

# PRICE REVISION INCIDENT REPORT – 5 SEPTEMBER 2011

PREPARED BY: Electricity Market Performance

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FINAL

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## Abbreviations and Symbols

Abbreviation	Term
AEMO	Australian Energy Market Operator Ltd
DI	dispatch interval
FCAS	frequency control ancillary service
MII	manifestly incorrect input
MVA	Megavolt-ampere
MW	megawatt
MWh	megawatt hour
NEM	National Electricity Market
NER	National Electricity Rules
QNI	Queensland-New South Wales 330kV interconnector
SCADA	Supervisory Control and Data Acquisition

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## 1 Introduction

On 5 September 2011 AEMO identified dispatch intervals (DIs) ending 1105 hrs and 1110 hrs as subject to review using its automated procedures for detecting a manifestly incorrect input (MII), in accordance with clause 3.9.2B of the National Electricity Rules (NER).

AEMO subsequently determined that DIs ending 1105 hrs and 1110 hrs contained MIIs and replaced all dispatch prices and ancillary services prices for these DIs with the corresponding prices for the previous DI ending 1100 hrs. These revised dispatch prices were used to determine the spot price for trading interval ending 1130 hrs. Under clause 3.8.24 of the NER, a scheduling error occurred in these two DIs.

The MIIs were dynamic ratings for the No.871 Calvale–Wurdong 275 kV line and the No.855 Calvale–Stanwell 275 kV line. A database failover at Powerlink resulted in incorrect data, which included incorrect ratings of these lines, being transmitted to AEMO. Subsequent investigation revealed that DIs ending 1055 hrs and 1100 hrs contained incorrect inputs, but as these were not detected by the automated procedures AEMO did not revise prices in those DIs.

AEMO considers that its determination that DIs ending 1105 hrs and 1110 hrs contained manifestly incorrect inputs was not correct. This report describes the reasons for the determination, why AEMO considers the determination to be incorrect, and the action taken to minimise the risk of a similar event in future, as required under clause 3.9.2B(g) of the National Electricity Rules.

## 2 Dispatch Intervals Subject to Review

The trigger thresholds for identifying DIs as subject to review relate to changes in dispatch price in a region and interconnector target flows between DIs, and are described in “*Effectiveness of Procedures for Manifestly Incorrect Inputs*”, located at <http://www.aemo.com.au/electricityops/140-0104.html>.

Table 1 lists the relevant dispatch prices, interconnector flows and ancillary service prices from DI ending 1050 hrs to 1100 hrs. Changes that exceeded the trigger levels are shaded. A dispatch price trigger and at least one interconnector flow trigger are both required for a DI to be automatically identified as subject to review.

Table 1 Queensland Dispatch Prices, Interconnector Target Flows and Ancillary Service Prices

	1050 hrs <sup>1</sup>	1055 hrs <sup>2</sup>	1100 hrs <sup>2</sup>	1105 hrs <sup>4</sup>	1110 hrs <sup>5</sup>	Threshold
Uncapped Qld price (\$/MWh)	\$28.54	\$82,162.68 <sup>3</sup>	\$91.78	\$5.77	-\$1000.00	
Change (Multiple of Previous DI price)		2878	894	15	174	3
Qld final price (\$/MWh)	\$28.54	\$12,500.00	\$91.78	\$91.78	\$91.78	
Directlink target flow (MW)	-60	17	64	-19	-96	
Change (MW)		77	47	83	77	80
QNI target flow (MW)	-215	-229	-322	-220	-237	
Change (MW)		14	93	102	17	240
Ancillary service prices (before revision) <sup>6</sup>						
Regulation lower	\$2.00	\$1.98	\$11,980.00	\$23.11	\$1033.59	
Fast lower	\$0.22	\$0.35	\$11,980.00	\$0.40	\$0.40	
Slow lower	\$0.34	\$0.32	\$4,700.00	\$0.52	\$0.39	
Delayed lower	\$0.10	\$0.10	\$11,980.00	\$20.51	\$1,030.99	

**Notes:**

1. Incorrect rating information was transmitted to AEMO in DI ending 1050 hrs, but was automatically identified as suspect and replaced with the last good rating information and so this DI was not affected by the incorrect inputs.
2. DIs ending 1055 hrs and 1100 hrs contained incorrect inputs but were not identified as subject to review because the change in interconnector target flow in the initial DI was less than the relevant trigger threshold.
3. DI ending 1055 hrs contained constraint violations that resulted in a violation-based dispatch price that exceeded the market price cap. The automated procedures for detecting a MII use the raw dispatch price determined before the over constrained dispatch price revision and price capping occurs.
4. DI ending 1105 hrs was the first to be identified as “subject to review”.
5. DI 1110 hrs was also identified as subject to review because the previous DI was identified as subject to review and because AEMO had not either accepted or rejected the prices.
6. Ancillary service prices in DI ending 1100 hrs were high as a result of a market response to the high dispatch price in DI ending 1055 hrs.

At 1107 hrs, AEMO rejected all dispatch and ancillary service prices for DIs ending 1105 hrs and 1110 hrs, and these were automatically replaced with the last correct dispatch interval prices from DI ending 1100 hrs in accordance with NER clause 3.9.2B(e).

Appendix 1 lists the sequence of events for this incident.

### **3 Determination of Manifestly Incorrect Inputs**

AEMO’s automated procedures identify a DI as subject to review if the trigger levels have been exceeded, or if the previous interval has been identified as subject to review, the price has either been revised or accepted, and it is less than 30 minutes since the DI has been identified as subject to review. In this way, up to 6 DIs following a trigger can be identified as subject to review.

At 1036 hrs a database failover at Powerlink resulted in a number of items being transmitted to AEMO with a value of zero and incorrectly tagged by Powerlink as good quality. AEMO’s central dispatch systems ignore zero values automatically replace them with the last non-zero rating value received, which was approximately 920 MVA for both lines, instead. At 1049 hrs the ratings of the 855 and 871 lines were transmitted as 10 MVA and incorrectly tagged by Powerlink as good quality. These incorrect quantities were used in central dispatch for DIs ending 1055 hrs and 1100 hrs. Although this was a significant change in ratings which resulted in a significant reduction in the relevant constraint limit, the constraints violated and the change to the interconnector target flows into Queensland was below the threshold level.

At 1057 hrs on advice from Powerlink, AEMO manually changed the ratings of the two lines to 855 MVA. This was used in the central dispatch process and resulted in changes to Queensland dispatch price and Directlink interconnector target flow for DI ending 1105 hrs above trigger thresholds and resulted in that DI being identified as subject to review. AEMO determined that bad data was still being used in the central dispatch process and revised the price for DIs ending 1105 hrs and 1110 hrs. However, subsequent investigation has revealed that no further bad data was used in the central dispatch and that the determination was not correct.

Appendix 1 shows the chronology of the ratings data sent to AEMO during this incident and AEMO’s subsequent actions.

## 4 Scheduling Error

Under clause 3.8.24(a)(3) of the NER, a scheduling error occurs when AEMO determines that a dispatch interval contained a manifestly incorrect input. Accordingly, a scheduling error occurred in DIs ending 1105 hrs and 1110 hrs.

DIs ending 1055 hrs and 1100 hrs contained incorrect inputs that did not trigger the automated procedure, hence the prices for these DIs were not revised and there was no scheduling error, as defined by the NER, in these DIs.

## 5 Further Action

AEMO is investigating the following issues and potential improvements as a result of this incident.

- **Failure of the automated procedures to trigger for DIs affected by the MII**  
The first interval actually affected by the MII was DI ending 1055 hrs. The central dispatch process could not resolve the sudden reduction in the line ratings without violating the relevant constraints, explaining why the change to the Terranora interconnector target flow was below the trigger threshold.
- **Quality of dynamic ratings data from Powerlink.**  
On 17 February 2011, a similar incident occurred with MII relating to the same two lines. That error occurred during testing of a new communications system. AEMO has sought comment from Powerlink on processes for ensuring data quality for dynamic line ratings.
- **Effectiveness of AEMO procedures for managing incorrect inputs**  
AEMO is investigating the extent to which AEMO's procedures are effective and were correctly followed for the incident, and will identify actions required.
- **Effectiveness of the NER provisions relating to manifestly incorrect inputs**  
The incidence of DIs genuinely affected by MIIs is rare. Of the 135 DIs identified as subject to review in 2010, one of those DIs was determined to be genuinely affected by an incorrect input. On the other hand, this incident highlights a genuine MII that did not trigger as subject to review. AEMO is further examining whether the MII procedures should either be reviewed or the price revision requirement removed from the NER.

The results of this review will be published in a separate Market Event Report.

## 6 Conclusions

Incorrect inputs were used in the central dispatch process in DIs ending 1055 hrs and 1100 hrs on Monday 5 September 2011. Neither of these two intervals triggered the automated procedures for detecting MIIs.

The incorrect inputs affected dynamic ratings of the No.871 Calvale–Wurdong No.855 Calvale–Stanwell 275 kV lines in Queensland. As a result Queensland experienced high prices for DI ending 1055 hrs due to operation of constraints that manage contingencies affecting these two lines. AEMO manually changed the ratings of the lines, which resulting in the automated procedures identifying DI ending 1105 hrs (and subsequent DIs, to DI ending 1130 hrs) as subject to review.

AEMO determined that additional incorrect inputs were likely to be affecting central dispatch and rejected prices for DIs ending 1105 hrs and 1110 hrs. Under clause 3.8.24(a)(3) of the NER, a scheduling error has occurred in the two intervals that were the subject of the price revision.

AEMO considers that all incorrect inputs that affected central dispatch were corrected at 1057 hrs by a manual change to the ratings on advice from Powerlink. Accordingly, AEMO concludes the determination of an MII affecting DIs 1105 hrs and 1110 hrs was not correct.

AEMO will publish a Market Event Report outlining the results of its investigation into this incident.

## Appendix 1 Sequence of Events

Table 2 Data and Dispatch Sequence of Events

TIME	EVENT
10:30	Dynamic ratings for 855 and 871 were of the order of 920 MVA
10:36:25	Dynamic ratings for both lines reduced to zero. Value automatically identified as bad quality and previous good values were carried forward.
10:40 (approximately)	Dispatch algorithm run for DI ending 1045 hrs, using the automatically substituted line ratings. Queensland dispatch price: \$28.27/MWh.
10:45 (approximately)	Dispatch algorithm run for DI ending 1050 hrs, using the automatically substituted line ratings. Queensland dispatch price: \$28.54/MWh.
10:49:45	Dynamic ratings from Powerlink for both lines changed to 10 MVA. Values were identified as good quality and used for subsequent dispatch intervals.
10:50 (approximately)	Dispatch algorithm run for DI ending 1055 hrs, using the incorrect line ratings of 10 MVA. Constraint equations managing flows on the two lines violated, causing a Queensland capped dispatch price of \$12,500/MWh. Automated procedures for identifying MIs did not trigger because the change in interconnector flow was below the trigger threshold.
10:50:45	Dynamic ratings from Powerlink for both lines changed to 20 MVA.
10:51:45	Dynamic ratings from Powerlink for both lines changed to 30 MVA.
10:52:45	Dynamic ratings from Powerlink for both lines changed to 40 MVA.
10:53:45	Dynamic ratings from Powerlink for both lines changed to 50 MVA.
10:54:45	Dynamic ratings from Powerlink for both lines changed to 60 MVA.
10:55 (approximately)	Dispatch algorithm run for DI ending 1100 hrs, using the incorrect line rating of 60 MVA. Queensland dispatch price \$91.78.
10:57	AEMO manually changed the line ratings to 855 MVA, which was used in subsequent runs of the dispatch algorithm.
11:00 (approximately)	Dispatch algorithm run for DI ending 1105 hrs, using the manually entered line ratings. Automated procedures identify this DI as subject to review.
11:05 (approximately)	Dispatch algorithm run for DI ending 1110 hrs, using the manually entered line ratings. Automated procedures identify this DI as subject to review.
11:07	AEMO determined that DI ending 1105 and 1110 contained an MI to the dispatch algorithm and replaced all prices with those from DI ending 1100 hrs
11:10 (approximately)	Dispatch algorithm run for DI ending 1115 hrs, using the manually entered line ratings. Automated procedures are reset
14:00 (approximately)	Problem with dynamic ratings rectified and manually entered ratings removed.