

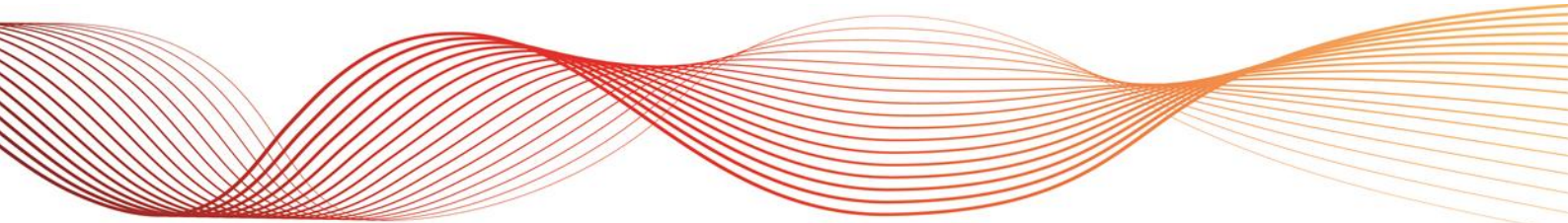


SCHEDULING ERROR REPORT

19 OCTOBER 2016 –

MANIFESTLY INCORRECT INPUTS FOR DI ENDING 1550 HRS

Published: **November 2017**





IMPORTANT NOTICE

Purpose

AEMO has prepared this report using information available as at October 2017, unless otherwise specified.

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1. SUMMARY

On 19 October 2016, AEMO identified a manifestly incorrect input (MII) for dispatch interval (DI) ending 1550 hrs as subject to review under the automated procedures for determining a manifestly incorrect input in clause 3.9.2B of the National Electricity Rules (NER). The subsequent DI ending 1555 hrs was also automatically marked for review, according to standard procedure.

Initial investigation into the event found no evidence of a MII, so the 5-minute dispatch prices were accepted for DI ending 1550 hrs as well as the subsequent DI ending 1555 hrs.

Following the investigation after the event, AEMO considers that:

- Its determination that DI ending 1550 hrs was not affected by MII was incorrect.
- The determination for the subsequent DI ending 1555 hrs was correct.

This report describes the reasons for the determination and provides the information to be published in accordance with NER clause 3.9.2B(g).

2. EVENT DETAILS

All times referenced in this report are market time (AEST).

The Heywood – South East Substation No. 2 275 kV transmission line was on a planned outage from 0723 hrs on 18 October 2016 to 1015 hrs on 22 October 2016. During the outage, one of the tasks undertaken was current injection tests on the transmission line protection relays.

At 1544 hrs on 19 October 2016, the flow on the Heywood – South East Substation No. 2 275 kV transmission line increased from 0 MVA to approximately 828 MVA for eight seconds, due to the planned current injection tests at the Heywood end. This increase in flow coincided with the next dispatch run, hence it was captured by AEMO's system and was used as an input for the dispatch run DI ending 1550 hrs.

The energy price in South Australia for DI ending 1550 hrs increased to the Market Price Cap (MPC) of \$14,000/MWh, while the Raise Regulation price increased to \$12,899.99/MWh. The Heywood Interconnector flow, which was flowing towards South Australia with a target of 250 MW, reversed towards Victoria with a target flow of 23 MW.

Table 1 compares the Energy Regional Original Prices (ROP) and target interconnector flows for all regions of the previous DI (1545 hrs), the DI that is affected by MII (1550 hrs), and the next DI (1555 hrs). The frequency control ancillary services (FCAS) prices other than the Raise Regulation price in South Australia were not materially impacted.

Table 1 Regional ROP and interconnector target flows for DIs ending 1545 hrs, 1550 hrs and 1555 hr

		DI ending 1545 hrs	DI ending 1550 hrs (Affected by MII)	DI ending 1555 hrs
Energy ROP (\$/MWh)	NSW	66.01	62.96	62.17
	QLD	66.50	64.50	64.50
	SA	70.33	26,899.98 ¹	32.17
	TAS	52.93	26.66	29.06
	VIC	57.44	28.94	31.54
Raise Regulation RRP (\$/MWh)	SA	74.69	12,899.99	1,106.85
Interconnector target flow (MW)	N-Q-MNSP1	-41	-37	-33
	NSW1-QLD1	-227.17	-130	-82
	T-V-MNSP1	307.10	309	306
	V-S-MNSP1	60.96	143	47
	V-SA	250	-23	40
	VIC1-NSW1	935.44	1090	1100

For DI ending 1550 hrs, constraint equations F_S+RREG_0035 and V>S_NIL_HYSE violated. Constraint equation F_S+RREG_0035 sets the Raise Regulation FCAS requirement to be greater than 35 MW. There was insufficient Raise Regulation available from South Australian generators for that DI as they were ramp-rate limited to provide energy, hence the equation violated.

The system normal constraint equation V>S_NIL_HYSE manages the flow on the Heywood Interconnector by avoid overloading either of the Heywood – South East 275 kV lines for the trip of the parallel line. One of the inputs to the right-hand-side (RHS) of the equation is the flow on the Heywood – South East No. 2 line.

Between DI ending 1545 hrs and 1550 hrs, the input into the equation changed from 0 MVA to 827.78 MVA, resulting in a significant change in the RHS of the constraint equation. The only variable on the left-hand-side (LHS) of the equation is the Heywood Interconnector flow. For DI ending 1550 hrs, the Heywood Interconnector target flow towards Victoria was 23 MW. This target flow violated the limit set by constraint equation V>S_NIL_HYSE to manage the supply balance in South Australia. The flow on the Heywood – South East No. 2 line returned to 0 MVA for the following DI. The formulation of the constraint equation can be found in Appendix A.

At 1636 hrs, following the detection of the SCADA injection, AEMO applied manual hand-dressing to keep the flow on the line to 0 MVA for the remaining duration of the outage.

3. MARKET IMPACT

The SCADA injection at the Heywood terminal had impacted the energy and Raise Regulation prices in South Australia, as shown in Table 1. The energy and FCAS prices in other regions were not materially affected.

The step change in South Australian price and Heywood Interconnector flow exceeded the relevant thresholds, and as a result DI ending 1550 hrs was automatically triggered as “subject to review”.

Market Notice (MN 55429) was automatically issued to inform the market of the non-firm prices for DI ending 1550 hrs. Whilst investigations were carried out, a subsequent Market Notice was automatically issued in the next 5 minutes notifying the non-firm prices for DI ending 1555 hrs.

¹ This ROP was capped to the Market Price Cap of \$14,000/MWh.



AEMO's initial investigation identified that the dispatch outcome for DI ending 1550 and the subsequent DI 1555 hrs were not affected by any manifestly incorrect input. Hence, the prices were accepted and Market Notices (MN 55431 and 55432) were automatically issued to inform the market of the unchanged (firm) prices.

Further investigations after the event revealed that only the dispatch for DI ending 1550 hrs was affected by MII. No further changes to the dispatch prices are allowed once the prices are firm.

To assess the market impact of this event, AEMO did a simulated rerun of the NEMDE files for DI ending 1550 hrs on 19 October 2016. The incorrect SCADA was replaced with the correct value of 0 MVA. A total of 20 MWh of generation was constrained off across all regions other than South Australian generators due to the MII.

4. SCHEDULING ERROR

A scheduling error occurs when AEMO determines that a dispatch interval contained a manifestly incorrect input (refer to clause 3.8.24(a)(3) of the National Electricity Rules (NER)).

As DI ending 1550 hrs on 19 October 2016 was the only interval affected by MII, a scheduling error occurred only in this dispatch interval.

Under NER clause 3.16.2(a), Market Participants affected by a scheduling error may apply to a dispute resolution panel established under NER clause 8.2.6A for a determination on whether they are entitled to compensation.

5. CORRECTIVE ACTION

As a result of the incident, AEMO has updated the input to the constraint equation $V > S_NIL_HYSE$ to use the switched MVA flow on both Heywood – South East lines on 2 December 2016. This means that if an unusual SCADA MVA line flow is received at one end of either transmission line, the value will be substituted with the good value from the other end.

6. CONCLUSION

A scheduling error occurred for DI ending 1550 hrs on 19 October 2016 because AEMO erroneously determined under NER clause 3.8.24(a)(3) that the dispatch interval did not contain a MII, which impacted the energy and Raise Regulation prices in South Australia.



APPENDIX A. CONSTRAINT FORMULATION FOR V>S_NIL_HYSE

Constraint type: LHS<=RHS

Effective date: 02/07/2015

Version No: 1

Weight: 30

Constraint active in: Dispatch and DS PASA, Predispatch and PD PASA, ST PASA

5 Min Predispatch RHS: Predispatch

Active in PASA for: LRC & LOR

Constraint description: Out = NIL, avoid O/L either Heywood to South East 275 kV line on trip of parallel circuit, flow VIC to SA, feedback

Impact: Vic - SA (Heywood) Interconnector

Source: AEMO

Limit type: Thermal

Reason: Avoid overloading either South East to Heywood 275 kV line on trip of parallel circuit

Modifications: New

Additional Notes: Ratings from SA and VIC end of the line considered. Lower end rating is used.

LHS=

MW flow west on the Vic-SA AC interconnector

RHS

Default RHS value= 650

Dispatch RHS=

Min

(

(Min

(

Victoria: #2 South East to Heywood 275 kV 15 Minute Rating,

Victoria: #2 Heywood to South East 275 kV 15 Minutes Rating

)

- SMVA flow on Heywood to South East No. 2 275 kV line at Heywood

- 1.035 x [SMVA flow on Heywood to South East No. 1 275 kV line at Heywood]

- 20 {Operating_Margin} ,

(Min

(

Victoria: #1 South East to Heywood 275 kV 15 Minute Rating,

Victoria: #1 Heywood to South East 275 kV 15 Minutes Rating

)

- MVA flow on Heywood to South East No. 1 275 kV line at Heywood

- 1.035 x [MVA flow on Heywood to South East No. 2 275 kV line at Heywood]

- 20 {Operating_Margin}

)

+ MW flow west on the Vic-SA AC interconnector

Predispatch RHS=

Min

(

Victoria: #2 South East to Heywood 275 kV 15 Minute Rating,

Victoria: #1 South East to Heywood 275 kV 15 Minute Rating,

Victoria: #2 Heywood to South East 275 kV 15 Minutes Rating,

Victoria: #1 Heywood to South East 275 kV 15 Minutes Rating

)

- 20 {Operating_Margin}

DS, PD and ST PASA RHS=

Min

(

Victoria: #2 South East to Heywood 275 kV 15 Minute Rating,

Victoria: #1 South East to Heywood 275 kV 15 Minute Rating,

Victoria: #2 Heywood to South East 275 kV 15 Minutes Rating,

Victoria: #1 Heywood to South East 275 kV 15 Minutes Rating

)

- 20 {Operating_Margin}



ABBREVIATIONS

Abbreviation	Expanded name
AEMO	Australian Energy Market Operator
DI	Dispatch Interval
FCAS	Frequency Control Ancillary Service
LHS	Left-Hand-Side
MII	Manifestly Incorrect Input
MN	Market Notice
MPC	Market Price Cap
MW	Megawatt
MWH	Megawatt Hour
NEM	National Electricity Market
NEMDE	National Electricity Market Dispatch Engine
NER	National Electricity Rules
RHS	Right-Hand-Side
RRP	Regional Reference Price
SCADA	Supervisory Control and Data Acquisition