

# MARKET EVENT REPORT:

## 3 NOVEMBER 2009

High Prices: Queensland and New South Wales

Negative Prices: Victoria, South Australia and  
Tasmania

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## 1. INTRODUCTION

This report has been prepared to explain the unusual market outcomes and circumstances that led to high prices in New South Wales and Queensland and negative prices in South Australia, Victoria and Tasmania on Tuesday, 3 November 2009.

New South Wales experienced high temperatures, reaching 38°C on Tuesday, 3 November 2009. Due to the high demand and the loss of a large generating unit in New South Wales, high prices were recorded in Queensland and New South Wales for a number of Trading Intervals (TIs).

The demand in South Australia and Victoria was lower than usual because of Melbourne Cup Day and cooler weather. The low demand resulted in excess generation in these two states and negative energy prices were recorded in Victoria and South Australia for one TI. Basslink offered its capacity in negatively priced bands for flow towards Victoria for four Trading Intervals. Interconnector flow was towards Victoria for a number of dispatch intervals during one of these TI's, resulting in negative energy prices in Victoria and South Australia for one TI. Tasmania recorded slightly negative prices for two TIs when its excess generation offered in negative price bands could not be exported to Victoria due to binding constraints.

The FCAS (sum of all services) price in Tasmania reached almost \$1000 for one Trading Interval due to a binding FCAS R6 constraint and the co-optimisation of energy and FCAS.

## 2. Pricing Outcomes

### 2.1 Energy Prices

Figure 1 shows the 5-minute dispatch interval energy prices in the NEM.

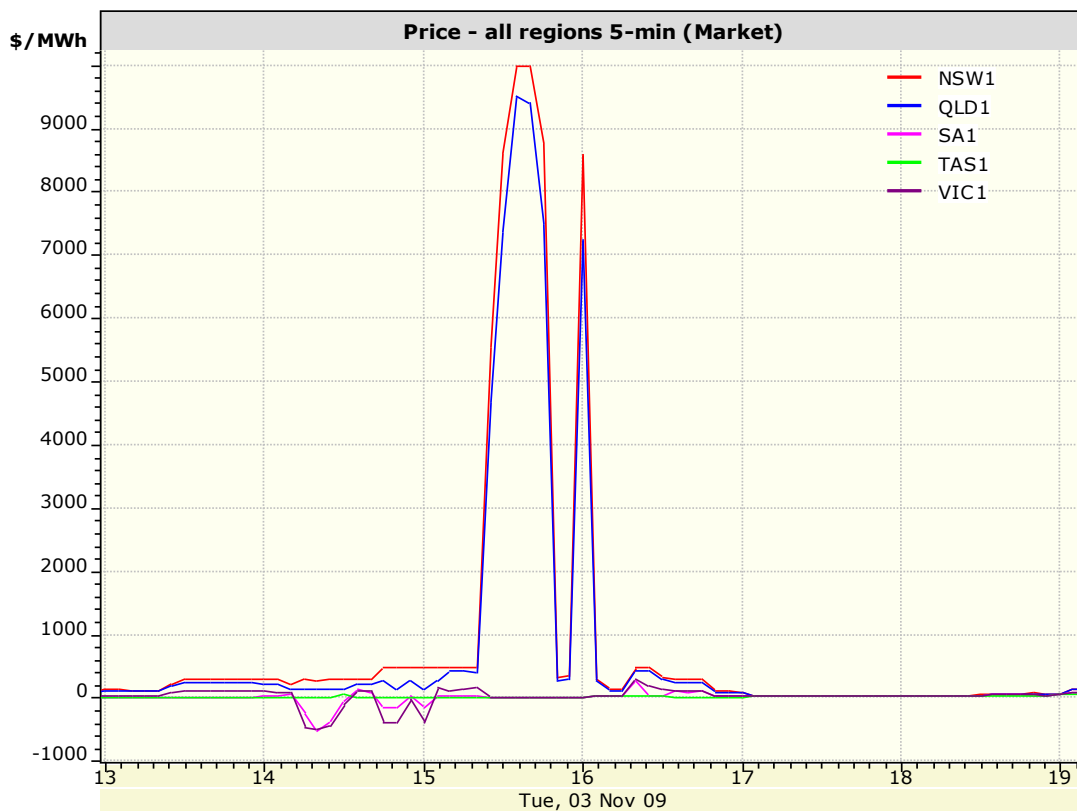


Figure 1 Energy Dispatch Prices in the NEM (\$/MWh)

The 30-minute regional reference prices for each of the NEM regions on 3 November 2009, during TIs 14:30hrs to 16:30hrs are provided in Table 1 below.

TABLE 1: TRADING INTERVAL ENERGY PRICES IN \$/MWh - 3 NOVEMBER 2009

	14:30	15:00	15:30	16:00	16:30
QLD	\$155.24	\$213.90	\$2267.68	\$5706.28	\$277.98
NSW	\$282.67	\$430.83	\$2693.45	\$6337.10	\$317.57
VIC	-\$217.69	-\$150.19	\$102.12	\$0.01	\$121.19
SA	-\$172.88	-\$31.72	\$19.36	\$0.01	\$74.87
TAS	\$23.25	\$11.51	-\$0.40	-\$0.82	\$34.24

Trading intervals where the energy prices are above \$300/MWh or below \$0/MWh are highlighted.

### 2.1.1 New South Wales and Queensland

New South Wales recorded high energy prices during the TIs 15:00 to 16:30hrs on Tuesday, 3 November 2009. Queensland recorded high energy prices for the two TIs 15:30 and 16:30hrs.

New South Wales demand was high due to temperatures reaching 38°C in Sydney. During the TI ending 15:00hrs the high demand in New South Wales was met by clearing generation offers in price bands of \$297/MWh and \$497/MWh, resulting in a New South Wales regional reference price of \$430.83/MWh at 15:00hrs.

At 15:25hrs a binding voltage stability constraint reduced transfer on the VIC-NSW interconnector by 260MW and at 15:30hrs a thermal constraint reduced the flow towards New South Wales by a further 140MW to 750MW. More expensive offers were cleared from New South Wales generators during these two DI's and the price spikes resulted in spot prices of \$2693.45/MWh for New South Wales and \$2267.68/MWh for Queensland, for the TI ending 15:30hrs.

At 15:26hrs Eraring unit 3 tripped from 430MW. New South Wales generation was either dispatched in full or up ramp rate constrained for Dispatch Intervals (DIs) ending 15:35 and 15:40hrs. During these DIs network constraints were limiting flow on the VIC-NSW interconnector towards New South Wales to approximately 700MW, whilst flow from Queensland to New South Wales was limited to approximately 1000MW. A feasible dispatch solution could not be found for the New South Wales region during the dispatch intervals 15:35 and 15:40hrs and these network constraints were briefly violated to meet the New South Wales demand. Dispatch prices reaching the Market Price Cap (MPC) in New South Wales and Queensland for two dispatch intervals, resulting in New South Wales and Queensland energy prices reaching \$6337.10/MWh and \$5706.28/MWh during TI 16:00hrs.

New South Wales and Queensland energy prices lowered to \$317.57/MWh and \$277.98/MWh respectively for TI 16:30hrs. New South Wales demand decreased by approximately 200MW from the previous TI and no constraints violated. Demand was met by clearing relatively high priced offers and prices were set accordingly.

## **2.1.2 Victoria and South Australia**

Victoria and South Australia recorded negative prices during TI 14:30 and 15:00hrs. Demand was low due mild temperatures of about 19°C in both states. Transfer from Victoria to New South Wales on the VIC-NSW interconnector was limited to between 930MW and 1125MW by two thermal constraints. The low demand in the two states and these constraints ensured that the generation offered in the negative price bands in South Australia and Victoria was not cleared in full.

During TI 15:00hrs, Basslink offered its transfer capacity (478MW) at -\$968.20/MWh. NEMDE includes this offer price in its calculation of the optimal dispatch solution, i.e. if a Tasmanian generating unit offers its energy at \$0/MWh, NEMDE will dispatch this unit in preference to any Mainland generator with an offer price of higher than -\$968.20/MWh (ignoring losses). The RRP in Victoria will then be -\$968.20/MWh (\$0/MWh - \$968.20/MWh), assuming the unit is marginal.

The negative Basslink offers caused three DIs (14:45, 14:50 and 15:00hrs) to have negative prices, resulting in negative TI prices of -\$150.19/MWh and -\$31.72/MWh in Victoria and South Australia respectively.

## **2.1.3 Tasmania**

Tasmania recorded slightly negative prices of -\$0.40 and -\$0.82 during TI 15:30 and 16:00hrs respectively. During TI 15:30hrs Basslink flow north was limited by a thermal constraint and during the next TI a binding Tasmanian FCAS L5 constraint required flow on the Basslink to go towards Victoria.

These binding constraints resulted in the excess Tasmanian generation offered at negative prices to not be cleared in full, and the energy price for the Tasmanian region was set accordingly.

## 2.2 Frequency Control Ancillary Services (FCAS) prices

The FCAS (sum of all services) price in Tasmania was \$995.51 for the TI ending 14:30hrs. This was due to a spike in the price of FCAS R6 services at DI ending 14:15 and 14:20hrs. The FCAS R6 price for Tasmania reached \$2855.17 for these two DIs (Figure 2).

FCAS prices for the mainland regions were not affected.

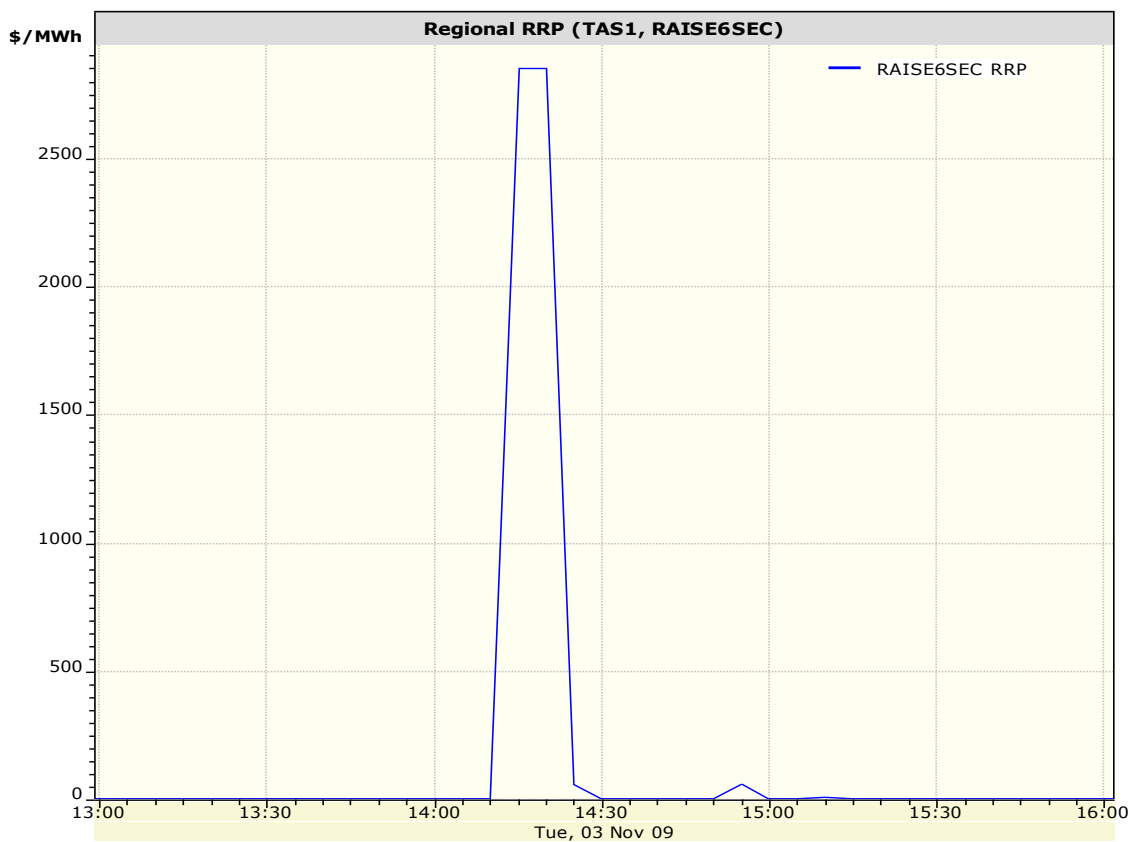


Figure 2 FCAS Raise 6 Second Prices in Tasmania

At 14:15hrs a network constraint (invoked to avoid pre-contingent overloading of the South Morang 500/330kV (F2) transformer) reduced flow from Victoria to Tasmania on Basslink from 220MW to 5MW. The support from Basslink was primarily replaced by two Tasmanian generators, increasing the R6 requirement for Tasmania from 46MW to 71MW. This increased requirement caused an associated FCAS R6 constraint for Tasmania to bind. The constraint was designed to provide adequate R6 services for the disconnection of the Woolnorth and Studland Bay windfarms, for the loss of a Smithton to Woolnorth line. Basslink was in its no-go zone and could not transfer FCAS

services from the mainland. This binding constraint caused the FCAS R6 price to reach \$2855 for DI 14:15hrs. The Woolnorth wind farm reduced its generation from 129MW to 7MW at 14:20hrs as indicated in Figure 3.

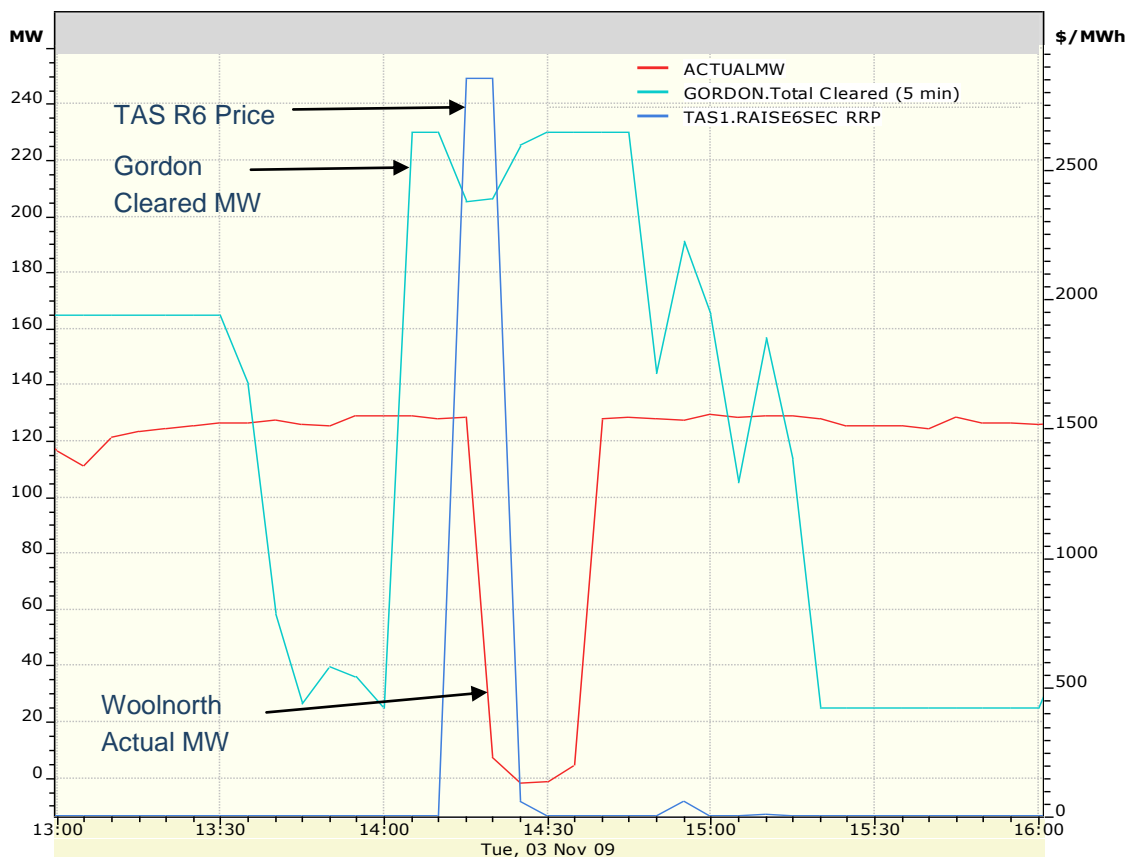


Figure 3 FCAS R6 price and Unscheduled Wind Generation - Tasmania

At 14:20hrs the FCAS R6 requirement was unchanged at 71MW, based on the 14:15hrs SCADA values (Initial MW) and with Basslink still in its no-go zone. Gordon power station was offering 230MW of energy at -\$991.18/MWh, but had to be dispatched down to 205MW to meet its R6 FCAS dispatch target of 20MW, as per its FCAS R6 trapezium. The FCAS R6 price is the marginal cost (i.e. the change in the value of NEMDE's objective function) of procuring an additional 1 MW of R6 FCAS. Since negatively priced energy was backed off the cost of the dispatch solution increased, contributing to the high FCAS R6 prices for the two DIs during which the FCAS R6 constraint was binding.



### 3. Interconnector Flow

Figure 4 shows the target flows and limits for VIC-NSW, Murraylink and Terranorra interconnectors on 3 November 2009.

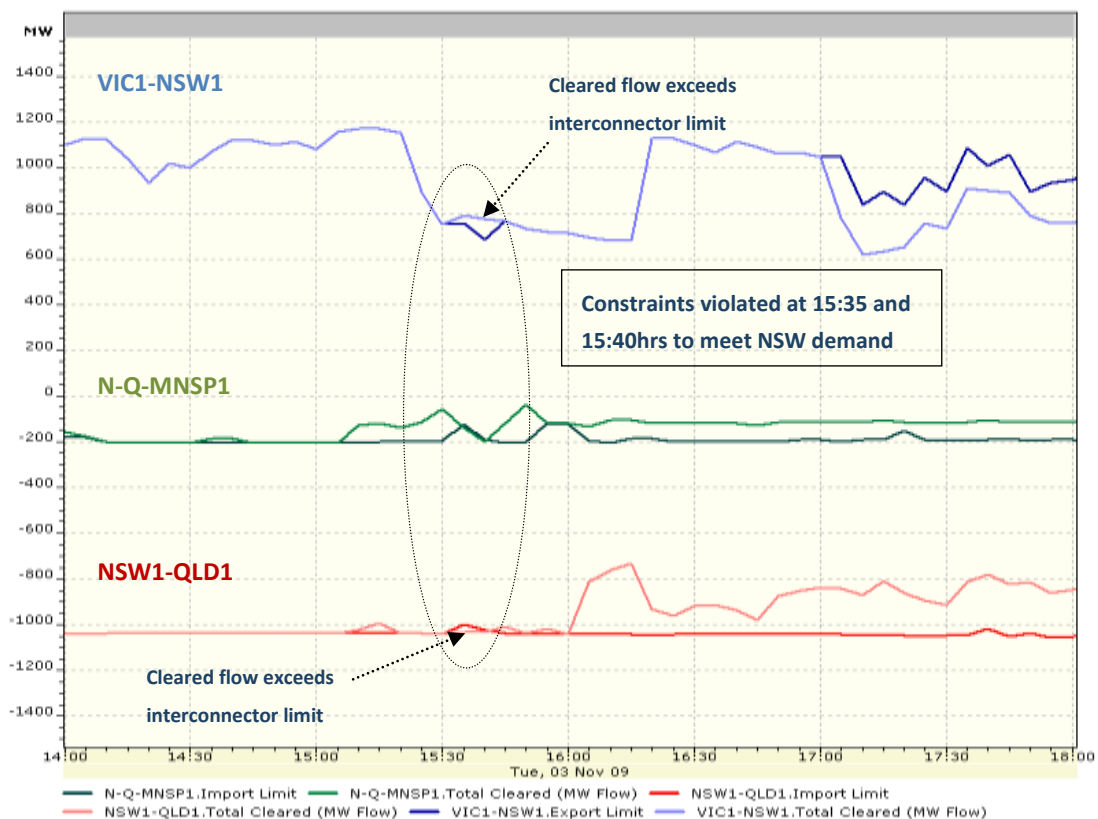


Figure 4 Interconnector Limits and Flows towards New South Wales

The interconnector limits are calculated for each interconnector in turn by assuming that all other variables remained unchanged. Therefore, the same constraint violation can be repeatedly shown in the limits of multiple interconnectors. The target flows on the three interconnectors were predominantly towards New South Wales.

During the TIs 14:30 and 15:00hrs, when Victoria and South Australia recorded negative energy prices, transfer from Victoria to New South Wales was limited by a thermal constraint to avoid pre-contingent overloading of the South Morang 500/330kV F2 transformer.

During TI 15:30hrs prices of \$2693.45/MWh and \$2267.68/MWh were recorded in New South Wales and Queensland respectively. A voltage stability constraint limited flow towards New South Wales on the VIC-NSW interconnection to 893MW during DI 15:25hrs. A thermal constraint, invoked to avoid

the overload of Buangor to Ararat 66kV line for the loss of the Ballarat to Horsham 220kV line, further reduced flow on the interconnector to 751MW during DI 15:30hrs. Cheaper generation in Victoria and South Australia could therefore not be dispatched to replace expensive generation in New South Wales and Queensland. Energy prices in Victoria and South Australia were \$102/MWh and \$19/MWh respectively for this TI. Prices in South Australia were lower than those in Victoria due to the action of the F2 transformer constraint equation, which allowed increased flow from Victoria to NSW when the flow from Victoria to South Australia was similarly increased. The benefit of the additional supply to NSW outweighed the cost of backing off the cheaper South Australian generation, even though a counter-price flow condition emerged on the Heywood interconnector. In accordance with procedures, AEMO acted to manage the accrual of negative residues during TI 15:30hrs by limiting the counter-price flow to 230MW.

During TI 16:00hrs, high prices were recorded in New South Wales and Queensland due to a shortage of generation in New South Wales. Binding system normal thermal constraints (Q>NIL\_757+758\_B and Q>N\_NIL\_8L\_8M) limited south flow on Terranora to 123MW and south flow on QNI to 1000MW during DI 15:35hrs. Flow on VIC-NSW towards New South Wales was limited to a maximum of 755MW by two system normal thermal constraints during DIs 15:35 and 15:40hrs. The purpose of these constraints was to prevent overload of the Yass-Marulan 4 330kV line on trip of the Yass-Marulan 5 line (N>>N-NIL\_1XN), and to avoid overload of the Liddell - Newcastle 81 330kV line on loss of the Liddell - Tomago 82 line (N>>N-NIL\_1E). The Liddell – Newcastle constraint also limited south flow on the Terranora interconnector to 190MW, and south flow on QNI to 1025MW during DI 15:40hrs.

The Yass-Marulan constraint equation (N>>N-NIL\_1XN) was violated for 10 minutes to meet the New South Wales demand, as shown in Figure 4. Constraint equation violation is usually indicated when the interconnector dispatched value exceeds the calculated limit value in magnitude.

## 4. Demand and Temperature

New South Wales and Queensland recorded high energy prices during the Trading Intervals (TIs) 15:00 to 16:30hrs on Tuesday, 3 November 2009. New South Wales regional demand reached 12283MW during TI 16:00hrs, with temperatures reaching a high of 38°C. Temperatures in Melbourne and Adelaide were a very mild 19 °C as shown in Figure 5.

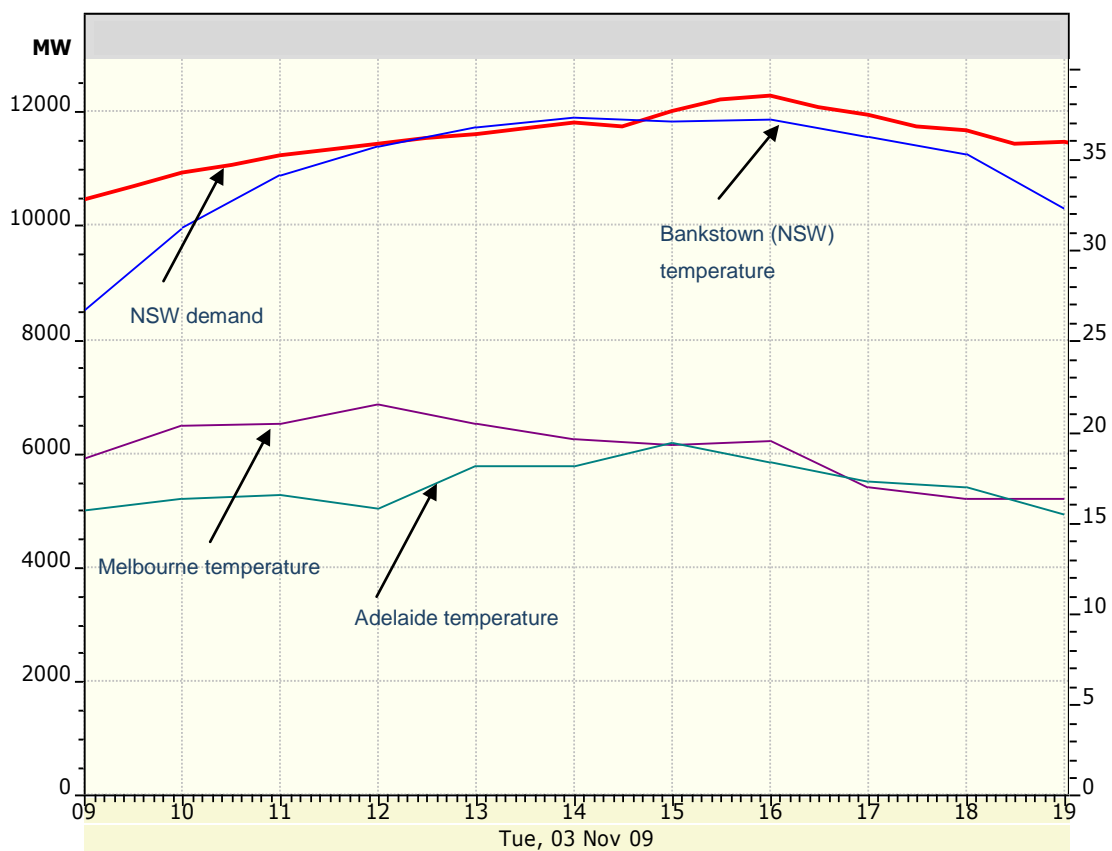


Figure 5 New South Wales Demand and Temperatures

The mild temperatures and the public holiday in Victoria resulted in a low peak demand in Victoria of only 5424MW. The mild temperatures in South Australia resulted in a highest demand of only 1749MW, as can be seen in Figure 6.

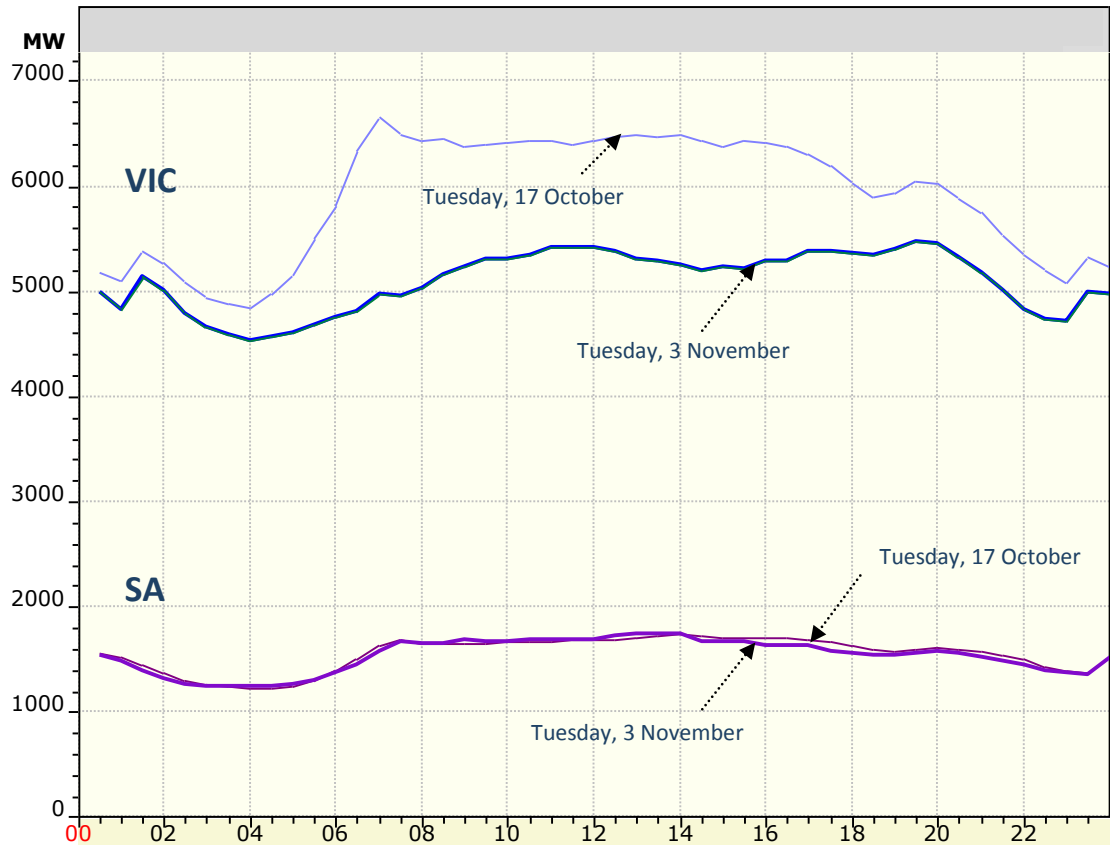


Figure 6 Comparison of Market Demand on Consecutive Tuesdays:  
Victoria and South Australia

Victorian demand was approximately 1150MW (18%) less than the same time the previous Tuesday afternoon, whilst South Australian demand was not markedly different.

## 5. Generating Plant Offers

Figures 7(a) – (c) show the 5-minute bid stacks of the generators in Victoria, South Australia and Tasmania respectively on 3 November 2009.

During TI 14:30hrs approximately 1400MW of generation in South Australia was offered at negative prices (Figure 7a), with wind generation reaching 500MW during the TI.

During TI 15:00hrs approximately 1100MW of generation in South Australia was offered at negative prices, with wind generation reaching 460MW.

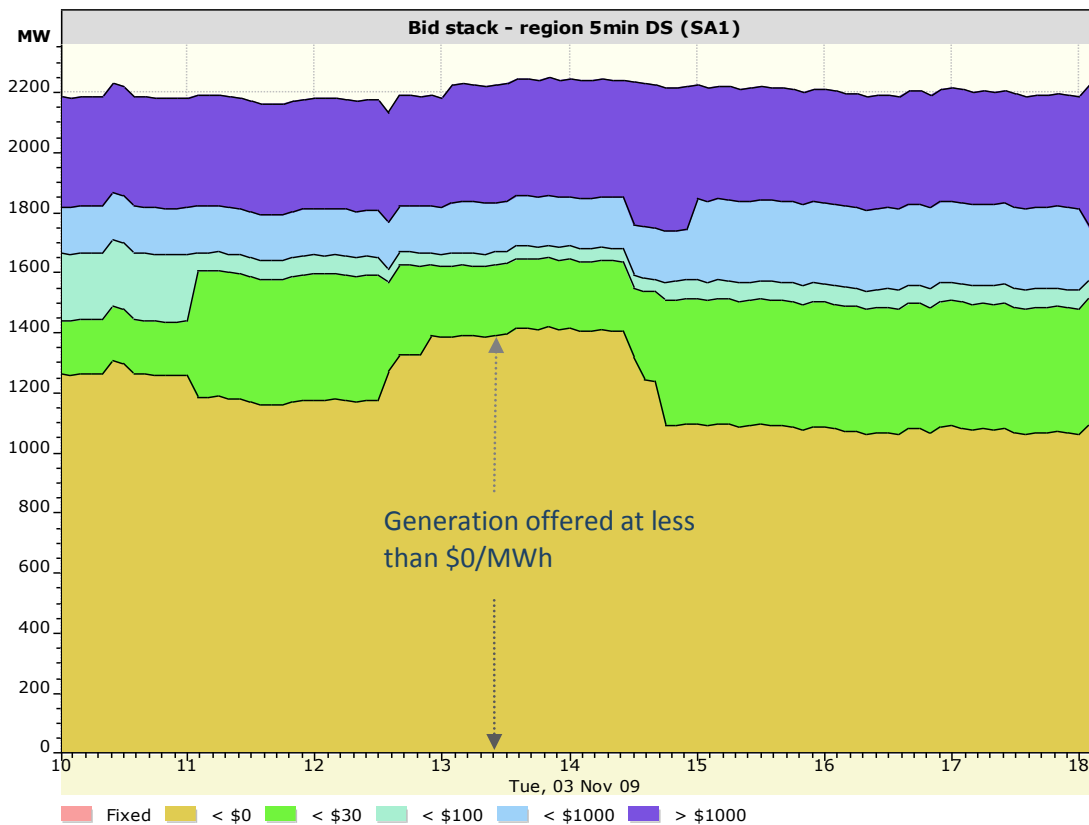


Figure 7(a) South Australia Bid Stack

During TI 14:30hrs and 15:00hrs between 5150MW and 5840MW of generation in Victoria was offered at negative prices (Figure 7b).

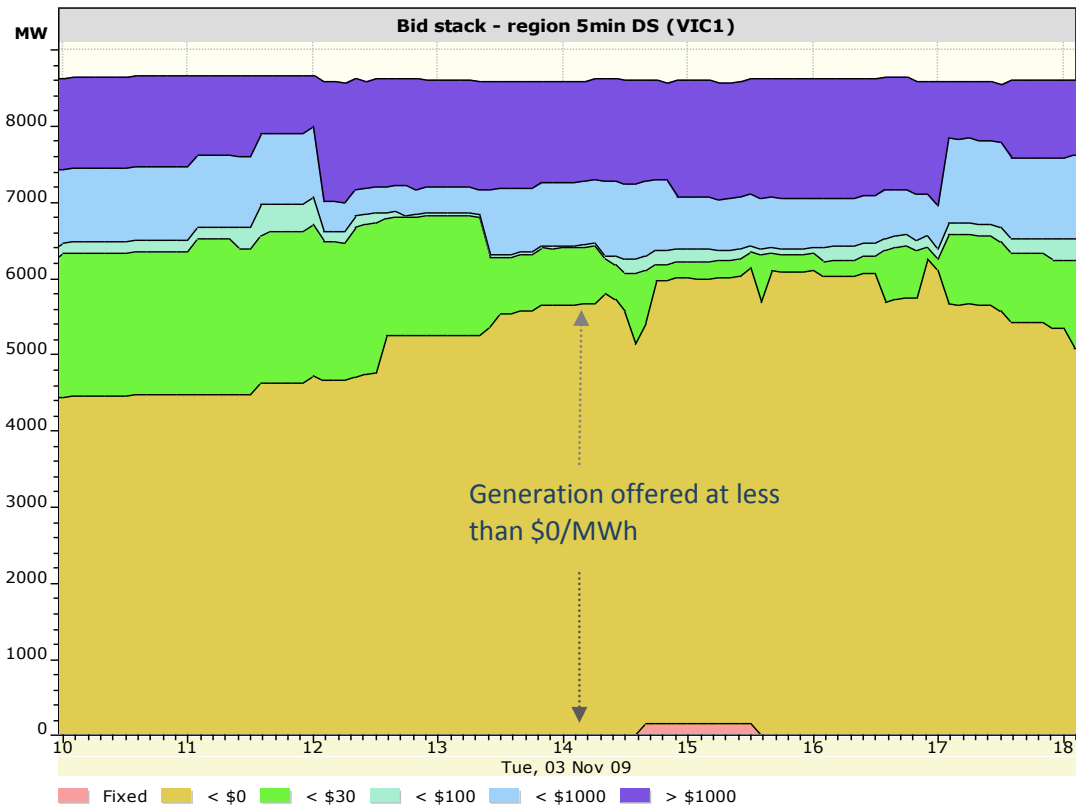


Figure 7(b) Victoria Bid Stack

During TI 14:30hrs over 1100MW of Tasmanian generation was offered at negative prices, and during 15:00hrs this figure increased to 1391MW (Figure 7c).

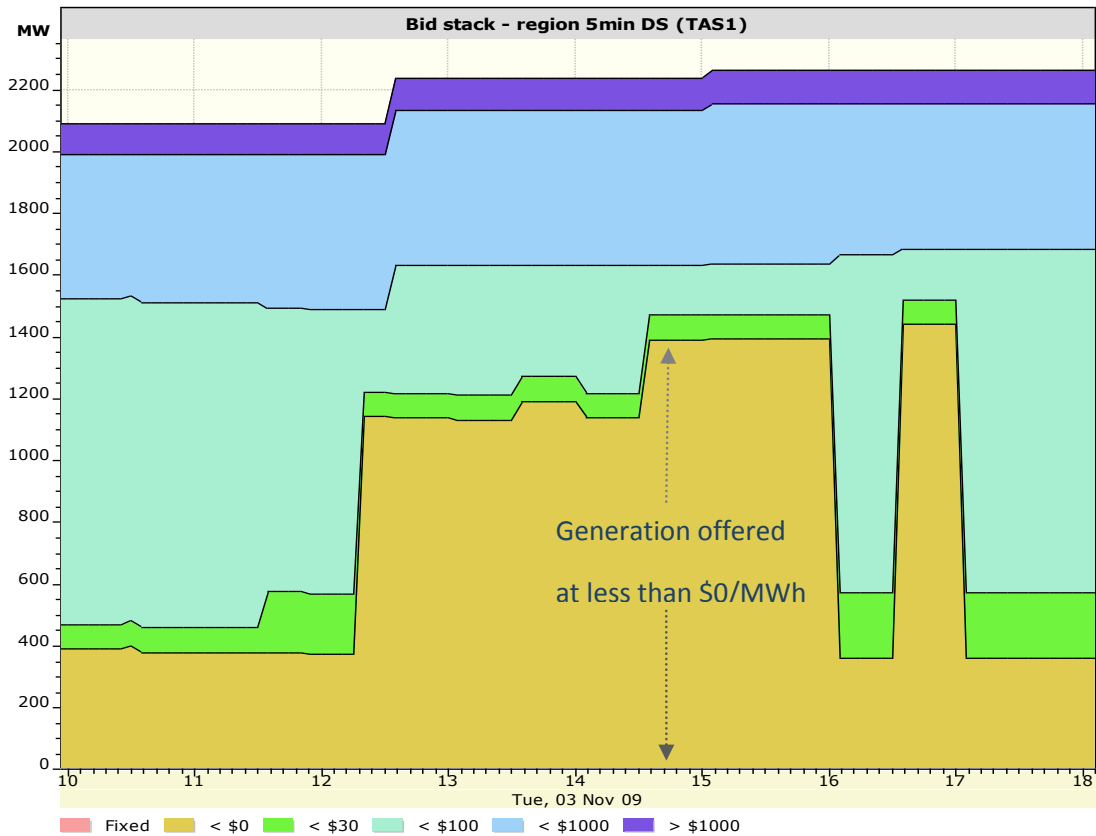


Figure 7c Tasmania Bid Stack

The excess generation offered in the negative price bands in Victoria, South Australia and Tasmania could not be exported to New South Wales due to binding constraints. This resulted in negative regional reference prices (RRP) in South Australia, Victoria and Tasmania for the TI ending 14:30hrs.

## 6. Conclusion

New South Wales and Queensland recorded high energy prices during the Trading Intervals 15:00 to 16:30hrs on Tuesday, 3 November 2009, due to very high temperatures and high demand in New South Wales. The situation was exacerbated by the tripping of 430MW of generation in New South Wales, resulting in prices reaching the Market Price Cap in New South Wales and Queensland for two Dispatch Intervals.

Victoria and South Australia recorded negative prices during TIs 14:30 and 15:00hrs due to low demand and mild temperatures of about 19°C in both states. The low demand in the two states and a number of binding constraints ensured that the generation offered in the negative price bands in South Australia and Victoria was not cleared in full. During TI 15:00hrs Basslink offered 200MW of its capacity in price bands of - \$968.20/MWh, whilst flow on Basslink was towards Victoria. This contributed to the negative regional reference price in Victoria.

Tasmania recorded slightly negative energy prices during TIs 15:30 and 16:00hrs. Flow towards Victoria on Basslink was limited due to a binding thermal constraint equation during TI 15:30hrs, and a binding FCAS Raise 6 second constraint constrained flow towards Tasmania during TI 16:00hrs, resulting in excess generation in the negative price bands not cleared in full.

The FCAS (sum of all services) price in Tasmania was \$995.51 for the TI ending 14:30hrs, due to a shortage of FCAS R6 services in Tasmania. A generator offering negatively priced generation was dispatched down to clear the generator for R6 services, increasing the FCAS R6 price in Tasmania. During the DIs 14:15 to 14:25hrs FCAS prices returned to typical values when the wind farms setting the FCAS R6 requirement reduced their output from 129MW to 0MW.

Outcomes appear to be consistent with the dispatch offers and power system conditions during these events.



## Appendix A – Glossary of Abbreviations

ABBREVIATION	MEANING
DI	Dispatch Interval
FCAS	Frequency Control and Ancillary Services
FCSPS	Frequency Control Special Protection Scheme
R6	Raise 6 second FCAS
MPC	Market Price Cap (\$10,000/MWh)
NEMDE	National Electricity Market Dispatch Engine
QNI	NSW1-QLD1 Interconnector
RRP	Regional Reference Price
TI	Trading Interval