

# Final Report: Victoria market suspension on 22 April 2023

May 2024

A market event report for the  
National Electricity Market





# Important notice

## Purpose

AEMO has prepared this final market event report in accordance with clauses 3.14.3(c)-(d) and 3.14.4(f)-(g) of the National Electricity Rules, using information available as at the date of publication unless otherwise specified.

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## Abbreviations

Abbreviation	Term
AEMO	Australian Energy Market Operator
AEST	Australian Eastern Standard Time
EMS	Energy Management System
FCAS	Frequency Control Ancillary Service
MSPS	Market Suspension Pricing Schedule
MW	Megawatts
NEM	National Electricity Market
NER	National Electricity Rules
NSP	Network Service Provider
PIR	Post Incident Review
PSSWG	Power System Security Working Group
SCADA	Supervisory Control and Data Acquisition



# Contents

1	Overview	5
2	Event summary	6
2.1	Changes in calculated Victorian demand	6
3	Adequacy of actions taken	6
4	Payments and compensation	7
4.1	Market suspension pricing schedule payments and compensation payments	7
4.2	Compensation costs payable	9
5	Actions taken since preliminary report	12
5.1	AusNet to share the root-cause and review the procedures relating to SCADA	12
5.2	Conducting routine failover testing to identify possible issues	13
5.3	Review of critical information technology systems to prevent a reoccurrence of SCADA related incidents	13
5.4	Improving visibility of market events	14
5.5	Implementing processes to update the firmware of all devices associated with critical infrastructure	14

# 1 Overview

This is the final report relating to AEMO's suspension of the spot market in Victoria on 22 and 23 April 2023. It consolidates and updates AEMO's preliminary report on the market suspension published in July 2023<sup>1</sup> and is based on information available to AEMO on 29 April 2024.

At approximately 1546 hrs<sup>2</sup> on 22 April 2023, multiple pieces of network equipment at AusNet's<sup>3</sup> primary and secondary data centres failed. This resulted in those data centres being unable to communicate with AusNet sites and AEMO, and consequently led to the total loss of Supervisory Control and Data Acquisition (SCADA) across all Victorian electricity transmission assets and AusNet's electricity distribution network in Victoria. This incident had no impact on AEMO's visibility of the Victorian gas transmission system or market. While AusNet also lost all SCADA relating to AusNet's gas distribution network, under normal conditions AEMO has no visibility of that network. AEMO subsequently suspended the electricity spot market in Victoria from 1620 hrs on 22 April 2023 to 1700 hrs on 23 April 2023. During the suspension period, Victorian prices were set using market suspension schedule pricing<sup>4</sup>.

As required by National Electricity Rules (NER) 3.14.3(c) and 3.14.4(f), AEMO has conducted a review of the market suspension. This final report includes the matters required by NER 3.14.3(c) and (d) and 3.14.4(g), namely:

- Any updated information on the reasons for the suspension, its effect on the operation of the spot market, analysis of system responses and actions, which is in Section 2. One new piece of information has become available to AEMO since the publication of the preliminary report in July 2023 and is detailed in Section 2. All other information, as required by NER 3.14.4(g), remains unchanged since the publication of the preliminary report, and is not included in Section 2.
- AEMO's assessment of the adequacy of the provision and response of facilities and services, and actions taken to maintain power system security, which is in Section 3.
- Details of the payments and compensation made to each Market Suspension Compensation Claimant and the share of compensation costs recovered from each Market Customer in Victoria Queensland, New South Wales, and South Australia. These details were not available at the time of the preliminary report and are provided in section 4.

This report also includes, in Section 5, an update on the progress of actions or recommendations set out in the preliminary report.

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<sup>1</sup> AEMO, Preliminary report: Victoria market suspension on 22 April 2023. Available at: [https://aemo.com.au/-/media/files/electricity/nem/market\\_notices\\_and\\_events/market\\_event\\_reports/2023/preliminary-report-vic-market-suspension.pdf?la=en](https://aemo.com.au/-/media/files/electricity/nem/market_notices_and_events/market_event_reports/2023/preliminary-report-vic-market-suspension.pdf?la=en).

<sup>2</sup> National Electricity Market time (Australian Eastern Standard Time [AEST]) is used in this report.

<sup>3</sup> AusNet Services is the Declared Transmission System Operator for Victoria.

<sup>4</sup> As required by NER 3.14.5.



## 2 Event summary

One piece of new information has become available to AEMO regarding details of the event since the publication of the preliminary report in July 2023 and is provided below.

### 2.1 Changes in calculated Victorian demand

#### 2.1.1 Preliminary report

Victoria remained connected to the rest of the National Electricity Market (NEM) during the event. Interconnectors in the direction of New South Wales, South Australia, and Tasmania were operating as normal. There were several 200 MW changes in calculated Victorian demand between 1848 hrs and 1934 hrs on 22 April 2023. During periods of failed SCADA affected generation terms in the regional demand calculation were using persisting last target values. The sudden changes in demand were likely due to intermittent restoration of SCADA where the demand calculation returned to using actual measurements. This will need further investigation.

#### 2.1.2 Final report

The ~200 MW increases and decreases to calculated Victorian demand between 1848 hrs and 1934 hrs on 22 April 2023 are predominantly attributable to changes in SCADA generation values from two hydroelectric power stations. These changes occurred at the same time SCADA values at nearby hydroelectric power stations moved from Good Quality to Remote Suspect qualities and vice versa, making it likely that the changes in SCADA generation values from the two power stations in question were being affected for the same reason. During periods where SCADA qualities were Remote Suspect, generation terms in the energy management system (EMS) regional demand calculation were using default values, not persisting last target values as indicated in the preliminary report. The changes in Victorian demand did not affect dispatch and did not affect the 5-minute and 30-minute average demand calculations used in demand forecasting. The affected periods have been excluded from forecast model training to remove the broader impacts of the SCADA outage.

## 3 Adequacy of actions taken

Under NER 3.14.3(c), AEMO has reviewed the adequacy of the provision and response of facilities and services during the market suspension, and the appropriateness of actions taken to restore or maintain power system security and has concluded all responses and actions were adequate in the circumstances.



# 4 Payments and compensation

## 4.1 Market suspension pricing schedule payments and compensation payments

Table 1 shows the market suspension pricing schedule (MSPS) energy and frequency control ancillary services (FCAS) payments and compensation payments for energy and FCAS made to each Market Suspension Compensation Claimant, as required by NER 3.14.3(d)(1)(i) and (ii). During the market suspension period there were 31 Market Suspension Compensation Claimants, being the scheduled generators and ancillary service providers who supplied energy or provided FCAS in an affected region.

The compensation payments shown in the table represent formula-based payments made under NER 3.14.5A, using the schedule of benchmark values published by AEMO and current for the period when the suspension occurred. These payments compensate a Market Suspension Compensation Claimant for any additional amount of costs it is deemed to have incurred based on its plant type, in excess of the payments received under the MSPS for energy and FCAS.

No additional compensation claims were made by any Market Suspension Compensation Claimant under NER 3.14.5B or 3.15.7B.

Values in Table 1 and Table 2 are rounded to the nearest whole dollar value.

**Table 1 MSPS payments and compensation payments**

Participant Name	MSPS Payment (Energy)	MSPS Payment (FCAS)	Compensation Payment (Energy and FCAS)
AETV Pty Ltd	\$23,566	\$0	\$17,847
AGL Dalrymple Pty Limited	\$28	\$1,248	\$0
AGL Hydro Partnership	\$71,061	\$69	\$0
AGL Loy Yang Marketing Pty Ltd	\$1,471,538	\$686	\$0
AGL Macquarie Pty Limited	\$1,109,787	\$14,273	\$0
AGL SA Generation Pty Limited	\$9,990	\$611	\$3,705
Alinta Energy Retail Sales Pty Ltd	\$1,043,402	\$176	\$0
Arrow Southern Generation Pty Ltd And Arrow Braemar 2 Pty Ltd	\$52,790	\$0	\$39,655
Berrybank 2 Asset Pty Ltd As The Trustee For Berrybank 2 Asset Trust	\$706	\$2,389	\$0
Braemar Power Project Pty Ltd	\$26,683	\$5,042	\$11,567
Bulgana Wind Farm Pty Ltd	\$0	\$1,738	\$0
CleanCo Queensland Limited	\$267,110	\$4,082	\$1,797
CS Energy Limited	\$879,371	\$12,650	\$0
Delta Electricity	\$315,745	\$7,374	\$0
EnergyAustralia Pty Ltd	\$635,151	\$9,600	\$96,277
EnergyAustralia Yallourn Pty Ltd	\$958,642	\$1,865	\$0
Hazelwood BESS Project Co Pty Ltd ATF The HBESS Asset Trust	\$7	\$0	\$0
Hornsedale Power Reserve Pty Ltd	\$1,440	\$8,607	\$0
Iberdrola Australia Wallgrove Pty Limited	\$3,334	\$9,932	\$0
Lake Bonney Wind Power Pty Ltd	\$14	\$649	\$0
Millmerran Energy Trader Pty Ltd	\$402,183	\$0	\$0
Mondo Power Pty Ltd	\$109	\$0	\$0
Origin Energy Electricity Limited	\$1,194,374	\$5,189	\$10,267
Pelican Point Power Limited	\$82,436	\$1,003	\$64,152
Shell Energy Retail Pty Ltd	\$26,291	\$0	\$15,457
Smithfield Power Generation Pty Ltd	\$6,757	\$0	\$861
Snowy Hydro Limited	\$536,171	\$7,425	\$0
South Australian Water Corporation	\$337	\$388	\$0
Stanwell Corporation Limited	\$1,230,363	\$7,364	\$0
Synergen Power Pty Limited	\$4,078	\$0	\$5,334
Victorian Big Battery Pty Ltd	\$12,019	\$18,054	\$0
<b>Total</b>	<b>\$10,365,486</b>	<b>\$120,415</b>	<b>\$266,918</b>





## 4.2 Compensation costs payable

Table 2 overleaf shows the share of compensation costs payable by each Market Customer to AEMO as required by NER 3.14.3(d)(1)(iii). The total of these amounts is equal to the total compensation payment from AEMO to the Market Suspension Compensation Claimants in Table 1.

Compensation costs were recoverable from Market Customers in Victoria, Queensland, New South Wales, and South Australia as those regions benefited from the payment of compensation from the market suspension in accordance with NER 3.15.8A.

**Table 2 Compensation costs payable**

Participant Name	Compensation cost
1st Energy Pty Ltd	\$571
AGL Hydro Partnership	\$3,847
AGL Sales (Queensland Electricity) Pty Limited	\$418
AGL Sales Pty Limited	\$35,171
AGL South Australia Pty Ltd	\$1,518
Alcoa Portland Aluminium Pty Ltd	\$10,129
Alinta Energy Retail Sales Pty Ltd	\$9,012
Amber Electric Pty Ltd	\$129
Ampol Energy (Retail) Pty Ltd	\$1
Blue NRG Pty Ltd	\$536
CleanCo Queensland Limited	\$2,816
CleanTech Energy Pty Ltd	\$1
Covau Pty Limited	\$310
CPE Mascot Pty Ltd	\$71
CS Energy Limited	\$14,230
CSR Building Products Limited	\$330
Darlington Point Solar Farm Pty Ltd	\$9
Delta Electricity	\$2,353
Diamond Energy Pty Ltd	\$521
Discover Energy Pty Ltd	\$11
Electricity In A Box Pty Ltd	\$3
Enel Energy Australia Pty Ltd	\$35
Energy Locals Pty Ltd	\$455
EnergyAustralia Pty Ltd	\$15,680
EnergyAustralia Yallourn Pty Ltd	\$9,843
Ergon Energy Queensland Pty Ltd	\$10,552
Gannawarra Solar Farm Pty Ltd	\$4
GEE Power & Gas Pty Ltd	\$1
GloBird Energy Pty Ltd	\$774
Group Energy Pty Ltd	\$325
Hanwha Energy Retail Australia Pty Ltd	\$320
Hazelwood Power	\$30
Iberdrola Australia Energy Markets Pty Limited	\$2,106
Iberdrola Australia Holdings Pty Limited	\$368
Liberty Greenpower Pty Ltd	\$343
Locality Planning Energy Pty Ltd	\$1

Participant Name	Compensation cost
Localvolts Pty Ltd	\$1
Lumo Energy (SA) Pty Ltd	\$159
Lumo Energy Australia Pty Ltd	\$2,599
M2 Energy Pty Ltd (T/As Dodo Power & Gas)	\$1,122
Maximum Energy Retail Pty Ltd	\$8
Mojo Power East Pty Ltd	\$60
Mojo Power Pty Ltd	\$81
Momentum Energy Pty Limited	\$6,632
MTA Energy Pty Limited	\$82
Next Business Energy Pty Ltd	\$879
Online Power And Gas Pty Ltd	\$3
Origin Energy Electricity Limited	\$45,550
OVO Energy Pty Ltd	\$287
OZGen Retail Pty Ltd	\$308
Powershop Australia Pty Limited	\$1,999
Progressive Green Pty Ltd	\$1,918
QEnergy Limited	\$214
ReAmped Energy Pty Ltd	\$50
Red Energy Pty Limited	\$13,147
RTA Yarwun Pty Ltd	\$975
Shell Energy Retail Pty Ltd	\$25,024
Simply Energy	\$5,725
SmartestEnergy Australia Pty Ltd	\$1,007
South Australian Water Corporation	\$171
Stanwell Corporation Limited	\$16,442
Sumo Power	\$1,061
Sun Metals Corporation Pty Ltd	\$1,235
Sun Retail Pty Ltd	\$1,555
Tango Energy Pty Ltd	\$2,454
Telstra Energy (Retail) Pty Ltd	\$3
The Trustee For Finley Solar Trust	\$8
Tomago Aluminium Company Pty Ltd	\$11,359
TotalEnergies Gas & Power Australia Pty Ltd	\$941
WINconnect Pty Ltd	\$4
Y.E.S. Energy (SA) Pty Ltd	\$15
Zen Energy Retail Pty Ltd	\$1,017
<b>Total</b>	<b>\$266,917</b>



Note that the total compensation cost payable in Table 2 is equal to the total compensation payments for energy and FCAS in Table 1, at \$266,918.

Participants that had a compensation cost payable of less than \$0.50 were excluded from Table 2, making up the discrepancy between Table 1 and Table 2. These participants were:

- Ellis Air Connect Pty Ltd.
- Energy Services Management Pty Ltd.
- M2 Energy Pty Ltd (T/As Commander Power & Gas).
- Onsite Energy Solutions Pty Ltd.
- PA Power Microgrid 1 Pty Ltd.
- Powow Power Pty Ltd.
- Radian Holdings Pty Ltd.
- Smart Energy Retail Pty Ltd.
- Synergen Power Pty Limited.

## 5 Actions taken since preliminary report

This section provides an update on progress of the actions or recommendations identified in the Next Steps section (Section 5) of the preliminary report.

### 5.1 AusNet to share the root-cause and review the procedures relating to SCADA

#### 5.1.1 Preliminary report

SCADA outages result in additional risks to power system operation and cause market impacts given the criticality of these systems. As such, to mitigate the risk of reoccurrence, AEMO recommends:


- AusNet to share the root-cause of this incident and factors that impacted the time to restore SCADA services with the Power System Security Working Group (PSSWG).
- AusNet to undertake a review of the procedures relating to SCADA failure response to identify any potential opportunities to improve overall speed of response. The review should also consider SCADA failure root-cause analysis, issue rectification, and remediation. In this incident, it took more than 13 hours from AEMO becoming aware of the Victorian SCADA loss (from 1546 hrs 22 April 2023 to approximately 0537 hrs 23 April 2023) for normal SCADA visibility in the AEMO control room to return. It is important to promptly rectify SCADA failures, and as far as practicable to ensure the critical outages do not exceed the time limits specified in the Power System Data Communication Standard<sup>5</sup>.
- AusNet to undertake a broader review of the procedures relating to SCADA system operation and control to identify any additional controls to be implemented to improve reliability, availability, and restoration times of SCADA services.

#### 5.1.2 Final report

- AusNet shared the root-cause of this incident and factors that impacted the time to restore SCADA services at the PSSWG on 12 May 2023. The root cause was confirmed to be a firmware issue on the primary switch. This issue also prevented failover to the secondary switch. The firmware of the devices at the backup site was updated between 29 and 31 May 2023 and the firmware of the primary site devices was updated between 27 and 29 June 2023. The firmware update is expected to permanently fix the issue.
- AusNet conducted a Post Incident Review (PIR) for the incident. Several actions were identified from the PIR into the response to the incident and these actions were progressively completed before the end of September 2023. These actions included training of staff, reviewing and updating processes and protocols, and reviewing potential knowledge gaps across teams in managing this type of event.

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<sup>5</sup> AEMO, Power System Data Communication Standard. Available at: [https://www.aemo.com.au/-/media/Files/Electricity/NEM/Network\\_Connections/Transmission-and-Distribution/AEMO-Standard-for-Power-System-Data-Communications.pdf](https://www.aemo.com.au/-/media/Files/Electricity/NEM/Network_Connections/Transmission-and-Distribution/AEMO-Standard-for-Power-System-Data-Communications.pdf)

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- AusNet has taken several steps to actively manage their distribution and transmission SCADA services towards achieving highest availability. These steps include:
    - Managing AusNet’s distribution and transmission SCADA environments to deliver 99.95% uptime,
    - Actively monitoring all components of the infrastructure stack and automatically alerting of abnormal operations or failures to relevant support teams,
    - Providing primary support for SCADA via a single team that operates 7x24x365 under a 15-response/4-hour resolution service-level agreement, and
    - Performing mandatory Disaster Recovery testing on all components annually.

## 5.2 Conducting routine failover testing to identify possible issues

### 5.2.1 Preliminary report

AEMO recommends Network Service Providers (NSPs) undertake routine failover testing to help identify possible issues following failover from primary to secondary and secondary to primary SCADA links.

### 5.2.2 Final report

This recommendation is captured by recommendation 4 in Table 1 (shown as ID 4) of AEMO’s March 2024 SCADA review report<sup>6</sup>. NSPs and AEMO are to review their existing automated backup and failover system testing procedures and identify opportunities for improvements by the end of Q3 2024.

## 5.3 Review of critical information technology systems to prevent a reoccurrence of SCADA related incidents

### 5.3.1 Preliminary report

Since January 2021, there have been five SCADA failures resulting in significant impacts on the market and additional complexities to the operation of the power system.


- AEMO plans to discuss these incidents through the PSSWG.
- AEMO also recommends all NSPs review their critical information technology systems. This review should consider any improvements to ensure high reliability of systems and effective, timely responses to system issues.

### 5.3.2 Final report

AEMO discussed these incidents at the PSSWG on 12 May 2023. In addition, this recommendation is captured by recommendations 1 and 2 in Table 1 (shown as ID 1 and ID 2) of AEMO’s March 2024 SCADA review report. Recommendation 1 includes actions to address improvement areas identified by AEMO in the SCADA baseline questionnaire sent to individual NSPs. As part of recommendation 1, AEMO will confirm that NSP after-hours

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<sup>6</sup> AEMO, Multiple incidents impacting NEM SCADA between 24 January 2021 and 18 November 2023. Available at: [https://aemo.com.au/-/media/files/electricity/nem/market\\_notices\\_and\\_events/power\\_system\\_incident\\_reports/2023/multiple-incidents-impacting-nem-scada-between-2021-and-2023.pdf?la=en](https://aemo.com.au/-/media/files/electricity/nem/market_notices_and_events/power_system_incident_reports/2023/multiple-incidents-impacting-nem-scada-between-2021-and-2023.pdf?la=en).



SCADA and EMS support is aligned with the requirements of the published Power System Data Communications Standard<sup>7</sup>. Recommendation 2 includes the establishment of a SCADA working group tasked with improving SCADA system resilience and reliability. The group works on improving change management, processes and procedures, training, knowledge sharing, monitoring of SCADA operations, and overall situational awareness in the NEM. Further detail on current actions is provided in row ID 1 and ID 2 in Table 1 of AEMO's March 2024 SCADA review report.

## 5.4 Improving visibility of market events

### 5.4.1 Preliminary report

AEMO is investigating options to improve visibility of market events such as suspension, administered pricing, and price revisions.

### 5.4.2 Final report

A project is currently being progressed aiming to uplift the existing AEMO NEM dashboard. This project will consider displaying on the updated AEMO NEM dashboard:

- Whether the administered pricing has been activated or not.
- If market prices have reached the market cap.
- Whether the market is suspended in one price region or more and whether there's price scaling active in any of their neighbouring regions.
- Whether the market price of the current trading interval is subject to review.
- Historical cumulative price values, the current cumulative price threshold value, and how far the cumulative prices are from breaching the threshold.

## 5.5 Implementing processes to update the firmware of all devices associated with critical infrastructure

### 5.5.1 Preliminary report

AEMO recommends all NSPs maintain/implement processes to update the firmware of all devices associated with critical infrastructure (such as SCADA systems) to the latest firmware version in a prompt and controlled manner.

### 5.5.2 Final report

This recommendation is captured by recommendation 2 in Table 1 (shown as ID 2) of AEMO's March 2024 SCADA review report. The recommendation captures the need to address inadequacies in change management processes. Further detail on current actions is provided in row ID 2 in Table 1 of AEMO's March 2024 SCADA review report. In addition, finding 9.1.4 of the report recommends that NSPs and AEMO ensure that learnings from

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<sup>7</sup> AEMO, Power System Data Communication Standard. Available at: [https://www.aemo.com.au/-/media/Files/Electricity/NEM/Network\\_Connections/Transmission-and-Distribution/AEMO-Standard-for-Power-System-Data-Communications.pdf](https://www.aemo.com.au/-/media/Files/Electricity/NEM/Network_Connections/Transmission-and-Distribution/AEMO-Standard-for-Power-System-Data-Communications.pdf)



an incident handled and resolved by one team/company at one site and the potential vulnerabilities in the critical infrastructure such as SCADA systems arising from firmware issues should be shared across all teams at all sites via regular internal meetings and via the PSSWG and through the establishment of a SCADA working group.