus year-round, not just during periods of peak summer electricity demand. The summer plan includes continued focus on management of frequency, voltage, system strength,

[1] The standard says that no more than 0.002% of demand can be unmet in a region in any year.

and inertia to maintain a secure power system throughout summer. As the power system continues its transformation, security challenges will increasingly arise at times of low, as well as high, grid demand.

Four-pillar plan for summer

Prepared resources

The plan focuses on having appropriate resources available for AEMO, as system operator, to call on so:

- Supply is adequate to meet consumers' energy requirements, including at peak demand times, and to manage risks at times of extreme weather.
- Power system security can be maintained at all times, including when times of low grid demand make it more challenging to manage frequency, voltage, system strength and inertia.

Areas addressed in this key work stream include:

- Working with generators and transmission network service providers (TNSPs) to mitigate any impacts of COVID-19 on maintenance and project works during non-summer months.
- Maximising the availability of existing generation in the NEM – working with generators to minimise planned outages during summer and identify and mitigate risks that could cause unplanned outages.
- Non-market generation and demand resources – establishing short notice RERT panel agreements. RERT reserves can be called on if needed to help manage risk when reserves are low or where power system incidents occur. Expressions of Interest for short notice RERT reserves have been sought for all NEM regions.
- Availability of fuel for generation – AEMO coordinates with generators to identify and mitigate risks to the availability of fuel for generation (coal, gas, hydro and diesel).
- Maximising the availability of transmission networks – AEMO coordinates with TNSPs so transmission networks are available as much as possible to carry the required levels of electricity supply.

Continuing operational improvements

AEMO continues to identify and to improve its operational systems and processes to be more adaptable and better manage increased uncertainty related to supply, demand, and reserve levels under varying power system conditions. Recent enhancements have included:

- Continuing the AEMO and Australian Renewable Energy Agency (ARENA) self-forecasting joint initiative for renewable energy generation.
- Enhancing the operational visibility of virtual power plants (VPPs) in real time.
- Further work on forecasting accuracy and uncertainty quantification, in collaboration with the meteorological industry and third-party forecasting providers.
- Initiating a project in collaboration with ARENA, to demonstrate the value in improved intra-day forecasts of weather, wind, solar and electricity demand by enhancing nowcasting capability utilising real-time observations.
- Assessing potential COVID-19 impacts on energy consumption and peak demand over the summer period, to ensure demand forecasts are as adaptable and accurate as possible.

Close collaboration with AEMO's weather service providers, including the BoM and Weatherzone, again proved valuable last summer, especially under extreme and changeable conditions.

AEMO has also continued to invest in the necessary control room and support staff skills and training, incorporating lessons learnt from the 2019-20 summer.

Contingency planning

AEMO has engaged with governments, generators, TNSPs, and other stakeholders to identify relevant summer risk scenarios and conduct extensive briefings and emergency exercises to test contingency plans, communication processes, and decision-making at all levels.

From November 2020 to March 2021, AEMO will host weekly briefings with jurisdictional representatives and TNSPs regarding forecast weather and power and gas system conditions for the week ahead, with a view to identifying and mitigating risks before they materialise, where possible.

Collaboration and communication

AEMO has engaged with stakeholders across government and industry to establish working groups and share contingency plans, procure RERT, co-ordinate gas and electricity outage management plans, facilitate new generator connections, confirm fuel availability, undertake emergency exercises, identify and implement forecasting improvements, and improve network resilience.

AEMO has also identified opportunities to improve communication with businesses and households around supply risks, before and during summer. This includes using digital platforms such as Energy Live, AEMO's website, and key social media sites.

COVID-19 impacts

AEMO and participants have worked together to minimise the impact of COVID-19 on preparations for summer operations. AEMO understands that rapid changes in pandemic progress and national and international response measures may have impacts on power system operation, and on other industries that support the delivery of energy. AEMO has worked with industry to prepare contingency plans and will continue to adapt these as conditions change.

As part of this collaboration, AEMO has worked with industry to understand the evolving impact of COVID-19 on operations, maintenance and project work. COVID-19 has impacted operations through:

- The changing demand profile.
- Impacts on participants' ability to access distant resources and essential parts, conduct corrective and preventative maintenance, and implement planned project work.

Close ongoing coordination with participants[2] has enabled essential summer preparations to proceed, and will remain important throughout the summer period as various impacts of the pandemic evolve.

[2] Including under interim and final authorisations granted by the Australian Competition and Consumer Commission (ACCC), available at https://www.accc.gov.au/public-registers/authorisations-and-notifications-registers/authorisations-register/australian-energy-market-operator-aemo.

Contents

1. Summer 2020-21

This section outlines the risks and challenges expected for the National Electricity Market (NEM) in summer 2020-21. It summarises weather forecasts, expected electricity demand, and uncertainties related to supply, and how these combine to deliver current power reliability assessments for summer. It also notes system security challenges in the changing power system.

1.1 Weather and climate

Weather forecasts are the most important input into forecasting of demand and supply of generation for the NEM.

As well as the impact of the increase in renewable resources, extreme temperatures and events including bushfires, lightning, storms and high winds can reduce the output of all types of generation, impact transfer capacity of transmission lines, and result in loss of supply. Drought is also a factor in the output of hydro generation, which uses water as fuel, and thermal generation, which uses water in cooling.

AEMO continues to work closely with both the Bureau of Meteorology (BoM) and Weatherzone so its operational planning and support is underpinned by the most accurate and up-to-date climatological forecasts.

The BoM has advised that[3]:

- A La Niña has developed in the Pacific Ocean and is expected to remain the key climate driver throughout spring and summer[4]. The La Niña is expected to be a moderate to strong event and persist until at least February 2021[4].
- A La Niña is expected to result in:
  - Above average spring and summer rainfall, particularly across eastern, central and northern Australia.
  - Increased chance of widespread flooding.
  - A more active tropical cyclone season for both Queensland and Western Australia.
  - Longer duration, less intense heatwaves in the south-east of Australia.
- The Indian Ocean Dipole (IOD) is expected to remain neutral across summer months so is not expected to have any significant influence on conditions across Australia during this period.

Although severe weather can occur at any time of the year, October to April is the peak period in Australia for bushfires, heatwaves, flooding, tropical cyclones and severe storms.

- Different climate drivers are influencing conditions for 2020-21 bushfire risk compared to the 2019-20 season, including:
  - Closer to average rainfall across large parts of the country since April (except south-east Queensland and Western Australia) means that for most of the NEM, rainfall deficiencies have reduced since last

[3] For the latest BoM climate outlook, see http://www.bom.gov.au/climate/outlooks/.

[4] For information on the BoM climate driver update, see http://www.bom.gov.au/climate/enso/.

year (see Figure 1)[5]. In particular, rainfall deficiencies have reduced significantly over large parts of drought-affected areas of New South Wales and Victoria.

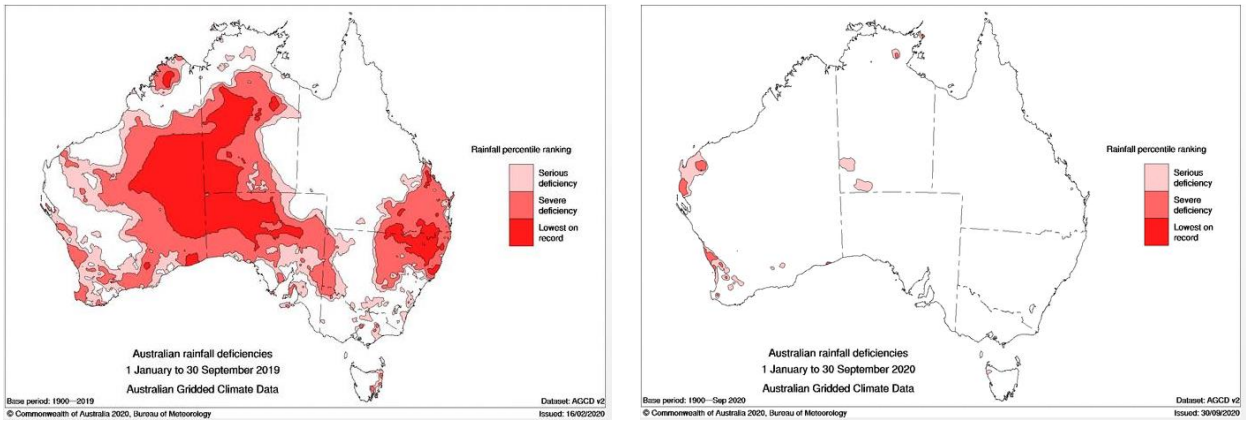
  - Despite the expectation of above average rainfall during spring, parts of Queensland, including the southeast and along the central coast, are forecast to experience above average fire potential [6] (see Figure 2).

- For the period December 2020 through to February 2021 (see Figure 3), there is less than 50% chance of exceeding the median maximum temperature over the bulk of the continent, although warmer than median maximum temperatures remain a greater than 50% chance over south-western Western Australia, northern and coastal Queensland, and parts of south-eastern Australia, including Melbourne and Hobart.

The figures below illustrate critical aspects of the weather forecast which can have a significant effect on the power system and are important considerations in AEMO's summer readiness planning.

Figure 1 shows Australia's rainfall deficiencies in the period 1 January to 30 September for 2019 and 2020, highlighting a clear reduction in rainfall deficiencies across most of Australia in 2020 compared to last year.

Figure 1 Australian rainfall deficiencies, 1 January to 30 September 2019 (left) and 2020 (right)



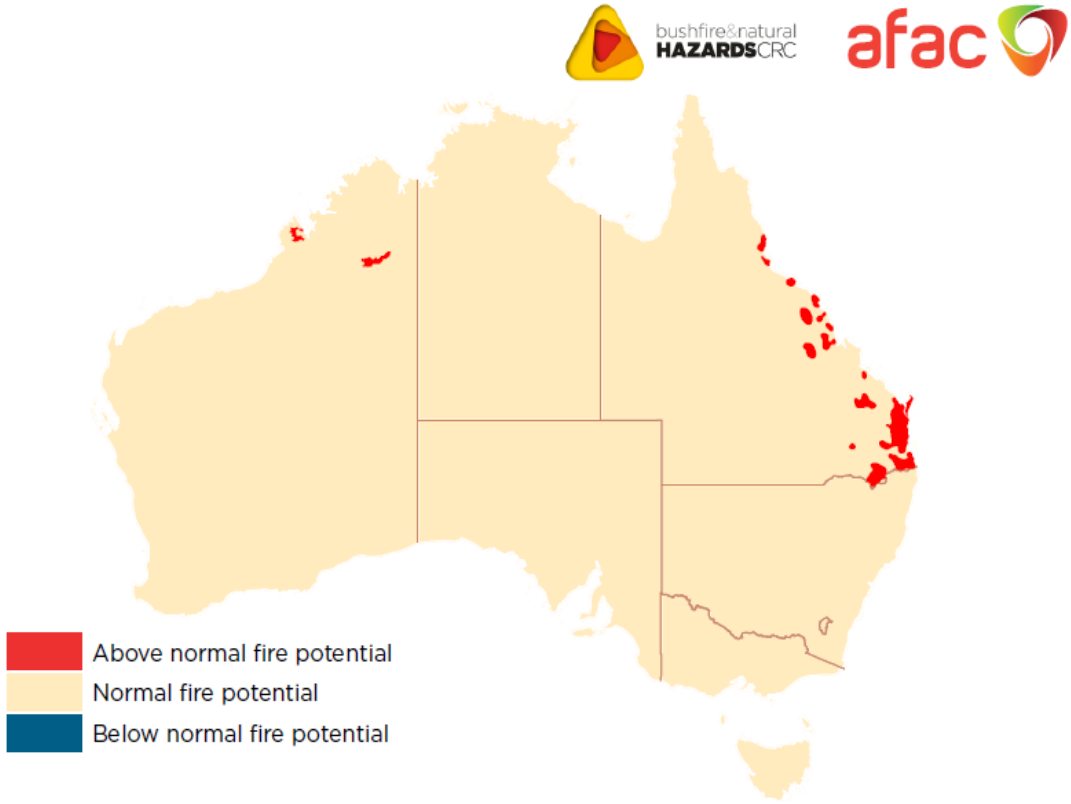
Source: BoM Drought Statements, http://www.bom.gov.au/climate/drought/

Figure 2 shows the Bushfire and Natural Hazard Cooperative Research Centre (CRC) seasonal bushfire outlook, illustrating above normal fire potential for coastal Queensland in the lead-up to the summer months.

[5] For the latest BoM drought statement, see http://www.bom.gov.au/climate/drought/. A "rainfall deficiency" is defined by the BoM as a situation where there is less rainfall over a six-month period than in similar periods over the whole historical record since 1900.

[6] For information on the Australian Seasonal Bushfire outlook, see https://www.bnhcrc.com.au/hazardnotes/77.

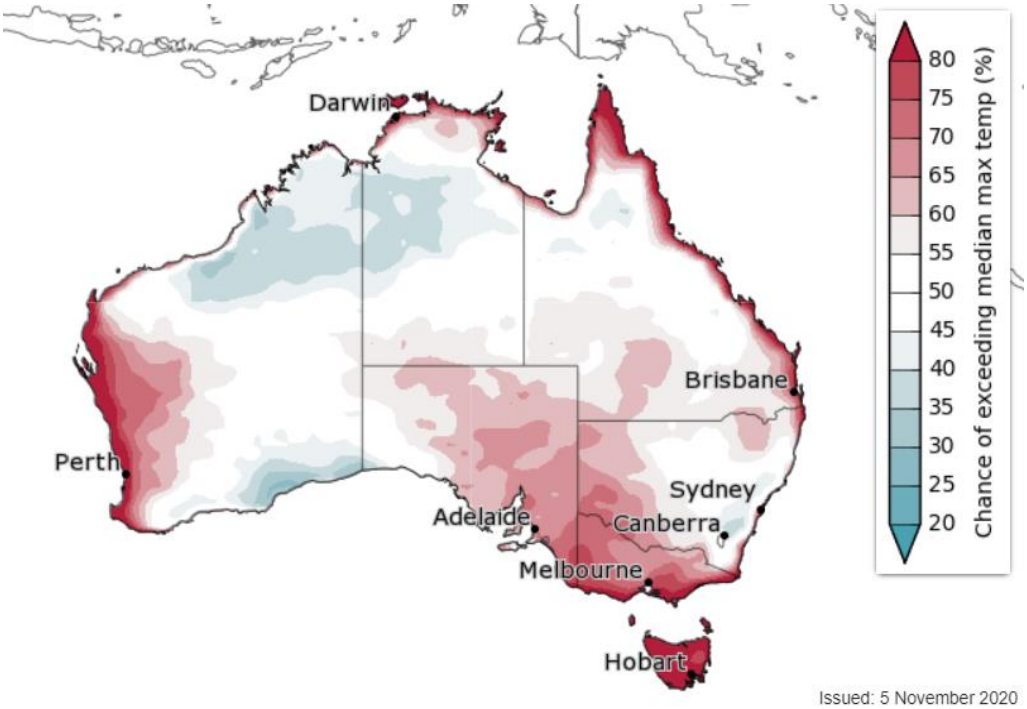
Figure 2 Australian seasonal bushfire outlook, August 2020



Source: Bushfire and natural hazards CRC, https://www.bnhcrc.com.au/hazardnotes/77.

Figure 3 shows that, over the period December 2020 through February 2021, most of south-eastern Australia, and in particular Victoria and South Australia, and parts of South Australia and Queensland, are forecast to have a high chance of warmer than average maximum temperatures.

Figure 3 Chance of exceeding median maximum temperature, December 2020 to February 2021



Source: BoM climate outlooks, http://www.bom.gov.au/climate/outlooks/#/temperature/maximum/median/seasonal/1.

1.2 Peak demand expectations

Forecast operational consumption (resources drawn from the grid over a period of time) has reduced due to both:

- The ongoing growth in rooftop photovoltaic (PV) systems (installed in households and businesses).
- The impacts of COVID-19, including those on population growth and Gross Domestic Product (GDP), subject to substantial uncertainty due to the unfolding nature of the pandemic.

Business operational energy consumption has reduced slightly compared to the 2019 ESOO forecasts as a consequence of COVID-19, while forecast residential consumption has increased due to people staying in their homes.

Recent observations support this forecast trend; in Victoria, a combination of strict COVID-19 restrictions and mild weather in the second half of Q3 2020 resulted in a 90 megawatts (MW) average reduction in underlying electricity demand in Victoria compared to a 5 MW reduction for the remainder of the NEM[7].

Generally, maximum demand (resources required from the grid at a single point in time) forecasts for summer 2020-21 indicate similar or reduced outcomes compared to summer 2019-20. This summer's forecasts are influenced by the same drivers as operational consumption yet to differing degrees. In the case of COVID-19 impacts, this driver also has uncertainty around the direction of impact[8]. Tasmania is the only region expected to have similar summer maximum demand levels to 2019-20. In contrast to all other regions, Tasmania experiences its highest demand levels in winter.

Recent years have seen a trend of maximum demand shifting later in the day, which is expected to continue, as consumers generate more of their own energy supply from rooftop PV during daylight hours, before drawing on grid supply into the evening. Because the timing of operational maximum demand has already moved to later in the day, any additional distributed PV now installed has a small impact on maximum operational demand[9], relative to its impact on annual consumption.

COVID-19 has also influenced the demand shape, creating further complexity with forecasting maximum demand. Summer 2020-21 maximum demand impacts from COVID-19 will be driven by the lockdown measures in place at the time, and the state of transition between residential and business sector load as workplaces reopen. Section 2.1 of the 2020 ESOO illustrates a range of downward impacts of COVID-19 on regional (all seasons) maximum demand. AEMO recently explored the potential for an upwards impact of COVID-19 on maximum demands, finding that an increased overlap of reopened workplaces with higher residential consumption could increase peak demands in New South Wales, Victoria and South Australia.

These maximum and minimum demand offsets are shown in Figure 4.

[7] See https://aemo.com.au/-/media/files/major-publications/qed/2020/qed-q3-2020.pdf?la=en.

[8] For further information see the 2020 ESOO.

[9] Operational demand refers to the electricity supplied by scheduled, semi-scheduled and significant non-scheduled generating units, excluding demand from scheduled loads.

Figure 4 Maximum and minimum demand offsets for COVID-19

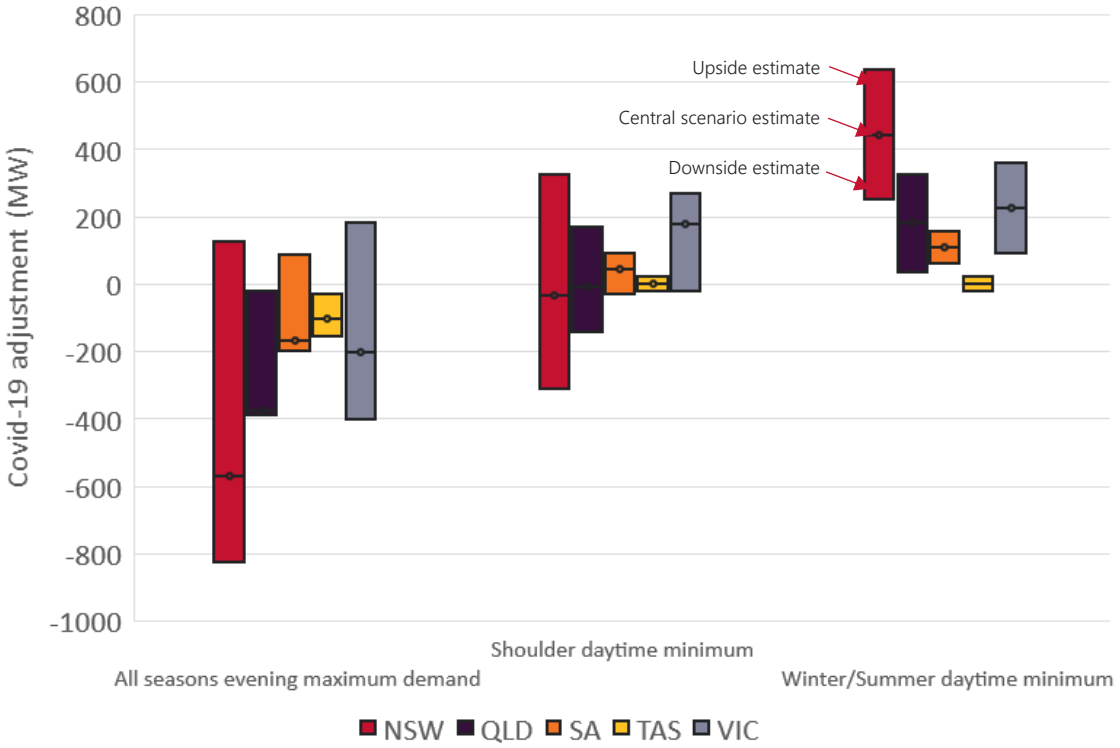
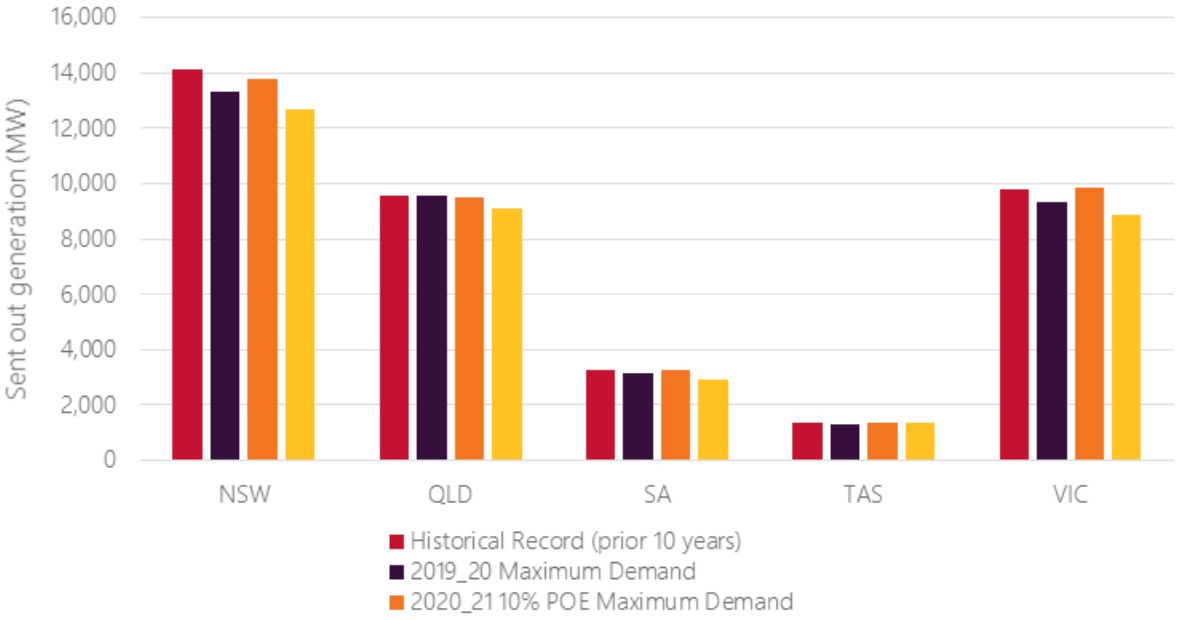


Figure 5 shows the 10% and 50% probability of exceedance (POE) maximum demand forecasts for this summer, compared to both the previous historical record and the 2019-20 peak, for each NEM region[10].

Figure 5 Summer maximum demand comparison



These comparisons illustrate that:

- The 10% POE forecast demand for each region is similar to or less than historical record for the region.

[10] From ESOO 2020 and other AEMO sources

- The 50% POE forecast demand for each region is similar to or less than actual demand last summer.

To understand POE forecasts:

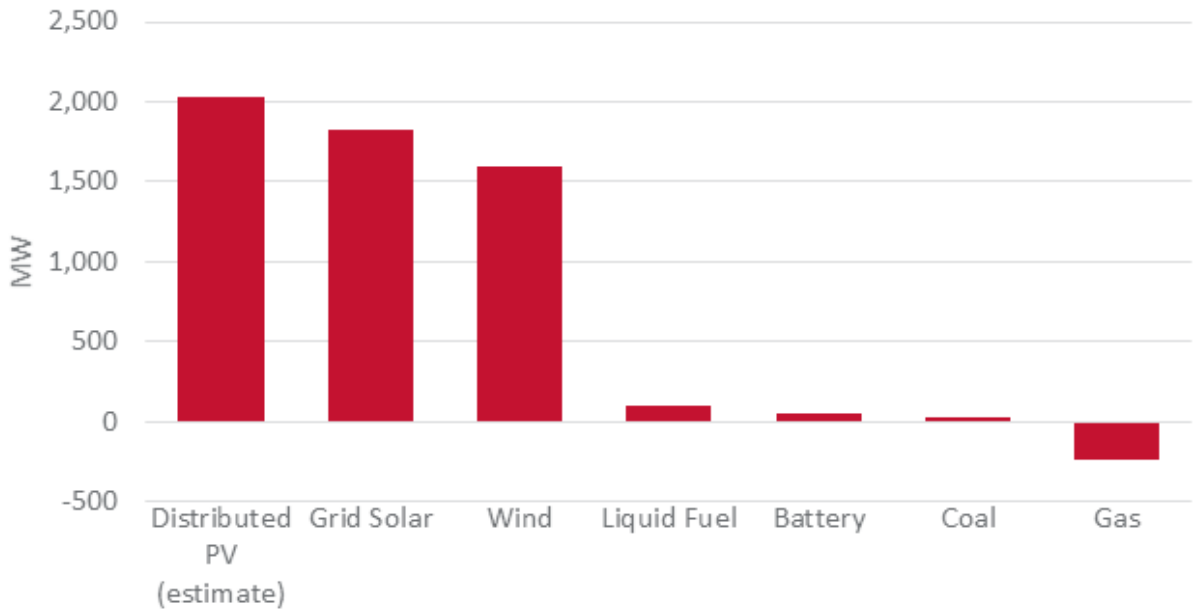
- POE is the statistical probability of a forecast being met or exceeded.
- A 10% POE forecast is expected on average to be exceeded only one year in 10, while 50% forecasts are expected to be exceeded one year in two.
- The difference between 10% and 50% POE forecasts is driven by the difference between average and extreme weather conditions, because weather is a major driver of maximum demand, especially in regions where residential demand makes up a larger proportion of the total demand (New South Wales, South Australia, and Victoria). Other drivers of maximum demand include weekend/weekday as well as the coincidence of individual consumer behaviour in response to weather and other factors.
- A 10% POE demand forecast is based on the conditions AEMO would expect under very high temperatures, at major load centres (normally capital city locations) in each region, on a weekday in January or February when industrial and commercial businesses have returned from the Christmas holiday period, and where prior days have also had high temperatures.

All states in the NEM peak in summer, except Tasmania, which is winter-peaking due to demand for heating.

1.3 Supply for summer

The NEM continues to see the connection of large amounts of new variable renewable energy (VRE)[11] capacity, with an additional new capacity of up to 3,400 MW forecast to be operational this summer compared to what was available last summer (see Figure 6)[12]. This grid-scale wind and solar contributes almost all (> 90%) of the new grid-connected capacity, and includes new capacity in every NEM region. Approximately 2,000 MW of additional distributed PV will further increase supply. Due to the operational maximum demand typically occurring in late afternoon, this significantly reduces the available capacity both of distributed PV to offset this demand, and of grid solar to meet this demand.

Figure 6 NEM additional new capacity since summer 2020



[11] Including solar, wind, and other variable renewable energy resources at the utility level.

[12] As reported in 12 November 2020 update on AEMO's Generation Information web page, at http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Generation-information.

For context, the NEM's total registered generation capacity in November 2020 was approximately 56,500 MW, of which wind and solar represented around 12,200 MW[13].

For more information on supply capacity and availability, see Section 2.1.

1.4 Power supply reliability in summer 2020-21

AEMO assesses reliability – the ability of supply to meet demand – over forecast periods from a decade out down to the next 5-minute dispatch interval, and provides information to the market to support generation capacity being available to supply consumers.

Under the National Electricity Rules, AEMO also has the option of seeking additional reserves from outside the market or directing available but unutilised generation into service if electricity supply is scarce, known as a reserve shortfall[14].

AEMO's 2020 NEM ESOO projected that unserved energy is not forecast to exceed the reliability standard[15], nor exceed the Interim Reliability Measure (IRM)[16] in any NEM region in 2020-21. The highest level of unserved energy forecast for this period is 0.00034% in Victoria, which is still below the IRM of 0.0006%.

AEMO conducted sensitivity analysis which identified that a confluence of risks, including higher than expected forecast outage rates, and a delay in the commissioning of new plant. This analysis identified that under these outcomes, forecast USE increases to above the IRM, but remains below the reliability standard.

[13] As reported in the 12 November 2020 update on AEMO's Generation Information web page, at http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Generation-information.

[14] AEMO is also able to utilise out of market reserves and issue directions to market participants to maintain or restore power system security.

[15] Unserved energy means energy that cannot be supplied to consumers, resulting in involuntary load shedding (loss of customer supply), as a result of insufficient levels of generation capacity, demand response, or network capability, to meet demand. 'Expected' in this case is a mathematical definition, describing the weighted-average outcome. The current reliability standard requires that expected USE within a given financial year does not exceed 0.002% in any NEM region.

[16] The IRM is a new interim reliability measure, agreed to at the March 2020 COAG Energy Council and introduced by the National Electricity Rules (Interim Reliability Measure) Rule 2020, that sets a maximum expected USE of no more than 0.0006% in any region in any financial year.

2. Prepared resources

2.1 Capacity and availability of resources in the market

A key focus of planning for every summer is confirming resources are available at times they are needed, especially times of peak demand during very high summer temperatures.

Initiatives to maximise availability and reduce supply uncertainty through the summer months include:

- AEMO will continue to monitor outages advised by generators and transmission network service providers (TNSPs) through Medium Term Projected Assessment of System Adequacy (MT PASA), Short-Term (ST) PASA, and Pre-Dispatch (PD) PASA[17]. If required during periods of potential low electricity reserves, AEMO may also ask generators or TNSPs to reschedule or cancel planned outages, where this does not increase any risk to future reliability of equipment or present a safety issue.
- AEMO will continue working with all generators to better understand and manage risks to availability, particularly generators more susceptible to reduction at maximum power output or with increasing temperatures. AEMO has developed an understanding of this potential capacity reduction for all generation across the NEM and is addressing heightened risks with specific generators.
- AEMO will continue to coordinate with generators and TNSPs as needed under interim and final authorisations granted by the Australian Competition and Consumer Commission (ACCC)[18] to assess and mitigate risks associated with COVID-19 restrictions.
- AEMO continues to work closely with TNSPs to ensure preventative maintenance, bushfire mitigation, and network upgrade plans are performed ahead of summer, as well as to implement ongoing coordination of planned outages to ensure a more resilient secure system. To mitigate emerging risks to the system during low demand conditions as the generation fleet evolves, AEMO has continued working with TNSPs to develop voltage control and system strength strategies.
- AEMO has improved the process for advising participants when high temperatures are forecast in NEM regions. Through use of more location-specific temperature alerts, it is envisaged that this will provide a better representation of supply availability in the NEM.

2.2 Non-market generation and demand resources

The Reliability and Emergency Reserve Trader (RERT) is a function conferred on AEMO under the National Electricity Rules. Under RERT, AEMO can enter into reserve contracts with resources (generation or load) not available to the market if needed to ensure reliability of supply meets the reliability standard or the IRM.

RERT contracts can be entered into in advance of reserve shortfalls, with short (less than a week), medium (between one week and 10 weeks) and long (between 10 weeks and one year) notice periods and, for interim reliability reserves, between 10 weeks and one year's notice.

The RERT process includes AEMO:

[17] The MT PASA looks ahead two years and is published weekly. Every day, AEMO publishes the ST PASA, looking two to seven days ahead, and the PD PASA for the following day.

[18] Available at https://www.accc.gov.au/public-registers/authorisations-and-notifications-registers/authorisations-register/australian-energy-market-operator-aemo.

- Negotiating contracts.
- Developing, testing and implementing enhancements to RERT management systems, to be operationally ready to manage RERT reserves.
- Consulting with jurisdictions (state governments in NEM regions), market participants, and other stakeholders.

In consultation with governments, AEMO has identified reserves under the RERT mechanism for the coming summer. Short notice RERT reserves have been identified across most NEM regions as a precautionary measure under AEMO's panel arrangements. Reserve contracts for those resources are only formed when it is considered likely they will be needed. Medium and Long notice RERT and interim reliability reserves have not been sought as a result of current forecasts indicating that the reliability standard and the IRM will be met.

RERT resources for this summer

The 2020 ESOO does not project reserve shortfalls in excess of the reliability standard in any NEM region this summer. AEMO is entering into short notice panel agreements for RERT in Victoria, South Australia, Queensland and New South Wales. These panel agreements allow AEMO to manage the risk of not meeting the reliability standard due to unforeseen operational conditions (such as bushfires or the trip of multiple generation or transmission assets), without committing to reserve contracts until they are needed.

This year, AEMO will seek to enter into short notice RERT panel agreements which allow AEMO to more rapidly enter into reserve contracts if required.

These agreements do not commit AEMO to a reserve contract or require upfront availability payment commitments. To date, AEMO has received expressions of interest for more than 1,918 MW of emergency reserves across the NEM that is available to cover the risks associated with extreme system scenarios.

If at any time this review process indicates additional reserve is required to meet the reliability standard or the IRM under forecast conditions, beyond the RERT already secured, AEMO will consider seeking more reserves, as appropriate, relative to the timing and quantity of the projected reserve shortfall.

AEMO currently anticipates that the procurement approach outlined above will deliver more emergency reserves under panel arrangements than last year.

RERT use during 2019-20 summer

Last summer, the RERT portfolio was used on 30 December 2019 (in Victoria), 4 January (New South Wales), 23 January (New South Wales), and 31 January (Victoria and New South Wales), to mitigate the risk of load shedding had the largest credible event occurred during the periods where RERT was activated. Further details are in AEMO's NEM Summer 2019-20 Operations Review Report[19].

2.3 Availability of fuel for generation

Gas supplies for electricity generation

As in previous years, AEMO continues to regularly engage with gas production, storage and pipeline operators to discuss and understand maintenance plans, and to coordinate outages via quarterly maintenance coordination forums. These mechanisms have not identified any gas availability shortfalls for Australia's eastern and south-eastern gas markets for the 2020-21 summer period.

AEMO will continue to work with gas facility operators to manage gas supplies and prevent gas supply shortfalls for power generation, using the Gas Supply Guarantee process that was extended for three years in March 2020.

[19] Available at https://aemo.com.au/-/media/files/electricity/nem/system-operations/summer-operations/2019-20/summer-2019-20-nem-operations-review.pdf?la=en.

AEMO's work with gas facility operators includes understanding and allowing for the risk posed to maintenance and operations by COVID-19.

AEMO's processes also include coordination to prevent major TNSP outages conflicting with major gas facility outages, to prevent, for example, a major gas supply reduction coinciding with an interconnector outage for the same region.

Supplies for hydro, diesel, and coal generation

AEMO has been working with generators to identify whether there are any existing or anticipated key fuel supply risks to their operations. In addition to direct dialogue with and assurances from generators, AEMO uses the Generator Energy Limitation Framework (GELF) survey, in which generators provide specific information around potential energy constraints (fuel limitations). This could include, for example, water available for hydro generation, or cooling water for thermal generation during drought conditions.

Insights gained through the GELF survey are published in AEMO's Energy Adequacy Assessment Projection (EAAP). The November 2020 EAAP indicates that drought and other energy limitations are unlikely to significantly affect reliability in the two year horizon, even under low hydro inflow conditions[20].

2.4 Availability of transmission networks

Transmission capacity must be optimised so power can flow where and when it needs to, and to avoid unnecessary network limitations that could reduce power transfer capability.

The summer readiness plan focuses on the following areas.

- AEMO continues to work with TNSPs to co-ordinate preparation plans for summer, and better understand and manage potential risks. This has included:
  - Confirming preventive maintenance on critical elements of the transmission network is performed in preparation for the summer period to deliver a more resilient transmission system, including bushfire mitigation works and network upgrade plans.
  - Maximising transmission availability during periods when it is required. This means minimising planned outages during periods of extreme conditions, to reduce risk to the power system.
  - Understanding and managing the impacts of COVID-19 on normal maintenance activities.
- AEMO liaises with TNSPs on an ongoing basis so the latest changes to the network, including connection of new generation, are reflected in the limit advices and constraint equations (mathematical representation of the transmission system capacity) used to determine electricity dispatch through AEMO's market systems, to get the best capacity from the networks.
- AEMO has continued to work with TNSPs and interconnector providers to optimise and increase interconnector capacity.

[20] See https://www.aemo.com.au/energy-systems/electricity/national-electricity-market-nem/nem-forecasting-and-planning/forecasting-and-reliability/energy-adequacy-assessment-projection-eaap.

3. Operational improvements

AEMO continuously works to improve its short-term operational forecasting models, enhance situational awareness, and increase its investment in the skills of AEMO's team.

3.1 Forecasting improvement activities

Short-term demand and renewable generation forecasting remains a key focus for AEMO.

The following improvement activities have been ongoing in the lead up to summer 2020-21:

- Strong uptake of the AEMO and Australian Renewable Energy Agency (ARENA) self-forecasting joint initiative for renewable energy generation has continued in 2020. As of early October 2020, 24 solar farms and nine wind farms in the NEM are accredited for self-forecasting in dispatch.
  - On average, the self-forecasts provide approximately 16% more accuracy than the forecasts AEMO used previously[21] (based on mean absolute error). This project continues to demonstrate the benefit of uplifting participants' engagement with forecasting, and the valuable information generation asset operators can provide to AEMO to ensure efficient dispatch and best practice forecasting.
- On-boarding of operational data from registered virtual power plant (VPP) trial[22] participants is enabling operational visibility of VPPs in real time. VPPs have also continued improving their self-forecasting data submissions to AEMO. With strong expected growth of VPPs, understanding of the behaviour of VPPs in real time and in the short-term horizon is critical to maintaining reasonable demand forecast accuracy in the NEM, particularly at times of extreme (high or low) demand.
- Further temperature forecast accuracy investigations have been released, focusing on aspects of operational weather forecasting critical to demand forecasting during peak summer events[23]. In 2020, AEMO also conducted a comparison of weather forecasting performance for the previous two summers. The results continue to be explored in collaboration with the meteorological industry to investigate potential methods for improving weather forecasts that are critical to energy forecasting.
- AEMO has continued to work in close collaboration with its weather service providers and forecasting vendors on initiatives to improve the quality and timeliness of weather and hazard information available to support operational decision-making in real time. A key initiative is the recently announced collaboration with ARENA and Solcast for the Gridded Renewables Nowcasting demonstration project over South Australia[24]. The project aims to demonstrate the value in improved intra-day forecasts of weather, wind,

[21] Forecasts from the Australian Wind Energy Forecasting System (AWEFS) and Australian Solar Energy Forecasting System (ASEFS).

[22] A VPP is an aggregation of distributed resources, co-ordinated to deliver energy and ancillary services to the power system and electricity markets. AEMO is collaborating with ARENA, the Australian Energy Market Commission (AEMC), the Australian Energy Regulator (AER), and members of the Distributed Energy Integration Program (DEIP) on a VPP Demonstrations trial project in the NEM. The VPP Demonstrations began in 2019 and have been extended (pending more participants enrolling) until mid-2021. For more, see https://aemo.com.au/initiatives/major-programs/nem-distributed-energy-resources-der-program/pilots-and-trials/virtual-power-plant-vpp-demonstrations.

[23] For latest temperature forecast analysis, see https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/nem-forecasting-and-planning/operational-forecasting/load-forecasting-in-pre-dispatch-and-stpasa

[24] For information on the nowcasting project, see https://arena.gov.au/projects/gridded-renewables-nowcasting-demonstration-over-south-australia/

solar and electricity demand by enhancing the nowcasting capability using real-time observations, including satellite imagery. With weather forecasts being the most important input into AEMO's forecasting systems, AEMO recognises that continued improvement is essential as increased levels of renewable generation enters the NEM.

- Investigations were undertaken into the factors affecting high temperature wind de-rating that occurred on a number of occasions in summer 2019-20, and real-time analysis tools and forecast monitoring capability have been enhanced to uplift AEMO's situational awareness of such events.
  - Before summer, AEMO will release an improved guide for operational forecasts of intermittent generators in the NEM, to assist asset operators with their required actions before and during de-rating events.
  - AEMO's Operational Forecasting team continues to provide one-on-one training for new participants on the operation of wind/solar forecasting systems in dispatch, pre-dispatch and PASA processes. Further training for existing participants is also available on request.
- The COVID-19 pandemic has resulted in a fundamental shift in a number of behavioural factors that impact demand. The impacts included reduced small-and-medium enterprise commercial consumption and increased residential consumption during restrictions. Analysis of demand during the 2020 winter period suggests that at certain levels of eased restrictions and under extreme temperatures, demand is likely to increase and exceed pre-COVID-19 levels.

  The extent to which such impacts may be observed during summer depends on the level of restrictions in the region, the underlying economic impacts of the pandemic, and the extent to which people continue to work from home.

  The situation for summer will be highly dynamic, and carries significant uncertainty due to the unprecedented nature of the pandemic. To ensure demand forecasts are as adaptable and accurate as possible through the summer period, AEMO has explored:

  - COVID-19 impacts during the summer period internationally.
  - Using publicly available Google mobility data to track the extent to which underlying behavioural changes exist. This has been made a dynamic variable in each of AEMO's regional demand models.
  - Applying changes to the temperature-demand response curve observed in winter to the space cooling side of the curve to assess potential changes to summer peak demand.
- More broadly, to continue to improve its demand forecasting capability, AEMO has:
  - Shifted to more regular updates of installed rooftop solar capacity in the Australian Solar Forecasting System (ASEFS).
  - Further developed machine learning techniques to enhance the ensemble-based approach to operational load forecasting. AEMO now uses a suite of demand forecast models to deliver a spread of forecasts which provide performance benchmarking and an understanding of forecast variance. This assists greatly in quantifying operational risk, particularly on extreme (high or low) demand days.

3.2 Operator skills and training

AEMO continues to invest in a team with diversified skills, including engineers, forecasting analysts, and data science specialists, to meet the technical challenges of a rapidly transforming industry.

AEMO has continued to deliver extensive training for control room operators and operational support staff across a range of areas such as reserve management, system restart, enhancements to forecasting systems, and other situational awareness tools. The NEM real-time operations summer readiness training is focusing on lessons learnt from summer 2019-20, in addition to the key areas of reserve management, load forecasting, system strength and security.

4. Contingency planning

As well as preparing for a range of operating scenarios over summer, AEMO collaborates with all governments and electricity and gas market participants to identify relevant, tailored, risk-based summer readiness scenarios for each region, develop contingency plans, and run emergency exercises.

4.1 Emergency exercise, November 2020

The annual emergency exercise of the National Electricity Market Emergency Management Forum (NEMEMF) was conducted on the afternoon of 17 November 2020, in a virtual format (due to COVID-19 restrictions). This year the exercise was held separately to the National Gas Emergency Response Advisory Committee (NGERAC) exercise, to allow each committee to pursue objectives specific to their needs.

Entitled Exercise GARNET, the emergency exercise included NEMEMF members and observers and had the following objectives:

- Test the suitability of the NEM-wide Power System Emergency Management Plan (PSEMP) for response during a multi-jurisdictional supply shortage scenario.
- Explore the inter-relationship of different measures to response to a multi-jurisdictional supply shortfall.
- Explore the potential for alternatives to emergency powers to disrupt a coordinated response to a multi-jurisdictional emergency.

This exercise was conducted as a discussion-style exercise and facilitated by an independent facilitator. All objectives were successfully met, and a report will be made available to NEMEMF members prior to the conclusion of 2020.

4.2 Summer Readiness Jurisdictional Sessions

AEMO held briefing sessions with each jurisdiction, including the Australian Government, to ensure alignment across both operational and communication activities. These sessions included the discussion of government, industry and AEMO summer readiness activities. A desktop scenario exercise was also included, on the loss of generation under high demand conditions.

4.3 Weekly readiness briefings

AEMO will be hosting weekly summer readiness outlook briefings from November 2020 to March 2021. The briefings will bring together jurisdictional government representatives, TNSPs, and AEMO to help foster open communication so all relevant stakeholders are briefed and aware of forecast conditions regarding weather, supply (including fuel for generation), demand, planned outages and the potential for unplanned outages, and broader risks such as bushfires, for the week ahead.

5. Collaboration and communication

With increasing public awareness and interest in the changing energy sector, AEMO continues to collaborate closely with external stakeholders and to communicate and engage openly and transparently with NEM consumers.

Summer 2019-20 again illustrated that considered planning and collaboration across governments and industry was crucial to the power system having the required resources to meet extreme peaks in demand, particularly given the major environmental challenges faced by the power system.

Before and during last summer, AEMO communicated and engaged openly and transparently with stakeholders and the wider community. Building on the success of last summer, AEMO will continue this summer to:

- Engage in intensive communication with the wider industry and government jurisdictions.
- Take a proactive approach to communicating with the broader community about the upcoming summer, particularly where there are apparent risks to the power system such as heatwave events or during serious bushfires which could potentially impact major energy system infrastructure.

5.1 Collaborating with industry and government

AEMO is working closely with jurisdictional representatives, TNSPs, and generators, through one-on-one discussions, working group meetings, and desktop exercises, to share information and progress and expand on summer preparedness activities. Key briefings will be initiated in the lead up to and during significant Lack of Reserve (LOR)[25] conditions across the NEM to ensure key information is exchanged. Collaboration with governments on messaging protocols, including the potential use of voluntary reductions, will be paramount for the coming summer.

AEMO has worked with industry to understand the evolving impact of COVID-19 on operations, maintenance and project work. COVID-19 has impacted operations through a changing demand profile, and has impacted participants' ability to access distant resources and essential parts, conduct corrective and preventative maintenance, and implement planned project work. Close ongoing coordination with participants, including under interim and final authorisations granted by the ACCC[26], has enabled essential summer preparations to proceed, including reviewing and modifying maintenance plans. This coordination will remain important throughout the summer period as various impacts of the pandemic evolve.

[25] LOR conditions indicate the system may not have enough spare energy if something major and unexpected happened, like the loss of a generator or interconnector, and AEMO issues LOR notices to inform the market of times extra reserves may be required to avoid the need for load shedding to maintain or restore power system security. This is addressed in clause 4.8.4 of the National Electricity Rules.

[26] Available at https://www.accc.gov.au/public-registers/authorisations-and-notifications-registers/authorisations-register/australian-energy-market-operator-aemo.

5.2 Communicating with households and businesses

AEMO will continue to use its website (aemo.com.au and Energy Live) and social media channels to inform the community on summer preparedness activities and how AEMO, industry, and governments have prepared and will respond to extreme conditions and unforeseeable events.

AEMO will also be sharing relevant information pieces, such as why there is a need for strategic reserves, and tips on how consumers can stay cool while using less energy.