

# SCHEDULING ERROR REPORT

Middle Ridge-Tangkam 731 Line Outage:  
19 & 20 November 2009

PREPARED BY: Electricity Market Operations Performance

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## 1 Scheduling Error

In accordance with Rule 3.8.24(a)(2), a scheduling error occurs when AEMO declares that it failed to follow the central dispatch process set out in rule 3.8.

The Middle Ridge-Tangkam 731 110kV line in south-west Queensland was out of service for a planned outage from 07:20hrs, 18 November 2009 to 15:40hrs, 21 November 2009. An outage constraint set was invoked, but a system normal constraint was limiting generation from the Oakey power station for a number of Dispatch Intervals (DIs) during the outage.

AEMO has determined, in accordance with Rule 3.8.24(a)(2), that a scheduling error affected dispatch outcomes for 53 DIs. The periods affected were 19 November 2009 from 14:50 to 17:05hrs, and 20 November 2009 for the majority of the DIs 10:55 to 13:15hrs.

## 2 Introduction

The Middle Ridge-Tangkam 731 110kV line was removed from service for a planned outage. The outage constraint set Q>MRTA\_731, containing the equation  $Q > MRTA_{731}$ , was invoked at 07:20hrs on 18 November 2009 to manage the outage.

During the DIs 12:50hrs and 13:10 to 17:05hrs, 19 November and DIs 10:55 to 13:15hrs, 20 November the Oakey generating units were constrained by the Middle Ridge-Tangkam 731 line outage. New ratings for Middle Ridge-Tangkam 732 110kV line were advised by Powerlink and entered in the Energy Market System (EMS), but both Oakey units remained constrained to ensure that the transmission flows on the 732 line were below the revised ratings.

Further examination revealed the binding constraint was the system normal constraint (Q>MRTA) and not the outage constraint (Q>MRTA\_731). The system normal constraint **uses the minimum rating of both transmission lines 731 and 732**, and since line 731 was not re-rated the new line ratings had no impact on the binding constraint. At 13:10hrs, November 20 the rating for transmission line 731 was changed in the EMS to relieve the binding constraint.

## 3 Event Details

The Middle Ridge-Tangkam 731 110kV was out of service for a planned outage from 07:20hrs, 18 November 2009 to 15:40hrs, 21 November 2009. The outage constraint set Q>MRTA\_731, containing the constraint equation  $Q > MRTA_{731}$ , was invoked at 07:20hrs on 18 November 2009 to manage the outage. As per AEMO procedures, the system normal constraint Q>MRTA remained invoked when the outage constraint Q>MRTA\_731 was applied, on the basis that the system normal constraint equation should be no more restrictive on dispatch outcomes than the outage constraint equation.

The rating of the 732 line was increased from 219MVA to 280MVA at Tangkam and Middle Ridge for the period 12:16 to 17:11hrs, 19 November. Despite the re-rating, the Oakey generating units were constrained during DI12:55 and during DIs 13:10 to 17:05hrs by the system normal constraint equation.

At 17:18hrs the default ratings of 219MVA for the 732 line were restored at Tangkam.

At 10:09hrs the next day, 20 November 2009, the rating of the 732 line 732 was increased from 219MVA to 261MVA at Tangkam as per advice from Powerlink. Despite the re-rating, the Oakey generating units were constrained during DIs 10:55 to 11:30hrs, and again at the end of DI 12:20. At 12:33hrs, as per advice from Powerlink, the rating of the 732 line was further increased to 274MVA at Tangkam, but this had no impact on the dispatch level of Oakey generation.

At approximately 13:00hrs it was discovered that the binding constraint equation was Q>MRTA, i.e the system normal constraint and not the constraint equation invoked for the outage. The system normal

constraint uses the minimum rating of both transmission lines 731 and 732<sup>1</sup>, and since line 731 was not re-rated the system normal constraint was unaffected by this change. At 13:11 Middle Ridge-Tangkam **731** was re-rated from 219MVA to 274MVA and this relaxed the binding system normal constraint at DI 13:20hrs. The periods during which the system normal (Q>MRTA) constraint was binding<sup>2</sup> is shown in Figure 1.

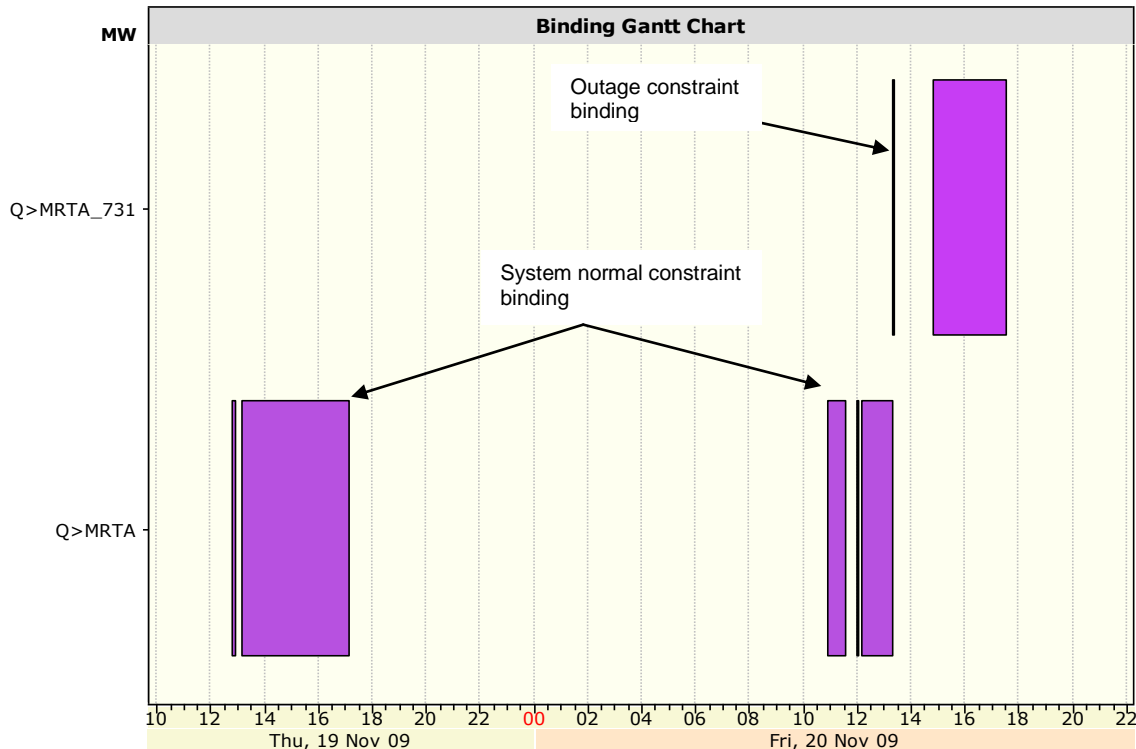


Figure 1 Binding constraints: System Normal and Outage

Also shown in figure 1 are the DIs between 13:20 and 17:30 hrs during which the outage constraint Q>MRTA\_731 was binding. This is considered a correct outcome as this constraint equation uses only the rating of line 732<sup>3</sup>.

During these periods market prices were not materially affected. Accordingly, the changes in regional reference price were insufficient to trigger the Manifestly Incorrect Input procedure set out under Rule 3.9.2B

## 4 Conclusion

During the planned outage of the Middle Ridge-Tangkam 731 110kV line, Oakey generating units were constrained for significant periods over two days due to constraint equation Q>MRTA binding with an inappropriate and conservative limit.

This condition should have come to the attention of AEMO when the marginal cost of the constraint became significant for two consecutive dispatch intervals ie at 14:30 and 14:35 on 19 November. Taking into account the complexity of problem and the demands of other power system issues at the time, it could reasonably be expected to take 15 minutes to determine that the constraint was acting in an overly conservative manner and that it could be removed without threatening system security. After blocking the constraint, it would have taken another 5 minutes for the next dispatch run would set targets.

<sup>1</sup> The formulation of the constraint is provided in Appendix 5.1.

<sup>2</sup> Refer to Appendix 5.2 for a list of dispatch intervals when the constraint Q>MRTA was binding.

<sup>3</sup> The formulation of the constraint is provided in Appendix 5.3

Accordingly, AEMO has determined under Rule 3.8.24 (a)(2) that a scheduling error occurred for the dispatch intervals 14:55hrs to 17:05hrs on 19 November, and the 10:55hrs to 13:15hrs dispatch intervals on 20 November, in which the constraint equation  $Q > MRTA$  was binding.

## 5 Appendices

### 5.1 Formulation of System Normal Constraint $Q > MRTA$

**Constraint:**  $Q > MRTA$   
**Constraint type:**  $LHS \leq RHS$   
**Effective date:** 14/06/2007

#### Constraint description:

Out = NIL, OakeyPS constrained for continuous rating of Middle-Ridge-Tangkam 110kV lines

**Impact:** Qld Generation  
**Source:** Powerlink  
**Limit type:** Thermal

#### Additional Notes:

##### LHS

Oakey GT unit 1  
 + Oakey GT unit 2

##### RHS

Oakey GT unit 1  
 + Oakey GT unit 2

+ ( *Min* ( **Qld: 731 Tangkam to Middle Ridge 110kV continuous rating,**  
**Qld: 732 Tangkam to Middle Ridge 110kV continuous rating**  
 ) )  
 - MVA on 732 110kV feeder from Tangkam, Line end switched MW  
 - MVA on 731 110kV feeder from Tangkam, Line end switched MW

## 5.2 List of Dispatch Intervals Affected

| DI               | Line 731 Rating | Line 732 Rating | Marginal Cost Q>MRTA |
|------------------|-----------------|-----------------|----------------------|
| 19/11/2009 14:50 | 219             | 280             | 8392.74              |
| 19/11/2009 14:55 | 219             | 280             | 7312.87              |
| 19/11/2009 15:00 | 219             | 280             | 6997.77              |
| 19/11/2009 15:05 | 219             | 280             | 4612.44              |
| 19/11/2009 15:10 | 219             | 280             | 56.54                |
| 19/11/2009 15:15 | 219             | 280             | 58.98                |
| 19/11/2009 15:20 | 219             | 280             | 5994.95              |
| 19/11/2009 15:25 | 219             | 280             | 5835.08              |
| 19/11/2009 15:30 | 219             | 280             | 1306.56              |
| 19/11/2009 15:35 | 219             | 280             | 1306.78              |
| 19/11/2009 15:40 | 219             | 280             | 1302.39              |
| 19/11/2009 15:45 | 219             | 280             | 7486.6               |
| 19/11/2009 15:50 | 219             | 280             | 8000.76              |
| 19/11/2009 15:55 | 219             | 280             | 6302.22              |
| 19/11/2009 16:00 | 219             | 280             | 2070.13              |
| 19/11/2009 16:05 | 219             | 280             | 2056.91              |
| 19/11/2009 16:10 | 219             | 280             | 1305.92              |
| 19/11/2009 16:15 | 219             | 280             | 1301.55              |
| 19/11/2009 16:20 | 219             | 280             | 1300.84              |
| 19/11/2009 16:25 | 219             | 280             | 7414.79              |
| 19/11/2009 16:30 | 219             | 280             | 8288.28              |
| 19/11/2009 16:35 | 219             | 280             | 1302.26              |
| 19/11/2009 16:40 | 219             | 280             | 1302.21              |
| 19/11/2009 16:45 | 219             | 280             | 1300.16              |
| 19/11/2009 16:50 | 219             | 280             | 1302.42              |
| 19/11/2009 16:55 | 219             | 280             | 2906.73              |
| 19/11/2009 17:00 | 219             | 280             | 2777.03              |
| 19/11/2009 17:05 | 219             | 280             | 629.15               |
| 19/11/2009 17:10 | 219             | 280             | 0                    |
| 19/11/2009 17:15 | 219             | 280             | 0                    |
| 19/11/2009 17:20 | 219             | 280             | 0                    |
| 19/11/2009 17:25 | 219             | 219             | 0                    |
| 19/11/2009 17:30 | 219             | 219             | 0                    |
| 19/11/2009 17:35 | 219             | 219             | 0                    |
| 20/11/2009 09:55 | 219             | 219             | 0                    |
| 20/11/2009 10:00 | 219             | 219             | 0                    |
| 20/11/2009 10:05 | 219             | 219             | 0                    |
| 20/11/2009 10:10 | 219             | 219             | 0                    |
| 20/11/2009 10:15 | 219             | 261             | 0                    |
| 20/11/2009 10:20 | 219             | 261             | 0                    |
| 20/11/2009 10:25 | 219             | 261             | 0                    |
| 20/11/2009 10:30 | 219             | 261             | 0                    |
| 20/11/2009 10:35 | 219             | 261             | 0                    |
| 20/11/2009 10:40 | 219             | 261             | 0                    |

|                  |     |     |         |
|------------------|-----|-----|---------|
| 20/11/2009 10:45 | 219 | 261 | 0       |
| 20/11/2009 10:50 | 219 | 261 | 0       |
| 20/11/2009 10:55 | 219 | 261 | 123.68  |
| 20/11/2009 11:00 | 219 | 261 | 20.92   |
| 20/11/2009 11:05 | 219 | 261 | 1134.49 |
| 20/11/2009 11:10 | 219 | 261 | 1119.81 |
| 20/11/2009 11:15 | 219 | 261 | 24.5    |
| 20/11/2009 11:20 | 219 | 261 | 1162.33 |
| 20/11/2009 11:25 | 219 | 261 | 85.74   |
| 20/11/2009 11:30 | 219 | 261 | 84.42   |
| 20/11/2009 11:35 | 219 | 261 | 0       |
| 20/11/2009 11:40 | 219 | 261 | 0       |
| 20/11/2009 11:45 | 219 | 261 | 0       |
| 20/11/2009 11:50 | 219 | 261 | 0       |
| 20/11/2009 11:55 | 219 | 261 | 0       |
| 20/11/2009 12:00 | 219 | 261 | 3408.27 |
| 20/11/2009 12:05 | 219 | 261 | 0       |
| 20/11/2009 12:10 | 219 | 261 | 6620.82 |
| 20/11/2009 12:15 | 219 | 261 | 6627.54 |
| 20/11/2009 12:20 | 219 | 261 | 8391.55 |
| 20/11/2009 12:25 | 219 | 261 | 6722.49 |
| 20/11/2009 12:30 | 219 | 261 | 4883.3  |
| 20/11/2009 12:35 | 219 | 261 | 6708.65 |
| 20/11/2009 12:40 | 219 | 274 | 7549.78 |
| 20/11/2009 12:45 | 219 | 274 | 7719.12 |
| 20/11/2009 12:50 | 219 | 274 | 8457.84 |
| 20/11/2009 12:55 | 219 | 274 | 9411.97 |
| 20/11/2009 13:00 | 219 | 274 | 8737.64 |
| 20/11/2009 13:05 | 219 | 274 | 8627.89 |
| 20/11/2009 13:10 | 219 | 274 | 8752.46 |
| 20/11/2009 13:15 | 219 | 274 | 6890.34 |
| 20/11/2009 13:20 | 274 | 274 | 0       |

### 5.3 Formulation of Outage Constraint Q>MRTA\_731

**Constraint:** Q>MRTA\_731  
**Constraint type:** LHS<=RHS  
**Effective date:** 23/02/2004

#### Constraint description:

Out = Middle-Ridge-Tangkam 110kV line 731, Oakey PS constrained for continuous rating of Line 732.

**Impact:** Qld Generation  
**Source:** Powerlink  
**Limit type:** Thermal  
**Reason:** Outage of Middle-Ridge-Tangkam 110kV line 731

#### Additional Notes:

##### LHS

Oakey GT unit 1  
+ Oakey GT unit 2

##### RHS

Oakey GT unit 1  
+ Oakey GT unit 2  
**+ Qld: 732 Tangkam to Middle Ridge 110kV continuous rating**  
- MVA on 732 110kV feeder from Tangkam, Line end switched MW