Resource Adequacy
2019-20 Black Summer bushfires

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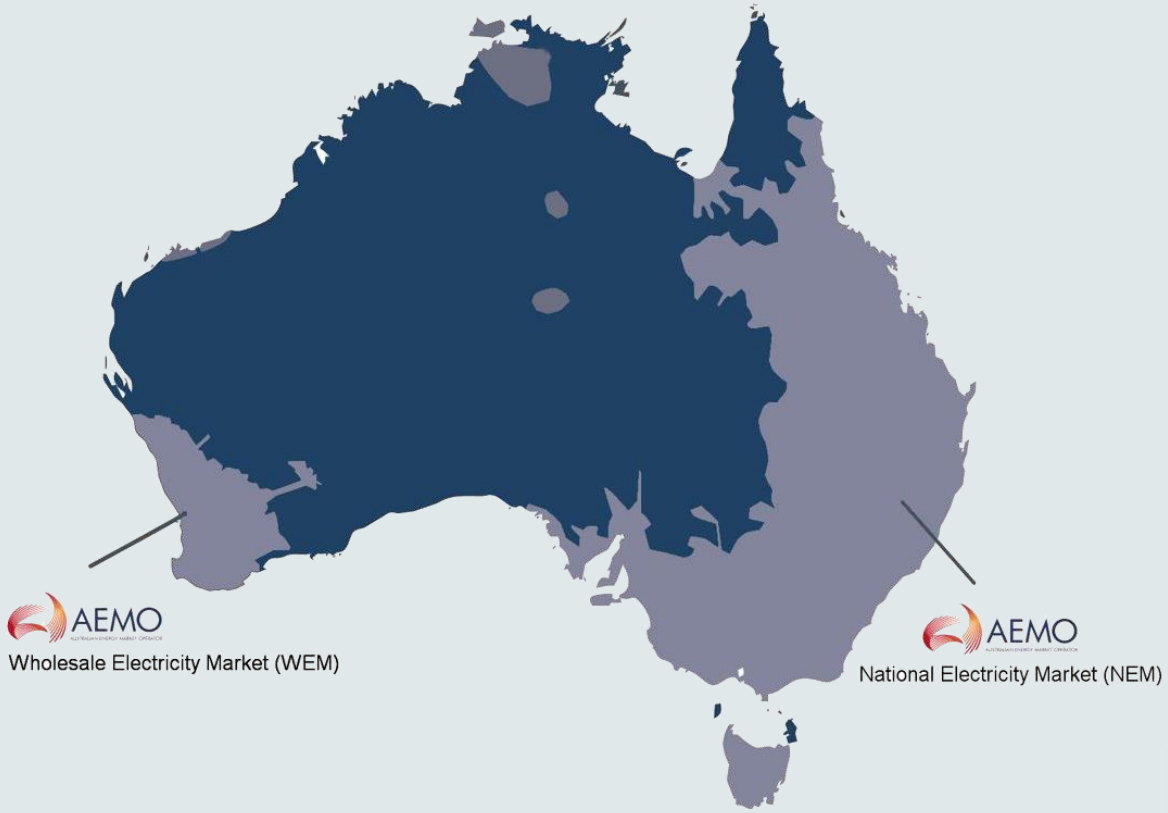
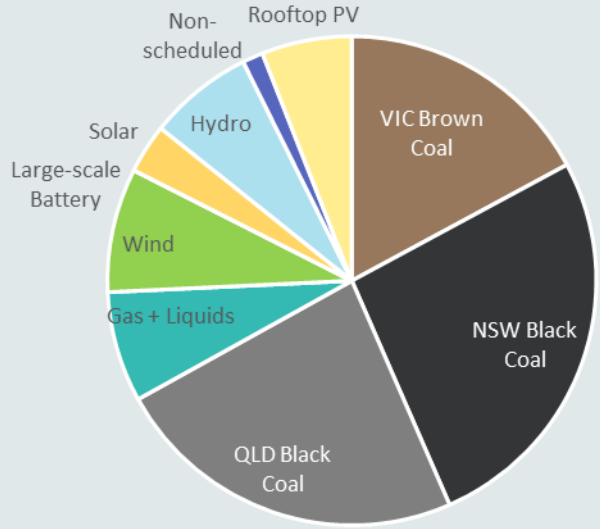
National Electricity Market



Current Energy Generation Mix -NEM



- About 4500 km long
- Up to 500 kV transmission
- About 47 GW capacity
- About 35 GW peak
- About 190 TWh annual energy

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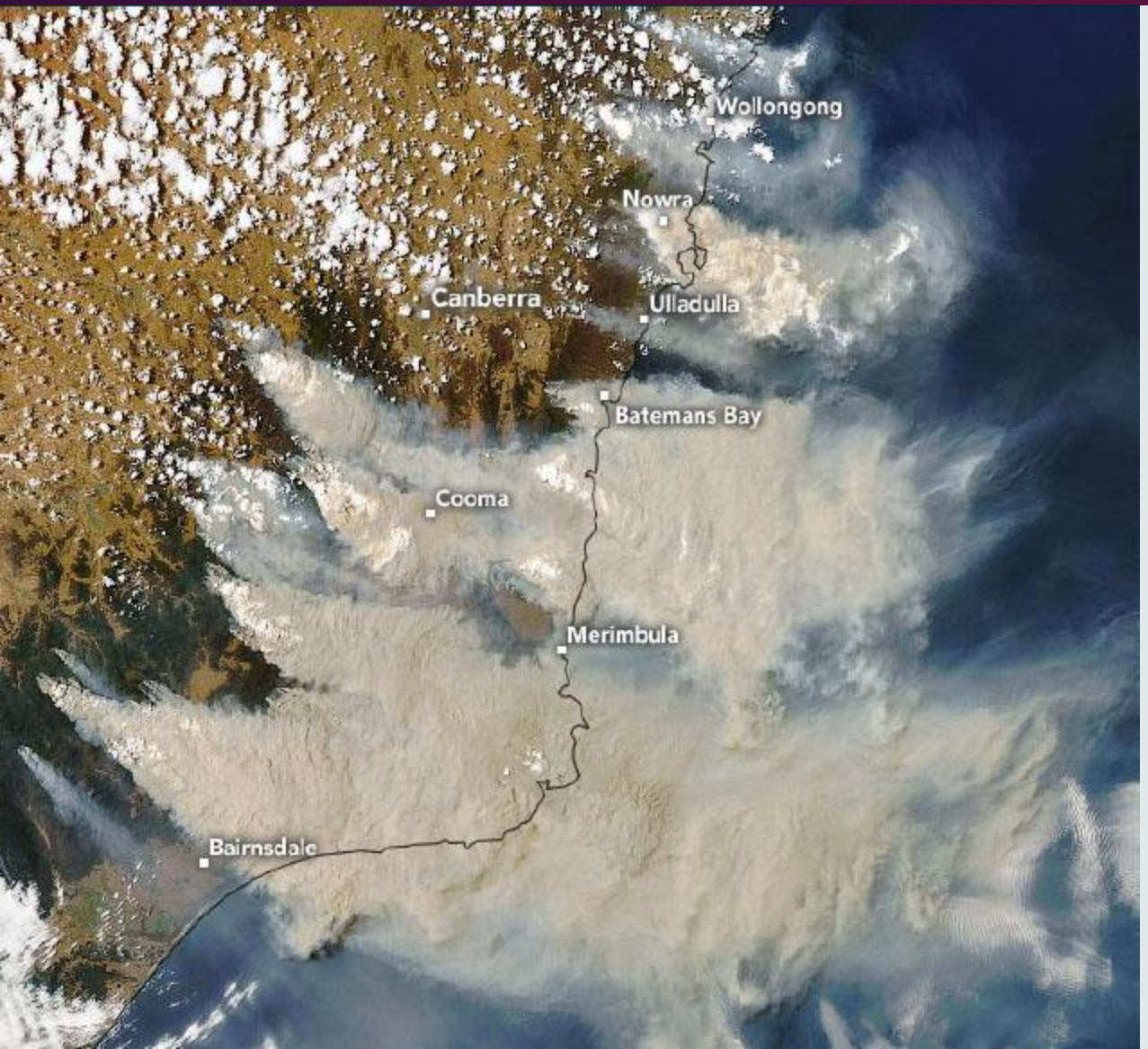
2019-2020 Black Summer Bushfires



December 2019 and January 2020 included a number of periods with extreme heat, and on **4 January 2020** the most extreme heat occurred in eastern New South Wales and the Australian Capital Territory. The hot conditions combined with the dry landscape and strong winds produced dangerous fire conditions and some of the worst and most prolonged fires in recent Australian history.

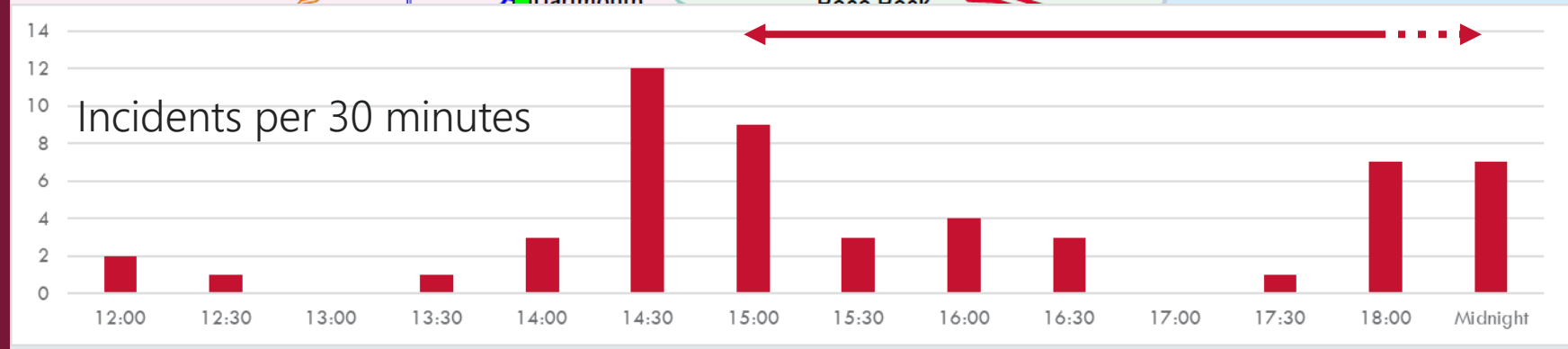
Power system impacts included:

- Unexpected temperature derating of wind farms
- Reductions in PV output due to smoke, particulate and voltage fluctuations
- Numerous local distribution and transmission outages
- 55 bushfire related transmission impacts resulting in 28 unplanned outages on the 330kV transmission network
- The separation of NSW and VIC, with frequency excursions
- Lack of Reserve 2 (LOR2) conditions declared
- Dispatch of emergency reserve mechanisms
- The later separation of NSW and QLD

NSW/VIC Separation

4 January separation

- 55 incidents from 11:47 to midnight
- Separation of NSW/VIC from 15:10 to 21:56
- 1 line stayed out until 26 January



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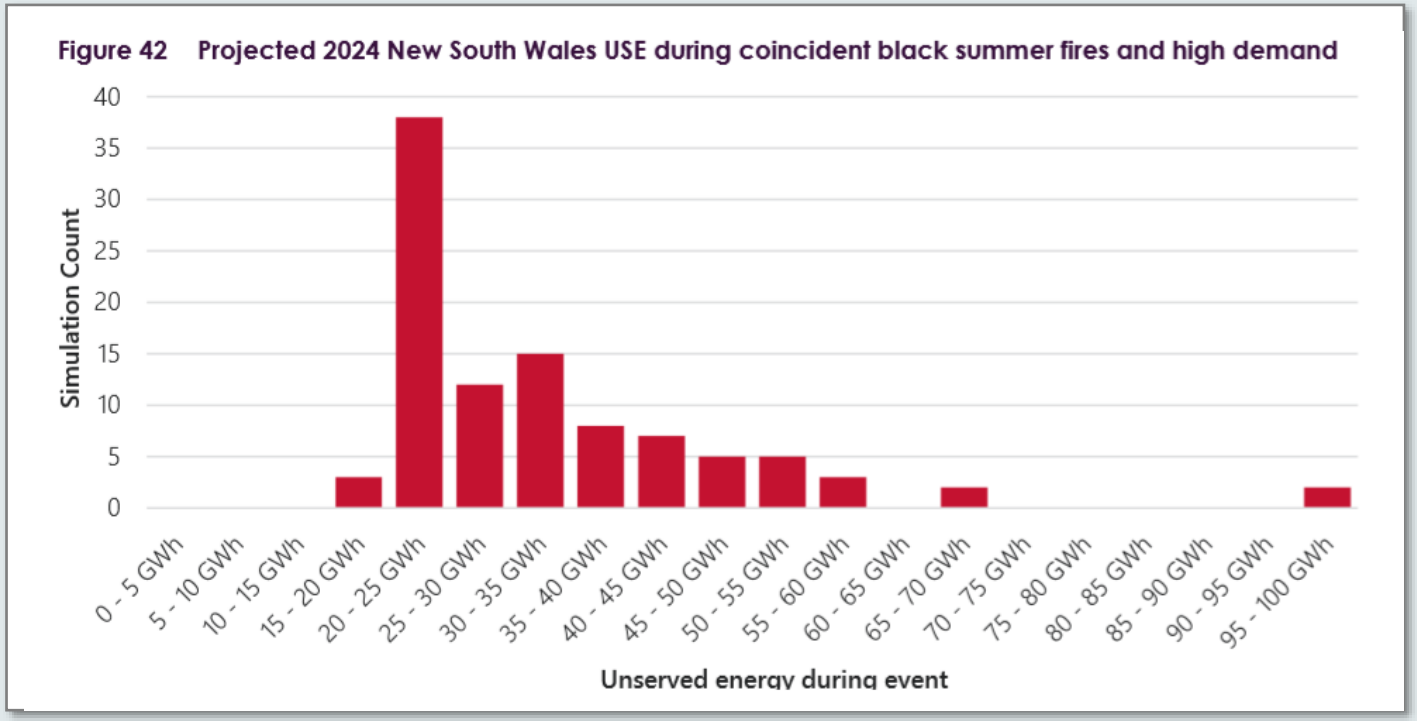
Bushfire occurrence simulations

- The bushfires and separations presented extensive operational challenges, however the 4th January timing minimised the need for load shedding.
- Simulations were used to identify possible outcomes should the bushfires have occurred during peak demand periods when business and industry were in full operation.
- Numerous simulation instances were identified where USE exceeded 3 GW which would represent a need to disconnect over 1,000,000 households.



Climate projections

More project information is available at: https://climatechangeinaustralia.gov.au/en/climate-projections/future-climate/esci/

AEMO is working with Australia's science and meteorological agencies to improve planning for the physical risks of climate change.

Focus on the highest vulnerabilities:

- Projected increases in both average and extreme temperatures
- Likely increases in extreme bushfire weather
- Changes in high wind events and cyclones
- Likely decrease in precipitation, possible increase in extreme rainfall events
- Projected increase in sea level
- **Possible increase in frequency or magnitude of compound extreme weather events**

Australian Government
Department of Industry, Science, Energy and Resources

CSIRO

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Australian Government
Bureau of Meteorology

AEMO considers climate resilience in multiple ways

Risk analysis and risk evaluation

Where possible, risk analysis considers both the impact of acute and chronic hazards. Where captured, these risks contribute to the estimation of system reliability, security and calculated project market benefits. While efforts have been taken to improve risk analysis and evaluation to capture climate resilience, **many acute hazards remain excluded from standard decision making frameworks.**

Planning standards

Planning standards consider climate and resilience when developing physical designs, and technology solutions, predominantly through the use of good planning practises. Through this consideration, proposed risk management solutions often enhance system resilience, but may not yet appropriately address all risks.

Operator flexibility and procedures

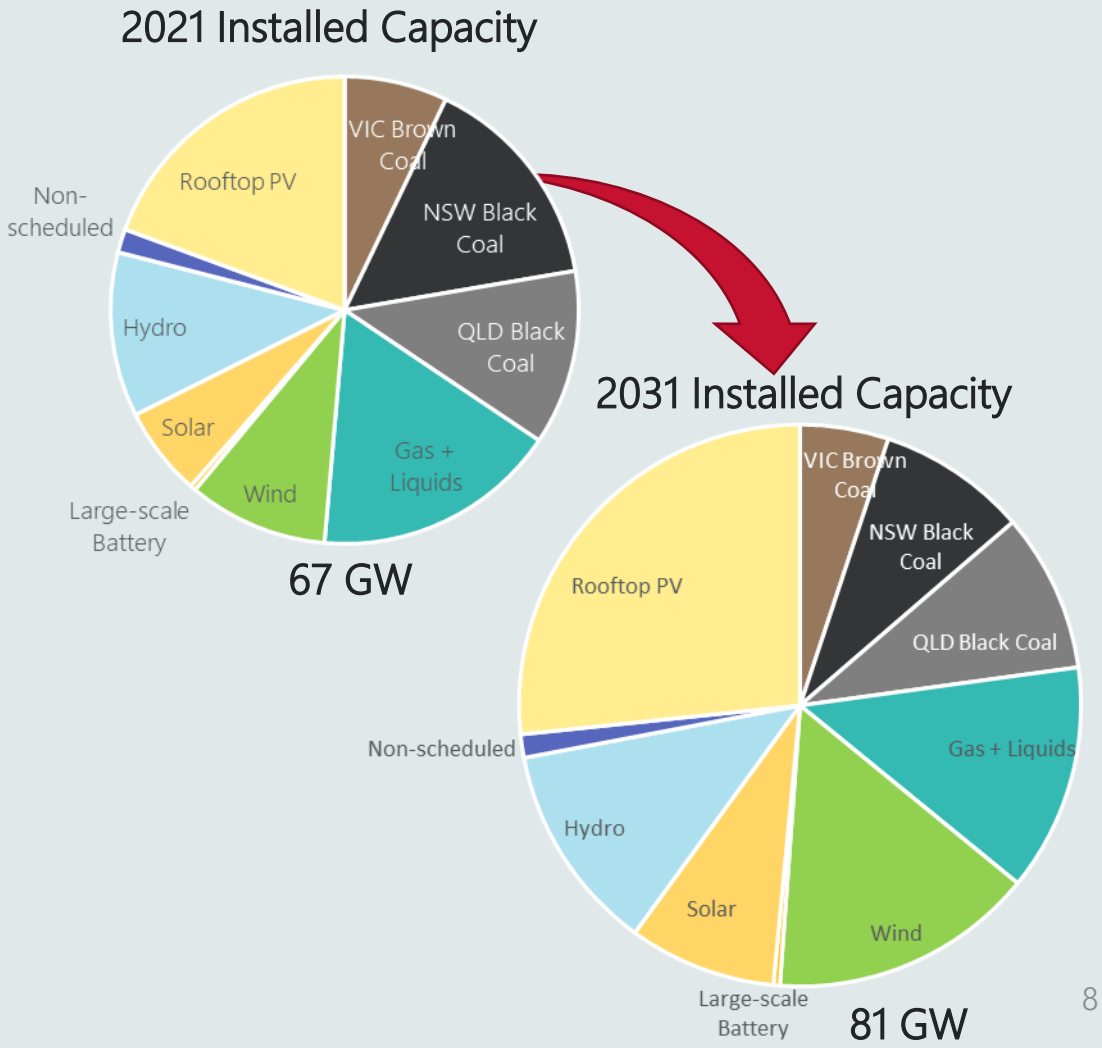
Where possible, operational controls are used to manage system resilience and security in the presence of increasing and coincident hazards. Operators are however limited by the infrastructure and systems available at the time of hazard.

'Power system resilience is the ability of the system to limit the extent, severity, and duration of system degradation following an extreme event'

CIGRE C4.47 WG Members. 2019. Defining power system resilience reference paper. Electra No.306 – October 2019.

Compound extreme event simulation

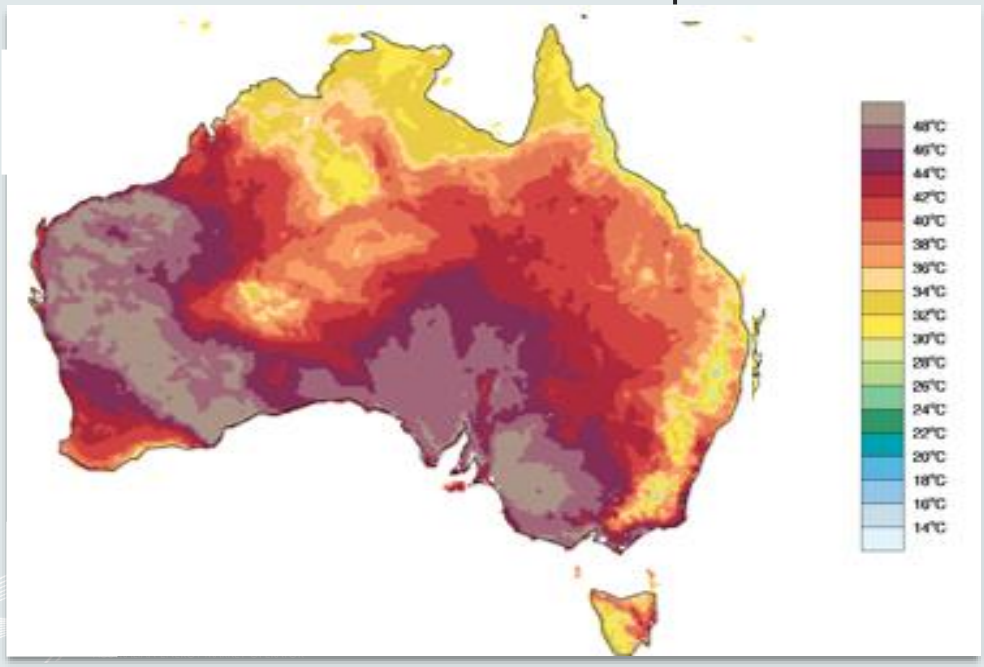
- Through the use of extreme event case studies, AEMO intends to explore risks to society and work with industry, consumer groups, market bodies and governments to assess the benefits of investments, procedures and systems that mitigate these risks.
- This case study explores the impact of a heatwave and bushfire event on consumer outcomes and is set in the year 2031, based on Central power system plans.
- The event is taken from the global climate model CanESM2 in a high emissions scenario RCP8.5, which has been downscaled to increase the resolution over Australia and enabling a better representation of weather around topography. While the event was found in the simulated year 2045, the case study is set in 2031.

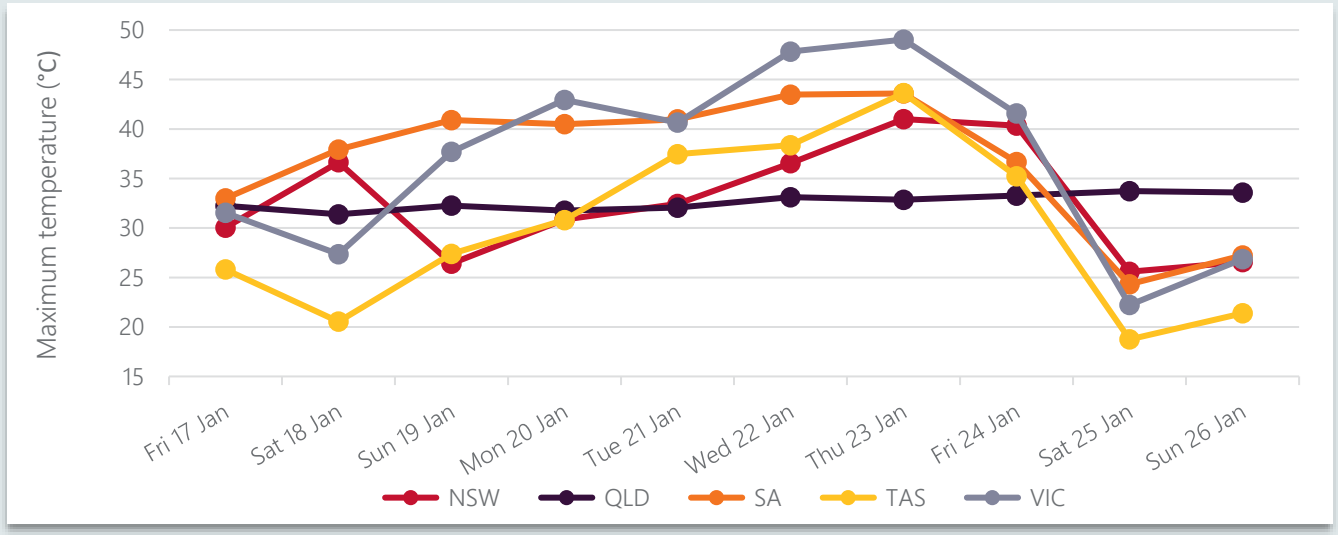


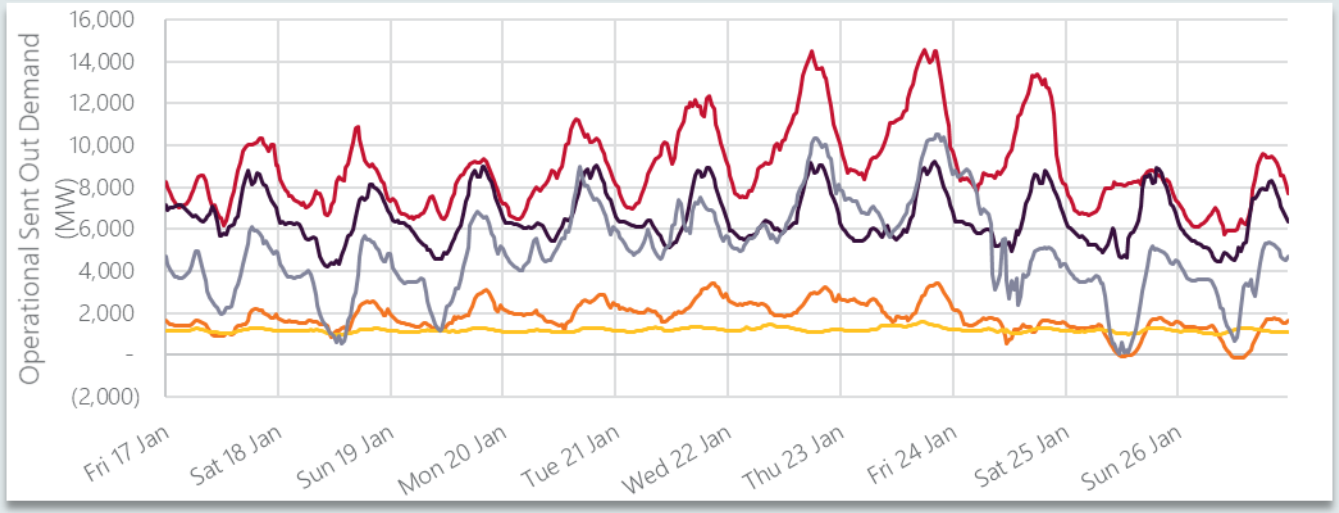
Coincident heatwave…

This case study explores the impact of a coincident national heatwave and bushfire event on consumer outcomes in the year 2031. The graphs show the simulated consumer demand.

Simulated Event – max temp

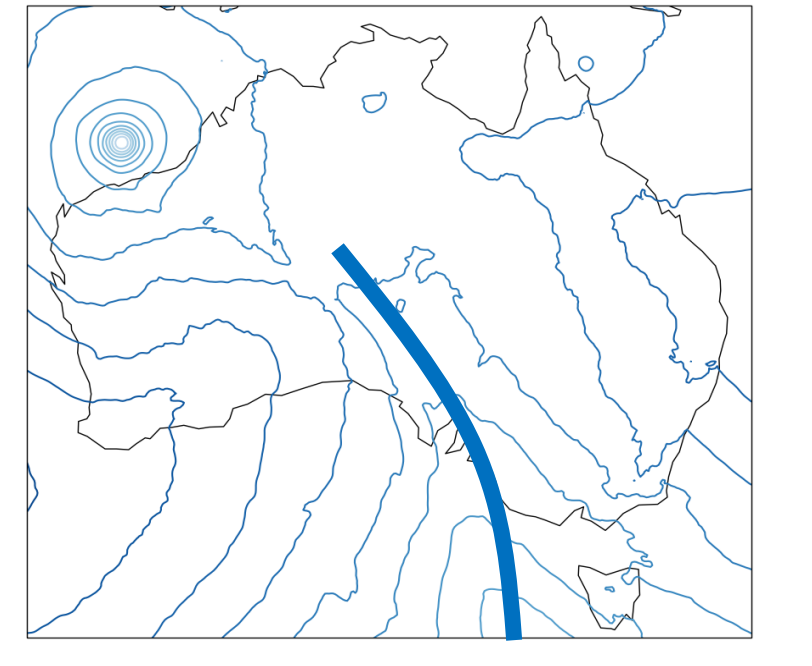


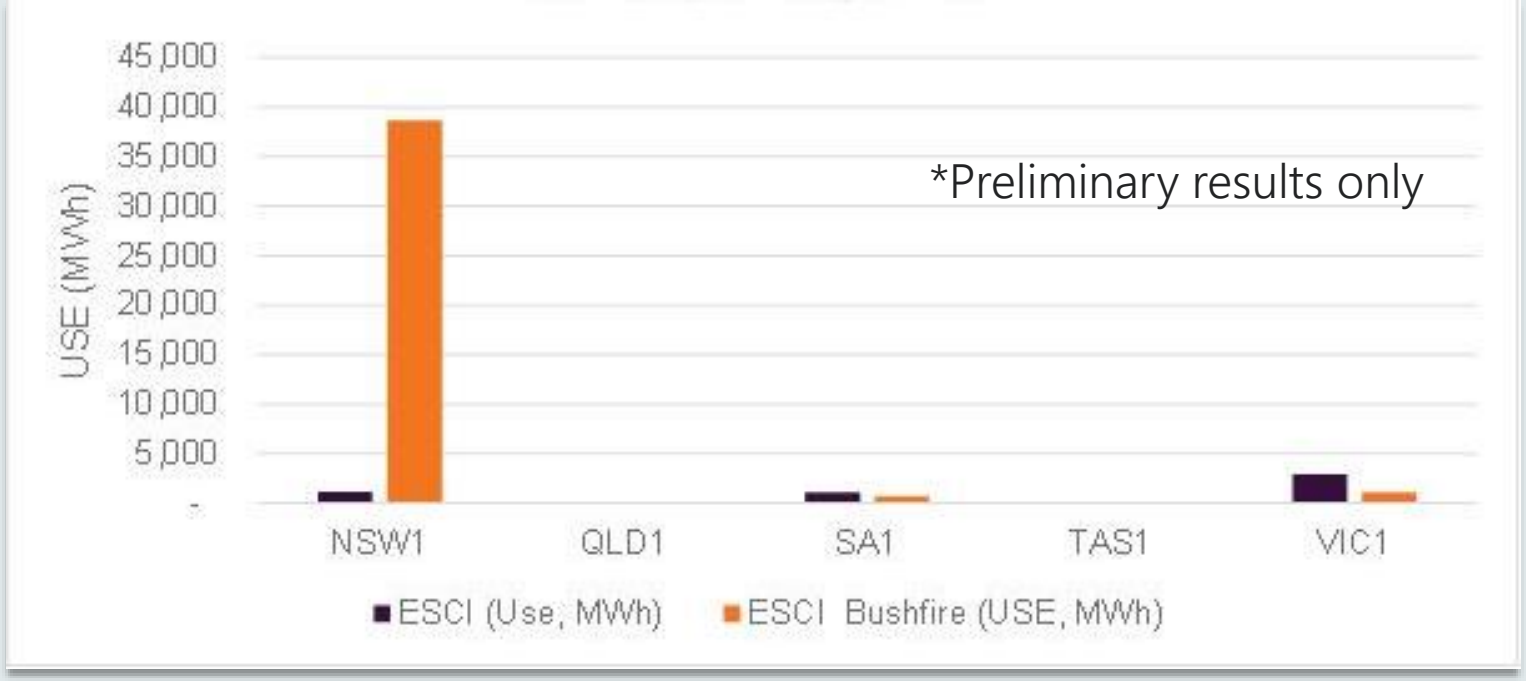




…followed by a cold front

Following a prolonged national heatwaves, a cold front brings damaging winds that fan existing bushfires. The impacts of the coincident heat on load, generation and transmission, and bushfire impacts on transmission, result in load shedding.





In response to high coincident demand, load shedding is required. Inclusion of a bushfire further worsens the situation, with high amounts of simulated load shedding in NSW.

Implications

Several operational changes are occurring in response to observed disasters, including SA system black and 2020 black summer bushfires.

- These include changes in System Restart services, and the rule change 'Enhancing operational resilience in relation to indistinct events'.

But arresting the decline in resilience won't happen without further intervention.

Further work is required to better consider climate and resilience impacts in power system planning time frames.

- AEMO is considering resilience in the development paths considered in it's planning documents (see Appendix 8 of the 2020 ISP, or Chapter 8 of the 2020 ESOO).
- There will be a role for all industry participants in ensuring design, operation and market participation is fit for purpose in a future climate