Maintaining operational demand in South Australia (400 MW): 14 March 2021 event

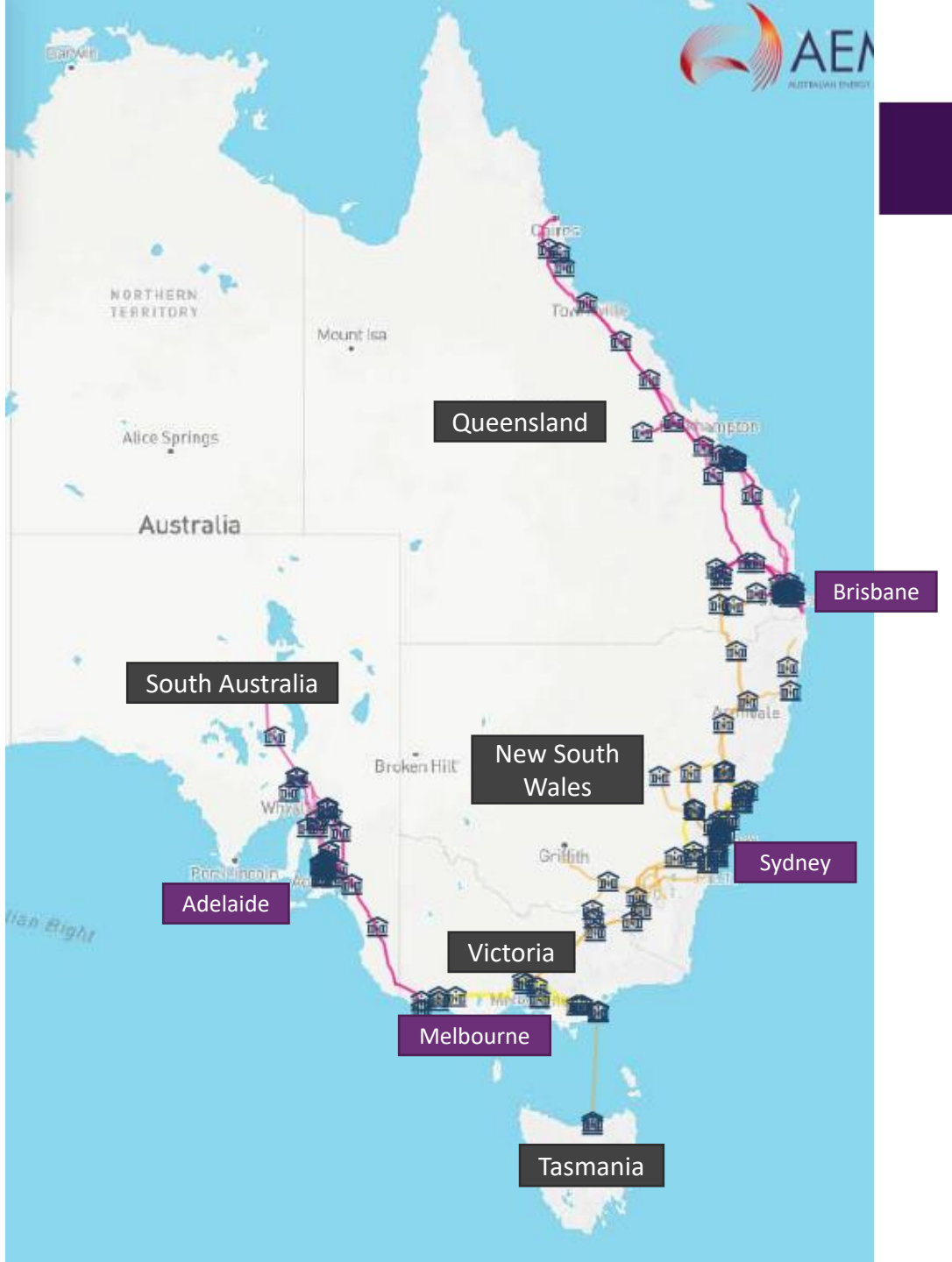
21 March 2022

Agenda

- Overview of the National Electricity Market – South Australia region
- Case study: South Australia low demand system incident, 14 March 2021
- Improvement actions and recommendations
- Questions

National Electricity Market

- Longest interconnected power system (5,000 km)
- 40,000 km of transmission
- 10 million customers
- Peak load: 36 GW
- Minimum load: 14 GW
- 59 GW of generation capacity
- 14 GW rooftop solar (25% of capacity)

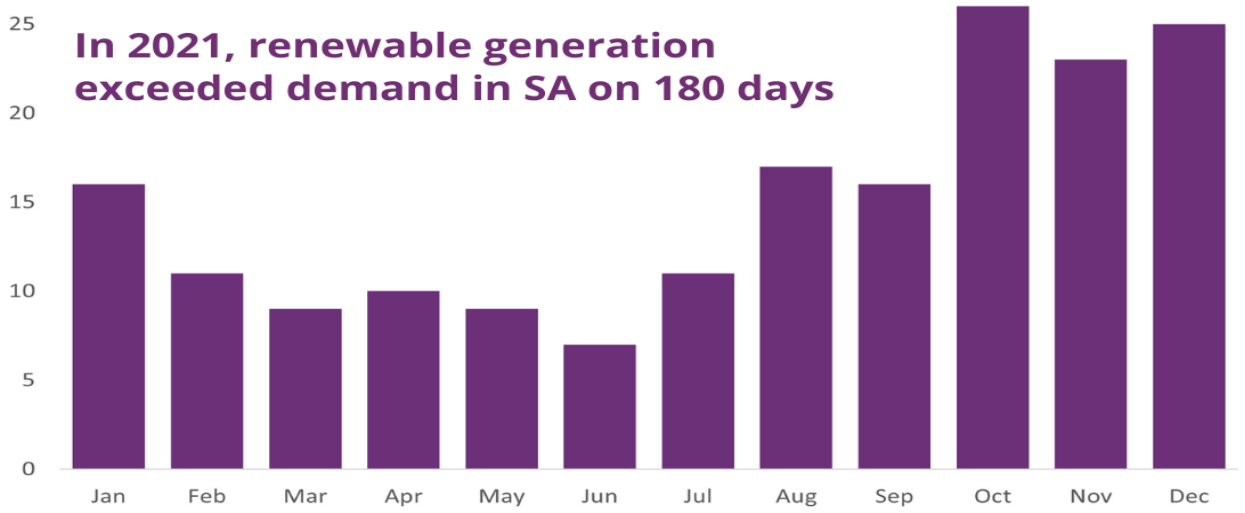


South Australia region

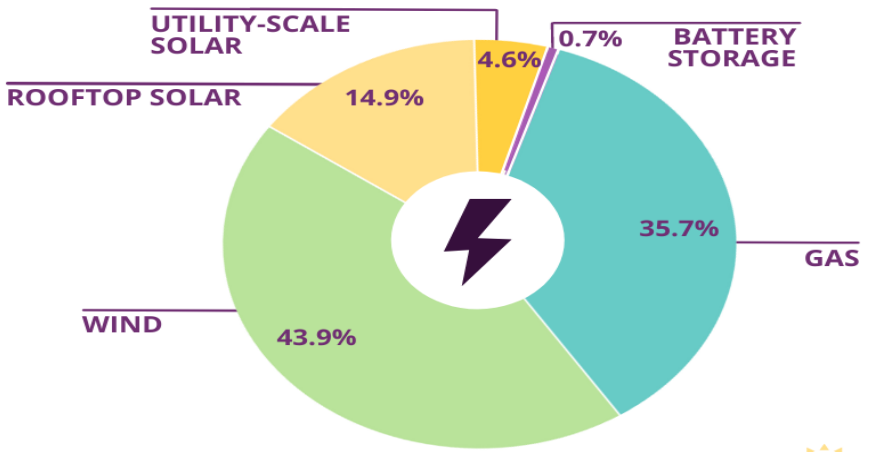
- Synchronous generators
- High renewable penetration
  - 416 MW grid solar
  - 2.05 GW grid wind
  - 1.8 GW of distributed PV
  - Growing at ~20 MW p/month
- 1 x HVDC interconnector
- 2 x 275 kV AC circuits

AEMO Insights: South Australia

In 2021, renewable generation exceeded demand in SA on 180 days

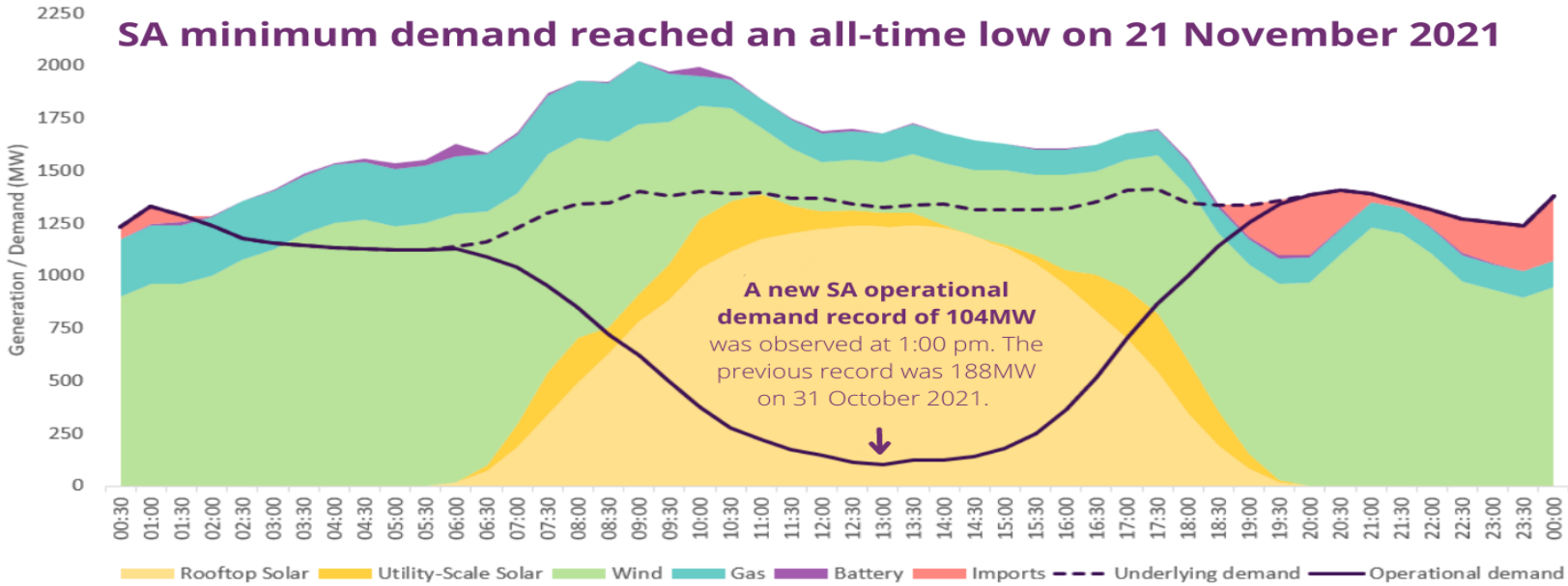


SA's average generation by fuel source in 2021



In 2021, renewable energy generaton met an average of **63%** of underlying demand*.

SA minimum demand reached an all-time low on 21 November 2021



A new SA operational demand record of 104MW was observed at 1:00 pm. The previous record was 188MW on 31 October 2021.

The all-time record for maximum renewable energy penetration in SA was set on 27 November 2021 at **135%** of underlying demand.

At the time, rooftop solar met **92%** of underlying demand.

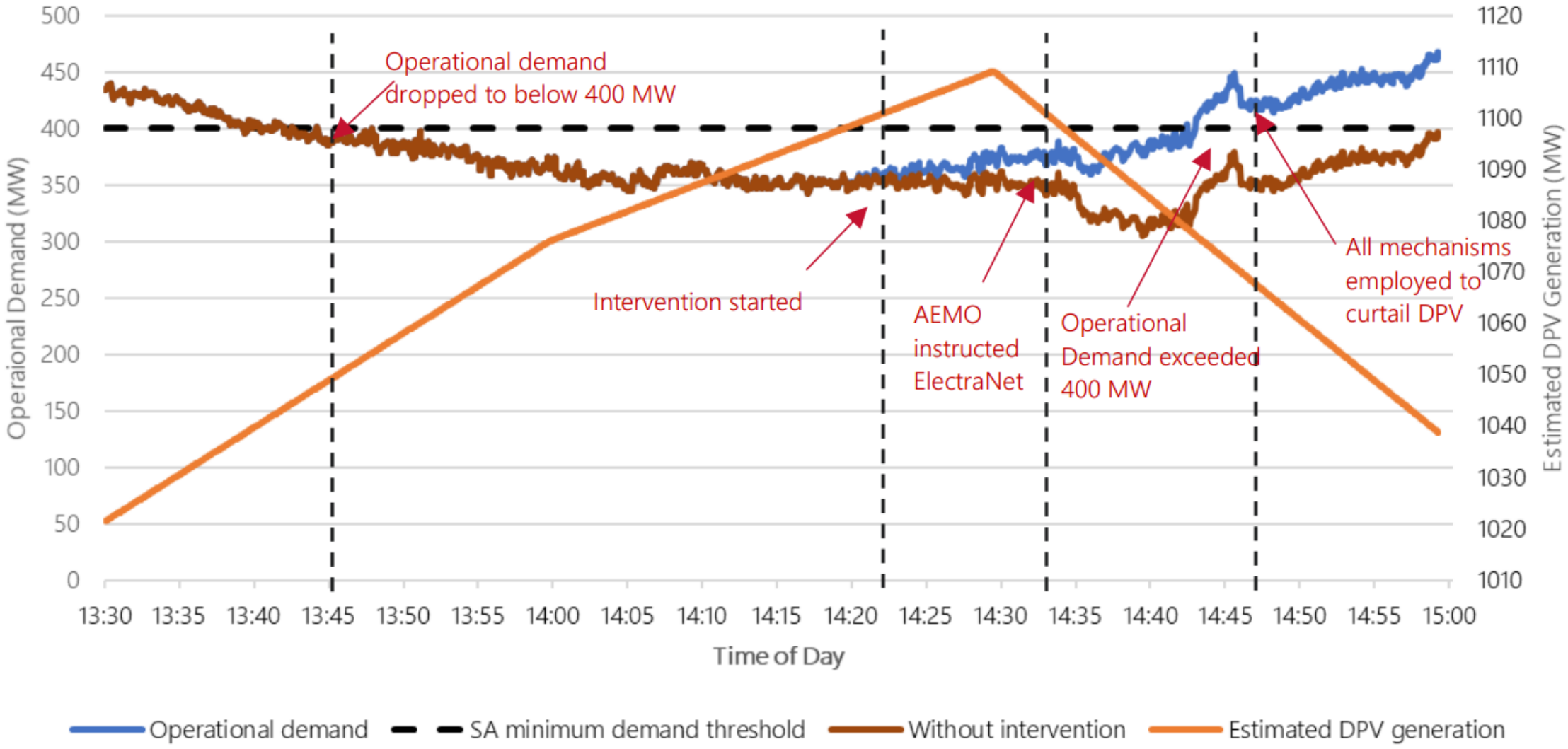
*Underlying demand includes consumption met by behind-the-meter rooftop solar and battery storage.

Pre-incident conditions: 14/03/2021

- Planned outage put South Australia at credible risk of separation
- AEMO limits advice requires operational demand be maintained above a minimum threshold
- This is to manage two system security risks:
  - Risk A: Insufficient demand to maintain units online for system strength purposes
  - Risk B: Simultaneous loss of DPV (DPV contingency) - AEMO is seeing a trend of DPV disconnecting in response to transmission system trips.
- No issues shown in forecasts prior to 14 March and on the day

Key events

14 March 2021 South Australian actual operational demand and estimated DPV generation



Curtailment of DPV by SA Power Networks (SAPN)

- Direct SCADA control (~17 MW) – SAPN has direct SCADA control over DPV systems with capacity above ~200 kW

- Via Smarter Homes agents (~14 MW) – SAPN contact the relevant agent responsible for disconnecting/reconnecting DPV

- Enhanced Voltage Control (~40 MW) – SAPN increases the voltage on its network causing a subset of DPV system to disconnect from the system

Findings

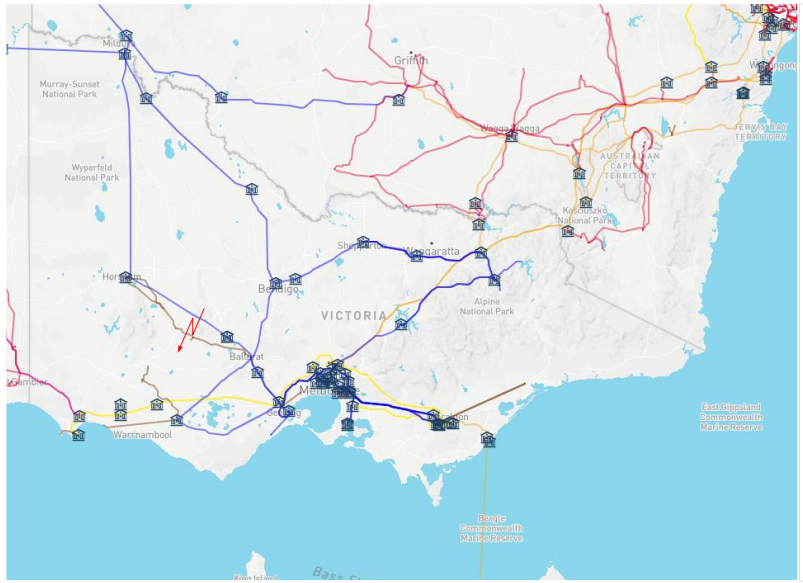
Figure 2. Timeline of events

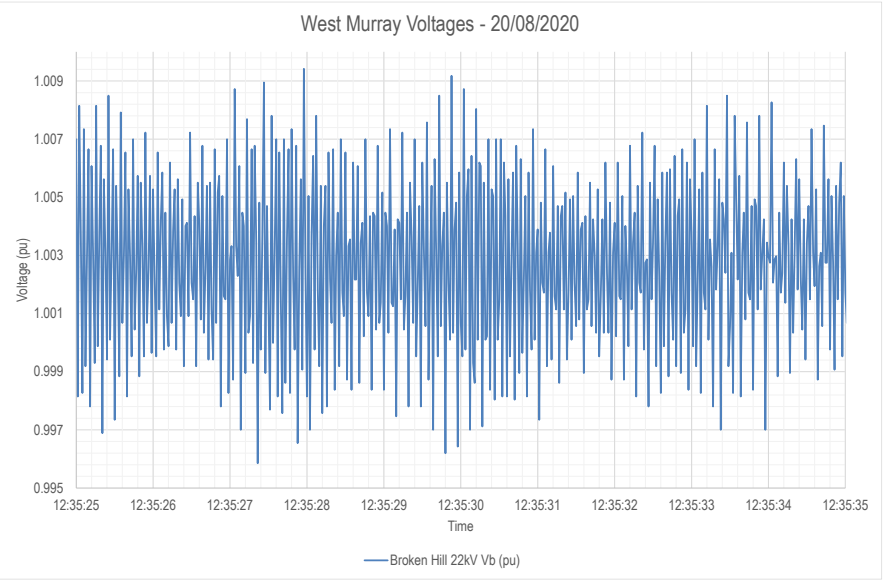
Recommendations

- DPV curtailment
- Minimum demand threshold
- Permission to Proceed
- Monitoring of real time demand
- Forecast uncertainty

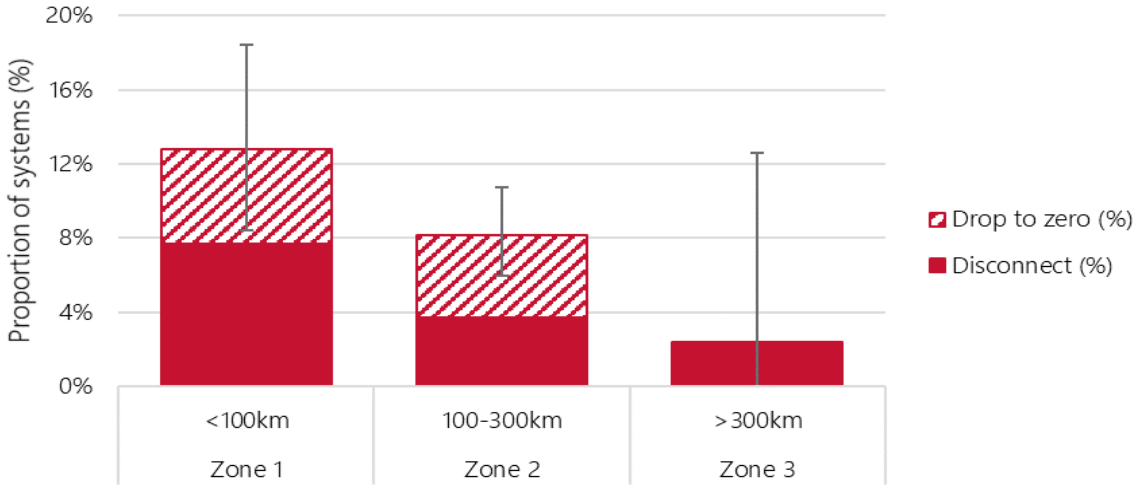
Other Incidents

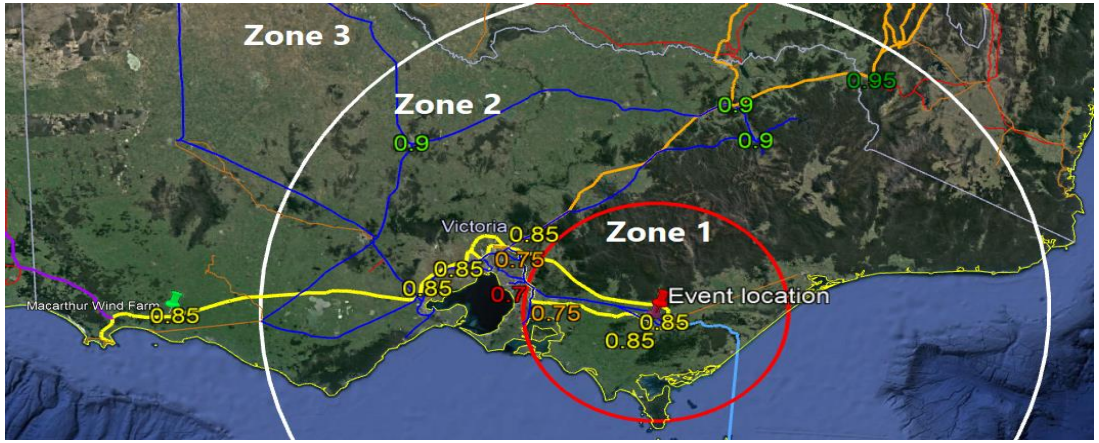
20 August 2020





11 April 2020





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Operational Demand

- Operational demand in a region is demand that is met by local scheduled generating units, semi-scheduled generating units, non-scheduled intermittent generating units of aggregate capacity greater than or equal to 30 MW, and generation imports to the region.
- It excludes the demand met by non-scheduled non-intermittent generating units, non-scheduled intermittent generating units of aggregate capacity less than 30 MW, exempt generation, and demand of local scheduled loads.
- Because it excludes demand met by DPV, operational demand decreases as DPV generation increases.