AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

NEM Event – Direction 16-18 and 24-27 November 2018

November 2019

Important notice

PURPOSE

Where the Australian Energy Market Operator (AEMO) intervenes in the National Electricity Market (NEM) through the use of directions, AEMO must publish a report in accordance with National Electricity Rules (NER) clause 4.8.9(f) and 3.13.6A(a). This report satisfies those NER obligations, and is based on information available to AEMO at 15 November 2019.

Unless otherwise indicated, terms in this report have the same meanings as those defined in the NER.

All references to time in this report are based on Australian Eastern Standard Time (AEST).

DISCLAIMER

AEMO has made every reasonable effort to ensure the quality of the information in this report but cannot guarantee its accuracy or completeness. Any views expressed in this report are those of AEMO unless otherwise stated, and may be based on information given to AEMO by other persons.

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ABBREVIATIONS

Abbreviation	Expanded name
AEMO	Australian Energy Market Operator
AEST	Australian Eastern Standard Time
DI	Dispatch Interval
KTS	Keilor Terminal Station
MN	Market Notice
NEM	National Electricity Market
NER	National Electricity Rules
PS	Power Station
RTO	Real Time Operations (AEMO Control Room)
VIC	Victoria

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1. Summary

Clause 4.8.9 of the National Electricity Rules (NER) allows AEMO to intervene in the market by issuing directions or clause 4.8.9 instructions, if AEMO is satisfied that it is necessary to maintain or re-establish the power system to a secure, satisfactory, or reliable operating state. Section 116 of the National Electricity Law allows AEMO to issue directions to take certain action if AEMO considers that it is necessary to maintain power system security or for reasons of public safety.

Between 16 and 18 November 2018, and 24 and 27 November 2018, AEMO issued four directions to Victorian Market Participants to maintain power system security. These four directions events are summarised in Table 1.

Table 1 Summary of the four Victorian directions between 16 and 27 November 2018

Directed plant	Directed Participant	Event No.	Issue time	Cancellation time	Direction instruction
Newport PS	Energy Australia Ecogen Pty Ltd	1	2200 hrs, 16 November 2018	1500 hrs, 17 November 2018	To synchronise and follow dispatch targets from 0100 hrs on 17 November 2018.
Mortlake PS Unit 12	Origin Energy Pty Ltd	2	0230 hrs, 18 November 2018	0800 hrs, 18 November 2018	To synchronise and follow dispatch targets from 0250 hrs on 18 November 2018.
Newport PS	Energy Australia Ecogen Pty Ltd	3	2030 hrs, 24 November 2018	0600 hrs, 26 November 2018	To synchronise and follow dispatch targets from 0001 hrs on 25 November 2018.
Newport PS	Energy Australia Ecogen Pty Ltd	4	1800 hrs, 26 November 2018	0510 hrs, 27 November 2018	To synchronise and follow dispatch targets from 2200 hrs on 26 November 2018.

2. Intervention assessment

2.1 The need for intervention

The directions over consecutive weekends of 16-18 and 24-27 November in Victoria were for system security requirements (to manage post-contingent voltage violations).

Event no. 1 – direction to Newport Power Station

At 2100 hrs on 16 November 2018, system studies indicated that with Loy Yang A Power Station (PS) units 3 and 4, Yallourn "W" PS unit 3, and Loy Yang B PS unit 2 out of service, post contingent voltage violations in the Keilor area from 0130 hrs could not be managed within applicable system security limits.

The relevant credible contingency events were:

- For loss of the Alcoa Portland (APD)–Heywood–Tarrone 500 kV Line, the post contingent voltages at Keilor Terminal Station (KTS) were exceeded.
- For loss of the APD No. 4 Transformer, the post contingent voltages at KTS were exceeded.

System studies indicated that with Newport PS in service, the post contingent voltage violations around the KTS area were mitigated and the power system would return to a satisfactory operating state. EnergyAustralia Ecogen Pty Ltd (Ecogen) required three hours notice to start and synchronise Newport PS. All other options for managing the voltage violations were investigated and exhausted.

The direction was cancelled when system studies ceased indicating post contingent voltage violations.

Event no. 2 – direction to Mortlake Power Station unit 12

At 0215 hrs on 18 November 2018, with Loy Yang A units 3 and 4 and Yallourn "W" PS units 1 and 3 out of service, and three 500 kilovolt (kV) lines switched out of service for voltage control, studies indicated post contingent voltage violations at KTS.

All options for managing the voltage violations were investigated and exhausted with no resolution.

System studies indicated that with a Mortlake PS unit 12 in service at minimum generation and absorbing 100 megavolt amperes reactive (MVar), the post contingent voltage violations at KTS were eliminated and the power system would return to a satisfactory operating state.

The direction was cancelled when system studies ceased indicating post contingent voltage violations.

Events no. 3 and no. 4 – directions to Newport Power Station

On 24 November 2018, system studies indicated that the reactive power reserve available to manage post contingent voltage violations in the Keilor area from 0000 hrs on 25 November 2018 was insufficient to maintain a secure operating state.

AEMO identified that the only effective course of action to manage post contingent voltage violations would be to direct Newport PS in order to provide voltage support. This was confirmed with further studies at 0900 hrs and 1800 hrs on 25 November 2018.

The direction was cancelled when it was identified that there was sufficient load online and Newport PS was no longer required for voltage support.

Again, on 26 November 2018, system studies indicated that the reactive power reserve available to manage post contingent voltage violations in the Keilor area from 2200 hrs 26 November 2018 was insufficient to maintain a secure operating state.

AEMO identified that the only effective course of action to manage post contingent voltage violations would be to direct Newport PS into service in order to provide voltage support.

The direction was cancelled when Ecogen decided to commence commercial operation at Newport PS.

2.2 Assessment of market response and latest time to intervene

Under NER clause 4.8.5A(a) and (c), AEMO must notify the market of any anticipated power system security or reliability issue, and the latest time for market response before AEMO would need to intervene.

AEMO contacted all participants who operate suitable synchronous generating units in Victoria to confirm their availability and the latest time to intervene. For both of the first two directions, AEMO determined there was insufficient time for a market response and AEMO issued the direction within one hour (for the first direction) and 15 minutes (for the second). For the third and fourth directions, participants indicated they did not intend to adjust their market offers, but identified units that would be available if directed.

For these last two direction events, AEMO assessed the latest time to intervene taking account of the advised lead times. The latest times to intervene were 2030 hrs on 24 November 2018 and 1800 hrs on 26 November 2018, respectively.

2.3 Decision to intervene

With insufficient market response available before intervention was required, AEMO issued directions as listed in Table 1. AEMO cancelled the directions when when it was identified that there was sufficient load online and the direction was no longer required for voltage support, or when the directed particpant decided to commence commercial operation.

3. Intervention process

AEMO considers that it followed all applicable processes under NER rule 4.8 for the management of the directions between 24 to 27 November 2018[1]. For the directions between 16 to 18 November, AEMO followed all applicable processes other than to issue market notices under NER rule 4.8.5(a) and (c) prior to directing. AEMO had first contacted all participants capable of providing a response, after which there was limited time before intervention had to occur. Table 2 provides a high-level timeline of the intervention event.

Table 2 Timeline of key events between 16 and 27 November 2018

Time	Events / comments
16 November 2018	
2100 hrs	System studies indicated that with Loy Yang unit A3, Loy Yang unit A4, Yallourn West PS unit 3 and Loy Yang unit B2 out of service, the management of post contingent voltage violations in the Keilor area from 0130 hrs did not meet system security requirements.
2200 hrs	AEMO published a market notice advising the market that a participant had been directed in VIC in order to maintain the power system in a secure operating state. (MN 65421).
2200 hrs	Direction issued to Energy Australia Ecogen Pty Ltd for Newport PS to synchronise and follow dispatch targets from 0100 hrs on 17 November 2018.
17 November 2018	
0105 hrs	Newport PS synchronised.
0956 hrs	AEMO published a market notice advising the market that a participant had been directed in VIC in order to maintain the power system in a secure operating state and that intervention pricing would apply from 0955 hrs on 17 November 2018. (MN65425).
1500 hrs	AEMO published MN 65431 declaring the cancellation of the direction from 1500 hrs on 17 November 2018.
1510 hrs	Newport PS de-synchronised.
18 November 2018	
0215 hrs	System studies indicated post contingent voltage violations at Keilor, with Loy Yang unit A3, Loy Yang unit A4, Yallourn PS unit 1 and Yallourn PS unit 2 out of service, and three 500kV Lines switched out of service for voltage control.

[1] AEMO. Power system operating procedure SO_OP 3707, "Intervention, direction and clause 4.8.9 instructions", 11 September 2014, available at http://aemo.com.au/-/media/Files/Electricity/NEM/Security_and_Reliability/Power_System_Ops/Procedures/SO_OP_3707---Intervention-Direction-and-Clause-4-8-9-Instructions.pdf.

Time	Events / comments
0230 hrs	Direction issued to Origin Energy to synchronise Mortlake PS unit 12 at 0250 hrs.
0242 hrs	AEMO published a market notice advising the market that a participant had been directed in VIC in order to maintain the power system in a secure operating state. (MN654441).
0250 hrs	Mortlake PS unit 12 synchronised.
0805 hrs	Mortlake PS unit 12 de-synchronised.
0812 hrs	AEMO published MN 65444 declaring the cancellation of the direction from 0800 hrs.
24 November 2018	
1931 hrs	• System studies carried out on 24 November 2018 indicated that the reactive power reserve available to manage post contingent voltage violations in the Keilor area from 0000 hrs on the 25 November 2018 was insufficient to maintain a secure operating state • AEMO published a market notice (MN65567) seeking a market response by 2030 hrs on 24 November 2018.
2038 hrs	AEMO published a market notice advising the market that a participant had been directed in Victoria in order to maintain the power system in a secure operating state (MN65569).
0010 hrs	• Newport PS synchronised. • Intervention pricing was already in place from 0205 hrs on 24 November 2018 for directions issued in South Australia for system strength.
25 November 2018	
0922 hrs	AEMO published MN 65577 updating the direction to extend to 2000 hrs on 25 November 2018.
1904 hrs	AEMO published MN 65586 updating the direction to extend to 0700 hrs on 26 November 2018.
26 November 2018	
0539 hrs	AEMO published MN 65588 declaring the cancellation of the direction from 0600 hrs on 26 November 2018.
0605 hrs	Newport PS commenced commercial operation.
1449 hrs	• Further system studies carried out on 26 November 2018 indicated that the reactive power reserve available to manage post contingent voltage violations in the Keilor area from 2200 hrs on 26 November 2018 was insufficient to maintain a secure operating state • AEMO published a market notice (MN65591) seeking a market response by 1900 hrs on 26 November 2018.
1812 hrs	• AEMO published a market notice advising the market that a participant had been directed in Victoria in order to maintain the power system in a secure operating state. (MN65596). • To be able to achieve 2200 hrs start time, latest time to intervene would need to be at 1800 hrs, as Newport PS (the preferred generator based on its reactive capability compared to other generators) lead time to start was four hours, based on the information provided by Energy Australia Ecogen Pty Ltd.
1813 hrs	AEMO published a market notice advising the market that all dispatch intervals during the direction were to be intervention price dispatch intervals (MN65597).
2205 hrs	Newport PS synchronised.
27 November 2018	
0516 hrs	• AEMO published MN 655601 declaring the cancellation of the direction from 0510 hrs on 27 November 2018. • Newport PS commenced commercial operation.

3.1 Adequacy of responses to AEMO inquiries

NER 4.8.5A(d) permits AEMO to request information from Scheduled Network Service Providers, Scheduled Generators, Semi-Scheduled Generators, and Market Customers.

AEMO is satisfied with the timeliness, adequacy, and effectiveness of all responses to its requests from Energy Australia Ecogen Pty Ltd and Origin Energy Pty Ltd for information prior to issuing the directions between 16 and 27 November 2018.

3.2 Participant ability to comply with the intervention

NER 4.8.9(d) requires that a Registered Participant must immediately notify AEMO of its inability to comply, or intention not to comply, with a direction or clause 4.8.9 instruction.

AEMO did not receive any indication that a Registered Participant would be unable to comply with the direction. AEMO is satisfied that Energy Australia Ecogen Pty Ltd and Origin Energy Pty Ltd complied with the directions listed in Table 1.

4. Dispatch and pricing outcomes

4.1 Changes to dispatch outcomes due to the direction

The direction to Newport PS during the first event resulted in approximately 1,213 megawatt hours (MWh) of generation being added to the market, 443 MWh of which was during intervention pricing. During the third and fourth direction events 2,630 MWh and 621 MWh of generation respectively were added to the market.

The direction to Mortlake PS unit 12 during the second event, resulted in approximately 107 MWh of generation being added to the market, however, no intervention pricing was applied.

Under NER 3.8.1(b)(11), AEMO must ensure that, as far as reasonably practicable, the number of participants affected by the intervention and the resulting changes to interconnector flows are minimised[2]. AEMO considered the application of counter-action constraints to achieve this objective, but concluded this was not practical during these interventions.

Tables 3 to 8 summarise the estimated change to dispatch outcomes resulting from all four directions. These are estimated by comparing against a simulated dispatch with the direction removed.

Directions in one region can cause dispatch changes to other regions. In particular, these changes are driven by economic co-optimisation within the market, and by the interplay between network constraint equations across multiple regions.

[2] AEMO's power system operating procedure SO_OP 3707 "Intervention, Direction and Clause 4.8.9 Instructions" describes this objective. In practice, AEMO meets the objective by selecting generating units located in the same region as the directed generation (and, if possible, belonging to the same participant) and then constraining the dispatch of the selected generating units by an equal and opposite amount to that of the directed generating units.

Table 3 Direction 1 estimated changes to local generation in each region (MWh)

	QLD	NSW	VIC	SA	TAS
Without direction	33,323	34,835	17,756	5,357	4,200
Actual	33,159	34,445	18,384 + 1,213[A]	5,346	4,149
Change	-164	-390	628	-11	-51

A. 1,213 MWh is the directed energy (of which 443 is the directed energy during the intervention pricing period).

Table 4 Direction 1 estimated changes to interconnector flow between regions (MWh)

	Terranora	QNI	VIC-NSW	Heywood	Murraylink	Basslink
Without direction[A]	-243	-1,719	844	-1,795	-193	-1,071
Actual[A]	-224	-1,579	1,404	-1,786	-192	-1,123
Change[B]	**19 MWh less into NSW**	**141 MWh less into NSW**	**560 MWh more into NSW**	**9 MWh less into VIC**	**1 MWh less into VIC**	**51 MWh more into TAS**

A. Positive numbers are for flows flowing north or west, negative for flows flowing south or east.
B. Change = |Actual - Without direction|.

Table 5 Direction 3 estimated changes to local generation in each region (MWh)

	QLD	NSW	VIC	SA	TAS
Without direction	187,518	208,981	106,848	29,219	38,353
Actual	187,392	207,743	108,646 + 2,630[A]	29,083	38,043
Change	**-126**	**-1,238**	**1,798**	**-136**	**-310**

A. 2,630 MWh is the directed energy.

Table 6 Direction 3 estimated changes to interconnector flow between regions (MWh)

	Terranora	QNI	VIC-NSW	Heywood	Murraylink	Basslink
Without direction[A]	-860	-3,181	-11,761	1,560	704	4,623
Actual[A]	-837	-3,080	-10,469	1,729	727	4,323
Change[B]	**23 MWh less into NSW**	**101 MWh less into NSW**	**1292 MWh less into VIC**	**170 MWh more into SA**	**23 MWh more into SA**	**300 MWh less into VIC**

A. Positive numbers are for flows flowing north or west, negative for flows flowing south or east.
B. Change = |Actual - Without direction|.

Table 7 Direction 4 estimated changes to local generation in each region (MWh)

	QLD	NSW	VIC	SA	TAS
Without direction	45,633	49,315	27,783	6,459	8,903
Actual	45,490	49,310	28,367 + 621[A]	6,074	8,881
Change	**-143**	**-5**	**584**	**-385**	**-22**

A. 621 MWh is the directed energy.

Table 8 Direction 4 estimated changes to interconnector flow between regions (MWh)

	Terranora	QNI	VIC-NSW	Heywood	Murraylink	Basslink
Without direction[A]	-345	-2,191	-2,527	2,158	439	1,197
Actual[A]	-333	-2,063	-2,393	2,502	491	1,176
Change[B]	**12 MWh less into NSW**	**128 MWh less into NSW**	**134 MWh less into VIC**	**344 MWh more into SA**	**52 MWh more into SA**	**21 MWh less into VIC**

A. Positive numbers are for flows flowing north or west, negative for flows flowing south or east.
B. Change = |Actual - Without direction|.

4.2 Application of intervention pricing

AEMO declares intervention pricing for periods subject to an AEMO intervention event. Provided the 'regional reference node test' described below is met, NER 3.9.3(b) requires that AEMO set the dispatch price and ancillary service prices at the value which AEMO, in its reasonable opinion, considers would have applied had the intervention event not occurred. AEMO determines and publishes these prices in accordance with the Intervention Pricing Methodology[3].

The methodology is applied whenever the direction meets the regional reference node test, that is, in AEMO's reasonable opinion a direction in respect of plant at the regional reference node would have avoided the need for the direction that was issued (NER 3.9.3(d)).

There were four separate directions issued during the weekends of 16 to 18 November 2018, and 24 to 27 November 2018. Each direction was required to manage post contingent voltage violations in the Keilor area of Victoria:

1. Direction 1 issued to Newport PS on the evening of 16 November 2018 to the morning of 17 November 2018, was to provide voltage control at Keilor 500 kV Terminal Station. At the time this was considered a localised problem that did not require intervention pricing and would not have satisfied the regional reference node test. However, from Saturday morning of 17 November 2018, a review of the direction was conducted and AEMO concluded that a voltage profile by a combination of:
   - switching all available reactive plant (capacitors off & reactors on),
   - absorbing MVar on on-line generators,
   - de-energising 2 x 500 kV lines and finally directing Newport on-line so it could absorb MVar.

   If it had been possible to direct plant at the regional reference node with the capability to absorb sufficient MVar, that would have been effective in resolving the voltage issue. Therefore, AEMO commenced application of intervention pricing from DI ending 0955 hrs on 17 November 2018 to DI ending 1500 hrs on 17 November 2018.

[3] Intervention Pricing Methodology, available at http://www.aemo.com.au/-/media/Files/Electricity/NEM/Security_and_Reliability/Dispatch/Policy_and_Process/2018/Intervention-Pricing-Methodology.pdf.

2. Direction 2 issued to Mortlake PS unit 12 on 18 November 2018 was for voltage control and the need was sufficiently remote from the regional reference node that the test was not met. AEMO therefore continued to apply dispatch pricing in accordance with NER 3.9.3(d).
3. Direction 3 issued to Newport PS on 24 November 2018 was to manage power system security in Victoria. Intervention pricing was in place for the entire direction from DI ending 0005 hrs on 25 November 2018 to DI ending 0600 hrs on 26 November 2018, together with a concurrent direction event in South Australia.

Direction 4 issued to Newport PS on 26 November 2018 was to manage power system security in Victoria. Intervention pricing was in place for the entire direction from DI ending 2205 hrs on 26 November 2018 to DI ending 0510 hrs on 27 November 2018.Note that AEMO has proposed a rule change to clarify the application of the regional reference node test. The AEMC is expected to make a final determination on this rule on 19 December 2019[4].

4.

5. Conclusions and further actions

Between 16 and 27 November 2018, AEMO issued four directions to two Victorian Market Participants to maintain power system security, by managing post contingent voltage violations in the region.

AEMO is satisfied that all applicable procedures and processes were followed in assessing the need for intervention and determining the latest time to intervene, other than the issue of market notices prior to issuing Directions 1 and 2. Appropriate procedures were followed in each case in enacting and managing the intervention, and seeking market response from all generators capable of meeting the system strength requirements. The market was informed after each direction was issued.

AEMO is satisfied that all applicable procedures and processes were followed in applying appropriate intervention pricing for Directions 2, 3, and 4. AEMO applied different approaches to intervention pricing in Direction 1. AEMO has subsequently proposed a rule change to clarify the application of the regional reference node test to intervention pricing.

AEMO is also satisfied with the timeliness and adequacy of participant responses and communication throughout.

[4] Application of the Regional Reference Node Test to the RERT https://www.aemc.gov.au/rule-changes/application-regional-reference-node-test-reliability-and-emergency-reserve-trader