AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

Reliability and Emergency Reserve Trader (RERT) Quarterly Report Q1 2020

May 2020

A report for the National Electricity Market

Important notice

PURPOSE

AEMO publishes the Reliability and Emergency Reserve Trader (RERT) Quarterly Report under clause 3.20.6 of the National Electricity Rules.

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Executive summary

The Reliability and Emergency Reserve Trader (RERT) is an intervention mechanism under the National Electricity Rules (NER) that allows AEMO to contract for emergency reserves, such as generation or demand response that are not otherwise available in the market. AEMO uses RERT as a safety net in the event that a critical shortfall in reserves is forecast. RERT is activated when all market options have been exhausted, typically during periods when the supply demand balance is tight.

AEMO has observed a significant increase in National Electricity Market (NEM) reliability risk following the retirement of a number of baseload generators (including the Hazelwood, Northern, Munmorah, Wallerawang and Anglesea power stations). The reliability risk is further exacerbated by a combination of extreme weather conditions and higher outage rates from ageing generation assets. AEMO determined that an additional 125 megawatts (MW) of reserves were required in Victoria over the 2019-20 summer period, to meet the reliability standard.

In November 2019, AEMO secured 137 MW[1] of Long Notice Reserves[2] in Victoria and has since established medium and short notice panel arrangements for 1,698 MW of reserves across the NEM to manage unexpected risks to supply reliability.

The first quarter of 2020 saw extreme environmental impacts on the power system, with high temperatures resulting in high demand events and bushfire activity severely impacting the electricity network, particularly at the beginning of the quarter, and at times resulting in Lack of Reserve (LOR) conditions. Multiple unplanned transmission outages, regional separation events, and sudden loss of generation availability occurred throughout the period, significantly impacting reserves and resulting in increased RERT activity compared to previous quarters.

AEMO activated RERT on four occasions during Q1 2020:

- In New South Wales on 4 January, to reduce the potential impact of load shedding associated with 257 MW reserve shortfall, AEMO activated 232 megawatt hours (MWh) of RERT at a cost of $8.36 million.
- In New South Wales on 23 January, to reduce the potential impact of load shedding associated with a 258 MW reserve shortfall, AEMO activated 456 MWh of RERT at a cost of $7.54 million.
- In Victoria on 31 January, to reduce the potential impact of load shedding associated with a 360 MW reserve shortfall, AEMO activated 697 MWh of RERT at a cost of $7.54 million.
- In New South Wales on 31 January, to reduce the potential impact of load shedding associated with a 275 MW reserve shortfall, AEMO activated 418.5 MWh of RERT at a cost of $10.93 million.

The average energy cost (in MWh) payable by AEMO for each of the RERT activations in Q1 2020 is presented in Table 1.

Table 1 AEMO's average amount payable for RERT activation in Q1 2020

	State	Cost per megawatt hour ($/MWh)
4 January 2020	New South Wales	$28,703.86
23 January 2020	New South Wales	$14,821.80

[1] In addition to the 125 MW needed to meet the reliability standard, an additional 12 MW of reserve was contracted to account for statistical under-performance of contracted reserves when called upon on a given day.

[2] Of the 137 MW of long notice reserves secured by AEMO for summer 2019/20, 72 MW were contracted by AEMO using long notice RERT provisions with the balance being made up from the projects funded under the AEMO/Australian Renewable Energy Agency (ARENA) Demand Side Participation (DSP) trial.

31 January 2020	Victoria	$12,823.13
31 January 2020	New South Wales	$22,381.03

For each of these activations, the cost per MWh is less than the average value of customer reliability[3] (VCR), which is $42,120 per MWh for New South Wales and $41,210 per MWh for Victoria.

Assuming the cost of RERT is apportioned by consumption[4], the average cost per household for the four activation events in January 2020 is estimated to be $3.24 in New South Wales and $1.62 in Victoria (including GST).

AEMO's contracting and activation of RERT was consistent with the principles of having the least distortionary effect on the market, while improving reliability of the system and minimising cost to consumers.

This report is published under clause 3.20.6 (b) of the NER , and accounts for reserve contracts entered into and activated by AEMO in the period from 1 January 2020 to 31 March 2020.

[3] See https://www.aer.gov.au/system/files/AER%20-%20Values%20of%20Customer%20Reliability%20Review%20-%20Final%20Report%20-%20December%202019.pdf.

[4] AEMO recovers RERT costs from *market customers* who are typically retailers and transmission connected large industrial customers. AEMO does not have visibility or control on how retailers pass RERT costs on to their end use customers.

Contents

Tables

Figures

1. RERT activity in Q1 2020

1.1 Procurement

In Q4 2019, AEMO secured 137 megawatts (MW) of Long Notice[5] Reserve, effective from 1 November 2019 to 31 March 2020. No additional Long Notice Reserve was procured in Q1 2020, and since 31 March 2020 there is currently no Long Notice Reserve contracted in the National Electricity Market (NEM).

In Q4 2019, AEMO also established a panel of providers for up to 1,698 MW of potential reserve capacity across the NEM through panel agreements for the provision of reserves at Medium[6]/Short[7] Notice. No additional potential reserve capacity was added to Medium/Short Notice Panel in Q1 2020. Note that under the panel agreements no capacity is contracted until a reserve shortfall arises.

In Q1 2020, Short Notice Reserve was contracted on RERT activation days as detailed below and also on 30 January 2020 in response to an actual Lack of Reserve 2 (LOR 2) condition[8].

1.2 Activation

AEMO intervened in the market by activating RERT on the following occasions during the reporting period:

- Saturday 4 January 2020 due to an actual LOR 2 condition in New South Wales.
- Thursday 23 January 2020 due to a forecast LOR 2 condition which developed into an actual LOR 2 condition in New South Wales.
- Friday 31 January 2020 due to actual LOR 2 conditions in Victoria and New South Wales.

1.3 Costs incurred

The amount payable by AEMO under RERT in Q1 2020 was $34.93 million. Table 2 shows a breakdown of the amounts payable in Victoria and New South Wales including payment type for all contracts activated in Q1 2020. No other RERT costs were incurred in Q1 2020.

Table 2 AEMO's amount payable under reserve contracts, Q1 2020

NEM region	Availability[9] costs ($ million)	Pre-activation costs ($ million)	Activation costs ($ million)	Intervention costs ($ million)	Total cost ($ million)
New South Wales	$0	$14.06	$10.08	$2.68	$26.82
Victoria	$0.56[10]	$0.01	$5.35	$2.19	$8.11
Total cost					**$34.93**

[5] Long-notice situations occur between 12 months and 10 weeks before a projected shortfall in reserves.

[6] Short-notice situations occur less than seven days before a projected shortfall in reserve.

[7] Medium-notice situations occur between 10 weeks and seven days before a projected reserve shortfall.

[8] LOR 2 signals a tightening of electricity supply reserves. This condition exists when reserve levels are lower than the single largest supply resource in a state. At this level, there is no impact to the power system, but supply could be disrupted if a large incident occurred. Once a forecast LOR 2 is declared, AEMO has the power to direct generators, cancel network outages or activate the RERT mechanism to improve the supply demand balance.

[9] Availability payments apply for long notice contracts only. Availability payments are subject to change, any changes will be captured in routine revised statements.

[10] The availability payments of $0.56m in Victoria went solely to those reserve providers contracted directly by AEMO under long notice provisions. The providers funded under the AEMO/Australian Renewable Energy Agency (ARENA) Demand Side Participation (DSP) trial receive funding from ARENA to be available to provide reserves in emergency situations, this funding is similar to the availability payments to long notice reserve providers.

2. Reserve procurement

2.1 Long Notice Reserves

The 2019 Electricity Statement of Opportunities (ESOO) determined that Victoria was at risk of supply interruptions that could exceed the reliability standard for unserved energy (USE) in 2019-20. This risk was projected to arise in Victoria, under a scenario where the unplanned outages of two major Victorian power stations, Loy Yang A2 (500 MW) and Mortlake unit 2 (259 MW), extended into the peak summer period, posing a significant risk of insufficient supply that could lead to material involuntary load shedding[11]. Using a probabilistic forecast that assumed an extension of either of these outages, in combination with a number of other operating risks including the higher than average forced outage rates, AEMO determined an expected USE of 0.0026% for 2019-20 over the summer period.

AEMO simulated the impact that delayed return to service from generator outages would have on reserve levels across four scenarios, as detailed in Table 3 below. The weighted expectation of the delayed return to service scenarios for Loy Yang A2 and Mortlake translated into an additional 125 MW of reserves being required in the Victorian region to meet the reliability standard for 2019-20.

Table 3 Scenarios from 2019 ESOO showing potential reserve outcomes in Victoria, summer 2019-20

	Loy Yang A2 out (30% probability weighting)	Loy Yang A2 in (70% probability weighting)
Mortlake out (60% probability weighting)	• 0.0047% expected USE • 260,000 to 1.3m households without power for four hours • 460 MW required to meet the reliability standard • 18% probability of this scenario occuring	• 0.0023% expected USE • 155,000 to 720,000 households without power for four hours • 70 MW required to meet the reliability standard • 42% probability of this scenario occuring
Mortlake in (40% probability weighting)	• 0.0030% expected USE • 195,000 to 910,000 households without power for four hours • 215 MW required to meet the reliability standard • 12% probability of this scenario occuring	• 0.0013% expected USE • 90,000 to 445,000 households without power for four hours • 70 MW required to meet the reliability standard • 28% probability of this scenario occuring

Based on the above forecasts, in consultation with the relevant state governments and through open tendering processes under the NER, AEMO secured Long Notice Reserve that met detailed cost, technical, and verification criteria in order to meet the reliability standard under expected conditions.

In determining the quantity of Long Notice Reserves required, AEMO took into account the reserves available from the third year of the three-year joint AEMO – Australian Renewable Energy Agency (ARENA) Demand Side Participation (DSP) trial. Under this trial, 149 MW of reserves are currently available, of which 65 MW can support reliability in Victoria. Contracting of the ARENA reserve providers is managed through medium/short notice panel arrangements.

AEMO entered into Long Notice Reserve contracts to secure an additional 60 MW of out-of-market reserves to bring the total to 125 MW of reserves required to meet the reserve shortfall reported in the 2019 ESOO

[11] 2019 ESOO, at https://www.aemo.com.au/energy-systems/electricity/national-electricity-market-nem/nem-forecasting-and-planning/forecasting-and-reliability/nem-electricity-statement-of-opportunities-esoo.

under expected conditions. An additional 12 MW of reserve was also contracted (137 MW total reserve secured), in addition to the 125 MW needed to meet the reliability standard. Analysis of last year's performance of contracted RERT identified that dispatched reserves statistically underperformed when called on. This statistical underperformance was utilised to determine that following any given activation, RERT providers would deliver the required amount to meet USE.

Table 5 below shows the Long Notice Reserve contracts entered into by AEMO. The trigger basis for these Long Notice Reserve contracts was the forecast reliability shortfall as described above. The total cost of RERT availability payments for Long Notice Contracts in Victoria for Q1 2020 was $0.56M, as shown in Table 2.

Table 4 Long Notice Reserve contracts in Victoria

RERT Provider	Reserve Period Start	Reserve Period End	Reserve Period duration	Capacity (MW)	Region
Enel X Australia Pty Ltd	1 November 2019	31 March 2020	5 months	42	Victoria
Enel X Australia Pty Ltd	1 January 2020	31 March 2020	3 months	10	Victoria
Visy Industries Australia Pty Ltd	1 November 2019	31 March 2020	5 months	20	Victoria

The term of the Long Notice Contracts entered into by AEMO, aligns with the declaration of a Low Reserve Condition made in the 2019 ESOO. AEMO is currently not projecting any low reserve conditions and the long-notice reserve contracts referred to above have since expired.

2.2 Medium/short-notice panel arrangements

The 2019, ESOO modelling also found that to reduce the likelihood of exceeding the standard to a 'one-in-10 year' event, 560 MW of additional reserves in Victoria and South Australia would be required to meet the reliability standard.

Based on these forecasts and through open tendering processes under the NER, AEMO established a panel of providers representing estimated additional reserves of up to 1,025 MW in Victoria and South Australia and 1,698 MW in total across the NEM under panel agreements. These agreements enable potential RERT providers to offer reserves in short- or medium-notice situations, on pre-negotiated contract terms, in South Australia, Victoria, New South Wales, and Queensland, to enable AEMO to manage risks such as demand exceeding forecast expectations, and unplanned events resulting in a reduction in generation and/or network capacity.

In consultation with relevant state governments, AEMO entered into panel agreements with potential reserve providers that met detailed cost, technical, and verification criteria. Each RERT resource has different response lead times, activation conditions, and response capability; as a result, not all resources can necessarily be activated for a given shortfall event.

Under the panel agreements utilising short-notice contracts, there are no fixed costs incurred and payments will only be made based on pre-activation and/or actual MWh activated. There is no cost to consumers unless this reserve is required[12]. AEMO did not contract for Medium Notice Reserve in Q1 2020.

[12] For more information on RERT costs please refer to the AEMO webstite: https://aemo.com.au/en/energy-systems/electricity/emergency-management/reliability-and-emergency-reserve-trader-rert

2.3 Short Notice Reserves contracted

AEMO may enter into reserve contracts at short notice when the probability of load shedding (other than the reduction or disconnection of interruptible load) is, or is forecast to be, more than remote, which is when AEMO expects a lack of reserve (LOR) condition may occur. The Reserve Level Declaration Guidelines[13] provides details for determining the term and quantity associated with a reserve shortfall.

A forecast or actual LOR 2 and/or LOR 3[14] condition are the main criteria for contracting Short Notice Reserve. Under AEMO's panel arrangements, AEMO can contract for Short Notice Reserve once a forecast or actual LOR 2 and/or LOR 3 condition is identified, with no cost to consumers (unless the reserve is pre-activated or activated). As the event descriptions in sections 2.3.1 and 3 below show, RERT contracting occurs in the context of highly uncertain and complex power system condtions, where real and projected reserve levels can change at short notice. To manage the associated uncertainty of reserve shortfall quantities, AEMO typically contracts with all available short-notice providers in the relevant region. Where there is spare export capacity between regions, AEMO will also consider reserve levels across multiple regions together.

On this basis, AEMO contracted for Short Notice Reserve on the following occasions in Q1 2020. AEMO activated RERT on all these occasions except for Thursday 30 January:

- On 4 January, in response to an actual LOR 2 condition in New South Wales, AEMO contracted 368 MW of RERT for a reserve shortfall of 257 MW.
- On 23 January, in response to a forecast LOR 2 condition in New South Wales, AEMO contracted 520 MW of RERT for a reserve shortfall of 258 MW.
- On 30 January, in response to an actual LOR 2 condition in South Australia and Victoria, AEMO contracted 227 MW of RERT in South Australia and 60 MW in Victoria, for a reserve shortfall of 165 MW in South Australia and 495 MW in Victoria.
- On 31 January, in response to a forecast LOR 2 condition in Victoria, AEMO contracted 235 MW of RERT for a reserve shortfall of 154 MW.
- On 31 January, in response to an actual LOR 2 condition in New South Wales, AEMO contracted 478 MW of RERT for a reserve shortfall of 275 MW in New South Wales.

Chapter 3 details the conditions leading up to activation of RERT.

Note that although AEMO contracted for a greater amount of Short Notice Reserves than required to address the relevant LOR declarations, no costs were incurred in doing so (because panel agreements utilise short-notice contracts that have no ongoing fixed costs and payments are only be made based on pre-activation and/or actual MWh activated). This allows AEMO to maximise available reserves in order to manage uncertainty at no additional costs to consumers.

2.3.1 Short Notice Reserves contracted but not activated

Thursday 30 January 2020 saw extreme conditions in Victoria and South Australia, with temperatures reaching 39.3°C at Melbourne Airport and 43.9°C at Adelaide (Kent Town) respectively. This resulted in high forecast maximum operational demands of 8,742 MW at 1800 hrs in Victoria and 2,973 MW at 1830 hrs extending to 1900 hrs in South Australia.

An actual LOR 1 condition was declared in Victoria from 1700 hrs to 1830 hrs, as the minimum reserve forecast of 1,039 MW was 86 MW lower than the LOR 1 trigger of 1,125 MW. In response to high spot prices between 1700 and 1930 hrs, AEMO observed approximately 215 MW of price-responsive load reduction in Victoria and approximately 55 MW in South Australia.

At 1805 hrs, Loy Yang Unit A3 tripped off from 560 MW, followed at 1824 hrs by a price-responsive load reduction of at least 147 MW (of the 215 MW total in Victoria) due to high spot prices.

[13] At https://www.aemo.com.au/-/media/Files/Electricity/NEM/Security_and_Reliability/Power_System_Ops/Reserve-Level-Declaration-Guidelines.pdf.

[14] LOR 3 indicates the balance of supply and demand is so tight that load shedding is imminent or has begun.

At 1832 hrs, AEMO declared actual LOR 2 conditions in Victoria and South Australia from 1820 hrs. In Victoria, the minimum reserve forecast of 70 MW was 495 MW lower than the LOR 1 trigger of 565 MW, while in South Australia the minimum reserve forecast of 70 MW was 165 MW lower than the LOR 1 trigger of 235 MW. This meant that AEMO needed up to 495 MW of additional reserves in Victoria and 165 MW of additional reserves in South Australia to remove the threat of load shedding from 1820 hrs. AEMO sought a market response and noted that an insufficient market response may require a market intervention.

AEMO informed the market at 1845 hrs and 1855 hrs that it intended to commence negotiations with RERT Panel members in Victoria and South Australia respectively for additional reserves from 1900 hrs to 2200 hrs. AEMO contracted 227 MW in South Australia and 60 MW in Victoria of short notice reserves.

By 1900 hrs, Victorian operational demand had reduced from the peak of 9,423 MW at 1800 hrs to 9,133 MW. South Australian operational demand had not yet peaked at this stage, however AEMO was forecasting a peak of 3,040 MW at 1930 hrs and a subsequent reduction to 2,940 MW by 2000 hrs. The actual peak operational demand in South Australia was 3,100 MW at 1900 hrs. Wind in South Australia was increasing from 210 MW at 1900 hrs and was expected to reach 312 MW by 2000 hrs. Since reserve conditions had already begun to improve by 1900 hrs, AEMO determined that RERT activation was not required.

Actual LOR 2 conditions were cancelled from 1910 hrs in South Australia and 1940 hrs in Victoria. No costs were incurred on 30 January associated with contracting of short-notice reserves.

2.4 Short Notice Reserve contracts

Table 5 below shows Short Notice Reserve contract terms entered into by AEMO in Q1 2020.

Table 5 Term of Short Notice Reserve contracts

	Term start	Term end	Term duration	Capacity (MW)	Region	Basis for contract
Cadia Holdings Pty Ltd	4 Jan 2020 16:30	4 Jan 2020 22:00	5 hrs 30 mins	68	New South Wales	Actual LOR 2
Tomago Aluminium Company Pty Ltd	4 Jan 2020 17:20	4 Jan 2020 22:07	4 hrs 27 mins	300	New South Wales	Actual LOR 2
Infrabuild NSW Pty Ltd	23 Jan 2020 11:30	23 Jan 2020 20:00	9 hrs 30 mins	38	New South Wales	Forecast LOR 2
Cadia Holdings Pty Ltd	23 Jan 2020 11:30	23 Jan 2020 20:00	9 hrs 30 mins	68	New South Wales	Forecast LOR 2
Progressive Green Pty Ltd	23 Jan 2020 11:30	23 Jan 2020 20:00	9 hrs 30 mins	24	New South Wales	Forecast LOR 2
AGL Energy Services Pty Ltd	23 Jan 2020 11:30	23 Jan 2020 20:00	9 hrs 30 mins	12	New South Wales	Forecast LOR 2
Enel X Australia Pty Ltd	23 Jan 2020 11:30	23 Jan 2020 20:00	9 hrs 30 mins	20	New South Wales	Forecast LOR 2
Reposit Power Pty Ltd	23 Jan 2020 11:30	23 Jan 2020 20:00	9 hrs 30 mins	4	New South Wales	Forecast LOR 2
Tomago Aluminium Company Pty Ltd	23 Jan 2020 11:30	23 Jan 2020 20:00	9 hrs 30 mins	300	New South Wales	Forecast LOR 2
Visy Industries Australia Pty Ltd	23 Jan 2020 11:30	23 Jan 2020 20:00	9 hrs 30 mins	32	New South Wales	Forecast LOR 2

Energy Australia Pty Ltd	23 Jan 2020 11:30	23 Jan 2020 20:00	9 hrs 30 mins	22	New South Wales	Forecast LOR 2
Enel X Australia Pty Ltd	30 Jan 2020 19:00	30 Jan 2020 22:00	3 hrs	30	Victoria	Actual LOR 2
United Energy Distribution Pty Ltd	30 Jan 2020 19:00	30 Jan 2020 22:00	3 hrs	30	Victoria	Actual LOR 2
SA Power Networks	30 Jan 2020 19:00	30 Jan 2020 22:00	3 hrs	217	South Australia	Actual LOR 2
Intercast & Forge Pty Limited	30 Jan 2020 19:00	30 Jan 2020 22:00	3 hrs	10	South Australia	Actual LOR 2
Australian Steel Company (Operations) Pty Ltd	31 Jan 2020 14:00	31 Jan 2020 22:00	8 hrs	51	Victoria	Forecast LOR 2
Paper Australia Pty Ltd	31 Jan 2020 14:00	31 Jan 2020 22:00	8 hrs	30	Victoria	Forecast LOR 2
Progressive Green Pty Ltd	31 Jan 2020 14:00	31 Jan 2020 22:00	8 hrs	50	Victoria	Forecast LOR 2
Powershop Australia Pty Ltd	31 Jan 2020 14:00	31 Jan 2020 22:00	8 hrs	4	Victoria	Forecast LOR 2
Enel X Australia Pty Ltd	31 Jan 2020 14:00	31 Jan 2020 22:00	8 hrs	30	Victoria	Forecast LOR 2
Victoria Power Networks Pty Ltd	31 Jan 2020 14:00	31 Jan 2020 22:00	8 hrs	40	Victoria	Forecast LOR 2
United Energy Distribution Pty Ltd	31 Jan 2020 14:00	31 Jan 2020 22:00	8 hrs	30	Victoria	Forecast LOR 2
Infrabuild NSW Pty Ltd	31 Jan 2020 15:30	31 Jan 2020 21:00	5 hrs 30 mins	38	New South Wales	Actual LOR 2
Cadia Holdings Pty Ltd	31 Jan 2020 15:30	31 Jan 2020 21:00	5 hrs 30 mins	50	New South Wales	Actual LOR 2
Progressive Green Pty Ltd	31 Jan 2020 15:30	31 Jan 2020 21:00	5 hrs 30 mins	24	New South Wales	Actual LOR 2
AGL Energy Services Pty Ltd	31 Jan 2020 15:30	31 Jan 2020 21:00	5 hrs 30 mins	10	New South Wales	Actual LOR 2
Enel X Australia Pty Ltd	31 Jan 2020 15:30	31 Jan 2020 21:00	5 hrs 30 mins	20	New South Wales	Actual LOR 2
Reposit Power Pty Ltd	31 Jan 2020 15:30	31 Jan 2020 21:00	5 hrs 30 mins	4	New South Wales	Actual LOR 2
Tomago Aluminium Company Pty Ltd	31 Jan 2020 15:30	31 Jan 2020 21:00	5 hrs 30 mins	300	New South Wales	Actual LOR 2
Visy Industries Australia Pty Ltd	31 Jan 2020 15:30	31 Jan 2020 21:00	5 hrs 30 mins	32	New South Wales	Actual LOR 2

2.5 AEMO's methodology for contracting RERT

AEMO's Procedure for the Exercise of the Reliability and Emergency Reserve Trader[15] sets out the methodology which it follows in determining the triggers for RERT, as well as the quantity and term of reserves contracted.

AEMO followed its procedures and the NER in contracting for long and medium/short notice RERT, including:

- RERT Panel recruitment.
- Publication of notices.
- Ensuring unscheduled reserves are not otherwise offered to the market or engaged.
- Determining the term and quantity of reserves to be contracted.
- The basis for determining the estimated VCR.

Under NER clause 3.20.2(b), AEMO must have regard to the RERT principles in exercising the RERT. These principles stipulate that AEMO is to take actions that have the least distortionary effect on the operation of the market, and actions taken should aim to maximise the effectiveness of reserve contracts at the least cost to end use consumers of electricity.

When entering into reserve contracts, AEMO factored these RERT principles into its decision-making:

- To minimise distortionary effects on the operation of the market AEMO categorises RERT into the following three types based on their pre-activation and activation times:
  - Type 1 – contracts that can be exercised (pre-activated and activated) in < 30 minutes. These contracts are pre-activated and activated post-contingency when an actual LOR 3 occurs.
  - Type 2 – contracts which must be pre-activated for a forecast LOR 2 condition, but once pre-activated, can be activated in < 30 minutes. As for Type 1, these contracts are activated post-contingency.
  - Type 3 – contracts whereby activation requires > 30 mins. These contracts need to be pre-activated and activated in advance to ensure RERT is being delivered on time.

  During the majority of RERT events this summer, a large portion of the RERT contracts utilised were short-notice Type 1 and Type 2 contracts. This resulted in minimal pre-activation and activation payments and market distortions, as these categories of RERT can be activated post-contingent (during LOR 3). Therefore, this not only minimises impacts on the market but also maximises the effectiveness of reserve contracts at the least cost to end use consumers of electricity.
- During the long and medium/short notice procurement process, AEMO implemented the use of VCR as the maximum for assessing offers by potential RERT providers. As a result, no RERT contract AEMO entered into exceeds VCR. The utilisation of such a criterion was beneficial in achieving cost effectiveness and resulted in the average amount payable by AEMO not exceeding VCR during the RERT events.

[15] At https://www.aemo.com.au/-/media/files/electricity/nem/emergency_management/rert/procedure_for_the_exercise_of_reliability_and_emergency_reserve_trader_rert.pdf.

3. Intervention on 4 January 2020

3.1 Decision to intervene

Saturday 4 January 2020 saw extreme weather conditions in New South Wales, with temperatures reaching 47°C at Bankstown, as well as extreme bushfire conditions, with about 137 bushfires burning in New South Wales and about 50 in Victoria. These had very significant impacts on the transmission system in southern and central New South Wales. Forecast peak operational demand in New South Wales was 12,299 MW at 1600 hrs.

At 1510 hrs, an operating incident occurred that resulted in the separation of the Victorian and New South Wales regions during a major bushfire event in the Snowy Mountains. AEMO has published a preliminary operating incident report[16] which provides a detailed review of this event.

During the period prior to the separation event on 4 January 2020, there were 28 unplanned outages of 330 kilovolt (kV) transmission lines in southern New South Wales due to bushfires, resulting in a significant impact on transmission 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 Lower Tumut – Upper Tumut 64 330 kV line and Murray – Upper Tumut 65 330 kV line 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 of lines being out of service), that consisted of:
  - Murray – Lower Tumut 66 330 kV line.
  - Redcliffs – Buronga OX1 220 kV line.
  - Wodonga – Jindera 060 and Jindera – Wagga 062 330 kV lines and the 132 kV subsystem operating in parallel between Wagga 330 kV and Yass 330 kV substations.
- The rapidly developing situation resulted in AEMO constraining interconnector flow from Victoria to New South Wales to 650 MW at 1500 hrs and to 450 MW at 1510 hrs.

At 1510 hrs on 4 January 2020, the Murray – Lower Tumut 66 330 kV line tripped, resulting in a significant increase in the power flow on the Wodonga – Jindera 060 and Jindera – Wagga 062 330 kV lines and the 132 kV subsystem between Wagga and Yass 330 kV substations. About two seconds later:

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

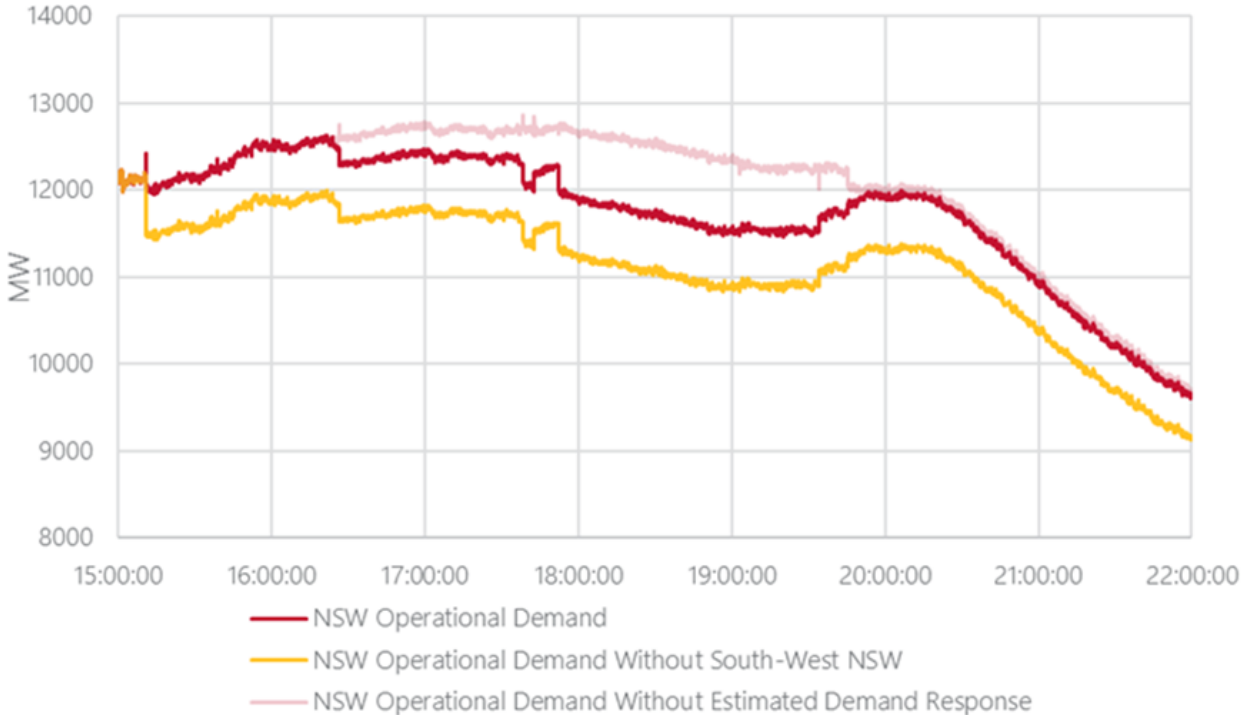
As a result of the loss of multiple transmission lines at around the time of the separation event, 2,267 MW of generation in New South Wales was made unavailable, due to either the generation having no connection to

[16] At https://aemo.com.au/-/media/files/electricity/nem/market_notices_and_events/power_system_incident_reports/2020/preliminary-report-nsw-and-victoria-separation-event-4-jan-2020.pdf?la=en.

the transmission network or constraint action by AEMO to maintain power system security. At this time approximately 620 MW of demand in the Wagga Wagga area and generation at the Uranquinty power station was geographically located in New South Wales, but remained electrically connected to the Victorian island section of the NEM.

Figure 1 below shows the operational demand under three scenarios, the scenario without south-west New South Wales reflects the operation demand in the main part of the New South Wales network, which was relevant to the reserve shortfall.

Figure 1 Operational demand in New South Wales



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. As such, there was no ability to import supply from Victoria into New South Wales, resulting in a sustained LOR 2 condition in New South Wales.

Semi-scheduled and non-scheduled wind generation was de-rated and under-forecast throughout the day. This was primarily due to high wind de-rating and wind speed forecast deviations, as a result of the approaching cold front moving up the New South Wales south coast. This front resulted in gusty wind conditions, causing variable wind generation, elevated temperatures ahead of the front, and increased fire danger. At 1530 hrs, wind generation in New South Wales was 392 MW, 161 MW below the 4-hour ahead forecast and 132 MW below the day-ahead forecast, which contributed to the uncertainty during the event.

AEMO declared an actual LOR 2 condition for the New South Wales region from 1600 hrs[17]. Due to the unusual system configuration after the separation event[18], the Projected Assessment of System Adequacy (PASA) calculations of reserve were no longer accurate, so the reserve shortfall was determined based on manual calculations.

The minimum forecast reserve of 594 MW was 257 MW lower than the LOR 2 trigger level of 851 MW. This meant AEMO needed up to 257 MW of additional reserves in New South Wales to remove the threat of load shedding if a contingency occurred (such as the trip of a large generation unit or an interconnector).

[17] MN 72297.

[18] Due to the load in south west Victoria being fed radially from the Victorian network.

To maintain power system reliability, AEMO determined that contracting of reserves would be required on the basis of the actual LOR 2 condition, with an estimated reserve shortfall of 257 MW from 1600 hrs to 2200 hrs.

The recorded New South Wales peak operational demand on 4 January was 12,502 MW at 1630 hrs, including the Wagga Wagga load.

3.2 Assessment of market response and latest time to intervene

At 1605 hrs on 4 January 2020, AEMO issued market notice MN 72297[19], declaring an actual LOR 2 condition in New South Wales at 1600 hrs, seeking an immediate market response and noting that an insufficient market response may require an AEMO market intervention.

Since the LOR 2 condition had already commenced, the reserve shortfall was substantial (257 MW) and it was unlikely that a market response would have occurred in time to avoid the need for RERT, AEMO immediately (at 1607 hrs) advised the market[20] of its intention to commence RERT contract negotiations for the period from 1700 hrs until midnight. At 1618 hrs AEMO refined the timing to the period from 1630 hrs to 2200 hrs, to minimise the reserve shortfall.

At 1619 hrs, AEMO issued invitations to tender for the provision of short-notice reserve from 1630 hrs to 2200 hrs. AEMO commenced pre-activation from 1630 hrs, and activation of reserve contracts from 1820 hrs.

3.3 Intervention event

RERT contracts vary in terms of pre-activation and activation lead times, as well as response times (for example, an industrial load responding to a request to reduce load under RERT may need several hours to prepare plant or undertake a safe shutdown) and minimum continuous run times. Due to the fast response times of some RERT contracts (Type 1 and 2), AEMO can defer activation of these contracts until after a LOR 3 condition arises. This enables AEMO to avoid activation costs until or unless additional reserves are required in real time.

On 4 January 2020, in response to the actual LOR 2 condition in New South Wales, AEMO activated two contracts (RERT 1[21] and 2 – 68 MW) at 1820 hrs, both were pre-activated as required at 1725 hrs. AEMO also pre-activated, but did not activate, one other contract (RERT 3 – 300 MW), due to its fast response times of less than 30 minutes (Type 2) and no LOR 3 condition eventuating. The pre-activation of RERT 3 allowed AEMO to meet the requirements of the projected reserve shortfall of 257 MW, having activated only 68 MW of reserve.

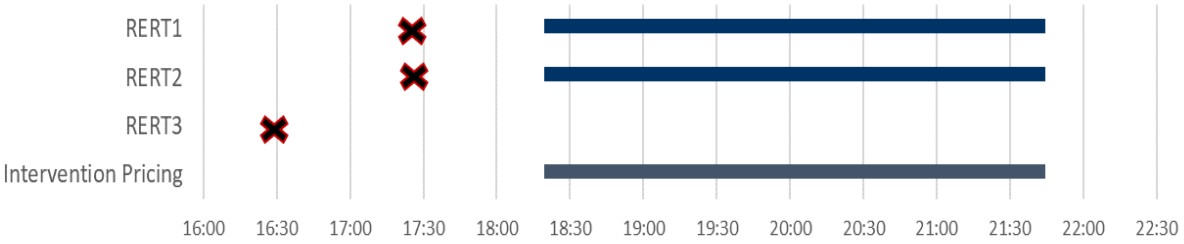
Although AEMO forecast the need to activate reserves up to 2200 hrs, following the cancellation of the LOR 2 condition at 2106 hrs both activated contracts (RERT 1 and 2) were instructed to de-activate. Following completion of their minimum de-activation lead time of 30 mins, both contracts were de-activated by 2145 hrs. Figure 2 details the timing of activation.

[19] All market notices are published at https://aemo.com.au/Market-Notices.

[20] MN 72301.

[21] The names of companies that provide RERT services are confidential.

Figure 2 Timing of activation of RERT and intervention pricing 4 January 2020



✖ denotes pre-activation.

The total volume of reserve activated on 4 January was 232 MWh. AEMO notes that 291 MWh was delivered on the day, this was due to some reserve providers delivering more reserve than they were contracted to provide. RERT providers are paid as per their contract, for the volume of RERT delivered, capped by the volume of RERT activated. Table 6 shows a breakdown of RERT activated per trading interval.

Table 6 RERT activated in New South Wales on 4 January 2020

Trading Interval ending	RERT activated capacity (MW)	RERT activated volume (MWh)
4/01/2020 18:30	68[A]	11
4/01/2020 19:00	68	34
4/01/2020 19:30	68	34
4/01/2020 20:00	68	34
4/01/2020 20:30	68	34
4/01/2020 21:00	68	34
4/01/2020 21:30	68	34
4/01/2020 22:00	68[B]	17
Total (MWh))		**232**

A. Activation started at 1820 hrs.
B. De-activated at 2145 hrs.

At 2106 hrs AEMO cancelled the LOR 2 condition. The following factors contributed to the improved reserve condition:

- Between 1625 and 2015 hrs, up to 400 MW of price-responsive load reduced in New South Wales in response to high spot prices.
- Activation of 68 MW of RERT.

3.4 Intervention pricing

Intervention pricing[22] was applied for this event in accordance with NER 3.9.3(b) for the intervention periods from the dispatch intervals (DIs) ending 1825 hrs to 2145 hrs on 4 January 2020.

[22] AEMO sets the energy or ancillary service prices at the value that would have applied had the intervention not occurred, using the intervention pricing methodology developed by AEMO under clause 3.9.3(e). https://aemo.com.au/-/media/files/stakeholder_consultation/consultations/nem-consultations/2019/dispatch/guide-to-intervention-pricing.pdf?la=en&hash=4EB7C0EA39AB0103A5674182F58C64B8

The RERT event on 4 January 2020 saw anomalous intervention prices as a result of a particular constraint, NQ_VST_ISLE. On this day, intervention prices would generally be expected to be slightly higher than the outturn prices. Instead, the intervention prices in New South Wales were generally lower than the outturn prices. In the intervention pricing run, NQ_VST_ISLE_A ratcheted up exports from Victoria, where power was cheaper, to New South Wales, where power was more expensive, eventually reducing the intervention price in New South Wales to below the outturn price. NQ_VST_ISLE_A – and its analogue NQ_VST_ISLE_B – are designed to allow the functioning elements of the Victoria – New South Wales interconnector to supply load in Wagga Wagga or northern Victoria if the Victoria and New South Wales regions separate.

These constraints are designed to keep the Victoria – New South Wales target within 20 MW of the measured flow, however, NQ_VST_ISLE_A is not currently a Force_SCADA constraint. This meant that the assumed Victoria – New South Wales flow at the start of each DI was the target from the previous DI in the intervention pricing run. Other things being equal, NEMDE would then tend to keep increasing flow on Victoria – New South Wales interconnector as long as power was cheaper in Victoria than New South Wales.

AEMO is currently reviewing the appropriate Force_SCADA status of NQ_VST_ISLE_A and constraints similar to this.

3.5 Changes in dispatch outcomes

The addition of RERT capacity in New South Wales had the effect of increasing generation in New South Wales, Queensland, and Tasmania, with reductions in South Australia and Victoria when comparing the difference in output between the physical and revised pricing runs as shown in Table 7. Table 8 compares the variation in total interconnector flows between the physical and revised pricing runs. Aggregate flows from Queensland to New South Wales (Terranora and QNI) increased during the RERT event and less energy flowed from Victoria to New South Wales.

Table 7 Summary of total energy generation during 4 January 2020 RERT event (MWh)

	NSW	QLD	SA	TAS	VIC
Physical run	34,451	28,208	4,311	2,588	17,187
Revised pricing run	34,097	27,887	4,572	2,573	17,963
Change	354	320	-261	15	-777

Table 8 Summary of total interconnector flows during 4 January 2020 RERT event (MWh)

	Terranora	QNI	VIC-NSW	Heywood	Murraylink	Basslink
Physical run[A]	-217	-2,352	1,420	320	-351	-985
Revised pricing run[A]	-173	-2,087	2,383	-63	-238	-1,000
Change	-43	-265	-963	383	-112	15

A. Positive numbers are for flows flowing north or west, negative for flows flowing south or east.

3.6 Impact on reliability

For the events of 4 January 2020, no instances of unserved energy have yet been identified[23]. AEMO activated RERT on the basis of an actual LOR 2 condition according to AEMO operating procedures. The activation of RERT assisted in removing the reserve shortfall and reducing the risk of load shedding if a credible contingency was to occur.

[23] During the separation event, 43 MW of load was lost when a small island formed and then collapsed in southern New South Wales. Instances of unserved energy have yet to be identified and the incident remains under investigation by AEMO, however this is not considered material to the decision to activate RERT.

4. Intervention on 23 January 2020

4.1 Decision to intervene

On Thursday 23 January 2020, hot, dry winds preceded a cold front passing over the south-eastern NEM regions, with the temperature in New South Wales reaching 41.8°C at Bankstown. Extreme temperatures contributed to a day-ahead forecast operational demand of 13,035 MW at 1630 hrs in New South Wales.

Due to severe weather warnings issued for damaging winds and heavy rainfall in the Snowy Mountains and South West slopes, at 0010 hrs AEMO limited power transfer between Victoria and New South Wales to 500 MW in both directions (constraint sets I-VN_0500 and I-NV_0500)[24]. On 19 January 2020, AEMO had advised the market[25] that due to recent bushfire impacts, these constraint sets would be invoked in the event of abnormal weather conditions present in this area, in order to manage the risk of multiple contingency events.

On the preceding day (22 January) AEMO declared a forecast LOR 2 condition for New South Wales on 23 January[26] from 1530 hrs to 1730 hrs, which was cancelled later in the day due to an increase in generation availability.

Throughout the day, Bayswater Unit 4 (660 MW) was out of service and Mount Piper Unit 2 (700 MW) was only available at approximately 50% capacity. Approximately 700 MW of additional scheduled generation was expected to be unavailable at the time of forecast operational demand in New South Wales, primarily due to temperature-related limitations, collectively reducing the available supply in the region by at least 1,600 MW.

At 1116 hrs on 23 January[27], AEMO re-declared a forecast LOR 2 condition for New South Wales from 1530 hrs to 1700 hrs, following an update to the 1100 hrs predispatch demand forecast with peak operational demand increasing from 13,035 MW to 13,488 MW at 1630 hrs.

The minimum forecast reserve of 463 MW was 258 MW lower than the LOR 2 trigger level of 721 MW. This meant that AEMO needed up to 258 MW of additional reserves in New South Wales to remove the threat of load shedding between 1530 and 1700 hrs if a contingency occurred (such as the trip of a large generation unit or an interconnector).

To maintain power system reliability, AEMO determined that contracting of reserves would be required on the basis of the forecast LOR 2 condition, with an estimated reserve shortfall of 258 MW.

Semi-scheduled and non-scheduled generation was de-rated throughout the day due to the effects of high wind speed on equipment. At the time of peak demand (1700 hrs), AEMO systems observed a 290 MW discrepancy between New South Wales semi-scheduled and non-scheduled wind generation availability and actual capability, attributable to a combination of:

- High wind speed de-rating.
- Fluctuating wind output associated the wind change moving through New South Wales.

[24] MN 72876 issued at 0011 hrs on 23 January 2020.

[25] MN 72723.

[26] MN 72851 issued at 1417 hrs on 22 January 2020.

[27] MN 72883 issued at 1116 hrs 23 January 2020.

At 1437 hrs, AEMO declared an actual LOR 2 condition from 1435[28]. The minimum forecast reserve of 568 MW was 174 MW lower than the LOR 2 trigger of 742 MW. At this time AEMO had already pre-activated and activated RERT contracts on the basis of the forecast LOR 2 condition.

4.2 Assessment of market response and latest time to intervene

At 1116 hrs on 23 January 2020, AEMO issued market notice MN 72883, declaring a forecast LOR 2 condition in New South Wales from 1530 to 1700 hrs. AEMO sought a market response and estimated the latest time to intervene as an intervention event at 1330 hrs.

AEMO estimates the latest time to intervene on the basis of the pre-activation and activation lead times of the reserve contracts required to resolve the reserve shortfall. In this case at least one of the contracts (Type 3) required a two-hour activation lead time, which determined the latest time to intervene of 1330 hrs, two hours prior to the forecast reserve shortfall at 1530 hrs.

At 1122 hrs AEMO issued market notice 72884, declaring its intention to commence negotiations with RERT Panel members for the provision of additional reserve by issuing requests for tender for the following period from 1130 to 2000 hrs.

At 1125 hrs AEMO issued invitations to tender for the provision of Short Notice Reserve from 1130 to 2000 hrs. At 1330 hrs, AEMO commenced pre-activation and activation of RERT from 1530 hrs, with a forecast end time of 1730 hrs.

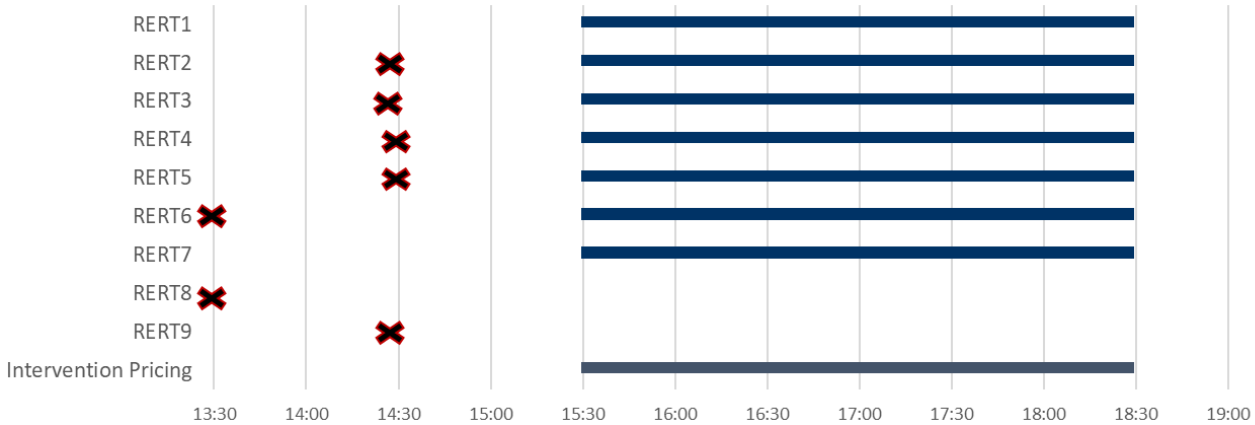
4.3 Intervention event

On 23 January 2020, in response to the forecast LOR 2 condition in New South Wales, AEMO activated seven reserve contracts (RERT 1-7 – 152 MW) at 1530 hrs with five of these contracts (RERT 2, 3, 4, 5, and 6 – 104 MW) requiring pre-activation.

AEMO also pre-activated, but did not activate, two additional reserve contracts (RERT 8 and 9 – 302 MW) due to their fast response times of less than 30 minutes (Type 2) and no LOR 3 condition eventuating. The pre-activation of RERT 8 and 9 allowed AEMO to meet the requirements of the projected reserve shortfall of 258 MW, having activated only 152 MW of reserve.

Although AEMO forecast the need to activate reserves up to 1730 hrs on the basis of the forecast LOR 2 condition, the actual LOR 2 condition as declared at 1437 hrs extended to 1900 hrs. As reserve conditions improved, all activated contracts were de-activated by 1830 hrs, however the Type 2 contracts (RERT 8 and 9) remained pre-activated until the LOR 2 condition was cancelled at 1900 hrs. Figure 3 details the timing of activation.

Figure 3 Timing of activation of RERT and intervention pricing on 23 January 2020



[28] MN 72923 issued at 1437 hrs 23 January 2020, MN 72951 issued at 1900 hrs 23 January 2020.

✖ denotes pre-activation.

The total volume of reserve activated on 23 January 2020 was 456 MWh. AEMO notes that 509 MWh was delivered on the day, this was due to some providers delivering more reserve than they were contracted to provide. RERT providers are not paid for over-delivery. Table 9 shows a breakdown of RERT activated per trading interval.

Table 9 RERT activated in New South Wales on 23 January 2020

Trading Interval ending	RERT activated capacity (MW)	RERT activated volume (MWh)
23/01/2020 16:00	152	76
23/01/2020 16:30	152	76
23/01/2020 17:00	152	76
23/01/2020 17:30	152	76
23/01/2020 18:00	152	76
23/01/2020 18:30	152	76
Total (MWh)		**456**

At 1900 hrs, AEMO cancelled the LOR 2 condition. The following factors contributed to the improved reserve condition:

- Between 1730 and 2000 hrs, up to 360 MW of price-responsive load reduced in New South Wales in response to high spot prices.
- Activation of 152 MW of RERT.

4.4 Intervention pricing

Intervention pricing was applied for this event in accordance with NER 3.9.3(b) for the intervention periods from the DIs ending 1535 hrs to 1830 hrs on 23 January 2020.

4.5 Changes in dispatch outcomes

The addition of RERT capacity in New South Wales had the effect of reducing generation across all regions and less energy flowing from Queensland to New South Wales when comparing the difference in output between the physical and revised pricing runs.

Table 10 Summary of total energy generation during 23 January 2020 RERT event (MWh)

	NSW	QLD	SA	TAS	VIC
Physical run	37,477	28,665	3,822	1,985	13,815
Revised pricing run	38,568	29,884	3,985	2,059	14,113
Change	-1,091	-1,219	-163	-74	-297

Table 11 Summary of total interconnector flows during 23 January 2020 RERT event (MWh)

	Terranora	QNI	VIC-NSW	Heywood	Murraylink	Basslink
Physical run[A]	-159	-2,126	-647	-511	-275	-771
Revised pricing run[A]	-212	-2,553	-650	-568	-309	-774
Change	53	427	3	57	34	3

A. Positive numbers are for flows flowing north or west, negative for flows flowing south or east.

4.6 Impact on reliability

On 23 January 2020, there was no unserved energy. AEMO activated RERT according to AEMO operating procedures, on the basis of a forecast LOR 2 condition which subsequently developed into an actual LOR 2 condition. The activation of RERT assisted in reducing the reserve shortfall and reducing the risk of load shedding if a credible contingency was to occur.

5. Intervention on 31 January 2020

5.1 Decision to intervene in Victoria

Friday 31 January 2020 saw a continuation of extreme temperatures across Victoria, with a temperature of 43.6°C recorded at Melbourne Airport[29]. A high pressure system over the Tasman Sea, combined with an approaching cold front, resulted in north to northwest winds and very hot and humid conditions across south-east Australia. Thunderstorms were forecast to develop over western and central Victoria during the afternoon, with the risk of severe thunderstorms bringing damaging winds and heavy rain.

On the morning of 31 January 2020, AEMO issued a media statement requesting Victorian consumers to reduce their energy usage between approximately 1.00 pm and 8.00 pm (Melbourne time) due to extreme temperatures combined with unusually high humidity. Victorian electricity demand was forecast to be 9,864 MW at 1600 hrs, the highest since January 2014. At 1241 hrs, AEMO advised the market of a forecast LOR level 1[30] condition in Victoria for the period 1500 to 1700 hrs.

At approximately 1324 hrs, a severe convective downburst near Cressy, in Victoria, resulted in the collapse of a number of steel transmission towers carrying the Moorabool – Mortlake and Moorabool – Haunted Gully 500 kV lines, which resulted in these lines tripping and remaining unavailable for service.

The outage of the Moorabool – Mortlake and Moorabool – Haunted Gully 500 kV lines resulted in the separation of the South Australia region from Victoria. This left generation at Mortlake Power Station and the Macarthur and Portland wind farms connected to the South Australia network. Coincident with the faults on the above lines, both potlines at the Alcoa Portland (APD) aluminium smelter tripped, resulting in the loss of approximately 450 MW of load.

AEMO has published a preliminary operating incident report that provides further details about this event[31]. As a result of the loss of these two transmission lines approximately 1,100 MW of generation and interconnector supply east of the event location was made unavailable to the main Victorian network.

Reserve levels in Victoria fell sharply following separation from South Australia, due to the loss of generation and imports from South Australia. At 1347 hrs, a forecast LOR 2 condition for the Victoria region was declared[32] for the period 1500 hrs to 1800 hrs on 31 January. The minimum forecast reserve of 406 MW was 154 MW lower than the LOR 2 trigger level of 560 MW. This meant AEMO needed up to 154 MW of additional reserves in New South Wales to remove the threat of load shedding between 1500 and 1800 hrs if a contingency occurred (such as the trip of a large generation unit or an interconnector).

To maintain power system reliability in Victoria, AEMO determined that contracting of reserves would be required on the basis of the forecast LOR 2 condition, with an estimated reserve shortfall of 154 MW.

Just prior to the forecast LOR 2 being declared in Victoria, approximately 400 MW of scheduled generation was unavailable in Victoria, mostly due to high ambient temperatures.

[29] Source www.bom.gov.au.

[30] MN 73169 issued at 1241 hrs.

[31] At https://aemo.com.au/-/media/files/electricity/nem/market_notices_and_events/power_system_incident_reports/2020/preliminary-report-31-jan-2020.pdf?la=en.

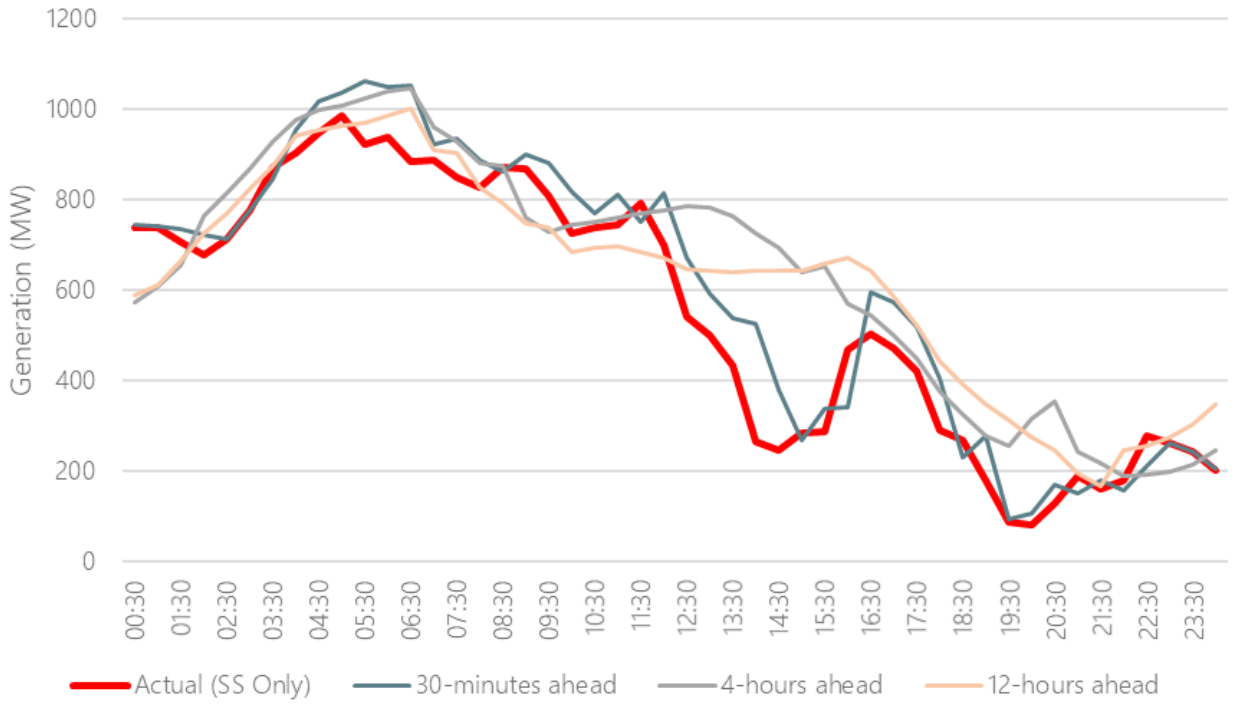
[32] MN 73173 issued at 1347 hrs included the incorrect date and forecast capacity reserve requirement; the date was corrected at 1404 hrs through MN 73181 and the capacity reserve requirement was corrected at 1416 hrs through MN 73183.

Both semi-scheduled and non-scheduled wind farms in Victoria experienced four different phenomena that led to reductions in generation, causing deviations between forecast and actual generation throughout the day. These all occurred prior to the separation event, and continued into the evening:

- High temperature de-rating.
- High wind de-rating.
- Low wind drop-out.
- Network outage.

Each of these reductions contributed to an unforecast reduction of wind generation availability. The largest deviation between the 4-hour-ahead forecast and actual generation for semi-scheduled wind plant was 461 MW, at 1400 hrs.

Figure 4 Victorian semi-scheduled wind generation, pre-dispatch target at differing time horizons versus actual generation



At 1416 hrs, AEMO declared an actual LOR 2 condition[33] in Victoria from 1400 hrs. The minimum forecast reserve of 200 MW was 360 MW lower than the LOR 2 trigger level of 560 MW. This meant AEMO needed up to 360 MW of additional reserves in Victoria to remove the threat of load shedding from 1400 hrs if a contingency occurred (such as the trip of a large generation unit or an interconnector).

5.2 Assessment of market response and latest time to intervene in Victoria

At 1347 hrs on 31 January 2020, AEMO issued market notice MN 73173, declaring a forecast LOR 2 condition in Victoria from 1500 hrs to 1800 hrs. AEMO sought a market response and estimated the latest time to intervene at 1300 hrs.

AEMO estimates the latest time to intervene on the basis of the pre-activation and activation lead times of the reserve contracts required to resolve the reserve shortfall. In this case, at least one of the contracts (Type

[33] MN 73183.

3) required a two hour activation lead time, which determined that the latest time to intervene was 1300 hrs, two hours prior to the forecast reserve shortfall at 1500 hrs.

At 1351 hrs, AEMO issued market notice MN 73174, declaring that AEMO intended to commence negotiations with RERT Panel members for the provision of additional reserve by issuing requests for tender for the period from 1500 hrs to 1800 hrs.

At 1352 hrs, AEMO issued invitations to tender for the provision of Short Notice Reserve from 1400 to 2200 hrs.

At 1427 hrs, AEMO issued market notice MN 73187, advising that reserve contracts would commence delivery from 1530 to 2130 hrs.

5.3 Intervention event in Victoria

On 31 January 2020, in response to the actual LOR 2 condition in Victoria, AEMO activated six reserve contracts (RERT 1-5 and 8 – 84 MW) at 1530 hrs, and an additional three contracts (RERT 6, 7, and 9 – 101 MW) at 1630 hrs. Two of these contracts (RERT 8 and 9 – 70 MW) required pre-activation.

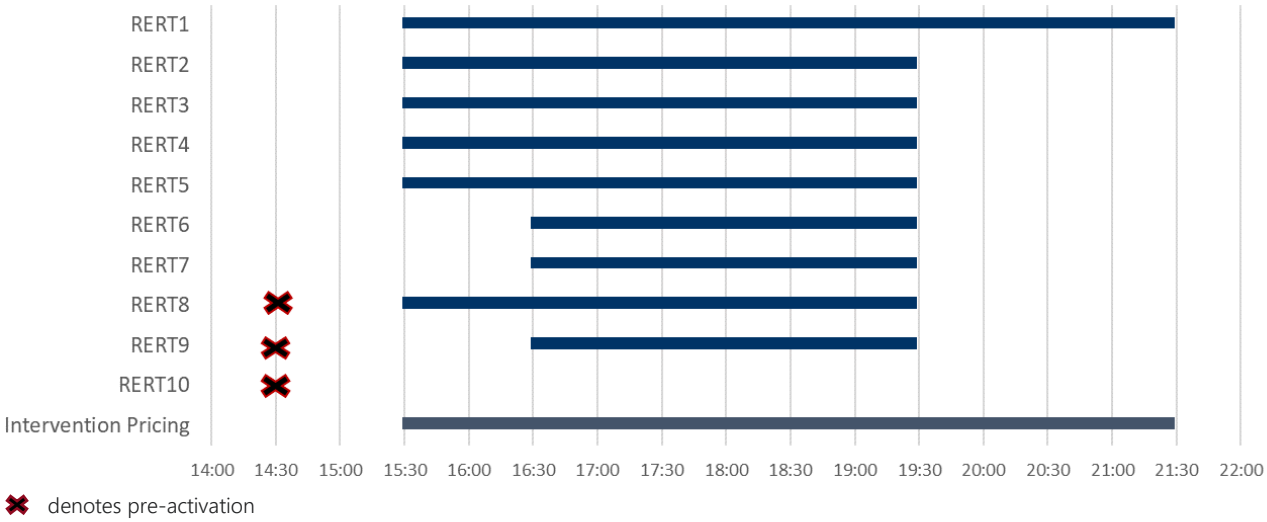
AEMO also pre-activated, but did not activate, one additional reserve contract (RERT 10 – 40 MW), due to its fast response times of less than 30 minutes (Type 2) and no LOR 3 condition eventuating.

AEMO had 285 MW of reserve available to meet the 360 MW shortfall, this included:

- Pre-activation (when required) and activation of all available Type 3 contracts. These contracts could not be activated post contingency.
- Pre-activation of one Type 2 contract. This contract needed to be pre-activated pre-contingency but could be activated post-contingency.
- Two additional Type 1 contracts with a combined capacity of 60 MW which were available to be activated post contingency

All activated contracts were de-activated at 1930 hrs, following the cancellation of the LOR 2 condition. The exception was RERT 1 which was deactivated at 2130 hrs following completion of its minimum continuous run time of six hours. Figure 5 details the timing of activation.

Figure 5 Timing of activation of RERT and intervention pricing on 31 January 2020 in Victoria



The total volume of reserve activated in Victoria on 31 January 2020 was 697 MWh. AEMO notes that 588 MWh was delivered on the day, this was due to some reserve providers delivering less reserve than they were contracted to provide. Table 12 shows a breakdown of RERT activated per trading interval.

Table 12 RERT activated in Victoria on 31 January 2020

Trading Interval ending	RERT activated (MW)	RERT activated (MWh)
31/01/2020 16:00	84	42
31/01/2020 16:30	84	42
31/01/2020 17:00	185	92.5
31/01/2020 17:30	185	92.5
31/01/2020 18:00	185	92.5
31/01/2020 18:30	185	92.5
31/01/2020 19:00	185	92.5
31/01/2020 19:30	181	90.5
31/01/2020 20:00	30	15
31/01/2020 20:30	30	15
31/01/2020 21:00	30	15
31/01/2020 21:30	30	15
Total (MWh)		**697**

At 1934 hrs, AEMO cancelled the LOR 2 condition. The activation of 185 MW contributed to the improved reserve condition. AEMO does not consider that demand response was a significant factor in Victoria, on this day.

5.4 Decision to intervene in New South Wales

Friday 31 January 2020 saw a continuation of extreme temperatures across New South Wales, with a maximum temperature of 35.5 °C being recorded at New South Wales (Bankstown)[34]. High temperatures and humidity contributed to a day-ahead forecast operational demand of 13,025 MW at 1630 hrs in New South Wales.

At 0722 hrs, AEMO declared a forecast LOR 1[35] condition in New South Wales from 1530 hrs to 1700 hrs.

At approximately 1415 hrs, scheduled generation availability was reduced by 290 MW, resulting in a total of approximately 2,800 MW of scheduled generation being unavailable in New South Wales due to unplanned outages or temperature-related limitations.

AEMO declared an actual LOR 2 condition in New South Wales from 1500 hrs[36]. The minimum reserve forecast of 500 MW was 275 MW lower than the LOR 2 trigger of 775 MW. The coincident LOR 2 condition in Victoria contributed to the reserve shortfall in New South Wales, due to limited interconnector support from Victoria to New South Wales.

To maintain power system reliability in New South Wales, AEMO determined that contracting of reserves would be required on the basis of the actual LOR 2 condition, with an estimated reserve shortfall of 275 MW.

The peak operational demand was 13,190 MW at 1530 hrs.

[34] Source www.bom.gov.au.

[35] MN 73167.

[36] MN 73188 issued at 1501 hrs.

5.5 Assessment of market response and latest time to intervene in New South Wales

At 1501 hrs on 31 January 2020, AEMO issued market notice MN 73188, declaring an actual LOR 2 condition in New South Wales from 1500 hrs. AEMO sought an immediate market response and advised that an insufficient market response may lead to an intervention event.

Since the LOR 2 condition had already commenced and the reserve shortfall was substantial (275 MW), it was unlikely that a market response would have occurred in time to avoid the need for RERT. AEMO immediately (at 1503 hrs) issued market notice MN 73189, declaring that AEMO intended to commence negotiations with RERT Panel members for the provision of short notice reserve by issuing requests for tender for the period from 1530 hrs to 2000 hrs. At 1514 hrs, AEMO advised the market of a refinement of the timing of its intention to commence RERT contract negotiations from 1530 hrs to 2100 hrs.

At 1516 hrs, AEMO issued invitations to tender for the provision of Short Notice Reserve from 1530 to 2100 hrs. At 1600 hrs, AEMO commenced pre-activation and activation of RERT.

5.6 Intervention event in New South Wales

On 31 January 2020, in response to the actual LOR 2 condition in New South Wales, AEMO activated:

- One reserve contract (RERT 16 – 50 MW) at 1600 hrs.
- Three reserve contracts (RERT 11, 13, and 14 – 42 MW) at 1700 hrs.
- An additional two reserve contracts (RERT 12 and 15 – 42 MW) at 1800 hrs.

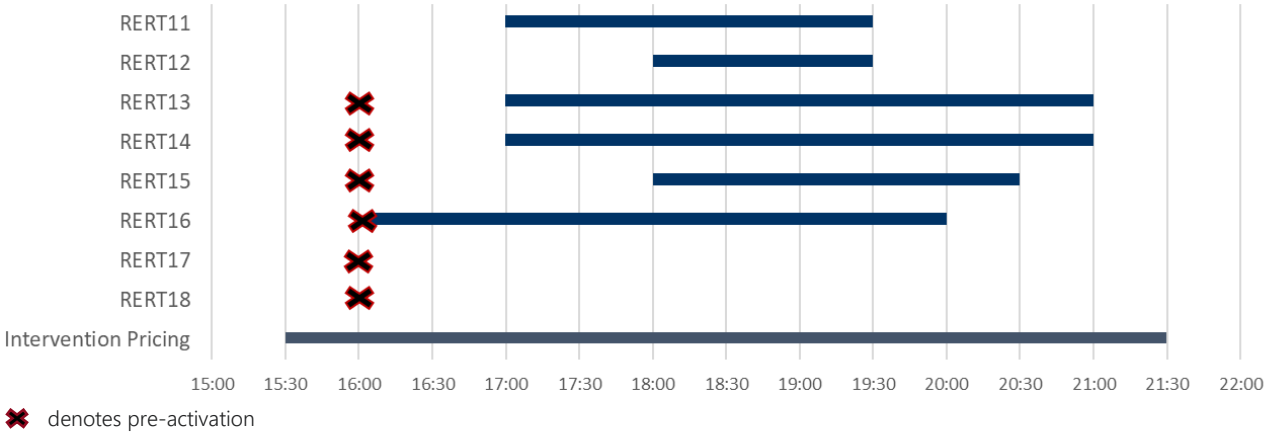
Four of these contracts (RERT 13, 14, 15, and 16 – 86 MW) required pre-activation. AEMO also pre-activated, but did not activate, two additional reserve contracts (RERT 17 and 18 – 304 MW), due to their fast response times of less than 30 minutes (Type 2) and no LOR 3 condition eventuating. The pre-activation of RERT 17 and 18 allowed AEMO to meet the requirements of the projected reserve shortfall of 275 MW, having activated only 134 MW of reserve.

All activated contracts were instructed to de-activate from 1930 hrs, following cancellation of the LOR 2 condition. All contracts were de-activated by 2100 hrs, following:

- RERT 13 and 14 completing their minimum de-activation lead time of 2 hours.
- RERT 15 completing its minimum de-activation lead time of 1 hours.
- RERT 16 completing its minimum continuous run time of 4 hours.

Intervention pricing continued until 2130 hrs when all reserve contracts in Victoria were de-activated. Figure 6 details the timing of activation.

Figure 6 Timing of activation of RERT and intervention pricing on 31 January 2020 in New South Wales



The total volume of reserve activated in New South Wales on 31 January 2020 was 418.5 MWh. AEMO notes that 488 MWh was delivered on the day, this was due to some providers delivering more reserve than they were contracted to provide. RERT providers are not paid for over-delivery. Table 13 shows a breakdown of RERT activated per trading interval.

Table 13 RERT activated in New South Wales on 31 January 2020

Trading Interval ending	RERT activated capacity (MW)	RERT activated volume (MWh)
31/01/2020 16:30	50	25
31/01/2020 17:00	50	25
31/01/2020 17:30	92	46
31/01/2020 18:00	92	46
31/01/2020 18:30	134	67
31/01/2020 19:00	134	67
31/01/2020 19:30	131	65.5
31/01/2020 20:00	86	43
31/01/2020 20:30	36	18
31/01/2020 21:00	32	16
Total (MWh)		**418.5**

At 1921 hrs, AEMO cancelled the LOR 2 condition. The following factors contributed to the improved reserve condition:

- Between 1530 and 1745 hrs, up to approximately 430 MW of price-responsive load reduced in New South Wales in response to high spot prices.
- Activation of 134 MW of RERT.

5.7 Intervention pricing for New South Wales and Victoria

Intervention pricing was applied for this event in accordance with NER 3.9.3(b) for the intervention periods from the DI ending 1535 hrs to the DI ending 2130 hrs on 31 January 2020.

On 31 January, a contract for 50 MW of reserve in Victoria was unavailable during the negotiation with panel providers but became available at short notice thereafter. AEMO managed this activation outside of the RERT scheduling tool due to the unusual nature and timing of the availability change. This 50 MW of reserve was contracted and activated at 1600 hrs however in doing so AEMO failed to create a constraint to manage the intervention pricing impact of this contract activation. As a result, the intervention pricing on 31 January does not reflect the activation of 50 MW of reserve from 1600 hrs to 1937 hrs.

5.8 Changes in dispatch outcomes New South Wales and Victoria

The addition of RERT capacity in New South Wales and Victoria had the effect of decreasing generation across all regions, reducing flows from Queensland to New South Wales and increasing flows from Victoria to New South Wales, when comparing the difference in output between the physical and revised pricing runs. No flows were recorded across Heywood during this period due to the damaged transmission towers in Cressy (see section 5.1 above).

Table 14 Summary of total energy generation during 31 January 2020 RERT event (MWh)

	NSW	QLD	SA	TAS	VIC
Physical run	67,368	55,431	14,806	9,964	50,445
Revised pricing run	68,835	56,513	15,081	10,145	51,363
Change	-1,467	-1,082	-275	-181	-918

Table 15 Summary of total interconnector flows during 31 January 2020 RERT event (MWh)

	Terranora	QNI	VIC–NSW	Heywood	Murraylink	Basslink
Physical run[A]	-736	-5,111	1,032	-	-384	2,521
Revised pricing run[A]	-847	-5,386	568	-	-430	2,591
Change	111	274	464	-	46	-70

A. Positive numbers are for flows flowing north or west, negative for flows flowing south or east.

5.9 Impact on reliability in Victoria and New South Wales

On 31 January 2020, there was no unserved energy[37]. AEMO activated RERT in Victoria and New South Wales according to AEMO operating procedures due to the actual LOR 2 conditions in both states[38]. The activation of RERT assisted in reducing the reserve shortfall and reducing the risk of load shedding if a credible contingency was to occur.

[37] Following the outage of the Moorabool – Mortlake and Moorabool – Haunted Gully 500 kV lines, which resulted in the separation of the South Australia region from Victoria, 450 MW of load at APD tripped. This did not result in unserved energy, since the contingency was a non-credible event.

[38] AEMO notes the failure to create a constraint associated with a 50 MW reserve contract in Victoria impacted intervention pricing, as detailed in section 5.7.

6. Cost of exercising RERT

NER clause 3.20.2(b)(2) requires that when AEMO activates RERT, it should aim to maximise the effectiveness of the activation at the least cost to end-use consumers of electricity. Accordingly, AEMO activated reserve contracts based on location, cost, capacity, time to activate, minimum activation time, and the profile of the forecast lack of reserve.

Table 16 shows a breakdown of the costs associated with exercising RERT during Q1 2020, which were included in the relevant[39] final statements, as per NER clause 3.20.6(f)(1). The total cost of exercising RERT was $34.37 million, which includes pre-activation, activation, and intervention costs. The cost per MWh has been calculated based on the total cost divided by the MWh delivered[40] for each activation event. The total cost per MWh associated with exercising RERT in Q1 2020 is $18,317.77.

Table 16 Costs associated with activating RERT in Q1 2020

	State	Pre-activation costs ($ million)	Activation costs ($ million)	Intervention costs[41] ($ million)	Total cost ($ million)	Cost per megawatt hour($/MWh)
4 January 2020	NSW	$4.6	$3.75	$0.015	$8.36	$28,703.86
23 January 2020	NSW	$4.61	$2.81	$0.12	$7.54	$14,821.80
31 January 2020	VIC	$0.01	$5.34	$2.19	$7.54	$12,823.13
31 January 2020	NSW	$4.85	$3.53	$2.55	$10.93	$22,381.03

Table 17 presents the cost recovery for each activation event, calculated by dividing the total RERT event cost by the state consumption during the relevant recovery period[42], as prescribed in NER 3.15.9(e).

Table 17 Total costs recovery associated with activating RERT in Q1 2020

Event	New South Wales, 4 January 2020	New South Wales, 23 January 2020	Victoria, 31 January 2020	New South Wales, 31 January 2020
Total RERT event cost ($ million)	$8.36	$7.54	$7.54	$10.93
State consumption during the relevant recovery period (MWh)	424,888	569,316	303,957	496,555
Total cost recovery ($/MWh)	$19.68	$13.24	$24.82	$22.019

[39] 4 January 2020 activation is detailed in final statement for 2020 Week 1

23 January 2020 activation is detailed in final statement for 2020 Week 4

31 January 2020 activations are detailed in final statement for 2020 Week 5

[40] RERT MWh delivered is the amount of RERT actually delivered (as opposed to activated) including any over-delivery, noting that RERT providers have not been paid for over-delivery.

[41] Intervention costs represent the compensation paid to Market Participants due to the intervention event (for example, to compensate for energy generation which is displaced by RERT capacity), and to Eligible Persons (SRA holders) due to changes in interconnector flows, and therefore changes in the value of Settlement Residues. Note that these costs are subject to change under clause NER 3.12.1(a).

[42] 8am to 8pm AEST on all business days in the billing week

A breakdown of the cost recovery from each Market Customer associated with RERT activation days, as per NER clause 3.20.6(f)(2) is provided in Appendix A.

Table 18 presents an estimated average cost per household in each state associated with the RERT events in Q1 2020 (a total of $3.24 in New South Wales and $1.62 in Victoria), assuming the cost of the RERT events in Q1 2020 are apportioned by consumption[43], based on the average residential consumption in each state as a portion of total energy in each state.

Table 18 Estimated cost per household per activation

Event	New South Wales, 4 January 2020 ($)	New South Wales, 23 January 2020 ($)	Victoria, 31January 2020 ($)	New South Wales, 31 January 2020 ($)
Estimated cost per household in relevant state ($ including GST)	1.01	0.91	1.62	1.32

During all of the RERT activation days in Q1 2020, activation of reserves avoided the risk of load shedding if a credible contingency had occurred. Table 19 presents the estimated avoided cost of load shedding as a result of the activations, assuming the largest credible contingency at the time had occurred.

Table 19 Estimated avoided cost of load shedding

Event	New South Wales, 4 January 2020 ($ million)	New South Wales, 23 January 2020 ($ million)	Victoria, 31January 2020 ($ million)	New South Wales, 31 January 2020 ($ million)
Estimated cost of load shedding avoided based on VCR	$9.77	$19.21	$28.72	$17.63

[43] AEMO recovers RERT costs from *market customers* who are typically retailers and transmission connected large industrial customers. AEMO does not have visibility or control on how retailers pass RERT costs on to their end use customers.

7. AEMO's intervention process

AEMO's general process for deploying RERT is documented in its Procedure for the Dispatch and Activation of Reserve Contracts[44].

AEMO considers that it followed all relevant provisions under NER clause 4.8 in the excercising of RERT in Q1 2020.

[44] At https://www.aemo.com.au/-/media/files/electricity/nem/emergency_management/rert/procedure_for_the_exercise_of_reliability_and_emergency_reserve_trader_rert.pdf.

Appendix A

Table 20 provides a breakdown of the cost recovery from each Market Customer associated with RERT activation days, as per NER clause 3.20.6(f)(2).

Table 20 Market customer cost recovery per region

Market Customer	New South Wales, 4 January 2020 ($ million)	New South Wales, 23 January 2020 ($ million)	Victoria, 31 January 2020 ($ million)	New South Wales, 31 January 2020 ($ million)	Total ($ million)
1st Energy Pty Ltd	0.01	0.01	0.01	0.01	0.04
AGL Hydro Partnership	0.34	0.22	0.00	0.40	0.96
AGL Macquarie Pty Limited	0.00	0.00	0.00	0.00	0.00
AGL Sales (Queensland Electricity) Pty Ltd	0.00	0.00	0.09	0.00	0.09
AGL Sales Pty Limited	1.28	1.13	1.20	1.66	5.27
AGL South Australia Pty Ltd	0.00	0.00	0.00	0.00	0.00
Alcoa Portland Aluminium Pty Ltd	0.00	0.00	0.49	0.00	0.49
Alinta Energy Retail Sales Pty Ltd	0.12	0.10	0.44	0.15	0.80
Amaysim Energy Pty Ltd	0.04	0.03	0.03	0.05	0.15
Blue NRG Pty Ltd	0.03	0.02	0.05	0.03	0.13
Covau Pty Limited	0.03	0.03	0.01	0.04	0.11
CS Energy Limited	0.00	0.00	0.00	0.00	0.00
Delta Electricity	0.10	0.09	0.03	0.12	0.34
Diamond Energy Pty Ltd	-0.01	0.00	0.00	-0.01	-0.01
Discover Energy Pty Ltd	0.00	0.00	0.00	0.00	0.00
Elysian Energy Pty Ltd	0.00	0.00	0.01	0.00	0.01
Energy Locals Pty Ltd	0.01	0.00	0.00	0.01	0.02
EnergyAustralia Pty Ltd	0.85	0.81	0.45	1.16	3.27
EnergyAustralia Yallourn Pty Ltd	0.61	0.57	0.40	0.72	2.29
Enova Energy Pty Ltd	0.00	0.00	0.00	0.00	0.00
ERM Power Retail Pty Ltd	0.80	0.78	0.93	1.17	3.67

Gannawarra Solar Farm Pty Ltd	0.00	0.00	0.00	0.00	0.00
Globird Energy Pty Ltd	0.00	0.00	0.02	0.00	0.02
Hanwha Energy Retail Australia Pty Ltd	0.00	0.00	0.00	0.00	0.00
Hazelwood Power	0.00	0.00	0.00	0.00	0.00
Infigen Energy Holdings Pty Limited	0.00	0.00	0.01	0.00	0.01
Infigen Energy Markets Pty Limited	0.04	0.04	0.00	0.05	0.14
Locality Planning Energy Pty Ltd	0.00	0.00	0.00	0.00	0.00
Lumo Energy (NSW) Pty Ltd	0.00	0.00	0.00	0.00	0.00
Lumo Energy Australia Pty Ltd	0.00	0.00	0.14	0.00	0.14
M2 Energy Pty Ltd (T/As Commander Power & Gas)	0.00	0.00	0.01	0.00	0.02
M2 Energy Pty Ltd (T/As Dodo Power & Gas)	0.03	0.02	0.04	0.03	0.12
Macquarie Bank Ltd	0.02	0.02	0.05	0.03	0.12
Mojo Power Pty Ltd	0.00	0.00	0.00	0.00	0.01
Momentum Energy Pty Limited	0.19	0.16	0.45	0.23	1.03
Next Business Energy Pty Ltd	0.04	0.03	0.02	0.05	0.14
Online Power and Gas Pty Ltd	0.00	0.00	0.00	0.00	0.00
Onsite Energy Solutions Pty Ltd	0.00	0.00	0.00	0.00	0.00
Origin Energy Electricity Limited	2.23	2.04	1.28	3.08	8.62
OVO Energy Pty Ltd	0.00	0.00	0.00	0.00	0.00
People Energy Pty Ltd	0.00	0.00	0.01	0.00	0.01
Pooled Energy Pty Limited	0.00	0.00	0.00	0.00	0.01
Power Club Limited	0.00	0.00	0.00	0.00	0.00
Powerdirect Pty Ltd	0.03	0.02	0.07	0.04	0.16
Powershop Australia Pty Limited	0.03	0.02	0.06	0.03	0.14

Progressive Green Pty Ltd	0.02	0.04	0.10	0.06	0.22
QEnergy Limited	0.01	0.01	0.00	0.01	0.04
ReAmped Energy Pty Ltd	0.00	0.00	0.00	0.00	0.01
Red Energy Pty Limited	0.27	0.23	0.51	0.34	1.34
Sanctuary Energy Pty Ltd	0.00	0.00	0.00	0.00	0.00
SIMEC Zen Energy Retail Pty Ltd	0.00	0.00	0.00	0.00	0.00
Simply Energy	0.07	0.07	0.33	0.11	0.57
Snowy Hydro Limited	0.00	0.00	0.00	0.00	0.00
Stanwell Corporation Limited	0.24	0.28	0.17	0.35	1.04
Sumo Power	0.01	0.00	0.04	0.01	0.06
Sun Retail Pty Ltd	0.00	0.00	0.00	0.00	0.00
Tango Energy Pty Ltd	0.01	0.00	0.13	0.00	0.14
Tomago Aluminium Company Pty Ltd	0.90	0.75	0.00	0.99	2.64
WINconnect Pty Ltd	0.00	0.00	0.00	0.00	0.01
Total	8.36	7.54	7.54	10.93	34.37

Appendix B

Tables 21, 22, and 23 below provide a summary timeline of each of the RERT events in Q1 2020 and the actions taken[45].

Table 21 Timeline of key events up to and including 4 January 2020

Date	Event/comment
22/12/2019	
1855 hrs	Sydney South – Wallerawang 76 and Ingleburn – Wallerawang 77 lines reclassified as a credible contingency.
31/12/2019	
1350 hrs	Murray – Upper Tumut 65 and Murray Lower Tumut 66 330 kV lines reclassified as a credible contingency.
4/1/2020	
0036 hrs	MN 72270 – general advice of potential for non-credible contingencies to occur in Victoria on 4 January due to extreme bushfire conditions. MN 72269 – general advice of potential for non-credible contingencies to occur in New South Wales on 4 January due to extreme bushfire conditions.
0758 hrs	TransGrid advised AEMO that auto-reclose disabled on 64, 66, 03, 07, and 051 lines. Manual reclose would be initiated if the lines tripped.
1147 hrs to 1510 hrs onwards	Multiple trips of transmission lines including: • Upper Tumut – Lower Tumut 64 330 kV. • Murray-Upper Tumut 65 330 kV line. • Murray – Lower Tumut 66 330 kV line. • Upper Tumut – Yass 02 33 0 kV line. • Upper Tumut – Canberra 01 330 kV line. • Kangaroo Valley – Capital 3W 330 kV line. • Ingleburn – Wallerawang 77 330 kV line. • Sydney South – Wallerawang 76 330 kV line. • Lower Tumut – Wagga 051 330 kV line.
1500 hrs	Constraint set I-VN_0650 invoked to limit power transfer from Victoria to New South Wales to 650 MW.
1510 hrs	Constraint set I-VN_0450 invoked to limit power transfer from Victoria to New South Wales to 450 MW.

[45] For further details and information sources for 4 January 2020 and 31 January 2020 events, see preliminary reports at https://aemo.com.au/energy-systems/electricity/national-electricity-market-nem/nem-events-and-reports/power-system-operating-incident-reports.

1510 hrs	Trip of multiple transmission lines: • Murray – Lower Tumut 66 330 kV line. • Wagga – Yass 990 132 kV line. • Wagga North – Murrumburrah 991 132 kV line. • Yass – Burrinjuck 970 132 kV line. • Wagga – Gadara 993 132 kV line. • Blowering generating unit tripped (33 MW). • New South Wales and Victoria now separated with Wagga area load fed from Victoria.
1511 hrs	AEMO re-configured the AGC system to manage the New South Wales – Victoria separation.
1525 hrs	Constraint sets F-NQ_ISLE, F-NQ_VST_ISLE_REG, F_VST_ISLE, I_VN_ZERO and NQ_VST_ISLE, invoked to manage separation of New South Wales and Victoria.
1605 hrs	• MN 72297 – declaring an actual LOR 2 condition in New South Wales from 1600 hrs. • AEMO sought an immediate market response. • AEMO noted that insufficient market response may require AEMO to implement a AEMO intervention event.
1607 hrs	MN 72299 – demand forecast change due to Wagga Wagga being area fed from Victoria.
1607 hrs	MN 72301 – AEMO advised intention to commence RERT contract negotiations for the period 1700 hrs 4/1/2020 to 0000 hrs 5/1/2020 for the New South Wales region.
1610 hrs	AEMO pre-activated 300 MW of RERT in New South Wales.
1618 hrs	MN 72310 – AEMO advised intention to commence RERT contract negotiations for the period 1630 to 2200 hrs on 4/1/2020 for the New South Wales region.
1715 hrs	• MN 72333 – advising that AEMO had entered RERT contracts and may activate RERT during the period 1800 hrs to 2200 hrs. • AEMO issued an pre-activated 68 MW of RERT in New South Wales.
1731hrs	• MN 72334 – AEMO advised RERT contracts activated for the period 1820 hrs to 2200 hrs. • AEMO issued an instruction to activate 68 MW of RERT in New South Wales.
1739 hrs	MN 72335 – AEMO intervention event commencing at 1820 hrs.
1820 hrs	68 MW of RERT activated in New South Wales.
1850 hrs	01 and 02 lines reclassified as a credible contingency due to bushfires.
2040 hrs	MN 72338 – inter-regional limitation extended due to New South Wales – Victoria separation.
2106 hrs	MN 72339 – LOR 2 cancelled in New South Wales.
2145 hrs	RERT services de-activated.
2147 hrs	MN 72340 – advising activation of RERT contracts ended from 2145 hrs.

Table 22 Timeline of key events on 23 January 2020

Date	Event/comment
0011 hrs	MN 72876 – due to abnormal conditions, namely damaging winds and heavy rainfall in Snowy Mountains and South West slopes, constraint sets I-VN_0500 and I-NV_0500 invoked from 0010 hrs, to limit power transfer between Victoria to New South Wales to 500 MW in both directions.

1116 hrs	• MN 72883 – forecast LOR 2 declared for New South Wales from 1530 to 1700 hrs, based on 1130 hrs PDPASA run. The forecast capacity reserve requirement was 721 MW, but the minimum capacity reserve available was 463 MW. • AEMO sought a market response and estimated the latest time to intervene as an intervention event at 1330 hrs.
1122 hrs	MN 72884 – AEMO advised intention to commence RERT contract negotiations for the period 1130 to 2000 hrs on 23/1/2020 for the New South Wales region.
1220 hrs	MN 72886 – advising AEMO had entered into RERT contracts and may activate RERT during the period 1530 to 1700 hrs for the New South Wales region.
1327 hrs	MN 72889 – AEMO advised RERT contracts activated for the period 1530 to 1730 hrs.
1437 hrs	• AEMO issued MN 72923, declaring an actual LOR 2 condition in New South Wales from 1435 to 1700 hrs. • The capacity reserve requirement was 742 MW but the minimum capacity reserve available was 568 MW.
1530 hrs	• MN 72928 – advised AEMO Intervention Event commenced[46] (dispatch of RERT). • 152 MW of RERT fully activated in New South Wales.
1830 hrs	RERT services de-activated.
1900 hrs	MN 72951 – LOR 2 cancelled in New South Wales.
1904 hrs	MN 72952 – advised activation of RERT contract ended from 1900 hrs.

Table 23 Timeline of key events on 31 January 2020

Date	Event/comment – Victoria	Event/comment – New South Wales
1324 hrs	• Collapse of a number of steel transmission towers on the Moorabool – Mortlake and Moorabool – Haunted Gully 500 kV lines (MLTS-MOPS and MLTS-HGTS lines). • South Australia now separated from remainder of the NEM.	
1347 hrs	• MN 73173 – forecast LOR 2 declared for Victoria from 1500 to 1800 hrs, based on 1400 hrs PDPASA run. The forecast capacity reserve requirement was 560 MW[47], but the minimum capacity reserve available was 406 MW. • AEMO sought a market response and estimated the latest time to intervene as an intervention event at 1300 hrs.	
1351 hrs	MN 73174 – AEMO advised of intention to commence RERT contract negotiations for the period 1500 to 1800 hrs on 31/1/2020 for the Victorian region.	

[46] MN 72928 detailed an incorrect start time for the AEMO Intervention Event of 1328 hrs instead of 1530 hrs.

[47] Both MN 73173 and 73181 detailed an incorrect forecast capacity reserve requirement of 1105 MW, which was corrected in MN 73183 declaring the actual LOR 2 condition.

Date	Event/comment – Victoria	Event/comment – New South Wales
1404 hrs	• Correction to MN 73173 issued at 1347 hrs (date corrected). MN 73181 – forecast LOR 2 declared for Victoria from 1500 to 1800 hrs, based on 1400 hrs PDPASA run. • The forecast capacity reserve requirement was 560 MW48, but the minimum capacity reserve available was 406 MW.	
1416 hrs	• AEMO issued MN 73183, declaring an actual LOR 2 condition in Victoria from 1400 hrs. • The capacity reserve requirement was 560 MW but the minimum capacity reserve available was 200 MW.	
1427 hrs	MN 73187 – AEMO advised RERT contracts activated for the period 1530 hrs to 2130 hrs for the Victorian region.	
1501 hrs		• AEMO issued MN 73188, declaring an actual LOR 2 condition in New South Wales from 1500 hrs. • The capacity reserve requirement was 775 MW but the minimum capacity reserve available was 500 MW.
1503 hrs		MN 73189 – AEMO advised of intention to commence RERT contract negotiations for the period 1530 to 2000 hrs on 31/1/2020 for New South Wales region.
1514 hrs		MN 73191 – AEMO advised intention to commence RERT negotiations for the period 1530 hrs to 2100 hrs on 31/1/2020 for New South Wales region.
1530 hrs	Six RERT services for Victoria (fully activated/commenced full capability delivery).	
1557 hrs		MN 73195 – AEMO advised RERT contracts activated for the period 1600 hrs to 2100 hrs for New South Wales region.
1608 hrs	MN 73198 – AEMO Intervention Event commenced at 1530 hrs (dispatch of RERT) for Victoria.	
1630 hrs	Three further RERT services for Victoria (fully activated/commenced full capability delivery).	
1700 hrs		Three RERT services for New South Wales (fully activated/commenced full capability delivery).
1800 hrs		One further RERT services for New South Wales (fully activated/ commenced full capability delivery).
1921 hrs		MN 73231 – advised cancellation of actual LOR 2 in the New South Wales region at 1920 hrs.
1930 hrs	Eight RERT services for Victoria commenced de-activation.	
1930 hrs	Two RERT services for Victoria commenced de-activation.	
1934 hrs	MN 73232 – advised cancellation of actual LOR 2 in the Victorian region at 1930 hrs.	

[48] Both MN 73173 and 73181 detailed an incorrect forecast capacity reserve requirement of 1105 MW, which was corrected in MN 73183 declaring the actual LOR 2 condition.

Date	Event/comment – Victoria	Event/comment – New South Wales
2100 hrs		Last RERT services for New South Wales de-activated.
2130 hrs	Last RERT service for Victoria de-activated.	
2138 hrs	MN 73243 – advised activation of RERT contracts for Victoria ended from 2100 hrs.	MN 73242 – advised activation of RERT contracts for the New South Wales ended from 2100 hrs.