
Preliminary Report – New South Wales and Victoria Separation Event on 4 January 2020

March 2020

A preliminary operating incident report for the National Electricity Market –
information as at 9.00 am, 3 March 2020

Important notice

PURPOSE

AEMO has prepared this preliminary report in accordance with clause 4.8.15(c) of the National Electricity Rules, using information available as at the date of publication, unless otherwise specified.

DISCLAIMER

AEMO has been provided with preliminary data by Registered Participants as to the performance of some equipment leading up to, during, and after the separation event, in accordance with clauses 3.14 and 4.8.15 of the Rules. In addition, AEMO has collated information from its own systems.

The information provided by Registered Participants and collated from AEMO's own systems is preliminary information only. Any analysis and conclusions in these findings are also preliminary in nature.

While AEMO has made every reasonable effort to ensure the quality of the information in this report, its investigations are incomplete, and the findings expressed in it may change as further information becomes available and further analysis is conducted. Any views expressed in this report are those of AEMO unless otherwise stated and may be based on information given to AEMO by other persons.

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VERSION CONTROL

Version	Release date	Changes
1.0	5/3/2020	Final Version

ABBREVIATIONS

Abbreviation	Term
AEMO	Australian Energy Market Operator
AEST	Australian Eastern Standard Time
LOR 2	Lack of Reserve level 2
FCAS	Frequency control ancillary service
MMS	Market Management System
MWs	Megawatt-second
NEM	National Electricity Market
NER	National Electricity Rules
PASA	Projected Assessment of System Adequacy
RERT	Reliability and Emergency Reserve Trader
RHS	Right Hand Side of a constraint equation active in the NEM Dispatch Algorithm
TNSP	Transmission Network Service Provider

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1. Overview

This report relates to the reviewable operating incident that occurred on 4 January 2020 in the New South Wales region, that resulted in the separation of the Victorian and New South Wales regions during a major bushfire event in the Snowy Mountains area.

This incident resulted in the loss of 34 megawatts (MW) of generation and 43 MW of customer load, and a reduction of approximately 2,267 MW of generation availability. Generation availability was progressively restored from 2045 hrs on 4 January with close to full capacity made available at 1930 hrs on 6 January 2020.

This reduction in generation availability, coupled with the loss of interconnection to Victoria, resulted in a Lack of Reserve Level Two (LOR 2) condition in New South Wales. In response to the LOR 2 condition AEMO activated its Reliability and Emergency Reserve Trading (RERT) services in New South Wales.

As this is a reviewable operating incident, AEMO is required to assess the adequacy of the provision and response of facilities and services, and the appropriateness of actions taken to restore or maintain power system security¹.

This preliminary report is prepared in accordance with clause 4.8.15(c) of the National Electricity Rules (NER). National Electricity Market (NEM) time (Australian Eastern Standard Time [AEST]) is used in this report. Local time in New South Wales at the time of this incident was AEST plus one hour.

2. Pre-event conditions

There had been significant bushfire activity for several days in southern New South Wales and eastern Victoria prior to 4 January 2020. Because of this, AEMO had already reclassified the simultaneous loss of the two 330 kilovolt (kV) transmission circuits between the Murray Power Station, and Upper Tumut and Lower Tumut Switching Stations as a credible contingency². TransGrid³ had also arranged for backburning to take place around the Upper Tumut Switching Station to reduce risks if the fires reached there.

On 4 January 2020, there were extreme fire weather conditions forecast with about 137 bushfires burning in New South Wales and about 50 in Victoria⁴.

These had very significant impacts on the transmission system in southern and central New South Wales. This had been identified by AEMO as a potential risk at the start of the day, and advice had been issued to market participants on the heightened risk in these areas.

During the period prior to the separation event on 4 January 2020, there were 28 unplanned outages of 330 kV transmission lines in the southern New South Wales due to bushfires. Refer to Appendix A1 for details of these unplanned outages.

In all cases, the lines were able to be quickly returned to service, except for:

¹ See NER clause 4.8.15(b).

² Murray – Upper Tumut 65 330 kV line and Murray – Lower Tumut 66 330 kV line.

³ TransGrid is a Transmission Network service Provider (TNSP) in New South Wales.

⁴ See <https://www.theguardian.com/australia-news/live/2020/jan/04/australia-nsw-fires-live-updates-victoria-bushfires-rfs-cfa-road-closures-near-sydney-melbourne-latest-news>.

- Upper Tumut – Yass 02 330 kV line (02 line), which tripped and remained out of service at 1431 hrs.
- Upper Tumut – Canberra 01 330 kV line (01 line), which tripped and remained out of service at 1448 hrs.
- Lower Tumut – Upper Tumut 64 330 kV line (64 line), which tripped and remained out of service at 1507 hrs.
- Murray – Upper Tumut 65 330 kV line (65 line), which tripped, reclosed, and tripped again at 1507 hrs.
- Lower Tumut – Wagga 051 330 kV line (051 line), which tripped, was then reclosed, and tripped again at 1508 hrs.

This rapidly developing situation meant that the normal process of applying specific outage constraint sets following each forced outage was not practical. Instead, at 1500 hrs, AEMO constrained flow from Victoria to New South Wales to 650 MW to maintain power system security. At 1510 hrs, the Victoria to New South Wales flow was further constrained to 450 MW.

In the case of an extended outage of the 051 line, the TNSP would normally open the following lines:

- The 132 kV parallel between Wagga and Yass 330 kV substations.
- The 220 kV parallel through the Victorian Region at Buronga substation.
- The 132 kV parallel between Jindera and Wagga 330 kV substations.

Neither this nor a restoration of the 051 line could be implemented prior to the separation event at 1510 hrs.

For the 1510 hrs dispatch interval, just prior to the separation event, the system conditions in the NEM were as shown in Tables 1 and 2. The actual interconnector flow shown in Table 2 is the flow at the start of this dispatch interval (i.e. at 1505 hrs). Positive flow means flow in a northerly or westerly direction.

Table 1 Regional demands and generation for Dispatch Interval ending 1510 hrs

Region	Scheduled demand (MW)	Dispatched generation (MW)
Queensland	6,923	7,806
New South Wales	11,997	10,573
Victoria	4,063	4,906
South Australia	800	1,251
Tasmania	959	514

Table 2 Interconnector flow for Dispatch Interval ending 1510 hrs

Interconnector	Actual Flow (MW) ^A	Target Flow (MW)
Queensland – New South Wales (QNI)	-790	-795
Directlink	-66	-65
Victoria – New South Wales	618	650
Victoria – South Australia	-333	-222
Murraylink	-152	-153
Basslink	-455	-445

A. A positive value is flow heading north or west. A negative value is flow heading south or east.

The transmission line outages over the previous 40 minutes had resulted in a significant impact on the transmission network and generation, in particular:

- Upper Tumut Switching Station and Tumut 1 and Tumut 2 Power Stations had been disconnected from the network following the tripping of 64 and 65 lines at 1507 hrs.
- The Victoria region and the main section of the New South Wales region were connected through an unusual combination of lines (due to a number lines being out of service) that consisted of:
 - Murray – Lower Tumut 66 330 kV Line (66 line).
 - Redcliffs – Buronga OX1 220 kV line (OX1 line).
 - Wodonga – Jindera 060 and Jindera – Wagga 062 330 kV lines (060 and 062 lines) and the 132 kV subsystem operating in parallel between Wagga 330 kV and Yass 330 kV substations.

Details of the events prior to separation are in Appendix A1.

The transmission network in the Snowy Mountains area just prior to the separation event is summarised in Appendix A2.

3. Event

At 1510 hrs on 4 January 2020, the 66 line tripped due to bushfires, resulting in a significant increase in the power flow on the 060 and 062 lines and the 132 kV subsystem between Wagga and Yass 330 kV substations.

About two seconds later:

- The Yass – Wagga 990 132 kV line (990 line) tripped at both ends.
- The Yass – Burrinjuck 970 132 kV line (970 line) tripped at Yass only.
- The Wagga North – Murrumburrah 991 132 kV line (991 line) tripped at the Wagga North end only.

This resulted in the NEM splitting into two islands:

- One consisted of the Victorian, South Australian, and Tasmanian regions and south west New South Wales.
- The other consisted of the Queensland region and the main part of the New South Wales region.

The transmission network in the Snowy Mountains area immediately after the separation event is summarised in Appendix A2.

About three seconds later, the 990 line reclosed successfully, reconnecting the two islands briefly before the line tripped a second later.

Shortly before the reclose of the 990 line, the Wagga 330 kV – Gadara 993 132 kV line (993 line) tripped, reclosed, and tripped again due to conductor failure within the bushfire zone.

This outage of the 993 line resulted in the temporary formation of a third small island, consisting of the Gadara and Tumut substations, generation at Blowering Power Station and local generation at Gadara. This was not a stable island, due to the mismatch of load and available generation, resulting in the island collapsing about 35 seconds later, with the ultimate loss of approximately 43 MW of customer load and 34 MW of generation.

To ensure the power system remained in a secure operating state in relation to the potential loss of either the 060 or 062 lines:

- The Wagga – ANM 996 132 kV line (996 line) was off-loaded at 1514 hrs.

- The OX1 line was off-loaded at 1519 hrs.
- The Finlay – Mulawa 9R4 132 kV line (9R4 line) was off-loaded at 1555 hrs.

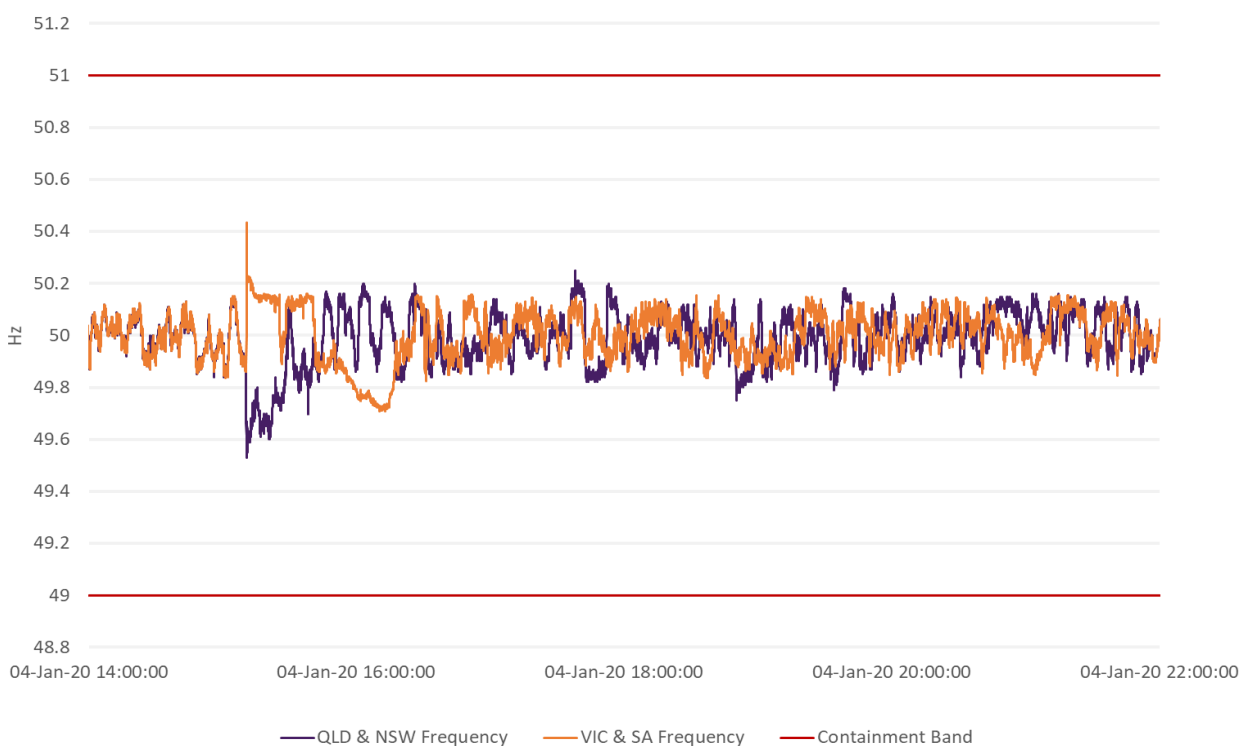
The separation of the Victoria and New South Wales regions had several significant impacts on the power system, which are discussed below.

3.1 Frequency

At 1510 hrs, the Automatic Generation Control (AGC) system was reconfigured by AEMO to control three frequency control regions instead of the normal two⁵.

As shown in Figure 1, there were initial frequency excursions when separation occurred, but these excursions did not exceed frequency tolerance bands for separation events. There was a brief excursion outside of the frequency standard at around 1600 hrs. AEMO will investigate this further.

Figure 1 New South Wales and Victoria frequency before and during separation



There was a shortage of some contingency raise frequency control ancillary services (FCAS) in the island consisting of the Queensland region and the main part of the New South Wales region, which meant that the raise FCAS requirements to cover the loss of the largest generating unit were not being met for significant periods from 1530 hrs to 1740 hrs including a continuous period in excess of 30 minutes.

See Appendix A4 for details of violations of the FCAS constraint equations which set these requirements (F_NQ+MG_R5, F_NQ+MG_R6 and F_NQ+MG_R60).

3.2 Voltage

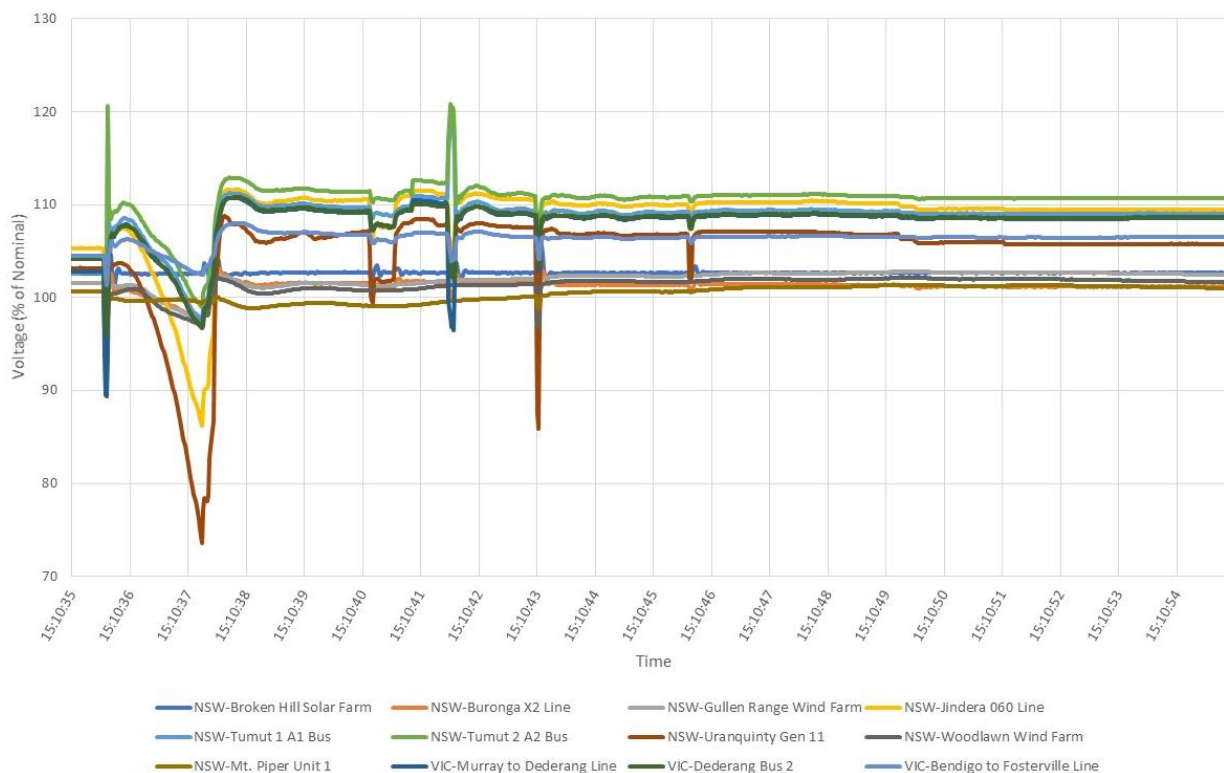
Immediately following the trip of the 66 line, there were voltage depressions down to approximately 73% of normal voltage levels, particularly in the Wagga area (as shown in Figure 2). These transient voltage drops

⁵ Normally there are two frequency control regions in the NEM – the Tasmanian region and the other (mainland) regions.

occurred due to the sudden large increase in flow on the 060 and 062 lines, and the 132 kV subsystem between the Wagga 330 kV and Yass 330 kV substations.

These voltage drops did not exceed the limits set in the NER to maintain a satisfactory operating state. The undervoltage condition was relieved within about two seconds when the 132 kV parallel between Yass and Wagga opened, due to the tripping of several other 132 kV transmission lines, as described earlier in this section.

Figure 2 Voltages at connection points close to point of separation



3.3 Queensland to New South Wales transfer

The separation resulted in an increase in flow from Queensland on the QNI interconnector, due to the loss of supply from the Victoria region and later the reduction in output from the Tumut 3 Power Station (see Section 3.4). The network constraint equations maintaining secure operation for export from the Queensland region to the New South Wales region were violated from 1550 hrs to 1615 hrs (see Appendix A3 for details).

At 1525 hrs, AEMO had invoked a constraint equation set for New South Wales – Victoria separation to ensure that the change in network conditions were properly modelled in the Market Management System (MMS). Subsequently one of these constraint equations was found to be overly conservative due to the Wagga area being supplied radially from the Victorian region. At 1615 hrs AEMO, after investigating this issue, made the constraint equations I-VN_ZERO non-active to address the constraint violation associated with the need to supply the Wagga area from Victoria.

3.4 Loss of generation

As a result of the loss of multiple transmission lines at around the time of the separation event, 2,267 MW of generation in New South Wales was made unavailable due to either the generation having no connection to the transmission network or by AEMO constraint action to maintain power system security.

As described in Section 2 above, the Tumut 1 and 2 Power Stations were disconnected from the transmission system at 1507 hrs, prior to the separation occurring. This resulted in an effective reduction in generation availability of 484 MW⁶.

As described earlier in Section 3, the separation event resulted in the formation of a small island consisting of Blowering Power Station supplying local load. This was not a stable island, and Blowering Power Station tripped about 27 seconds after the separation event, resulting in a reduction in generation availability of 34 MW⁷.

The collapse of this island may have also resulted in loss of non-scheduled generation at Burrinjuck Power Station and Gadara substation.

The output of the Tumut 3 Power Station was also constrained to 500 MW at 1540 hrs, and then to zero at 1550 hrs, to maintain the power system in a secure operating state. Since the tripping of the 03 line at 1533 hrs, Tumut 3 Power Station had been connected to the main transmission network only via the Lower Tumut – Canberra 07 330 kV line (07 line), which was under severe risk of tripping due to bushfires in the vicinity. This action was taken to reduce risks to the power system and to the power station that could arise if multiple generating units at the power station were offloaded simultaneously upon the loss of 07 line. This resulted in a reduction in generation availability of 1,749 MW⁸.

Additionally, certain generating units in southwest New South Wales were constrained to zero output as part of the normal arrangements for an outage of the 051 line.

3.5 Supply issues

As described earlier in Section 3, the separation event resulted in the islanding of and subsequent loss of supply at:

- Tumut 132 kV substation (20 MW).
- Gadara substation (23 MW).

Outages of transmission lines north and south of Canberra and the unavailability of the Shoalhaven power stations⁹ threatened security of supply to the Australian Capital Territory from about 1600 to 1930 hrs. During this period, AEMO, TransGrid and Evoenergy implemented measures to maintain security of supply, including switching capacitors into service to avoid low voltage conditions if another transmission line was lost.

These issues were in addition to local supply issues throughout Victoria and New South Wales due to the impact of bushfires on the distribution networks.

3.6 Reserve

Reserve levels in New South Wales fell sharply following the separation, due to the loss of import capability from Victoria and the reduced availability of Tumut generation.

An actual LOR 2 condition for the New South Wales region was declared from 1635 hrs to 2100 hrs.

⁶ The combined nominal maximum capacity of Tumut 1 and Tumut 2 Power Stations is 665 MW. Prior to this event these two power stations were not generating.

⁷ The nominal maximum capacity of Blowering Power Station is 80 MW. Prior to the event the power station was generating 34 MW.

⁸ The nominal maximum capacity of generation at Tumut 3 Power Station is 1800 MW. Prior to the output being constrained the power station was generating about 700 MW.

⁹ Shoalhaven Power Stations (Kangaroo Valley and Bendeela) were unavailable from 31 December 2019 to 6 January 2020 due to a bushfire-related issue.

4. Restoration

4.1 Reserve

Due to the active fires in the vicinity of the 65 and 66 lines, reconnection of New South Wales and Victoria was not immediately possible. As such, there was no ability to import supply from Victoria into New South Wales, resulting in the LOR 2 condition in New South Wales being sustained.

In response to the declaration of a forecast LOR 2 condition at 1600 hrs, negotiations for provision of RERT services were commenced by AEMO at 1607 hrs. For the period 1820 hrs to 2145 hrs, 68 MW of RERT contracts in New South Wales were activated and an additional 300 MW was made ready to be activated within 15 minutes¹⁰ (i.e. to be activated following a contingency event such as the further loss of generation or transmission capacity). These services represented all available RERT services that could contribute to ensuring reliability in the main section of the New South Wales region.

RERT services were activated or made ready to be activated based on manual calculations of New South Wales reserve, because the unusual system configuration after the separation event¹¹ meant the Projected Assessment of System Adequacy (PASA) calculations of reserve were not considered reliable. Because of this unusual region configuration, there was also a need for special adjustments to demand forecasts for the New South Wales and Victoria regions.

There was also significant demand side response in New South Wales commencing at 1626 hrs due to the high spot prices after separation. The level of demand side response varied considerably until 1945 hrs, ranging up to about 745 MW.

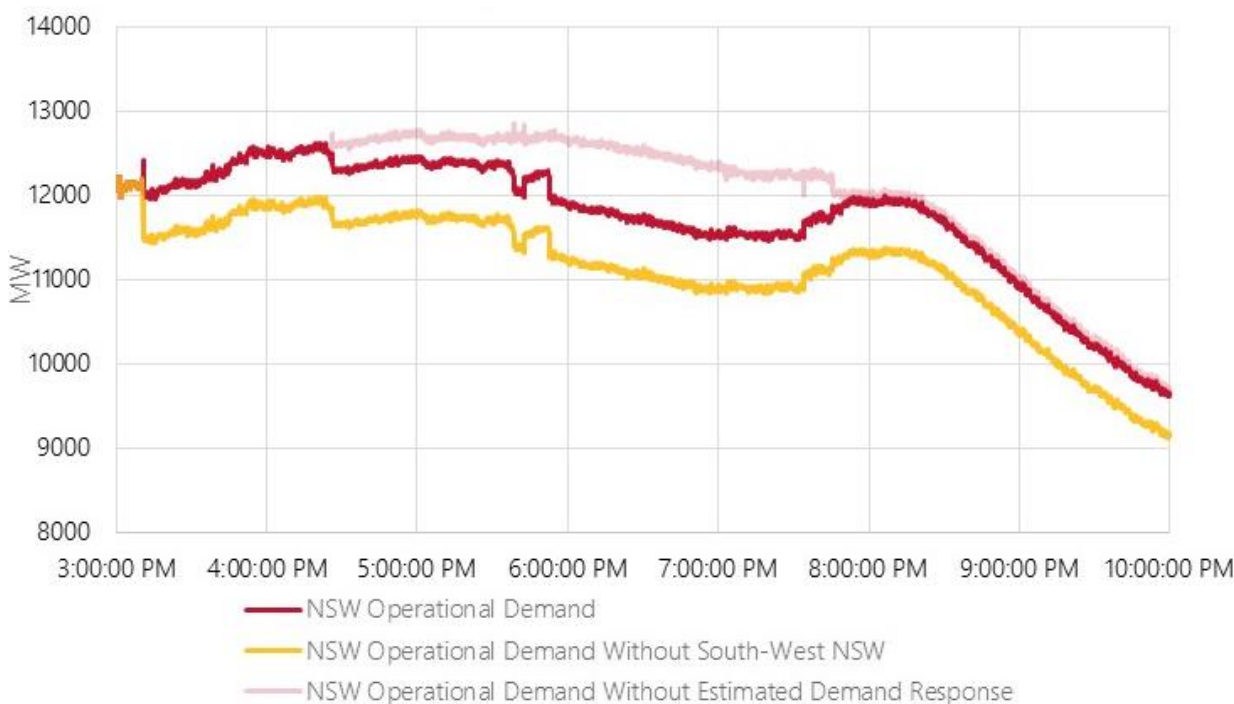
Figure 3 shows the operational demand in New South Wales under three scenarios. In these scenarios, the demand response includes the impact of RERT services.

The reduction in load due to both RERT and demand side response resulted in a significant improvement in the reserve levels in New South Wales, to the extent that by 2100 hrs there was no longer an LOR condition in New South Wales.

¹⁰ Refer RERT Activation Report for 4 January 2020 <https://www.aemo.com.au/energy-systems/electricity/emergency-management/reliability-and-emergency-reserve-trader-rert/rert-reporting>

¹¹ Due to the load in south west New South Wales being fed radially from the Victoria region.

Figure 3 Operational demand in New South Wales under three scenarios



4.2 Transmission network

Supply to the Gadara substation was restored at 1526 hrs, and supply to the Tumut 132 kV substation 66kV busbar was restored at 1519 hrs with Essential Energy then restoring load from 1537 hrs to 1539 hrs.

At 2038 hrs, the 64 line was returned to service, improving the connection for the Lower Tumut Switching Station and Tumut 3 Power Station to the main system. The restriction imposed by AEMO on the output of the Tumut 3 Power Station was removed at 2045 hrs. Initially Tumut 3 Power Station was then made available at reduced capacity, but it returned to full capacity at 1800 hrs on Sunday 5 January.

Attempts were made to reconnect the Upper Tumut Switching Station, and Tumut 1 and 2 power stations to the transmission network via either the 01 or 02 lines from 1535 hrs, but a stable connection was not achieved until 1830 hrs. The return to service of the Tumut 1 and Tumut 2 power stations was further delayed due to a number of bushfire-related issues. Tumut 1 and Tumut 2 Power Stations returned to partial availability at 1930 hrs on Monday 6 January. At the time of writing, the availability of Tumut 1 and 2 Power Stations remains below the levels prior to the event.

At 2156 hrs, the New South Wales and Victoria regions were reconnected when the 65 line was returned to service. Shortly afterwards, the 66 line was also returned to service to reinforce the interconnection. At 2159 hrs, the AGC system was returned to normal configuration.

The 051 line could then be returned to service at 2200 hrs to improve security of supply to southwest New South Wales and further reinforce the interconnection. The 132 kV parallel between Yass and Wagga 330 kV was then restored at 2204 hrs, via the 991 line and the 990 line. An attempt to restore the third circuit in this parallel failed when a reclose attempt on the 993 line failed. OX1 line was also returned to service at 2204 hrs.

The 02 line was returned to service on 26 January 2020. At this time all lines had been returned to service with the exception of 993 line which remains out of service for repairs.

Refer to Appendix A1 for further details of the restoration sequence.

5. Market advice

During the event, AEMO issued frequent market notices to keep market participants up to date with the developing situation. A summary of relevant market notices that were published is provided as part of the sequence of events in Appendix A1. The types of market notices issued were as follows.

5.1 Advice of forecast extreme temperature conditions

On Wednesday 1 January 2020, AEMO issued MN 72247 advising of forecast extreme temperature conditions for 4 January and requesting generators to update their offers to be consistent with the forecast extreme conditions.

5.2 Advice of forecast extreme power system conditions

At 0036 hrs on Saturday 4 January 2020, AEMO issued MN 72269 to advise that it had identified that a non-credible contingency event was more likely to occur in the New South Wales region because of the existence of abnormal conditions, namely severe and extreme bushfire conditions for Saturday 4 January.

5.3 Advice of changes to power system conditions

Following sustained forced outages of transmission circuits and actions by AEMO to restrict flows, AEMO (where practical) issued market notices to advise of the impact on inter-regional flows. MN 72288 was issued at 1516 hrs on 4 January 2020 to advise on the separation event itself. Market notices were also issued to advise on the progress of the restoration process.

5.4 Reclassification of contingencies

Due to the developing bushfire conditions, the losses of multiple transmission lines were on several occasions reclassified as credible contingencies. Market notices were issued to advise when this occurred

5.5 Advice on reserve conditions and RERT

At 1605 hrs on 4 January 2020, AEMO issued MN 72297 to advise of the declaration of a LOR 2 condition in the New South Wales region. Subsequent market notices were issued to advise of the commencement of negotiations for RERT contracts, the successful conclusion of these negotiations, and finally the actual dispatch of these RERT services and consequent introduction of intervention pricing.

Further details of the market notices can be obtained from the AEMO website¹².

¹² See <https://www.aemo.com.au/Market-Notices>.

6. Next steps

AEMO has identified several issues requiring further investigation:

1. Delivery of contingency FCAS across the NEM immediately after the separation event.
2. The availability of contingency raise FCAS after the separation event in the Queensland – New South Wales island to manage a subsequent contingency event, and the impact that constraints applied in response to the separation event had on this availability.
3. The frequency excursion in the Victorian and South Australian island during the period of separation.
4. The operation of and the interaction of protection schemes within the 132 kV network between Wagga and Yass substations, both prior to and after the separation event.
5. The ability of AEMO's PASA process to accurately calculate reserve levels under intra-regional system separation conditions.
6. Any potential major security of supply issues which arose during this incident.
7. The performance of generating units during the disturbance created by the separation event.

AEMO will investigate these issues and will publish a further report in due course.

AEMO will also publish information on the cost and quantity of RERT which has been dispatched in the Quarter 1 2020 RERT report which is due for publication in May 2020.

A1. Sequence of events

The table below provides a time ordered list of the significant events during this incident.

Table 3 Sequence of events

Date	Time	Event Type	Event
22/12/2019	18:55	Reclassification	76 and 77 lines reclassified as a credible contingency.
22/12/2019	23:15	Constraint	Constraint set N-X_76+77_N-2 invoked to manage reclassification of 76 & 77 lines.
31/12/2019	13:50	Reclassification	Murray – Upper Tumut 65 and Murray Lower Tumut 66 330 kV lines reclassified as a credible contingency.
3/01/2020	9:00	Notice	Market Notice 72261 – general advice concerning potential impact to New South Wales transmission elements due bushfires.
3/01/2020	12:10	Constraint	Constraint set I-NIL_65+66_N-2 invoked to manage reclassification of 65 and 66 lines.
4/01/2020	0:36	Notice	Market Notice 72270 – general advice of potential for non-credible contingencies to occur in Victoria on 4 January due to extreme bushfire conditions.
4/01/2020	0:36	Notice	Market Notice 72269 – general advice of potential for non-credible contingencies to occur in New South Wales on 4 January due to extreme bushfire conditions.
4/01/2020	7:58	Other	TransGrid advised AEMO that auto-reclose disabled on 64, 66, 03, 07 and 051 lines. Manual reclose would be initiated if the lines tripped.
4/01/2020	11:47	Transmission	Upper Tumut – Lower Tumut 64 330 kV line tripped.
4/01/2020	11:48	Transmission	Upper Tumut – Lower Tumut 64 330 kV line returned to service.
4/01/2020	11:59	Transmission	Upper Tumut – Lower Tumut 64 330 kV line tripped.
4/01/2020	12:20	Transmission	Upper Tumut – Lower Tumut 64 330 kV line returned to service.
4/01/2020	12:20	Constraint	Constraint set N-LTUT_64_15M invoked to manage outage of 64 line.
4/01/2020	12:22	Transmission	Upper Tumut – Lower Tumut 64 330 kV line tripped.
4/01/2020	12:33	Notice	Market Notice 72277 – inter-regional limitation due outage of 64 line.
4/01/2020	12:55	Transmission	Upper Tumut – Lower Tumut 64 330 kV line returned to service.
4/01/2020	13:05	Constraint	Constraint set N-LTUT_64_15M revoked.
4/01/2020	13:14	Transmission	Upper Tumut – Lower Tumut 64 330 kV line tripped.
4/01/2020	13:20	Constraint	Constraint set N-LTUT_64_15M invoked to manage outage of 64 line.
4/01/2020	13:24	Notice	Market Notice 72281 – inter-regional limitation due outage of 64 line.
4/01/2020	13:33	Transmission	Murray-Upper Tumut 65 330 kV line tripped.
4/01/2020	13:42	Transmission	Upper Tumut – Yass 02 33 0 kV line tripped.

Date	Time	Event Type	Event
4/01/2020	13:50	Constraint	Constraint set I-X_MSUT_LTUT invoked to manage outage of 64 and 65 lines.
4/01/2020	13:50	Constraint	Constraint set N-LTUT_64_15M revoked.
4/01/2020	13:50	Constraint	Constraint set I-NIL_65+66_N-2 revoked.
4/01/2020	13:51	Notice	Market Notice 72282 – inter-regional limitation due to outage of 65 line.
4/01/2020	13:57	Transmission	Lower Tumut – Wagga 051 330 kV line tripped.
4/01/2020	13:58	Transmission	Murray – Upper Tumut 65 330 kV line returned to service.
4/01/2020	13:59	Transmission	Upper Tumut Lower Tumut 64 330 kV line returned to service.
4/01/2020	14:00	Transmission	Upper Tumut – Yass 02 330 kV line returned to service.
4/01/2020	14:01	Transmission	Murray – Lower Tumut 66 330 kV line tripped.
4/01/2020	14:02	Transmission	Murray – Lower Tumut 66 330 kV line returned to service.
4/01/2020	14:02	Transmission	Upper Tumut – Lower Tumut 64 330 kV line tripped.
4/01/2020	14:04	Transmission	Murray – Lower Tumut 66 330 kV line tripped.
4/01/2020	14:05	Transmission	Murray – Lower Tumut 66 330 kV line returned to service.
4/01/2020	14:06	Transmission	Lower Tumut – Wagga 051 330 kV line returned to service.
4/01/2020	14:10	Transmission	Kangaroo Valley – Capital 3W 330 kV line tripped.
4/01/2020	14:11	Transmission	Upper Tumut – Yass 02 330 kV line tripped.
4/01/2020	14:12	Transmission	Upper Tumut – Lower Tumut 64 330 kV line returned to service.
4/01/2020	14:12	Transmission	Kangaroo Valley – Capital 3W 330 kV line returned to service.
4/01/2020	14:14	Transmission	Upper Tumut – Lower Tumut 64 330 kV line tripped.
4/01/2020	14:15	Constraint	Constraint set N-LTUT_64_15M invoked to manage outage of 64 line.
4/01/2020	14:15	Transmission	Upper Tumut – Yass 02 330 kV line returned to service.
4/01/2020	14:15	Constraint	Constraint set I-NIL_65+66_N-2 invoked to manage reclassification of 65 and 66 lines.
4/01/2020	14:15	Constraint	Constraint set I-X_MSUT_LTUT revoked.
4/01/2020	14:16	Transmission	Kangaroo Valley – Capital 3W 330 kV line tripped.
4/01/2020	14:17	Transmission	Upper Tumut – Canberra 01 330 kV line tripped.
4/01/2020	14:17	Transmission	Upper Tumut – Yass 02 330 kV line tripped.
4/01/2020	14:18	Transmission	Upper Tumut– Canberra 01 330 kV line returned to service.
4/01/2020	14:19	Transmission	Upper Tumut – Lower Tumut 64 330 kV line returned to service.
4/01/2020	14:21	Transmission	Ingleburn – Wallerawang 77 330 kV line tripped and auto-reclosed.
4/01/2020	14:25	Constraint	Constraint set N-KVCW_3W_15M invoked to manage outage of 3W line.
4/01/2020	14:25	Constraint	Constraint set N-UTYS_2 invoked to manage outage of 02 line.

Date	Time	Event Type	Event
4/01/2020	14:27	Transmission	Sydney South – Wallerawang 76 330 kV line tripped and auto-reclosed.
4/01/2020	14:27	Transmission	Upper Tumut – Lower Tumut 64 330 kV line tripped.
4/01/2020	14:28	Transmission	Kangaroo Valley – Capital 3W 330 kV line returned to service.
4/01/2020	14:30	Transmission	Upper Tumut – Yass 02 330 kV line returned to service.
4/01/2020	14:31	Transmission	Upper Tumut – Yass 02 330 kV line tripped.
4/01/2020	14:35	Notice	Market Notice 72284 – inter-regional limitation due outage of 3W line.
4/01/2020	14:36	Transmission	Upper Tumut – Lower Tumut 64 330 kV line returned to service.
4/01/2020	14:38	Notice	Market Notice 72285 – inter-regional limitation due to outage of Upper Tumut – Yass line.
4/01/2020	14:41	Transmission	Sydney South – Wallerawang 76 330 kV line tripped and auto-reclosed.
4/01/2020	14:41	Transmission	Ingleburn – Wallerawang 77 330 kV line tripped and auto-reclosed.
4/01/2020	14:42	Transmission	Kangaroo Valley – Capital 3W 330 kV line tripped.
4/01/2020	14:48	Transmission	Upper Tumut – Canberra 01 330 kV line tripped.
4/01/2020	14:55	Transmission	Murray – Upper Tumut 65 330 kV line tripped.
4/01/2020	14:56	Transmission	Lower Tumut – Wagga 051 330 kV line tripped.
4/01/2020	14:56	Transmission	Lower Tumut – Wagga 051 330 kV line returned to service.
4/01/2020	14:57	Transmission	Lower Tumut – Wagga 051 330 kV line tripped.
4/01/2020	14:58	Transmission	Kangaroo Valley – Capital 3W 330 kV line returned to service.
4/01/2020	14:59	Transmission	Murray – Upper Tumut 65 330 kV line returned to service.
4/01/2020	15:00	Constraint	Constraint set I-VN_0650 invoked to limit power transfer between New South Wales and Victoria.
4/01/2020	15:01	Transmission	Lower Tumut – Wagga 051 330 kV line re-energised from Lower Tumut and tripped.
4/01/2020	15:03	Transmission	Kangaroo Valley – Capital 3W 330 kV line tripped.
4/01/2020	15:03	Notice	Market Notice 72286 – limit New South Wales – Victoria flow to 650 MW.
4/01/2020	15:07	Transmission	Upper Tumut – Lower Tumut 64 330 kV line tripped.
4/01/2020	15:07	Transmission	Murray – Upper Tumut 65 330 kV line tripped.
4/01/2020	15:08	Transmission	Lower Tumut – Wagga 051 330 kV line re-energised from Lower Tumut and tripped.
4/01/2020	15:09	Notice	Market Notice 72287 – limit New South Wales – Victoria flow to 450 MW.
4/01/2020	15:10	Transmission	Kangaroo Valley – Capital 3W 330 kV line returned to service.
4/01/2020	15:10	Constraint	Constraint set I-VN_0650 revoked.
4/01/2020	15:10	Constraint	Constraint set I-VN_0450 invoked to limit power transfer between New South Wales and Victoria.

Date	Time	Event Type	Event
4/01/2020	15:10	Transmission	Murray – Lower Tumut 66 330 kV line tripped.
4/01/2020	15:10	Transmission	Wagga – Yass 990 132kV line tripped due to power swings.
4/01/2020	15:10	Transmission	Wagga North – Murrumbrah 991 132kV line tripped due to power swings.
4/01/2020	15:10	Transmission	Yass – Burrinjuck 970 132kV line tripped due to power swings.
4/01/2020	15:10	Transmission	Wagga – Gadara 993 132kV line tripped due to power swings.
4/01/2020	15:10	Other	Blowering generating unit tripped (33 MW).
4/01/2020	15:10	Transmission	New South Wales and Victoria now separated with Wagga area load fed from Victoria.
4/01/2020	15:11	Other	AEMO re-configured the AGC system to manage the New South Wales – Victoria separation.
4/01/2020	15:14	Transmission	Wagga – ANM 996 132 kV line opened at Wagga.
4/01/2020	15:16	Notice	Market Notice 72288 – New South Wales – Victoria separation event.
4/01/2020	15:19	Transmission	Redcliffs – Buronga OX1 220 kV line opened manually by TransGrid at Buronga.
4/01/2020	15:19	Transmission	Yass – Burrinjuck 970 132 kV line returned to service.
4/01/2020	15:25	Constraint	Constraint sets F-NQ_ISLE, F-NQ_VST_ISLE_REG, F_VST_ISLE, L_VN_ZERO and NQ_VST_ISLE, invoked to manage separation of New South Wales and Victoria.
4/01/2020	15:26	Transmission	Tumut – Gadara 99P 132 kV line returned to service.
4/01/2020	15:28	Transmission	Lower Tumut – Yass 03 330 kV line tripped.
4/01/2020	15:30	Constraint	Constraint set I-VN_0450 revoked.
4/01/2020	15:31	Transmission	Ingleburn – Wallerawang 77 330 kV line tripped and auto-reclosed.
4/01/2020	15:32	Transmission	Lower Tumut – Yass 03 330 kV line returned to service.
4/01/2020	15:33	Transmission	Lower Tumut – Yass 03 330 kV line tripped.
4/01/2020	15:35	Transmission	Upper Tumut – Yass 02 330 kV line returned to service.
4/01/2020	15:36	Transmission	Upper Tumut – Lower Tumut 64 330 kV line returned to service.
4/01/2020	15:36	Transmission	Upper Tumut – Yass 02 330 kV line tripped.
4/01/2020	15:37	Transmission	Upper Tumut – Yass 02 330 kV line returned to service.
4/01/2020	15:38	Transmission	Upper Tumut – Lower Tumut 64 330 kV line tripped.
4/01/2020	15:40	Constraint	Constraint set N-LTWG_L_RADIAL invoked.
4/01/2020	15:40	Constraint	Constraint set V-DBUSS_L invoked.
4/01/2020	15:40	Constraint	Constraint set V-DBUSS_T invoked.
4/01/2020	15:40	Constraint	Tumut 3 generation constrained to 500 MW.
4/01/2020	15:45	Constraint	N-KVCW_3W_15M revoked.

Date	Time	Event Type	Event
4/01/2020	15:47	Notice	Market Notice 72291 – inter-regional limitation due to New South Wales – Victoria separation
4/01/2020	15:50	Constraint	Tumut 3 generation constrained to 0 MW.
4/01/2020	15:55	Transmission	Finley – Mulwala 9R4 132 kV line opened at Mulwala.
4/01/2020	16:05	Other	Market Notice 72297 – AEMO declared LOR 2 in New South Wales from 1600 hrs.
4/01/2020	16:05	Notice	Market Notice 72297 – actual LOR 2 declared in New South Wales from 1600 hrs.
4/01/2020	16:07	Notice	Market Notice 72299 – demand forecast change due to Wagga Wagga being area fed from Victoria.
4/01/2020	16:07	Notice	Market Notice 72300 – RERT negotiations to commence for the period 1700-0000 hrs on 5/1/2020 in New South Wales.
4/01/2020	16:07	RERT	AEMO commenced negotiations for RERT in New South Wales for the period 1700-0000 hrs on 5/1/2020.
4/01/2020	16:14	Transmission	Upper Tumut – Yass 02 330 kV line tripped.
4/01/2020	16:15	Constraint	Constraint equation I-VN_ZERO blocked due to Wagga area load being fed from Victoria.
4/01/2020	16:18	Notice	Market Notice 72310 – RERT negotiations to commence for the period 1630-2200 hrs on 4/1/2020 in New South Wales.
4/01/2020	16:18	RERT	AEMO commenced negotiations for RERT in New South Wales for the period 1630-2200 hrs on 4/1/2020.
4/01/2020	16:21	Transmission	Ingleburn – Wallerawang 77 330 kV line tripped and auto-reclosed.
4/01/2020	16:24	Transmission	Lower Tumut – Canberra 07 330 kV line tripped.
4/01/2020	16:25	Constraint	Constraint set N-UTYS_2 revoked.
4/01/2020	16:26	Other	Tomago load reduced from 945 MW to 650 MW in response to high prices.
4/01/2020	16:35	Notice	Market Notice 72315 – actual LOR 2 declared in New South Wales.
4/01/2020	17:02	Transmission	Kangaroo Valley – Capital 3W 330 kV line tripped.
4/01/2020	17:14	Transmission	Lower Tumut – Yass 03 330 kV line returned to service.
4/01/2020	17:14	Transmission	Lower Tumut – Canberra 07 330 kV line returned to service.
4/01/2020	17:15	Notice	Market Notice 72333 – intervention event – AEMO entered into a RERT contract for New South Wales for the period 1800-2200 hrs on 4/1/2020.
4/01/2020	17:15	RERT	AEMO issued an instruction to activate 68 MW of RERT in New South Wales. AEMO pre-activated an additional 300 MW of RERT in New South Wales.
4/01/2020	17:24	Transmission	Kangaroo Valley – Capital 3W 330 kV line returned to service.
4/01/2020	17:31	Notice	Market Notice 72334 – intervention event – RERT dispatched.
4/01/2020	17:39	Transmission	Kangaroo Valley – Capital 3W 330 kV line tripped.
4/01/2020	17:39	Notice	Market Notice 72335 – intervention price dispatch intervals.
4/01/2020	17:40	Transmission	Lower Tumut – Canberra 07 330 kV line tripped.

Date	Time	Event Type	Event
4/01/2020	17:40	Constraint	Limit Upper Tumut to 0 MW.
4/01/2020	17:43	Transmission	Lower Tumut – Canberra 07 330 kV line returned to service.
4/01/2020	17:44	Transmission	Lower Tumut – Yass 03 330 kV line tripped.
4/01/2020	17:50	Constraint	Constraint set N-X_KVCW_WG_OP invoked to manage outage of 3W line.
4/01/2020	17:51	Transmission	Lower Tumut – Yass 03 330 kV line returned to service.
4/01/2020	17:55	Transmission	Kangaroo Valley – Capital 330 kV line returned to service.
4/01/2020	17:55	Transmission	Lower Tumut – Canberra 07 330 kV line tripped.
4/01/2020	18:00	Constraint	Constraint set F-VS_TL_0600 invoked.
4/01/2020	18:20	RERT	68 MW of RERT activated in New South Wales.
4/01/2020	18:24	Transmission	Lower Tumut – Yass 03 330 kV line tripped.
4/01/2020	18:28	Transmission	Upper Tumut – Yass 02 330 kV line returned to service.
4/01/2020	18:30	Transmission	Upper Tumut – Canberra 01 330 kV line returned to service.
4/01/2020	18:50	Reclassification	01 and 02 lines reclassified as a credible contingency due to bushfires.
4/01/2020	19:06	Notice	Market Notice 72337 – 01 and 02 lines reclassified as credible contingency.
4/01/2020	19:15	Constraint	N-BDKV_19 invoked.
4/01/2020	20:15	Constraint	Constraint set N-X_KVCW_WG_OP revoked.
4/01/2020	20:20	Constraint	Constraint set F-VS_TL_0600 revoked.
4/01/2020	20:20	Constraint	Constraint set F-VS_TL_0550 invoked.
4/01/2020	20:35	Transmission	Lower Tumut – Yass 03 330 kV line returned to service.
4/01/2020	20:36	Transmission	Lower Tumut – Canberra 07 330 kV line returned to service.
4/01/2020	20:38	Transmission	Upper Tumut – Lower Tumut 64 330 kV line returned to service.
4/01/2020	20:40	Notice	Market Notice 72338 – inter-regional limitation extended due to New South Wales – Victoria separation.
4/01/2020	20:50	Constraint	N-LTUT_64_15M revoked.
4/01/2020	20:55	Constraint	Constraint set F-VS_TL_0550 revoked.
4/01/2020	20:55	Constraint	Constraint set F-VS_TL_0500 invoked.
4/01/2020	21:06	Notice	Market Notice 72339 – LOR 2 cancelled in New South Wales.
4/01/2020	21:44	Transmission	Sydney South – Wallerawang 76 330 kV line tripped.
4/01/2020	21:44	Transmission	Ingleburn – Wallerawang 77 330 kV line tripped.
4/01/2020	21:47	Notice	Market Notice 72340 – intervention event – end of RERT dispatch.
4/01/2020	21:56	Transmission	Murray – Upper Tumut 65 330 kV line returned to service. New South Wales and Victoria re-synchronised.
4/01/2020	21:56	Transmission	Murray – Lower Tumut 66 330 kV line returned to service.

Date	Time	Event Type	Event
4/01/2020	21:59	Other	AGC returned to normal configuration.
4/01/2020	22:00	Transmission	Lower Tumut – Wagga 051 330 kV line returned to service.
4/01/2020	22:03	Transmission	Wagga North – Murrumbrah 991 132 kV line returned to service.
4/01/2020	22:04	Transmission	Redcliffs – Buronga OX1 220 kV line returned to service.
4/01/2020	22:04	Notice	Market Notice 72341 – New South Wales and Victoria synchronised between Murray and Upper Tumut.
4/01/2020	22:04	Transmission	Wagga – Yass 990 132kV line returned to service.
4/01/2020	22:13	Transmission	Wagga – Gadara 993 132kV line reclosed from Wagga but immediately tripped and remained out of service.
4/01/2020	22:15	Constraint	Constraint set F-VS_TL_0500 revoked.
4/01/2020	22:15	Constraint	Constraint set F-VS_TL_0500 invoked.
4/01/2020	22:20	Constraint	F-NQ_ISLE revoked.
4/01/2020	22:20	Constraint	F-NQ_VST_ISLE_REG revoked.
4/01/2020	22:20	Constraint	F-VST_ISLE revoked.
4/01/2020	22:20	Constraint	Constraint Set I_VN_ZERO revoked.
4/01/2020	22:20	Constraint	Constraint set NQ_VST_ISLE revoked.
4/01/2020	22:25	Constraint	Constraint set N-X_76+77_N-2 revoked.
4/01/2020	22:30	Constraint	Constraint set N-L_TWG_L_RADIAL revoked.
4/01/2020	22:30	Constraint	Constraint set V-DBUSS_L revoked.
4/01/2020	22:30	Constraint	Constraint set V-DBUSS_T revoked.
4/01/2020	22:30	Constraint	Constraint set I-VN_0450 invoked.
4/01/2020	22:30	Constraint	N-SSWW_76 invoked.
4/01/2020	22:35	Transmission	Upper Tumut – Yass 02 330 kV line tripped.
4/01/2020	22:36	Notice	Market Notice 72343 – inter-regional limitation due to New South Wales – Victoria separation ended.
4/01/2020	22:45	Constraint	Constraint set N-UTYS_2 invoked.
4/01/2020	22:50	Notice	Market Notice 72345 – inter-regional limitation New South Wales – Victoria due to continuation of bushfire activity.
4/01/2020	22:54	Notice	Market Notice 72344 – inter-regional limitation due to outage of 76 and 77 lines.
4/01/2020	22:55	Notice	Market Notice 72346 – inter-regional limitation due to outage to Upper Tumut – Yass line.
4/01/2020	23:07	Transmission	Sydney South – Wallerawang 76 330 kV line returned to service.
4/01/2020	23:07	Transmission	Ingleburn – Wallerawang 77 330 kV line returned to service.
4/01/2020	23:15	Constraint	Constraint set N-X_76+77_N-2 invoked.

Date	Time	Event Type	Event
4/01/2020	23:56	Transmission	Sydney South – Wallerawang 76 330 kV line tripped.
4/01/2020	23:56	Transmission	Ingleburn – Wallerawang 77 330 kV line tripped.
4/01/2020	23:57	Notice	Market Notice 72352 – inter-regional limitation due to outage of Eildon – Mt Beauty line.
5/01/2020	0:05	Constraint	Constraint set N-X_76+77_N-2 revoked.
5/01/2020	0:05	Constraint	Constraint set N-SSWW_76 revoked.
5/01/2020	0:26	Notice	Market Notice 72349 – update on potential for non-credible contingencies to occur in New South Wales due to ongoing bushfire activity.
5/01/2020	0:26	Notice	Market Notice 72351 – update on potential for non-credible contingencies to occur in Victoria due ongoing bushfire activity.
5/01/2020	0:27	Notice	Market Notice 72353 – inter-regional limitation due to outage of 76 and 77 lines.
5/01/2020	17:36	Transmission	Upper Tumut – Yass 02 330 kV line returned to service.
6/01/2020	10:50	Constraint	Constraint set I-VN_0450 revoked.
8/01/2020	13:35	Constraint	Constraint set I-NIL_65+66_N-2 revoked.

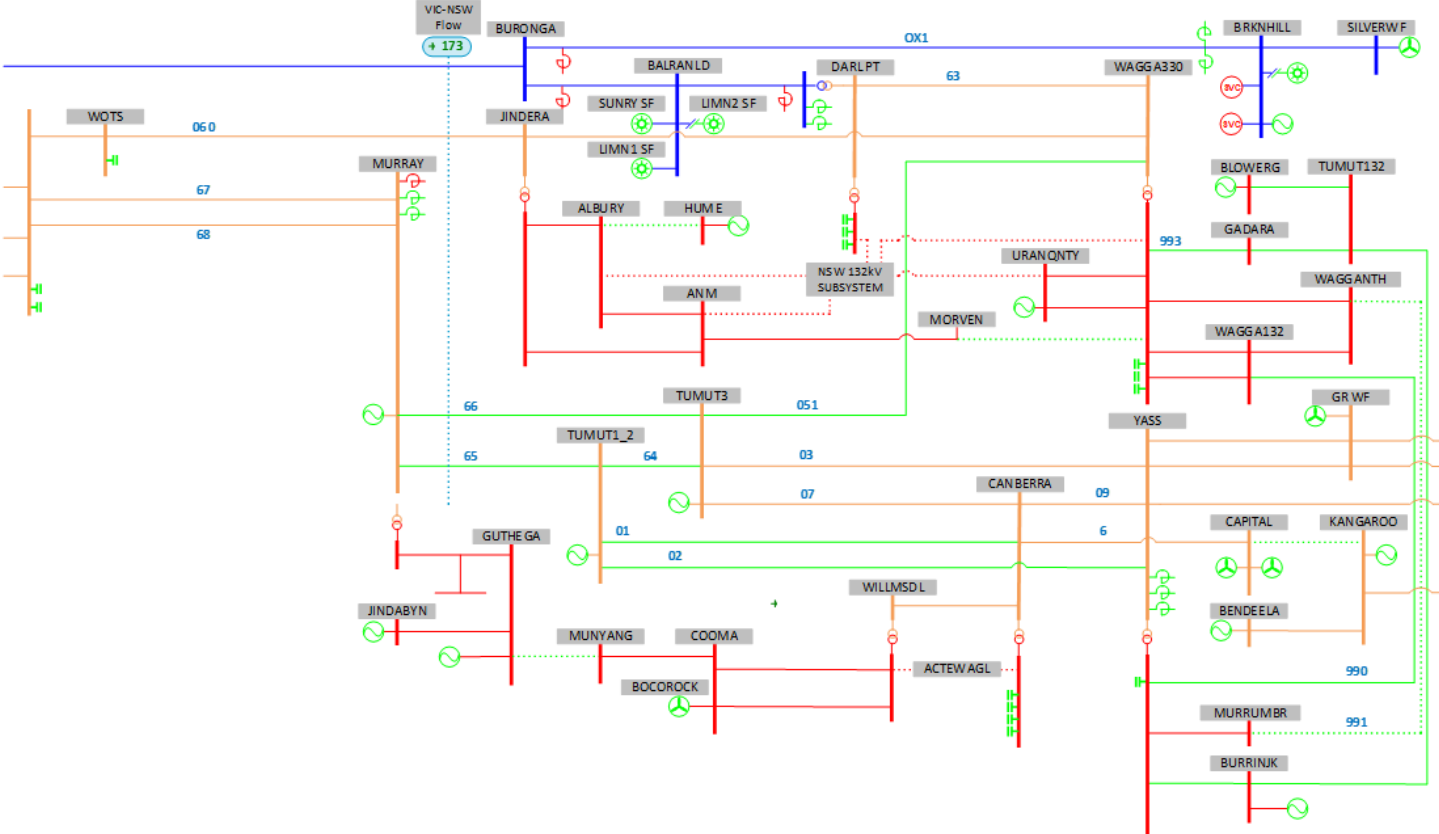
A2. Status of major transmission circuits prior to and after separation

Figures 4 and 5 below show the status of the circuits of the transmission network in southern New South Wales and northern Victoria immediately prior to and immediately after separation. The transmission circuits are shown as follows:

- Solid orange lines represent inservice 300 kV transmission circuits.
- Solid blue lines represent inservice 220 kV transmission circuits.
- Solid red lines indicate inservice 132 kV transmission circuits .
- Dotted red lines represent inservice 132 kV connections to other 132 kV subsystems.
- Solid green lines represent denergised 132 kV circuits.
- Dotted green lines represent 132 kV circuits which are energised but open at one end (that is, not carrying load).

The dotted blue line represents the boundary between the New South Wales and Victorian regions.

Figure 5 Status of major transmission circuits immediately after separation



A3. Details of violated network and FCAS constraint equations

The following are the details of all network and FCAS constraint violations reported in dispatch for Saturday 4 January 2020.

Table 4 Details of violated network and FCAS constraint equations

SETTLEMENTDATE	CONSTRAINTID	RHS	MARGINAL VALUE	VIOLATION DEGREE
4/01/2020 15:30	F_NQ+MG_R6	549.949	117600	-123.549
4/01/2020 15:30	F_NQ+MG_R60	549.949	88200	-73.0928
4/01/2020 15:30	NQ_VST_ISLE_B	186.9661	5292000	-186.9661
4/01/2020 15:35	NQ_VST_ISLE_B	35.4416	5292000	-35.4416
4/01/2020 15:40	NQ_VST_ISLE_A	-28.2414	-5292000	28.2414
4/01/2020 15:45	NQ_VST_ISLE_A	-120.044	-5292000	120.0441
4/01/2020 15:45	N_COLEASF1_ZERO	0	-17052000	94.0821
4/01/2020 15:45	N_FINLYSF1_ZERO	0	-17052000	77.7745
4/01/2020 15:45	N_URANQ12_ZERO	0	-17052000	104.1175
4/01/2020 15:45	N_URANQ13_ZERO	0	-17052000	104.1175
4/01/2020 15:45	N_URANQ14_ZERO	0	-17052000	102.8313
4/01/2020 15:50	F_NQ+MG_R5	605.9203	58800	-98.1864
4/01/2020 15:50	F_NQ+MG_R6	524.5342	117600	-119.2262
4/01/2020 15:50	F_NQ+MG_R60	524.5342	88200	-99.2526
4/01/2020 15:50	N>N-NIL_MBDU	200.9583	-441000	0.6417
4/01/2020 15:50	NQ_VST_ISLE_A	-4.8407	-5292000	4.8407
4/01/2020 15:50	N_COLEASF1_ZERO	0	-17052000	78.8
4/01/2020 15:50	N_FINLYSF1_ZERO	0	-17052000	62.725
4/01/2020 15:50	N_URANQ12_ZERO	0	-17052000	89.2187
4/01/2020 15:50	N_URANQ13_ZERO	0	-17052000	89.3313
4/01/2020 15:50	N_URANQ14_ZERO	0	-17052000	88.9813
4/01/2020 15:50	QNI_SOUTH_1150_DYN	1050	-514500	27.1589
4/01/2020 15:55	F_NQ+MG_R5	613.988	58800	-210.0741

SETTLEMENTDATE	CONSTRAINTID	RHS	MARGINAL VALUE	VIOLATION DEGREE
4/01/2020 15:55	F_NQ+MG_R6	532.6432	117600	-161.9843
4/01/2020 15:55	F_NQ+MG_R60	532.6432	88200	-138.3531
4/01/2020 15:55	NQ_VST_ISLE_B	47.682	5292000	-47.682
4/01/2020 15:55	N_COLEASF1_ZERO	0	-17052000	63.5
4/01/2020 15:55	N_FINLYSF1_ZERO	0	-17052000	47.8
4/01/2020 15:55	N_URANQ12_ZERO	0	-17052000	59.8959
4/01/2020 15:55	N_URANQ13_ZERO	0	-17052000	35.1515
4/01/2020 15:55	N_URANQ14_ZERO	0	-17052000	59.8959
4/01/2020 16:00	F_NQ+MG_R5	616.0071	58800	-243.9731
4/01/2020 16:00	F_NQ+MG_R6	535.4652	117600	-217.3475
4/01/2020 16:00	F_NQ+MG_R60	535.4652	88200	-207.3475
4/01/2020 16:00	F_Q++NIL_R5	1360	-58800	39.2187
4/01/2020 16:00	NQ_VST_ISLE_B	190.9662	5292000	-190.9662
4/01/2020 16:00	N_COLEASF1_ZERO	0	-17052000	47.7
4/01/2020 16:00	N_FINLYSF1_ZERO	0	-17052000	32.7562
4/01/2020 16:00	N_URANQ12_ZERO	0	-17052000	80
4/01/2020 16:00	N_URANQ14_ZERO	0	-17052000	80
4/01/2020 16:00	Q:N_NIL_AR_2L-G	1134.364	-514500	39.6349
4/01/2020 16:00	Q>NIL_MUTE_757	201.6	-441000	5.1
4/01/2020 16:00	Q>NIL_MUTE_758	201.6	-441000	5.1
4/01/2020 16:00	QNI_SOUTH_1150_DYN	1136.281	-514500	30.0302
4/01/2020 16:00	Q^^NIL_QNI_SRAR	1147.724	-514500	27.2127
4/01/2020 16:05	F_NQ+MG_R5	625.5026	58800	-63.1895
4/01/2020 16:05	F_NQ+MG_R6	545.0087	117600	-269.0596
4/01/2020 16:05	F_NQ+MG_R60	545.0087	88200	-278.2908
4/01/2020 16:05	F_Q++NIL_R5	1360	-58800	47.327
4/01/2020 16:05	NQ_VST_ISLE_B	375.6515	5292000	-375.6515
4/01/2020 16:05	N_COLEASF1_ZERO	0	-17052000	31.9
4/01/2020 16:05	N_FINLYSF1_ZERO	0	-17052000	17.7063
4/01/2020 16:05	N_URANQ12_ZERO	0	-17052000	64.8672
4/01/2020 16:05	N_URANQ14_ZERO	0	-17052000	69.5859

SETTLEMENTDATE	CONSTRAINTID	RHS	MARGINAL VALUE	VIOLATION DEGREE
4/01/2020 16:05	Q:N_NIL_AR_2L-G	1133.292	-514500	72.5208
4/01/2020 16:05	Q>NIL_MUTE_757	201.6	-441000	4.3
4/01/2020 16:05	Q>NIL_MUTE_758	201.6	-441000	4.3
4/01/2020 16:05	QNI_SOUTH_1150_DYN	1150	-514500	50
4/01/2020 16:05	Q^ ^NIL_QNI_SRAR	1127.129	-514500	79.3932
4/01/2020 16:10	F_NQ+MG_R5	611.3148	58800	-25.8336
4/01/2020 16:10	F_NQ+MG_R6	531.5494	117600	-236.9146
4/01/2020 16:10	F_NQ+MG_R60	531.5494	88200	-248.9146
4/01/2020 16:10	F_Q++NIL_R5	1360	-58800	57.74
4/01/2020 16:10	NQ_VST_ISLE_B	429.6533	5292000	-429.6533
4/01/2020 16:10	N_COLEASF1_ZERO	0	-17052000	16
4/01/2020 16:10	N_FINLYSF1_ZERO	0	-17052000	2.675
4/01/2020 16:10	N_URANQ12_ZERO	0	-17052000	54.9922
4/01/2020 16:10	N_URANQ14_ZERO	0	-17052000	54.9922
4/01/2020 16:10	Q:N_NIL_AR_2L-G	1133.006	-514500	73.2321
4/01/2020 16:10	Q>NIL_MUTE_757	201.6	-441000	5.1
4/01/2020 16:10	Q>NIL_MUTE_758	201.6	-441000	5.1
4/01/2020 16:10	QNI_SOUTH_1150_DYN	1150	-514500	50
4/01/2020 16:10	Q^ ^NIL_QNI_SRAR	1115.672	-514500	91.3261
4/01/2020 16:15	F_NQ+MG_R5	620.91	58800	-64.8614
4/01/2020 16:15	F_NQ+MG_R6	540.4333	117600	-305.6184
4/01/2020 16:15	F_NQ+MG_R60	540.4333	88200	-317.6184
4/01/2020 16:15	F_Q++NIL_R5	1360	-58800	88
4/01/2020 16:15	NQ_VST_ISLE_B	459.2541	5292000	-459.2541
4/01/2020 16:15	N_URANQ12_ZERO	0	-17052000	45.7143
4/01/2020 16:15	N_URANQ14_ZERO	0	-17052000	45.7143
4/01/2020 16:15	Q:N_NIL_AR_2L-G	1130.253	-514500	73.4438
4/01/2020 16:15	Q>NIL_MUTE_757	201.6	-441000	6.3
4/01/2020 16:15	Q>NIL_MUTE_758	201.6	-441000	6.3
4/01/2020 16:15	QNI_SOUTH_1150_DYN	1150	-514500	50
4/01/2020 16:15	Q^ ^NIL_QNI_SRAR	1129.351	-514500	74.7965

SETTLEMENTDATE	CONSTRAINTID	RHS	MARGINAL VALUE	VIOLATION DEGREE
4/01/2020 16:20	F_NQ+MG_R6	542.1999	117600	-145.9469
4/01/2020 16:20	F_NQ+MG_R60	542.1999	88200	-110.0633
4/01/2020 16:25	F_NQ+MG_R6	531.5294	117600	-157.1076
4/01/2020 16:25	F_NQ+MG_R60	531.5294	88200	-158.6314
4/01/2020 16:30	F_NQ+MG_R5	618.9256	58800	-204.6652
4/01/2020 16:30	F_NQ+MG_R6	538.3103	117600	-116.7669
4/01/2020 16:30	F_NQ+MG_R60	538.3103	88200	-128.7669
4/01/2020 16:45	F_NQ+MG_R5	612.6521	58800	-0.7951
4/01/2020 16:55	F_NQ+MG_R5	611.4879	58800	-97.6923
4/01/2020 16:55	F_NQ+MG_R6	530.6097	117600	-14.1685
4/01/2020 16:55	F_NQ+MG_R60	530.6097	88200	-26.1685
4/01/2020 17:00	F_NQ+MG_R5	611.9442	58800	-129.0196
4/01/2020 17:00	F_NQ+MG_R6	530.6139	117600	-38.9874
4/01/2020 17:00	F_NQ+MG_R60	530.6139	88200	-50.9874
4/01/2020 17:05	F_NQ+MG_R5	612.1115	58800	-55.4702
4/01/2020 17:25	F_NQ+MG_R5	605.6142	58800	-19.7003
4/01/2020 17:35	F_NQ+MG_R5	606.8235	58800	-99.4665
4/01/2020 17:35	F_NQ+MG_R6	525.8533	117600	-11.747
4/01/2020 17:35	F_NQ+MG_R60	525.8533	88200	-24.747
4/01/2020 17:40	F_NQ+MG_R5	610.3397	58800	-69.7493