AUSTRALIAN ENERGY REGULATOR

Final

The events of 16 January 2007

Investigation Report

September 2007

Contents

Glossary

AEMC	Australian Energy Market Commission
AER	Australian Energy Regulator
AGC	Automatic Generation Control
CFA	Country Fire Authority
DOF	Demand Offset Facility
DSE	Department of Sustainability and the Environment
FCAS	Frequency control ancillary services
NGF	National Generators Forum
JSSC	Jurisdictional System Security Coordinator
MW	Megawatt
NECA	National Electricity Code Administrator
NEL	National Electricity Law
NEM	National Electricity Market
NEMDE	National Electricity Market Dispatch Engine
NEMMCO	National Electricity Market Management Company
NER	National Electricity Rules
NSP	Network Service Provider
TNSP	Transmission Network Service Provider
VoLL	Price cap or Value of Lost Load

1 Executive Summary

1.1 The AER's investigation

On 16 January 2007, bushfires in the north east of Victoria caused fully loaded 330kV transmission lines between Victoria and New South Wales to trip. The event also caused transmission lines between South Australia and Victoria to trip, resulting in the separation of the national power system into three electrical islands. A major imbalance between supply and demand followed, which led to the activation of the Victorian automatic under-frequency load shedding scheme. Around 2200MW of load was shed. Load was fully restored within four hours.

In February 2007, the Australian Energy Regulator (AER) published a "$5000 report",[1] which explained market outcomes on 16 January. This report considers whether registered participants and the National Electricity Market Management Company (NEMMCO) complied with the National Electricity Rules (NER) on 16 January. It follows a detailed investigation.

1.2 Main findings and outcomes

Most aspects of the power system worked well on 16 January, despite the extensive shocks caused by the transmission failure and the resulting disruption. The power system remained stable even though 2200MW, or around a quarter of the load in Victoria, was disconnected. As frequency fell, load was automatically shed as intended. Load shedding together with the frequency control ancillary services (FCAS) market proved effective in stabilising frequency. Protection and control schemes also largely operated in accordance with design. The technical performance of most generators was acceptable.

However, this report identifies a number of shortcomings in NEMMCO's systems and processes. In particular:

- On 16 January, NEMMCO applied assessment criteria to determine whether to reclassify the risk of a transmission failure that appear to be inconsistent with its approach when similar bushfire conditions prevailed earlier during the summer of 2006-2007

- NEMMCO was not sufficiently transparent about its reclassification process and criteria

- NEMMCO managed the load restoration process poorly, compromising its ability to meet its system security obligations

- NEMMCO set the dispatch price to VoLL before the conditions in clause 3.9.2 of the NER had been satisfied

[1] Under clause 3.13.7(d) of the NER, the AER is required to publish a report when the spot price exceeds $5000/MWh.

- NEMMCO directed generation on following the transmission line failure, but failed to apply intervention pricing as required by clause 3.9.3 of the NER.

The AER identified two Rule breaches by NEMMCO, but will not take enforcement action since no penalties apply to the provisions in question. Rather, the AER is proposing Rule changes and modifications to NEMMCO's procedures, which the AER considers will be a more effective way to address the identified shortcomings. In part, the AER's proposals reflect the outcomes of reviews already undertaken by NEMMCO.

This report also identifies instances of non-compliance with the NER by participants other than NEMMCO. A number of compliance and enforcement outcomes flow from the findings, and are discussed in more detail in the report.

The AER's main findings and conclusions are summarised below together with the AER's enforcement response.

Reclassification of non-credible contingency events

The national electricity market (NEM) is operated to withstand "credible contingency events" but not lower probability "non-credible contingency events".

The concurrent loss of both 330kV transmission lines linking Victoria to Snowy and New South Wales is normally considered as a non-credible contingency event and was not reclassified as a credible contingency on 16 January by NEMMCO.

The AER is of the view that NEMMCO's reclassification process on 16 January was non-transparent and unduly relied upon the advice of SP AusNet. The AER also considers that NEMMCO's approach towards reclassification of the risk of a transmission failure appears to have been inconsistent with its approach on 11 and 14 December.

The AER is not confident that the decision not to reclassify on 16 January was appropriate given the lack of transparency and inconsistency in NEMMCO's reclassification process and criteria. Nevertheless, the AER is aware that NEMMCO's task in deciding whether or not to reclassify was made more difficult by conflicting information from SP AusNet about the risk the bushfires posed to the lines.

Under clause 4.2.3(f), NEMMCO has the discretion to reclassify contingency events when abnormal conditions arise, but is not obliged to do so in such circumstances. Accordingly, NEMMCO did not breach that clause on 16 January by not reclassifying the loss of the two 330kV transmission lines. However, reclassification would have allowed NEMMCO to introduce measures to reduce Victoria's dependence on electricity imported using the transmission lines in question. A reduced reliance on imports would have reduced (but not eliminated) the impact of the transmission line failure, including the extent of load shedding in Victoria.

The AER will propose a Rule change to clause 4.2.3(f) to make it clear that NEMMCO has full responsibility for the reclassification process and decisions and to make the reclassification process more transparent, rigorous and consistent.

Load shedding

When power system frequency falls below 49Hz, under-frequency load shedding systems are automatically triggered to protect the power system, which causes interruption of supply to customers.[2] While NEMMCO oversees the load shedding process, each jurisdiction (the Jurisdictional System Security Coordinators or JSSCs) is responsible for determining the sequencing of load shedding blocks. The owners of the affected transmission and distribution assets implement the load shedding process in accordance with NEMMCO's instructions and the applicable load shedding sequence.

On 16 January, following separation of the national power system into three electrical islands, the Victorian island had a net supply/demand deficit. This resulted in a frequency imbalance in that island, which triggered automatic under-frequency load shedding.

The automatic load shedding system in Victoria mostly performed as intended. Nevertheless, two load blocks out of 19 for which the relevant Victorian transmission asset owner - SP AusNet - was responsible, did not fully activate as planned. The reason for the failure was that parts of those load blocks had been disabled by SP AusNet while substation works were being undertaken. When the two load blocks failed to fully shed, another load block was shed in their place.

The AER found that the failure of the relevant load blocks to fully shed was not the result of a breach by SP AusNet of the relevant NER provisions and performance standards regarding the operation of its load shedding facilities. Rather, the facilities were disabled due to upgrading/refurbishment work. Nevertheless, as part of the AER's ongoing review of all NSPs' protection and control systems, the AER intends to target SP AusNet's protection and control systems and load shedding facilities in the upcoming round of compliance audits, which will be undertaken in the latter part of 2007.

SP AusNet may have failed to communicate or, at least, adequately communicate the unavailability of the parts of the relevant load blocks to NEMMCO and VENcorp, the body responsible for the load shedding schedule in Victoria. In certain circumstances, failures of this sort could affect the secure operation of the power system, for example, if NEMMCO and the relevant jurisdictional body had not been notified of widespread unavailability of load blocks for shedding. Failure to notify in these cases would result in a breach of clause 4.8.1 of the NER, which obliges participants to notify NEMMCO (or a System Operator) of any circumstance that could adversely affect the secure operation of the power system.

Accordingly, the AER recommends the establishment of formal and effective communication processes between all parties involved in load shedding to ensure that appropriate action can be taken. The AER requires NEMMCO to report back to the AER and to the market in general by the end of 2007 on the amended arrangements.

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[2] Circuit breakers are activated as frequency falls, disconnecting customer load. The load that is disconnected each time a circuit breaker is activated is referred to as a load block. In Victoria, the blocks are typically relatively large, for example one or a number of suburbs.

Load restoration

When load shedding has occurred and once the power system is considered secure, load restoration commences. The load restoration process is managed by NEMMCO. To assist in the process, NEMMCO has developed a Demand Offset Facility (DOF), which allows staff to manually input anticipated demand increases as load restoration occurs. The market dispatch process, NEMDE, can then increase supply to match the demand increases in accordance with clause 3.8.1(a), which requires NEMMCO to balance supply and demand using reasonable endeavours to maintain power system security.

There were deficiencies in NEMMCO's management of the load restoration process on 16 January. In particular, NEMMCO did not use the DOF, which resulted in demand being under-forecast and insufficient generation dispatched. In turn, this resulted in a recurrence of low frequency and NEMMCO was required to shed more customer load.

NEMMCO's failure to use the DOF during the load restoration process highlights the importance of integrating emergency power system management tools and processes with market systems designed primarily for steady state conditions. Further, it highlights the need for testing and simulations to ensure that those tools and processes are functional and effective under emergency conditions.

The AER considers that NEMMCO's failure to ensure its systems and processes operated effectively during the load restoration process compromised its ability to satisfy clause 3.8.1(a) of the NER. NEMMCO's failure also compromised its ability to comply with clauses 4.3.1, 4.3.2 and 4.2.6(a). These clauses require NEMMCO to use its best endeavours to maintain system security.

NEMMCO has committed to a review of its procedures and staff training program to ensure that its emergency systems operate as intended in assisting with restoration of load. The AER supports the measures NEMMCO is taking to address inadequacies with the load restoration process. The AER requires NEMMCO to report to the AER and the market by the end of 2007 with details of implemented changes.

Setting the dispatch price to VoLL

The NER requires NEMMCO to set the dispatch price to $10,000/MWh (the price cap, otherwise known as the value of lost load or VoLL) when manual load shedding occurs. The same obligation applies in the case of automatic load shedding that has been triggered by a contingency event, provided that the power system has first been allowed to return to a secure state and that there is an ongoing supply shortfall.

On 16 January, NEMMCO set the dispatch price to VoLL during the load restoration process following automatic load shedding. At the time, the conditions governing the application of VoLL in clause 3.9.2 had not been satisfied. On the basis of the conditions contained in clause 3.9.2, NEMMCO may have been at least half an hour premature in setting the dispatch price to VoLL. Therefore, at the time VoLL was imposed, NEMMCO failed to comply with clause 3.9.2.

NEMMCO's failure to comply with clause 3.9.2 on 16 January and on previous occasions,[3] emphasises the difficulty associated with the assessment required by the clause. The assessment is complex and subjective and is normally undertaken in the context of extreme market conditions. The AER considers that clause 3.9.2 is an unnecessary distraction for NEMMCO when it has more urgent system security issues to deal with.

Accordingly, the AER will propose a Rule change recommending the removal of the obligation on NEMMCO to set the dispatch price to VoLL following automatic load shedding resulting from a contingency event. This means the market would determine the spot price when automatic load shedding occurs.

Intervention pricing

Under the NER, NEMMCO has the power to issue directions to participants where necessary to maintain or re-establish security of the power system. For example, NEMMCO can direct generators to switch on or increase output. When the directions relate to a system security issue that affects more than a localised part of the NEM, NEMMCO is obliged to apply intervention pricing under clause 3.9.3 of the NER to avoid price distortion. The intervention price is NEMMCO's estimate of the price that would have prevailed if the direction had not been issued.

On 16 January, NEMMCO issued a number of directions to participants in the Victorian and South Australian regions but did not apply intervention pricing. The AER considers that NEMMCO's failure to use intervention pricing in those cases amounted to a breach of clause 3.9.3. In its report on the events of 16 January, NEMMCO admitted that it did not use intervention pricing under clause 3.9.3 when it should have.

In its report, NEMMCO also made recommendations to improve processes and training for staff responsible for the application of intervention pricing. The AER fully supports those recommendations. In addition, the AER will seek an undertaking from NEMMCO obliging it to take all steps necessary to ensure that clause 3.9.3 will not be breached in the future and to report to the AER and to the market by the end of 2007 with details of the measures it has taken.

Technical performance standards

The NER obliges registered participants to comply with certain technical performance standards. Among other things, generators are required to ensure "continuous uninterrupted operation" of their plant and equipment in the event of a power system disturbance.

At least one generator breached its technical standards obligations under Chapters 4 and 5 on 16 January. However, this occurred during a transitional phase in which pre-existing performance standards were being reviewed and formalised. Furthermore, in the case of the possible breach, NEMMCO's report indicates that the generator trip in

[3] The previous occasions are detailed later in this report.

question actually assisted in re-stabilising the power system.[4] The AER does not intend to take enforcement action for failure by generators to comply with the technical performance standard requirements in the NER on 16 January. The AER is satisfied that the post-event reviews of the incident by the participants involved, and the commitment to incorporate the lessons learnt from this extreme event into their respective compliance programs, will help to reduce the likelihood of under-performance in the future. However, now that the transitional phase has ended, the AER will commence auditing generators' performance standards compliance programs to assess compliance with the relevant provisions of Chapters 4 and 5 of the NER. The AER will act on failure by generators to comply with the technical performance standard requirements in the NER.

A number of generators operate under derogations in Chapter 9 of the NER. These derogations apply less onerous technical performance standards, including in cases when a power system disturbance has occurred. The events of 16 January highlight the need for generating units to be able to ride through disturbances to the power system. The application of less exacting technical standards to some Victorian generators through Chapter 9 derogations has the potential to compromise system security. On 16 January, two generators in Victoria tripped without breaching the derogations.

Now that all generators have registered the actual capability of their plant and equipment with NEMMCO, the derogations related to those standards appear to have become redundant. The AER will recommend that the Victorian government remove the Chapter 9 derogations relating to generator technical standards. Given that similar derogations exist in Queensland, the AER will make the same recommendation to the Queensland government.

Provision of frequency control ancillary services

Clause 4.9.9B of the NER provides that a participant that has classified a load as an ancillary service load must notify NEMMCO of any event that has changed or is likely to change the availability of the service, as soon as the participant becomes aware of the event. Similarly, the participant must notify NEMMCO if the capability of the load to respond in the manner contemplated by the Market Ancillary Service Specification changes or is likely to change.

On 16 January, a total of 880MW of aluminium smelter load at Point Henry and Portland was interrupted as a result of either a commercial decision or in response to the low frequency prevailing during the disturbance. None of the smelter load was available to provide FCAS for 36 minutes from 3.10pm.

The failure of Vicpower Trading to rebid the ability of Point Henry potlines to provide FCAS following the tripping of the load or unavailability of the load for commercial reasons probably amounts to a breach of clause 4.9.9B. The potential breach is particularly significant given that Vicpower Trading's FCAS offer, which it failed to honour, was dispatched by the market systems. The AER will be pursuing this matter directly with Vicpower Trading.

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[4] Power System Incident Report: System Separation and Load Shedding 16 January 2007, p. 58.

Under the NER, participants that provide FCAS are obliged to ensure that the plant and equipment used to supply such services comply with certain technical requirements. In addition, the NER obliges such participants to ensure that they can meet their offers for the provision of FCAS at all times.

NEMMCO's initial factual findings suggested that TRUenergy SA Generation failed to comply with clause 3.11.7(a) and aspects of NEMMCO's Market Ancillary Service Specification relating to monitoring equipment with respect to Torrens Island B (of which it was the owner on 16 January). The AER intends to seek further clarification from NEMMCO concerning the factual circumstances surrounding this and the other instances[5] of apparent failures to perform in accordance with FCAS specifications that occurred on 16 January.

Compliance with clause 4.9.8(d) and the relevant provisions of NEMMCO's Market Ancillary Service Specification is important for system security. These issues will be treated as a high priority in the AER's compliance audit program, which will commence later in 2007. The generators that failed to comply with the relevant FCAS requirements on 16 January will be targeted for audits in the first instance.

[5] The other instances are detailed later in this report.

Table 1: Summary of main findings and outcomes

Issue	Finding(s)	Proposed enforcement outcomes/other action	Participant(s) directly affected
Reclassification of non-credible contingency events	NEMMCO's reclassification process on 16 January was non-transparent and unduly relied upon the advice of SP AusNet, which was contradictory at times NEMMCO's approach towards reclassification of the risk of a transmission failure appears to have been inconsistent with its approach on 11 and 14 December	AER to propose Rule change to clause 4.2.3(f)	NEMMCO
Load shedding	SP AusNet may have failed to adequately communicate the unavailability of the relevant load blocks to NEMMCO and the JSSC	AER recommends formalising communication obligation in arrangements between NEMMCO, JSSCs and NSPs regarding load shedding	NEMMCO, JSSCs, NSPs
	SP AusNet did not breach the performance standards relevant to the operation of its load shedding facilities	AER to undertake compliance auditing of SP AusNet's protection and control systems	SP AusNet
Load restoration	NEMMCO's failure to use effective systems and operational tools during the load restoration process compromised its ability to satisfy its system security obligations	NEMMCO to report to the market by end 2007 on improved load restoration procedures and training	NEMMCO
Setting dispatch price to VoLL	NEMMCO breached the relevant provisions of the NER by setting the dispatch price to VoLL before the NER requirements had been satisfied	No enforcement action AER to propose Rule change to clause 3.9.2	NEMMCO
Intervention pricing	NEMMCO breached its obligation to apply intervention pricing after it issued directions	NEMMCO to provide an undertaking regarding compliance with clause 3.9.3	NEMMCO

Issue	Finding(s)	Proposed enforcement outcomes/other action	Participant(s) directly affected
Compliance with technical performance standards	Derogations in Chapter 9 of the NER apply less exacting technical standards than are otherwise applicable, including in cases when a power system disturbance has occurred. Chapter 9 derogations are redundant following registration of generators' actual technical capability with NEMMCO	AER will recommend to the Victorian and Queensland governments that technical standards derogations be removed from the NER	Victorian and Queensland Generators
	It appears that at least one breach of generators' technical standards occurred on 16 January	No enforcement action AER to undertake auditing of technical performance compliance programs	Generators
Provision of FCAS	Vicpower Trading probably breached its obligation to rebid its FCAS offer	AER to follow-up with participant	Vicpower Trading
	Further clarification of circumstances surrounding failure to comply with FCAS specifications by generators is needed	AER to undertake auditing of generators' FCAS performance	Generators and other providers of FCAS

1.3 Next steps

A number of participants are directly affected by the AER's findings, recommendations and enforcement actions, including NEMMCO, SP AusNet, generators and a market customer. Where improvements to operating practices and processes have been recommended, the AER will require affected parties to work to enhance outcomes and to report on progress. Many of the report's findings and recommendations affect NEMMCO. The AER will require NEMMCO to undertake improvements to ensure that the failures that occurred on 16 January are not repeated.

2 Introduction

2.1 Scope of the report

This report reviews the operation of the NEM on 16 January 2007, when around 2200MW of load in Victoria was shed after transmission lines between Victoria and New South Wales failed because of bushfires. Smoke and fire are good conductors and together caused the transmission lines to trip, preventing the flow of electricity on the lines.

The transmission lines were running at capacity, with electricity being supplied to Victoria from neighbouring regions. Once the transmission lines tripped, there was an immediate shortage of electricity supply in Victoria and load was automatically shed as frequency fell. Load was fully restored around four hours after the transmission lines tripped.

The event also caused transmission lines between Victoria and South Australia to trip, resulting in the separation of the national power system into three electrical islands (South Australia, Victoria/Tasmania and Queensland/New South Wales/Snowy). Victoria and South Australia were reconnected within one hour, and New South Wales was fully reconnected to Victoria after around eight hours.

The AER has reviewed this incident to determine whether registered participants and NEMMCO complied with the NER on that day.

2.2 AER functions and powers

The enforcement functions and powers of the AER are set out in section 15 of the National Electricity Law (NEL), which provides:

> The AER functions and powers include:
>
> (a) to monitor compliance by Registered participants and other persons with this Law, the Regulations and the Rules; and
>
> (b) to investigate breaches or possible breaches of provisions of this Law, the Regulations or the Rules that are not offence provisions; and
>
> (c) to institute and conduct proceedings:
>
> (i) against relevant participants under section 61 of this Law or section 44AAG of the Trade Practices Act 1974 of the Commonwealth; or
>
> (ii) in respect of Registered participants under section 63 of this Law; or
>
> (iii) against persons under section 68 of this Law; and
>
> (d) to institute and conduct appeals from decisions in proceedings referred to in paragraph (c); …

The AER fulfils these functions by engaging in ongoing monitoring of the operation and performance of the NEM and by conducting special investigations in response to market outcomes and/or specific events. This report is the product of the AER's investigation into the events of 16 January 2007.

3 Description of the event

The NER requires NEMMCO to publish a power system incident report whenever a major incident affects the operation of the power system.[6] NEMMCO's Power System Incident Report for 16 January provides a detailed assessment of the sequence of events of that day. VENCorp, the Victorian transmission network planner, also published a report into the events of the day. The summary of the events set out below is based on those reports.

Demand

On 16 January 2007, high temperatures across New South Wales, Victoria and South Australia saw the demand for electricity across the NEM reach a record high of 31,720MW at 3.00pm (market time).[7] A new record of 9012MW occurred in Victoria at the same time. In South Australia, demand peaked at 2813MW soon after, only 60MW short of the record.

The record demand in Victoria and market conditions resulted in significant imports from neighbouring regions with all of the transmission interconnectors into Victoria at near full capacity by 3.00pm.

Outage of interconnectors

When the events of 16 January took place, Victoria had been experiencing a severe bushfire season, with continuous fire activity over December and January. Between December and January, bushfires had affected the transmission network on six separate occasions.

On 16 January, the following transmission lines tripped out of service in quick succession from 3.02pm:

- Dederang to South Morang (DDTS-SMTS) Nos. 1 and 2, 330kV transmission lines
- Dederang to Eildon[8] (DDTS-EPS) No. 1, 220kV transmission line
- Eildon to Mt Beauty (EPS-MBTS) No. 2, 220kV transmission line
- Buronga to Darlington Point (X5) 220kV transmission line
- Bendigo to Shepparton (BETS-SHTS) 220kV transmission line

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6 Clause 4.8.15 of the NER.

7 Unless explicitly indicated otherwise, all references to time in this report are references to market time. Market time does not factor in daylight savings, so was one hour behind Eastern Summer Time on 16 January.

8 As at 16 January 2007, the Eildon-Mt Beauty 220kV line and Mt Beauty-Dederang 200kV line had been temporarily reconfigured into one continuous line between Eildon and Dederang as part of augmentation work.

- Heywood to South East (HYTS-SESS) Nos. 1 and 2, 275kV lines

The two Dederang to South Morang 330kV transmission lines tripped due to a bushfire in the Tatong area in northern Victoria. According to SP AusNet, the owner of the transmission lines, the most probable cause of the trip was that "thick smoke, flame and debris thrown up by the intense wildfire burning (probably in pine plantations on either side of the lines) caused a phase to earth fault". The power flow from these lines was re-distributed to the various 220kV lines connecting New South Wales to Victoria. However, those lines could not sustain the load and tripped. The resulting increased flow from South Australia through the Heywood interconnector could not be sustained either, resulting in those lines tripping.

This multiple contingency event resulted in the separation of the power system into three electrical islands comprising:

- Queensland, New South Wales, Snowy and part of northern Victoria
- The remainder of Victoria and Tasmania
- South Australia

Load shedding

Separation of the network into three electrical islands resulted in a major imbalance between supply and demand in Victoria,[9] which led to a reduction of around 2200MW of customer demand, largely through the operation of the Victorian automatic under-frequency load shedding scheme. South Australian demand fell by around 100MW because customer load tripped in response to the effects of the disturbance.

Frequency stabilisation and reconnection of interconnectors

Until Victoria was reconnected with South Australia at 3.42pm, the three electrical islands were stabilised with frequency in the Victorian island controlled manually and with support from Tasmania via Basslink. The power system was declared secure at 4.05pm following reconnection of South Australia to the Victorian island. Initial reconnection of Victoria, South Australia and Tasmania with New South Wales and Queensland took place at 5.48pm using the single 220kV line via Buronga in south west New South Wales. At that stage, the 330kV connection via the Snowy mountains had not yet been declared safe for use. The interconnection between the southern regions and the northern regions was completely restored at 11.23pm, when the 330kV lines that had tripped earlier had been inspected and declared safe.

[9] Victoria is not connected synchronously to Tasmania. Therefore, the frequency did not fall significantly in that region.

Load restoration

The process to restore the interrupted customer load commenced at 3.49pm. The final instruction to restore load was issued by NEMMCO at 6.15pm. Customer load was increased too rapidly during the restoration process, resulting in a period of sustained low frequency in Victoria from 4.12pm to 4.55pm. Curtailment of load restoration and the manual shedding of about 200MW of customer load were necessary to allow the frequency to recover during the restoration process. By 5.42pm, system frequency had recovered and load restoration could proceed.

Directions

At the time the Victorian island was being stabilised, NEMMCO issued seven directions to a number of generators to operate their plant at full load to assist with load restoration or to provide frequency control ancillary services.

Prices

Spot prices fluctuated widely throughout the afternoon. At 4.20pm, NEMMCO overrode the price in Victoria and set the price to $10,000/MWh (the price cap or VoLL) for the next two hours. Energy was exported from Victoria to South Australia from 3.50pm to 5.25pm. For most of this period, South Australian prices were lower than in Victoria, which meant that the flows across the Victoria to South Australia interconnector during that period were counter-price.

4 The AER's investigation

4.1 Procedure

In February 2007, the AER published a $5000 report dealing with market outcomes on 16 January 2007. In that report, the AER noted that it would be undertaking a broader and more detailed investigation to determine whether registered participants and NEMMCO complied with the NER.

As part of its subsequent investigation, the AER wrote to NEMMCO, SP AusNet, VENCorp, ElectraNet, TransGrid, AGL, Flinders Power, International Power, TRUenergy and Vicpower Trading, requesting information on:

- the circumstances surrounding the loss to service of multiple transmission lines
- communications between participants on the day concerning the progress of the fire and associated system security issues
- operational issues concerning the management of network limits and constraints and load shedding
- the operation of protection and control systems
- participant performance including with respect to compliance with dispatch instructions, energy and FCAS offers and technical standards

This report takes into account participants' replies to AER requests, available market data and the following reports concerning the events of 16 January:

- NEMMCO reports:
  - Power System Incident Report: System Separation and Load Shedding 16 January 2007 (published 15 June 2007)
  - Market Event Report: System Separation and Load Shedding 16 January 2007 (published 15 June 2007)
  - Directions – Victoria and South Australia Regions 16 January 2007 (published 18 June 2007)
  - Victorian Bushfires December 2006 (published June 2007)
  - Multiple Contingent Event in the Victorian Region 16 January 2007 (published 18 January 2007)
  - Summary Pricing Report 16 January 2007 (published January 2007)
- VENCorp report:
  - System Incident Report 16 January 2007 (published 22 June 2007)

4.2 Issues

Following the AER's review, a number of issues were identified as requiring further consideration in the context of assessing compliance with the NER on 16 January 2007, including:

- Reclassification of non-credible contingency events
- Load shedding
- Load restoration
- Setting the dispatch price to VoLL
- Intervention pricing
- Technical performance standards
- Non-compliance with dispatch instructions
- Provision of FCAS

This report addresses these issues.

5 Reclassification of non-credible contingency events

"Non-credible contingency" events are low probability events that can have a significant effect on the power system when they occur. In contrast, "credible contingency" events are events that are reasonably likely in the context of the normal operation of the power system. Credible contingency events are taken into account by NEMMCO when managing security of the power system whereas non-credible contingency events are not taken into account in the same way. However, when "abnormal conditions" arise, NEMMCO has power under the NER to reclassify non-credible contingency events as credible. In such cases, additional constraints are applied to the operation of the power system to protect the security of the system should the event occur.

On 16 January, two 330kV transmission lines linking Victoria to Snowy and New South Wales tripped when a bushfire crossed the transmission lines' easement. According to SP AusNet, the owner of the transmission lines, the most probable cause of the trip was that "thick smoke, flame and debris thrown up by the intense wildfire burning (probably in pine plantations on either side of the lines) caused a phase to earth fault". The concurrent loss of these lines is normally considered a non-credible contingency event. NEMMCO did not reclassify the concurrent loss of the lines as a credible contingency event on 16 January.

This section of the report considers the nature of the reclassification process; the information available to NEMMCO that was relevant to its decision not to reclassify the loss of the two 330kV lines on 16 January; and the role played by SP AusNet in the reclassification process.

5.1 Relevant NER provisions

5.1.1 NEMMCO's power system security obligations

Clause 4.3.1 of the NER sets out NEMMCO's power system security responsibilities, including the obligation to maintain "power system security". Power system security is defined in the NER to mean the safe scheduling, operation and control of the power system on a continuous basis in accordance with the principles set out in clause 4.2.6. Clause 4.3.2 also provides that NEMMCO must use reasonable endeavours to meet its power system responsibilities in accordance with the principles set out in clause 4.2.6. In turn, clause 4.2.6 provides that the power system should, to the extent practicable, be operated such that it is and will return to a "secure operating state".[10]

These clauses mean that the power system should be operated in a manner that allows it to withstand "credible contingency events", defined in clause 4.2.3(b) as events that NEMMCO considers to be reasonably possible, such as the loss of any single element

[10] For a secure operating state to exist, clause 4.2.4 requires that the power system is in a satisfactory operating state (which is defined in clause 4.2.2 to be when the power system is operating within various technical limits) and that it will return to a satisfactory operating state following the occurrence of a single credible contingency. The conditions for the power system to be considered as in a satisfactory operating state are set out in clause 4.2.2.

of the network or a single generation unit. To ensure that disruption to supply is avoided, NEMMCO takes into account credible contingency events when dispatching generators and determining flows on interconnectors. Given their relatively low probability, "non-credible contingency events"[11] are not taken into account in the same way. Clause 4.2.3(e)(2)(ii) refers to the loss or failure of double circuit transmission lines as an example of a non-credible contingency event.

5.1.2 Reclassification of non-credible contingency events

Clause 4.2.3(f) of the NER allows NEMMCO to declare an otherwise non-credible contingency event to be a credible contingency event when "abnormal conditions" exist. In particular, clause 4.2.3(f) provides that:

> *Abnormal conditions* are conditions posing added risks to the *power system* including, without limitation, severe weather conditions, lightning, storms, and bush fires. During such conditions, *NEMMCO* may, in its reasonable opinion, determine a *non-credible contingency event* (in particular, but without limitation, the tripping of some *substation* or *switchyard busbars* or both circuits of a double circuit *transmission line*) to be a *credible contingency event. NEMMCO* must notify all *Market Participants* of such a re-classification as soon as practicable.

When a non-credible contingency event is declared credible by NEMMCO under clause 4.2.3(f), additional constraints are applied to the operation of the NEM to ensure the security of the power system should the event occur. Therefore, the consequences of reclassification of a non-credible contingency event (or the failure to reclassify) can be significant from the perspective of system security and market outcomes.[12]

5.1.3 Role of Network Service Providers and other participants

NEMMCO may entrust its system security functions, including the ability to reclassify contingency events under clause 4.2.3(f), to "System Operators" under clause 4.3.3[13], although ultimately NEMMCO retains responsibility for those functions.

Further, NEMMCO can rely upon the assistance of participants other than System Operators to meet its system security obligations. Clause 4.8.1 requires participants to notify NEMMCO or the System Operator of any circumstance that could adversely affect the secure operation of the power system.

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[11] The term "non-credible contingency event" is defined in clause 4.2.3(e) of the NER.

[12] For example, reclassification may result in the restriction of flows on the interconnector in question which, in turn, will limit export and import of energy across that interconnector and will have an impact upon prices and generator dispatch in regions affected by such limitation.

[13] Clause 4.3.3(a) of the NER provides that:

"For the purpose of complying with its obligations under clause 4.3.2, *NEMMCO* may, from time to time, in addition to any other power or right under the *Rules*:

(1) engage such agents or appoint such delegates as it considers appropriate to carry out on its behalf some or all of its rights, functions and obligations under this Chapter (such persons being known as "*System Operators*" upon registration with *NEMMCO*); and

(2) organise, enter into and manage any contractual arrangements with appropriately competent service providers."

Under clause 4.3.3(f), agents engaged or delegates appointed pursuant to clause 4.3.3(a)(1) must be registered by NEMMCO as a System Operator."

Clause 4.3.4 requires Network Service Providers (NSPs) to use their reasonable endeavours in the exercise of their rights and obligations in relation to networks to assist NEMMCO discharge its power system security responsibilities.

NEMMCO, in conjunction with Transmission Network Service Providers (TNSPs), established a specific procedure to formalise the provision of participants' assistance in the context of deciding whether or not a non-credible contingency event should be reclassified as credible under clause 4.2.3(f).[14] In summary, the procedure reiterates participants' obligations under clause 4.8.1. The procedure also states that, whenever NEMMCO receives information on severe weather conditions from participants, NEMMCO will discuss the situation with the relevant TNSP to determine whether non-credible contingency events should be reclassified as credible. Further, all relevant TNSPs will be consulted if the severe weather conditions exist near a regional boundary. The reclassification of non-credible contingency events will be based on the assessment of the TNSP whose assets are at most risk or on the most conservative advice. The procedure does not state that the TNSP is responsible for reclassifying non-credible contingency events under clause 4.2.3(f).

5.2 Details of the incident

On 16 January 2007, two 330kV transmission lines linking Victoria to New South Wales tripped and were lost to service when a bushfire entered the transmission lines' easement. A further two 220kV lines in the easement and the remaining links to NSW and South Australia were then lost in a cascade system separation.

The concurrent loss of the two 330kV transmission lines linking Victoria to Snowy is normally considered a non-credible contingency event and was not reclassified as a credible contingency event on 16 January. Accordingly, NEMMCO operated the NEM to survive the loss of either of the lines, but not both on that day.

In its Power System Incident Report, NEMMCO notes that it relies on the judgement of a network asset owner for information regarding the level of operational risk to the network owners assets.[15] In its replies to the AER's questions, NEMMCO states that, on 16 January, SP AusNet acted as the conduit of all operational communications regarding the fire situation and that this accorded with normal practice. NEMMCO also states in its report that, based on the information received from SP AusNet on 16 January, NEMMCO decided not to reclassify the loss of both 330kV transmission lines as a credible contingency event on that day.[16]

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[14] NEMMCO Operating Procedure SO_OP6050 "Transmission Network Security Guidelines".

[15] Power System Incident Report: System Separation and Load Shedding 16 January 2007, p. 12. This approach is reflected in the procedure NEMMCO established with TNSPs for the reclassification of contingency events.

[16] Power System Incident Report: System Separation and Load Shedding 16 January 2007, p. 15.

The table below sets out a chronology of communications between the Victorian emergency services, SP AusNet and NEMMCO leading up to the two 330kV lines tripping on 16 January.[17]

Table 2: Chronology of communications

TIME	INFORMATION/FACTS AVAILABLE
12.25am	The Country Fire Authority (CFA) called SP AusNet foreshadowing a request for de-energisation of the 330kV Victorian-Snowy lines later in the day because of expected fire in the area. SP AusNet explained to the CFA at this time that it had a policy of not de-energising lines in these circumstances
1.26am	The incident controller for the Department of Sustainability and the Environment (DSE) and the CFA informed SP AusNet that the fire was probably going to follow direction of power lines and cross over the relevant easement during the course of the day. The State Fire Situation Report prepared by the DSE/CFA and received by SP AusNet early on the morning of 16 January indicated that the fire had escaped control lines and was spreading south. SP AusNet states this information was passed on to NEMMCO. SP AusNet also states that, at the time of passing on this information to NEMMCO, it cautioned NEMMCO to "be prepared" but that its approach was not to take the 330kV transmission lines out of service given the slim chance that smoke would affect all 4 lines on the easement
1.33am	SP AusNet called NEMMCO informing NEMMCO that the CFA expected the fire to reach the 330kV lines by 12.00pm. NEMMCO confirmed that this information was exchanged between SP AusNet's control room and NEMMCO's control room
4.45am	SP AusNet reiterated the advice that the fire could cross the 330kV lines by 12.00pm and noted that it would have staff on site to assess the risks. NEMMCO's log entry for this communication states "SPI advise that predicted fire front to be in the area Tolmie-Acheston by approx 1200hrs – SPI will organise staff to be on site if possible"
10.00am	SP AusNet held its regular operational incident response meeting. Fires were discussed and it was noted that they could affect the 330kV lines. It was also noted that fire fighters had undertaken considerable work to establish control lines around the easement. Further, it was noted that the 330kV lines were unlikely to trip to lockout because the lines consisted of 2 circuits on separate towers with large clearances. NEMMCO was present at the meeting. VENCorp had been invited to the meeting, but did not attend. NEMMCO states that there was no discussion at the meeting that it should assume that loss of the 330kV lines would occur. Rather, the lines were considered not to be at high risk because the fire was running parallel to the easement and that, even if the fire entered the easement, the 330kV lines would be able to auto reclose and, therefore, remain in service. SP AusNet states that, at the end of the meeting, a specific discussion took place during which it was agreed that requests to switch out a line by emergency services officers should be refused "due to current hot weather loads". NEMMCO noted that lines would be fully loaded and was "in full agreement and comfortable with this approach". This information was apparently relayed to the DSE. A representative from Alinta present at the operational incident response meeting, who had also attended the CFA meeting earlier that morning, indicated that the Tatong fire "may push into" the easement and that pine plantations would be under threat during the day if the fire ran south
12.06pm	Email received by NEMMCO from SP AusNet stating inter alia that "As discussed the worst case scenario, although we do believe it unlikely, is the loss of both the DDTS SMTS 1&2 lines". The email attached a document that stated inter alia that the "potential risk" to the DDTS SMTS 330kV lines was "high" and noted that the system impact of a loss of the lines would be a "large reduction in import capability if double contingency is declared credible". The "worst case scenario" of loss of both 330kV lines had been previously discussed by NEMMCO and SP AusNet on 12 January and in the early morning of 16 January
12.45pm	DSE/CFA issued an Urgent Fire Threat Message, which was received by SP AusNet. The message advised that certain properties in vicinity of easement were under immediate attack

[17] This table is based on information provided by SP AusNet and NEMMCO in response to questions posed by the AER or in documents published by NEMMCO regarding the events of 16 January.

TIME	INFORMATION/FACTS AVAILABLE
12.58pm	SP AusNet contacted VENCorp to discuss bushfire update and potential impact of the fire on the transmission lines in the easement. SP AusNet states that, although the fire was near the 330kV lines, it was considered that there was no immediate threat. The increased load in Victoria due to heat was also discussed
2.00pm	DSE/CFA issued an Urgent Fire Threat Message advising that the fire had spotted on northern side of private land. Residents were warned to be on full alert and prepare for impact from fire shortly. The message warned residents of possible power cuts because of "hot weather demands on the power supply state-wide and the fact that the fires are burning in proximity of lines"
2.43pm	SP AusNet received information that DSE and CFA were evacuating fire fighters and SP AusNet field personnel from fire fighting areas due to "spotting" behind firefighters. This information was passed on to NEMMCO at 2.46 pm together with the assessment that there was no immediate threat to the lines, but that SP AusNet could no longer be sure
2.50pm	SP AusNet's network controller called NEMMCO to advise that the fire had entered the easement and that "it would probably get under the lines". SP AusNet advised that it did not expect to lose both lines, only "one at a time"
2.57pm	SP AusNet reported to NEMMCO that bushfires had entered the easement. In its replies to the AER's questions, NEMMCO states that it was only at this point in time that it became aware that there was an immediate risk to the 330kV lines. NEMMCO states that, by this stage, it was too late to issue any notices informing the market of the risk
3.00pm	Dederang to South Morang No. 1 line tripped and auto reclosed. Victorian demand was approaching record levels at 9060MW. Power imports into Victoria were at near maximum levels approaching 2500MW
3.02pm	Both Dederang to South Morang lines opened, leading to separation of the national power system. SP AusNet immediately notified NEMMCO

5.3 Compliance assessment

Under clause 4.2.3(f) of the NER, NEMMCO has the power to declare an event that would otherwise be considered a non-credible contingency event to be credible when "abnormal conditions" exist. This involves the exercise of judgement by NEMMCO as to whether abnormal conditions exist and, if so, whether reclassification of the contingency status of the relevant event is warranted. The existence of abnormal conditions means that this decision is likely to be made in complex circumstances.

5.3.1 Information available to NEMMCO

On 16 January, NEMMCO did not reclassify the loss of both 330kV transmission lines as a credible contingency event. As noted earlier, NEMMCO has stated that this was based on information received from SP AusNet.

The essential information that was made available to NEMMCO on 16 January prior to the loss of the two 330kV transmission lines is set out immediately below:

- On 16 January and late on 15 January, SP AusNet advised NEMMCO that the loss of the two 330kV transmission lines was a "worst case scenario"[18]

- At 1.26am, emergency services personnel informed SP AusNet that the fire was probably going to cross the transmission lines easement during the day. SP AusNet provided this information to NEMMCO. This advice was reiterated at 1.33am and at 4.45am.

- At 10.00am, during the operational incident response meeting:

  - SP AusNet advised NEMMCO that the 330kV lines were unlikely to trip to lockout because the lines consisted of 2 circuits on separate towers with large clearances

  - The lines were considered not to be at high risk because the fire was running parallel to the easement and that, even if the fire entered the easement, the 300kV lines would normally automatically close again for transient faults (such as bushfires) and, therefore, remain in service

  - A representative from Alinta present at the operational incident response meeting, who had also attended the CFA meeting earlier that morning, indicated that the Tatong fire "may push into" the easement and that pine plantations would be under threat during the day if the fire ran south.

- At 12.06pm, SP AusNet identified the "potential risk" to the lines as "high" but stated that it believed the "worst case scenario" to be "unlikely"

- At 2.43pm, SP AusNet informed NEMMCO that areas around the easement were being evacuated, and that while there was no immediate threat to the 330kV lines, SP AusNet "could not be sure"

- At 2.50pm, SP AusNet informed NEMMCO that the fire had entered the easement and "would probably get under the lines" but SP AusNet did not expect to lose both lines, only "one at a time"

- At 2.57pm, SP AusNet informed NEMMCO that the bushfires had entered the easement.

The AER considers that, on 16 January, NEMMCO had received enough information from SP AusNet to question the latter's ability to provide reliable and credible information. During the course of the day, before the failure occurred, NEMMCO had been informed by SP AusNet that the loss of the two 330kV lines was a "worst case

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[18] In its Power System Incident Report (p. 13, footnote 5), NEMMCO states that:

"A worst case scenario describes a possible event which, out of all the possible events that might arise from a given abnormal condition, would result in the most severe disruption to the power system. Describing an event as a worst case scenario does not mean that it is now considered a credible contingency event. Rather the identification of such a scenario allows preparations to be made should the event actually become a credible contingency event. Such a process is not mandated in the Rules and the term 'worst case scenario' is not defined in the Rules".

scenario"; that the fire might cross the easement; and that the potential risk to the lines was high. NEMMCO was also advised by SP AusNet on that day that the lines were not at high risk; that there was no immediate threat to the lines; and that the loss of both lines was unlikely. In the AER's view, on the basis of the contradictory information and advice provided by SP AusNet concerning the risk to the 330kV transmission lines, NEMMCO should have made further enquiries but did not do so.

5.3.2 Role of SP AusNet

Pursuant to clause 4.8.1 of the NER, SP AusNet was required to notify NEMMCO of any circumstance that could adversely affect the secure operation of the power system.[19]

On 16 January, SP AusNet made inconclusive and, at times, contradictory statements about the likelihood that its two 330kV transmission lines would be lost to service. For example, at 12.06pm, even though SP AusNet identified the potential risk to the lines as being "high", it also stated that it considered that the loss of the lines was "unlikely". Moreover, at 2.43pm, shortly before the transmission lines failed, SP AusNet informed NEMMCO that areas in the vicinity of the easement were being evacuated and that, while there was no immediate threat to the 330kV lines, SP AusNet could not provide a definitive view of the risks.

SP AusNet's failure to provide clear and conclusive views on the risk of the loss of the two 330kV transmission lines made NEMMCO's task more difficult. SP AusNet had on-site operators who were present with emergency services officers near or in the vicinity of the easement in which the two 330kV lines were located. It acted as a conduit of information between the emergency services officers and NEMMCO, providing updates on the condition of the easement and the lines located on the easement. Had SP AusNet taken a more definitive stance on the risk to the two 330kV transmission lines, it is possible that NEMMCO would have reclassified the loss of the lines. In turn, the extent of load shedding would probably have been less than was actually the case.[20]

5.3.3 Prior instances of reclassification of the 330kV transmission lines

NEMMCO regularly reclassifies non-credible contingency events as credible. In the 12 months to March 2007, NEMMCO issued reclassification notices with respect to 100 events, two thirds of which were for lightning storms near interconnectors. In this 12 month period, the same 330kV lines that were lost on 16 January had been previously reclassified by NEMMCO:

- On 11 December 2006, concurrent loss of both 330kV lines between Dederang and South Morang was declared a credible contingency because of bushfires in and around the easement. The two 220kV lines in the easement were already out of service due to fires

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[19] This obligation is confirmed in the operating agreement established between NEMMCO and SP AusNet.

[20] Power System Incident Report: System Separation and Load Shedding 16 January 2007, p. 18.

- On 14 December 2006, the same credible contingency was declared. Both the 330kV lines had tripped in quick succession and unsuccessfully reclosed earlier that day due to fires in the easement

Presence of fire in the easement

In response to a question posed by the AER, NEMMCO distinguished the decisions to reclassify the 330kV transmission lines on 11 and 14 December from the decision not to reclassify the same lines on 16 January by stating that, in the case of the former, "[reclassification] was done due to the actual presence of the fires in the easements and was undertaken following advice from SP AusNet". The AER considers that, on 16 January, NEMMCO had information suggesting that bushfires would cross the same easement.

At 1.26am on 16 January, the emergency services personnel informed SP AusNet that the fire was probably going to follow the direction of the power lines and cross over the easement during the course of that day. That information was passed on to NEMMCO[21] and was reiterated at 1.33am and 4.45am. During the operational incident response meeting at 10.00am, SP AusNet informed NEMMCO that the fire was running parallel to the easement.[22] However, subsequent to that meeting, information was available suggesting that the original advice that the fire would cross the easement was correct. At 2.43pm, almost twenty minutes before the loss of the two 330kV lines, NEMMCO was informed that the easement was being evacuated. Further, at 2.50pm, 12 minutes before the loss of the lines, SP AusNet informed NEMMCO that the fire had entered the easement.

Fuel load

In its Power System Incident Report, NEMMCO also seeks to distinguish the decision to reclassify the two 330kV transmission lines on 14 December by suggesting that the fuel load on 16 January was relatively low. In particular, NEMMCO states:

> NEMMCO's experiences in December 2006 had demonstrated that a fire in an easement with low fuel load should not cause both 330kV transmission lines to trip. The trip to lock-out of one line and the partially unsuccessful automatic reclose of the other line on 14 December 2006 occurred due to a fire in a different section of the easement where there was a high fuel load due to debris having been inappropriately piled up adjacent to the line without the knowledge of SP AusNet. On all other occasions in December 2006 when the fire had entered the easement it had not resulted in the loss of both 330kV transmission lines.[23]

The information available to the AER suggests that, in fact, the fuel load adjacent to the easement (on both sides) on 16 January was relatively high. NEMMCO makes

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[21] Although a statement was made by SP AusNet at its operational incident response meeting at 10.00am that the lines were considered not to be at high risk because "the fire was running parallel to the easement", this is contradicted by SP AusNet's earlier statement that the fire would cross the easement that day. The basis upon which SP AusNet made the later statement is unclear from the facts available to the AER.

[22] The basis upon which SP AusNet made this statement is unclear from the information available to the AER.

[23] Power System Incident Report: System Separation and Load Shedding 16 January 2007, p. 14.

reference to the existence of pine plantations adjacent to the easement in its Power System Incident Report.[24] The AER was informed by SP AusNet that a representative from Alinta present at the operational incident response meeting held at 10.00am on 16 January indicated that the Tatong fire "may push into" the easement and that pine plantations would be under threat during the day if the fire ran south. In its reply to a question posed by the AER, SP AusNet also stated that its best assessment of the cause of the loss of the two 330kV lines was that "thick smoke, flame and debris thrown up by the intense wildfire burning (probably in the pine plantation) on either side of the lines caused a phase to earth fault on the DDTS-SMTS 300kV".

Circuit construction

In its Power System Incident Report NEMMCO states that "[t]he 330kV lines due to their construction would be unlikely to trip, auto reclose, trip again and then lockout should fire enter the easement. This assumption was based on the fact that the 330kV lines were two circuits on separate towers (as compared to the double circuit construction of the 220kV lines) and had much larger clearances than the 220kV lines".[25] However, the fact that the lines that failed on 16 January had already failed on 14 December tends to undermine NEMMCO's assertion that the risk to the lines was relatively low because of the circuit construction.

Conclusion

In the AER's view, NEMMCO's reclassification on 11 and 14 December 2006 of the same 330kV transmission lines that were not reclassified on 16 January 2007 highlights the inconsistency in NEMMCO's approach to reclassification.

5.3.4 Reclassification process

In summary, in the AER's view, there were deficiencies in NEMMCO's reclassification process on 16 January:

- NEMMCO applied assessment criteria to determine whether to reclassify the risk of a transmission failure that appear to be inconsistent with its reclassification approach when similar bushfire conditions prevailed earlier during the summer of 2006-2007

- NEMMCO's reclassification process on 16 January unduly relied upon the advice of the owner of the relevant transmission assets – SPAusNet[26]

NEMMCO has acknowledged that the process associated with its decision not to reclassify the contingency status of the loss of the two 330kV lines on 16 January could be improved. In its Power System Incident Report, NEMMCO states that "[t]here may

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[24] The report states that: "The sudden spread of the fire to the easement and adjacent pine plantations had not been foreseen by SP AusNet or NEMMCO" Power System Incident Report: System Separation and Load Shedding 16 January 2007, p. 15.

[25] Power System Incident Report: System Separation and Load Shedding 16 January 2007, p. 14.

[26] The information and advice provided by SP AusNet was often inconclusive and contradictory.

be an advantage in adopting a more systematic process that ensures that all relevant factors are appropriately considered".[27] Further, it recommends that it "should review its procedure to make clearer the decision making process relating to reclassification of non-credible contingency events after receiving advice from the asset owner of a significantly increased risk to their assets and input from other parties if appropriate".[28] The AER understands that NEMMCO has already commenced work to refine its reclassification procedures.

NEMMCO's role in reclassifying non-credible contingency events is set out in clause 4.2.3(f). The clause does not oblige NEMMCO to reclassify non-credible contingency events when abnormal conditions arise. Rather, it states that NEMMCO "may, in its reasonable opinion" determine a non-credible contingency event to be credible in such circumstances. In effect, the language used in clause 4.2.3(f) empowers NEMMCO to reclassify contingency events and it vests it with considerable discretion in deciding when and whether reclassification should occur. The manner in which discretion is exercised under 4.2.3(f) is critical given the consequences that can ensue if reclassification does not occur when it is warranted.

The events of 16 January illustrate the consequences of deciding not to reclassify non-credible contingency events as credible. NEMMCO's Power System Incident Report states that system separation could have been avoided had reclassification of the lines in question occurred.[29] Reclassification would have allowed NEMMCO to introduce measures to reduce Victoria's dependence on electricity imported using the transmission lines in question. In turn, reduced reliance on imports would have reduced (but not eliminated) the impact of the transmission line failure, including the extent of load shedding in Victoria.

5.3.6 Notification requirements

Clause 4.2.3(f) establishes notification requirements regarding the reclassification process. It obliges NEMMCO to notify participants of a reclassification "as soon as practicable" *after* the decision to reclassify has been taken. On 16 January, NEMMCO did not reclassify the loss of the 330kV transmission lines and was, therefore, not obliged to notify participants under clause 4.2.3(f). Nevertheless, NEMMCO advised participants that the 330kV transmission lines had failed at 3.09pm, seven minutes after the loss occurred.[30]

Clause 4.3.1(m) establishes an additional notification requirement. Under that clause, NEMMCO must provide participants with information about circumstances that *could have* or are having a significant impact upon system security,[31] including in the context

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27 Power System Incident Report: System Separation and Load Shedding 16 January 2007, p. 19.

28 Power System Incident Report: System Separation and Load Shedding 16 January 2007, p. 4.

29 Power System Incident Report: System Separation and Load Shedding 16 January 2007, p. 17.

30 The relevant market notice (Market Notice ID 15840 issued 1509 hrs 16/01/07) read as follows: "Non-credible contingency event VIC region 16th Jan 2007 At 1500 hrs a non credible contingency occurred in the VIC region with three main transmission lines tripping and SA separating".

31 Clause 4.3.1(m) of the NER obliges NEMMCO "to make available to *Registered Participants* as appropriate, information about the potential for, or the occurrence of, a situation which could

of the existence of abnormal conditions. On 16 January, NEMMCO did not alert the market of the potential or actual risk posed to those lines in advance of them being lost to service. NEMMCO explains that it did not issue any market notices prior to the loss of the transmission lines because, up until that point, it considered that the loss of both lines was unlikely. Nevertheless, improved availability of information in the lead-up to the loss of the lines might have assisted participants manage their operations, potentially leading to commitment of additional generating plant in Victoria. Additional plant availability would have reduced imports and the extent of load shedding. NEMMCO has stated that it is currently reviewing its approach towards notification under clause 4.3.1(m), particularly in relation to information concerning *potential* impact on power system security.

5.4 Outcomes

The discretion vested in NEMMCO by clause 4.2.3(f) means that NEMMCO did not breach the NER on 16 January. Nevertheless, there were a number of deficiencies in the reclassification process. In particular:

- NEMMCO applied assessment criteria to determine whether to reclassify the risk of a transmission failure that appear to be inconsistent with its reclassification approach when similar bushfire conditions prevailed earlier during the summer of 2006-2007

- NEMMCO was not sufficiently transparent about its reclassification process and criteria

- The AER is not confident that the decision not to reclassify on 16 January was appropriate given the lack of transparency and inconsistency in NEMMCO's reclassification process and criteria

The AER considers that Rule changes are needed to address these shortcomings.

The AER intends to submit a Rule change proposal to the Australian Energy Market Commission (AEMC) in order to ensure that these deficiencies do not recur. The Rule change proposal will contain the following elements:

- Clause 4.2.3(f) should be converted from a permissive, discretionary provision into one that imposes an obligation on NEMMCO to reclassify non-credible contingency events as credible when abnormal conditions exist. This will help to ensure that NEMMCO assumes full responsibility for its role in the process of reclassifying non-credible contingency events under clause 4.2.3(f) rather than exclusively relying on the advice of TNSPs.

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significantly impact, or is significantly impacting, on *power system security*, and advise of any *low reserve* condition for the relevant periods where the *short term capacity reserve* and/or *medium term capacity reserve* is assessed as being less than that determined in accordance with the *short term capacity reserve standard* or *medium term reserve capacity standard* respectively".

- Under clause 4.2.3(f), the inclusive definition of "abnormal conditions" should be qualified by the requirement that NEMMCO must apply pre-determined risk assessment criteria in establishing whether or not abnormal conditions exist. These criteria must be established in consultation with all relevant stakeholders and must take into account the particularities of the risk(s) (including probability and consequences) associated with the various types of abnormal conditions that might arise. This will help to enhance the consistency and rigour of the process for reclassifying non-credible contingency events under clause 4.2.3(f).

- Clause 4.2.3(f) should be amended to oblige NEMMCO to notify participants of all information it has as soon as it becomes available in cases where "abnormal conditions" are being assessed and where there is a possibility that those conditions might warrant reclassification under clause 4.2.3(f). Such an obligation would be a more specific extension of clause 4.3.1(m), which currently obliges NEMMCO to provide participants with information about circumstances that could have or are having a significant impact upon system security. It would significantly enhance the degree of transparency for participants as compared to the lack of relevant information that characterised NEMMCO's communication with the broader market on 16 January.

- Clause 4.2.3(f) should also be amended to include an obligation on NEMMCO to issue a report each time a reclassification takes place under clause 4.3.2(f). This will make NEMMCO's application of the reclassification criteria transparent and will effectively require NEMMCO to continually assess and, if necessary, refine the risk assessment process and criteria for reclassification of non-credible contingency events under clause 4.3.2(f).

6 Load shedding

When power system frequency falls below 49Hz, under-frequency load shedding systems are automatically triggered to protect the power system, which causes interruption to supply to customers. While NEMMCO oversees the load shedding process, jurisdictional bodies are responsible for determining the sequencing of load shedding blocks.[32] In addition, the owners of the affected transmission and distribution assets implement the load shedding process in accordance with NEMMCO's instructions and the applicable load shedding schedule.

On 16 January, following separation of the NEM into three electrical islands, the Victorian island had a net supply/demand deficit. This resulted in a frequency imbalance, which triggered load shedding. Two load shedding blocks, for which SP AusNet was responsible, failed to operate as expected.

6.1 Relevant NER provisions

When power system frequency falls below 49Hz, under-frequency load shedding systems are automatically triggered. These systems start to shed customer load in accordance with schedules developed by the relevant Jurisdictional System Security Coordinator pursuant to clause 4.3.2(f). The Jurisdictional System Security Coordinator may amend such schedules under clause 4.3.2(g). When it does so, a copy of the amended schedules must be provided to NEMMCO.

Pursuant to clause 4.3.2(h) of the NER, NEMMCO is obliged to develop, update and maintain a set of procedures for each participating jurisdiction under which load will be shed and restored in accordance with the sequences established in the schedules for each of the relevant participating jurisdiction provided under clause 4.3.2(f). Further, under clause 4.3.2(j)(3), after load is interrupted, that load must be restored as soon as this can be achieved in accordance with the schedules of loads referred to in clause 4.3.2(f).

The NER also imposes obligations on NSPs regarding the operation of load shedding processes. In particular, under clause 4.3.4(b), NSPs must use reasonable endeavours to ensure that interruptible loads are provided – that is, load that may be manually or automatically disconnected to assist in the restoration of power system frequency in the event of contingency events or shortages of supply. In addition, under clause 5.2.3(b)(1), NSPs must comply with the power system performance and supply standards described in schedule 5.1. Schedule 5.1 establishes standards regarding the operation of protection and control systems that are applicable to NSPs, including in the context of load shedding. Clause 5.7.4(a1) also obliges NSPs to institute and maintain compliance programs to ensure that their facilities, including control systems for load shedding, operate reliably and in accordance with the performance requirements stipulated in schedule 5.1. Like all other Registered Participants, NSPs are obliged under clause 4.8.1 to notify NEMMCO or the System Operator of any circumstance that could adversely affect the secure operation of the power system.

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[32] Circuit breakers are activated as frequency falls, disconnecting customer load. The load disconnected each time a circuit breaker is activated is referred to as a load block. In Victoria, the blocks are typically relatively large, for example one or a number of suburbs.

6.2 Details of the incident and participants' responses

Following separation of the NEM into three electrical islands, the Victorian island had a net supply/demand deficit of approximately 2200MW. In turn, this resulted in a frequency imbalance, which triggered the under-frequency load shedding scheme.

SP AusNet owns and operates the load shedding facilities that were triggered in Victoria on 16 January. SP AusNet implemented load shedding procedures in accordance with the schedules prepared by the Jurisdictional System Security Coordinator in Victoria, namely VENCorp.

In its Power System Incident Report, NEMMCO concluded that SP AusNet's load shedding facilities in Victoria generally performed according to design, with the exception of two load blocks that failed to operate as expected. NEMMCO also stated that the load shedding facilities in conjunction with the frequency control ancillary services, stabilised power system frequency within the limits and times required by the frequency operating standards.[33] Similarly, VENCorp found that automatic load shedding occurred in accordance with its design, but also identified two load blocks that failed to operate properly.[34]

SP AusNet acknowledged that two load blocks did not fully shed but does not believe that there was a failure to shed the necessary amount of load. One of the load blocks (block V5) failed to fully shed 30MW of load. SP AusNet advised NEMMCO that the failure occurred because relay settings had not been re-set following major substation refurbishment. The second load block (block V6) should have shed a further 40MW of load, but a relay failed to operate successfully. SP AusNet advised that the relay did not trip because it was part of a sub-transmission network upgrade not yet incorporated into the under-frequency load shedding system.[35] In addition, NEMMCO's report notes that some blocks of load operated more slowly than expected.[36]

According to NEMMCO's report, the failure of blocks V5 and V6 to shed properly did not adversely affect frequency recovery in light of the relatively large amount of load shed (2176MW) compared with the load that failed to shed (NEMMCO states that this amounted to around 70MW). Nevertheless, NEMMCO's report states that, had blocks V5 and V6 fully shed and had all relays operated more rapidly, the last load block of 533MW might not have been shed.[37]

In its report, VENCorp states that "the performance of the transmission network was found to be in accordance with the design except [that] … the automatic load shedding scheme did not trip load at Brunswick and Cranbourne".[38] VENCorp notes that the Brunswick load block did not shed because the automatic load shedding scheme was not

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33 Power System Incident Report: System Separation and Load Shedding 16 January 2007, p. 33.

34 System Incident Report 16 January 2007, p. 5

35 Power System Incident Report: System Separation and Load Shedding 16 January 2007, p. 31.

36 Power System Incident Report: System Separation and Load Shedding 16 January 2007, p. 33.

37 Power System Incident Report: System Separation and Load Shedding 16 January 2007, p. 33.

38 System Incident Report 16 January 2007, p. 5.

enabled as the relevant terminal station was undergoing refurbishment. VENCorp also notes that transmission changes at Cranbourne meant that aspects of that block were not covered by the automatic load shedding scheme. VENCorp concludes that the impact of the failure of the Brunswick and Cranbourne loads to trip was that other load tripped instead. There was a slight time delay that had no significant effect on the automatic load shedding scheme.[39]

VENCorp also states that one of the fundamental philosophies of the automatic load shedding design is that, if a particular load block does not trip because of maintenance work, project work or load transfers, the under-frequency load shedding scheme continues to operate by progressing down through the load blocks. In this way, the under-frequency load shedding scheme is designed to cover a diverse range of possible contingencies.

SP AusNet confirmed VENCorp's conclusions. In particular, it stated that, while load shedding was in accordance with the under-frequency load shedding scheme, "there were some instances where specific load shedding action was influenced by project activity. However, these instances had no system consequence".

6.3 Compliance assessment

The failure of blocks V5 and V6 to shed load as designed was not the result of non-compliance with the relevant performance standards applicable to NSPs' protection control systems and load shedding facilities under clauses 5.2.3(b)(1) and 5.7.4(a1) and schedule 5.1. Rather, it appears that the relevant load blocks were disabled due to upgrading/refurbishment work.

At times, upgrading and/or refurbishment work for load blocks will be necessary to ensure the proper functioning of the under-frequency load shedding scheme. Clause 4.8.1 effectively requires the NSP to notify the Jurisdictional System Security Coordinator and NEMMCO when load blocks are unavailable for load shedding.[40]

SP AusNet stated that both VENCorp and NEMMCO had been made aware of the works being undertaken at Cranbourne and Brunswick. According to SP AusNet, the Operational Planning Working Group and VENCorp informed NEMMCO of the works in Cranbourne.

NEMMCO has stated that it has no recollection of being informed about the upgrading/refurbishment works. In its report, VENCorp states that the failure of the Cranbourne load block to shed demonstrates that changes to the configuration of the sub-transmission network need to be communicated to the Demand Reduction Committee,[41] implying that VENCorp was not aware of the works in question at least

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39 System Incident Report 16 January 2007, p. 41.

40 In this regard, it is worthwhile recalling that NEMMCO's load shedding procedures and the actual load shedding process depend upon the load shedding schedules provided to NEMMCO by the Jurisdictional System Security Coordinator pursuant to clauses 4.3.2(h) and 4.3.2(j)(3) respectively.

41 System Incident Report 16 January 2007, p. 41. The Demand Reduction Committee acts as an advisory body in matters of load shedding and restoration in Victoria and is chaired by VENCorp.

with respect to the Cranbourne load block. Nevertheless, VENCorp also states that it is typically made aware of refurbishments and upgrades being undertaken by SP AusNet, and does not revise the schedule of load shedding to accommodate them as this is not required. VENCorp also states that the schedule of load shedding only changes if a new terminal station is developed and permanent load transfers occur, as was the case with Cranbourne, or if the entire load shedding scheme is revised.

SP AusNet states that a formal requirement to report unavailability of load blocks does not exist. However, as noted above, clause 4.8.1 contains a clear requirement to notify NEMMCO or the System Operator of any circumstance that could adversely affect the secure operation of the power system, which would include the unavailability of load blocks for load shedding. In certain circumstances, failures to notify unavailability of load blocks could affect the secure operation of the power system if, for example, there is widespread unavailability of load shedding. Furthermore, under clause 4.3.4(a), NSPs are required to use reasonable endeavours to assist NEMMCO with the proper discharge of its system security obligations, including the implementation of load shedding processes.

6.4 Outcomes

The failure of blocks V5 and V6 to fully shed load was not the result of non-compliance with the relevant performance standards applicable to SP AusNet's protection control systems and load shedding facilities. Nevertheless, questions remain as to whether or not SP AusNet adequately informed NEMMCO and VENCorp that the load blocks in question were unavailable for load shedding in accordance with clause 4.8.1 and 4.3.4(a) of the NER.

The AER recommends that arrangements between NEMMCO, Jurisdictional System Security Coordinators and NSPs for the implementation of load shedding processes should be amended to formalise the obligation on NSPs to provide information reasonably required by NEMMCO and the relevant Jurisdictional System Security Coordinator, including information on the unavailability of load blocks. The AER will require NEMMCO to report back to the AER and to the market in general by the end of 2007 on the amended arrangements.

Finally, in its report, VENCorp found that SP AusNet's and Transgrid's capacitor banks did not always operate according to design.[42] The AER intends to review the operation of SP AusNet's protection and control systems and load shedding facilities in the context of compliance audits to be undertaken later this year. The audits will review SP AusNet's compliance with its obligations under clause 5.7.4 of the NER. The AER has already written to all other TNSPs about compliance with these obligations.

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[42] In particular, VENCorp noted that "two 66kV capacitor banks at Bendigo and Geelong did not close from the control centre when required to do so before the incident, the Dederang No 1 330kV Capacitor Bank and the Heywood 275kV Capacitor Bank did not trip from automatic voltage switching controls during over-voltage conditions, the Dederang 220kV Capacitor Bank did not trip at the correct time delay of one (1) second": System Incident Report 16 January 2007, p. 4.

7 Load restoration

When load shedding has occurred and once the power system is considered to be secure, load restoration commences. The load restoration process is managed by NEMMCO. One of the challenges for NEMMCO is to balance supply and demand as load increases. To assist in the process, NEMMCO has developed a Demand Offset Facility (DOF), which allows staff to manually input anticipated demand increases as load restoration occurs. The market dispatch process, NEMDE, can then increase supply to match the demand increases.

On 16 January, NEMMCO did not use the DOF and, consequently, demand was systematically under-forecast and insufficient generation was dispatched. This resulted in a recurrence of low frequency and NEMMCO was required to shed more load.

7.1 Relevant NER provisions

Under clause 3.8.1(a) of the NER, NEMMCO is obliged to operate the central dispatch process in order to balance supply and demand using reasonable endeavours to maintain power system security in accordance with Chapter 4. In turn, Chapter 4 imposes a range of obligations on NEMMCO to ensure security of the power system.

To the extent that the load restoration process has an impact upon system security, this process is covered by the general obligation imposed on NEMMCO under clause 4.3.1 of the NER to "maintain power system security". The obligation to maintain power system security is elaborated in clause 4.3.2, which requires NEMMCO to comply with the "system security principles". Clause 4.2.6(a) contains such principles and provides that the power system must be operated such that it is in a "secure operating state". In general terms, this means that frequency, voltage magnitudes, current flows and operating ratings for plant must be within the relevant prescribed bands/limits.

7.2 Details of the incident

On 16 January, following load shedding and when the power system was considered to be secure, the load restoration process commenced. NEMMCO managed the load restoration process. It directed NSPs to reconnect load while simultaneously working to maintain a balance between supply and demand.

In managing the load restoration process, NEMMCO relies upon several internal operational tools. One such tool is the Demand Offset Facility (DOF). The DOF is a control room interface designed to factor demand increases flowing from load block restoration into the 5-minute market dispatch process. The DOF allows NEMMCO staff to manually enter and update a 5-minute profile of anticipated MW load block restorations within a particular region for one or more dispatch intervals up to six hours in advance. The DOF is integrated into the existing 5-minute demand forecasting process that automatically forecasts the change in demand for each region over the next 5-minutes based on analysis of historical data. The forecaster detects whether any DOF offset is entered for the next dispatch interval, adds that amount to the normal forecast change in demand and then passes this total as an input to the market dispatch process, NEMDE. NEMDE then calculates the forecast demand for each region by adding this

5-minute forecast demand change to the current actual demand based on metered generation and imports. The forecast demand then determines the required generation dispatched to meet that demand.

In its Power System Incident Report, NEMMCO identified deficiencies in its load restoration facilities and in particular the DOF. According to NEMMCO's report, the DOF was not used to adjust the demand forecast following restoration of the large potline (aluminium smelter) loads on 16 January due to difficulties experienced by operational staff at the time.[43] As a result, total generation dispatched by NEMDE was significantly less than actual demand when the potline loads were restored. This contributed to low frequency at 4.37pm which, in turn, forced NEMMCO to instruct SP AusNet to manually shed load at 4.46pm and 4.54pm.

7.3 Compliance assessment

In its Power System Incident Report, NEMMCO acknowledged that there were problems with its management of the load restoration process. NEMMCO's failure to use DOF on 16 January meant that it compromised its ability to balance supply and demand under clause 3.8.1. Further, it is possible that the system security principles set out in clause 4.2.6(a) were breached because frequency levels deviated from the prescribed limits during the load restoration process.

The AER considers that there is always a risk of unforeseen operational difficulties whenever a power system incident of this magnitude occurs. This event highlights the complex nature of integrating emergency power system management tools with market systems designed primarily for steady state conditions. This event also highlights the role of testing and simulation of systems and processes to ensure that those arrangements are functional and effective in emergency conditions.

NEMMCO has informed the AER that the DOF was first implemented in October 2006 and was first used in real time on 16 January. According to NEMMCO, a number of unforeseeable issues with the user interface of the DOF arose on 16 January that ultimately led NEMMCO to abandon the application and revert to manual processes.

NEMMCO has committed to a review of its procedures and staff training program to ensure that the DOF can be used as intended in assisting with restoration of large amounts of interrupted customer loads.[44]

7.4 Outcomes

The AER considers that NEMMCO's failure to ensure its systems and processes operated effectively during the load restoration process compromised its ability to satisfy clause 3.8.1(a) of the NER, which requires NEMMCO to balance supply and demand using reasonable endeavours to maintain power system security. NEMMCO's failure also compromised its ability to satisfy the requirements of clauses 4.3.1, 4.3.2 and 4.2.6(a), which together require NEMMCO to maintain system security.

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[43] Power System Incident Report: System Separation and Load Shedding 16 January 2007, p. 88.

[44] Power System Incident Report: System Separation and Load Shedding 16 January 2007, p. 89.

The inadequacies associated with NEMMCO's load restoration processes on 16 January 2007 are evident from NEMMCO's Power System Incident Report. The AER supports the measures NEMMCO has indicated it will take to address these inadequacies. The AER requires NEMMCO to report back to the AER and to the market in general by the end of 2007 with details of the changes it has implemented to ensure that their systems, including DOF, are capable of dealing with circumstances such as those that arose on 16 January.

8 Setting the dispatch price to VoLL

The NER requires NEMMCO to set the dispatch price to $10,000/MWh (or VoLL) when manual load shedding occurs. The same obligation applies in the case of automatic load shedding that has been triggered by a contingency event, provided that the power system has first been allowed to return to a secure state and that there is an ongoing supply shortfall.

On 16 January, NEMMCO set the dispatch price to VoLL during the load restoration process. This section of the report considers whether NEMMCO set the dispatch price to VoLL in accordance with the relevant provisions of the NER.

8.1 Relevant NER provisions

Clause 3.9.2(e) sets out the circumstances in which the dispatch price may be set to VoLL by NEMMCO and provides in relevant part that:

> …if
>
> (1) the *dispatch price* for that *dispatch interval* has not already been set by the *central dispatch* process and NEMMCO reasonably determines that the *central dispatch* process may determine that:
>
> (i) all *load* in a *region* could not otherwise be supplied and NEMMCO issues instructions that are current for that *dispatch interval* to *Network Service Providers* or *Market Participants* to shed *load*; or
>
> (ii) no more *interruptible load* that had been shed as a result of a *contingency event* can be restored in a *dispatch interval* immediately following the restoration of the frequency of the *power system* to within the normal band of the *frequency operating standards*,
>
> then, subject to 3.9.2(f), *NEMMCO* must set the *dispatch price* at that *region's regional reference node* to equal *VoLL*; …

In essence, clause 3.9.2(e) of the NER requires NEMMCO to set the dispatch price equal to VoLL in two sets of circumstances:

- all load in a region could not be supplied and NEMMCO issues instructions to shed load – manual load shedding (clause 3.9.2(e)(1)(i)); or
- load has been shed automatically as a result of the occurrence of a contingency event and no more load can be restored – automatic load shedding (clause 3.9.2(e)(1)(ii)).

Clause 3.9.2(f) imposes an additional requirement that must be fulfilled in the case of automatic load shedding under clause 3.9.2(e)(1)(ii):

> If *interruptible load* is shed as a result of a *contingency event* and *NEMMCO* has not set the *dispatch price* to equal *VoLL* pursuant to clause 3.9.2(e)(1)(i), *NEMMCO* must not set the *dispatch price* to *VoLL*, pursuant to clause 3.9.2(e)(1)(ii) prior to the commencement of the third *dispatch interval* following the restoration of the *power system* to a *secure operating state* and the

restoration of the *frequency* of the *power system* to the normal band of the *frequency operating standards*.

In other words, following automatic load shedding the power system must be allowed to return to a secure state (with, amongst other things, the frequency within the normal band)[45] for three dispatch intervals before the dispatch price can be set to VoLL by NEMMCO.

8.2 Details of the incident

During the load restoration process on 16 January, NEMMCO set the dispatch price in Victoria to VoLL (i.e $10,000/MWh) between 4.25pm and 6.20pm. NEMMCO explains in its Market Event Report that this was necessary because there was insufficient short-term capacity reserve to restore all interrupted load.[46]

The table below sets out the chronology of relevant events that occurred following separation of the power system at 3.02pm. This sequence is relevant in ascertaining whether or not NEMMCO complied with clause 3.9.2 when it decided to set the dispatch price to VoLL on 16 January 2007. The table is based on information in NEMMCO's Power System Incident Report, Market Event Report and Report on the Multiple Contingent Event in the Victorian Region.

Table 3: Chronology of relevant events

TIME	EVENT
3.02pm	The two 330kV lines locked out. Automatic load shedding commenced
3.42pm	Victoria and South Australia reconnected
3.49pm	Load restoration commenced. PTH No 3 Potline restored 100MW
4.03pm	NEMMCO instructed SP AusNet to restore 50MW of load
4.05pm	Victorian system was declared secure but approximately 2100MW of load had yet to be restored
4.09pm	NEMMCO instructed SP AusNet to restore 50MW of load
4.12pm	APD No 2 Potline restored 250MW. NEMMCO instructed SP AusNet to restore 200MW of load
4.20pm	VoLL override was imposed
4.31pm	PTH No. 1 Potline restored 100MW
4.38pm	APD No 1 Potline restored 250MW
4.42pm	PTH No. 2 Potline restored 100MW

[45] The Power System Security and Reliability Standards, including the frequency standards, are established by the AEMC reliability panel and available on its website (www.aemc.gov.au).

[46] Market Event Report: System Separation and Load Shedding 16 January 2007, p 2.

TIME	EVENT
4.47pm	Frequency fell to less than the normal band. NEMMCO instructed SP AusNet to manually shed 100MW of load to assist with frequency control
4.54pm	Frequency still outside the normal band. NEMMCO instructed SP AusNet to manually shed 100MW of load to assist with frequency control
5.26pm	Load restoration recommences. NEMMCO instructed SP AusNet to restore 100MW of load
5.42pm	NEMMCO instructed SP AusNet to restore 100MW of load
5.57pm	NEMMCO instructed SP AusNet to restore 100MW of load
5.58pm	Victoria and New South Wales reconnected
6.01pm	NEMMCO instructed SP AusNet to restore 100MW of load
6.04pm	NEMMCO instructed SP AusNet to restore 200MW of load
6.12pm	NEMMCO instructed SP AusNet to restore 100MW of load
6.15pm	NEMMCO instructed SP AusNet to restore all remaining load that had been shed, estimated at 800MW
6:16pm	VoLL override was removed

8.3 Compliance assessment

At 4.20pm on 16 January, when the dispatch price was set to VoLL by NEMMCO, automatic load shedding had occurred due to the multiple non-credible contingency event. When read together, clauses 3.9.2(e) and 3.9.2(f) require that the following conditions are met before the dispatch price can be set to VoLL in the case of automatic load shedding:

- No more load can be restored
- Three dispatch intervals have expired following restoration of the power system to a secure operating state and the frequency to within the normal band

To assess NEMMCO's compliance with these requirements, it is necessary to consider the situation during the three dispatch intervals prior to the imposition of VoLL, i.e. between 4.05pm and 4.20pm. At 4.12pm, APD No 2 Potline was restored (250MW). Concurrently, NEMMCO instructed SP AusNet to restore 200MW of load. NEMMCO has stated that the APD No. 2 Potline was restored because its maximum off-time had nearly been reached. However, NEMMCO has not justified why it concurrently instructed SP AusNet to restore 200MW of load, which was not potline load. During the three dispatch intervals before VoLL was imposed, NEMMCO was able to and did restore customer load, so the condition that no more load can be restored before VoLL can be imposed had not been met.

From 4.31pm until 4.42pm, NEMMCO continued to restore load. During this period, the condition that no interruptible load could be restored had not been met. All the load

restored during this period was potline load, which NEMMCO states had to be restored because the maximum off-time had almost been reached. In any case, from 4.47pm until around 4.54pm, the frequency was not within the normal band.[47] It was during this period that NEMMCO instructed SP AusNet to manually shed load in order to restore frequency.[48] In other words, during this period the power system had become insecure despite NEMMCO's announcement that the system was secure at 4.05pm.

The foregoing shows that NEMMCO set the dispatch price to VoLL before the NER requirements had been satisfied. The early imposition of VoLL meant that many generators in Victoria were not fully dispatched at the time the dispatch price was set to VoLL. This led to the following:

- Flows from Victoria to South Australia across the Heywood interconnector resulted in energy being supplied from a high-price region to a low-price region or counter-price.[49]

- For the majority of the period that the VoLL override applied, FCAS prices were considerably lower than the energy price. This meant that some generators were not compensated appropriately for providing FCAS instead of energy.

- Generators were only generating at part load at the time VoLL was imposed. In order to maximise dispatch given the high price payable, generators could have been incentivised to deviate from dispatch instructions, which could have put system security at risk

This is not the first occasion on which NEMMCO has set the dispatch price to VoLL in a manner inconsistent with clauses 3.9.2(e) and 3.9.2(f). For example, investigations into the events of 14 March 2005 and similarly 8 March 2004, identified instances where the spot price was set to VoLL inappropriately.[50] The response in previous cases was to recommend that NEMMCO alter its internal procedures to ensure compliance with the relevant provisions of the NER. However, the various alterations to

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47 Power System Incident Report: System Separation and Load Shedding 16 January 2007, p. 70, fig. 6.5.

48 The fact that frequency was not within the normal band at these time was implicitly accepted by NEMMCO in its replies to the AER's questions. In particular, NEMMCO agreed that, in hindsight, instead of instructing SP AusNet to shed 100MW at 4.47pm and 4.54 pm to assist with frequency control, other alternatives could have been utilised, including directing ancillary services providers in South Australia. NEMMCO qualified its response by stating that, based upon the information readily available to NEMMCO at the time, its actions were reasonable and prudent.

49 In its Power System Incident Report, NEMMCO states that there were some periods where power flowed between Victoria and South Australia in either direction as loads were being restored. Variation in these flows was a result of the additional support being provided by South Australian generation to pick up customer loads in Victoria, Victorian generators being directed to keep their plant on line at high generation levels in preparation for customer load restoration and later, generators in Victoria seeking to operate at high output levels in response to the VoLL price, which applied from 4.20pm: Power System Incident Report: System Separation and Load Shedding 16 January 2007, p. 4.

50 Report into power system incident on 14 March 2005 in South Australia, National Electricity Code Administrator, p. 10. See also Investigation into the Market's Performance in Extreme Conditions, Final Report, July 2000.

NEMMCO's procedures do not appear to have been successful, evidenced by the fact that, once again, NEMMCO failed to comply with the requirements of clauses 3.9.2(e) and 3.9.2(f) on 16 January 2007.

8.4 Outcomes

On 16 January, NEMMCO set the dispatch price to VoLL during the load restoration process following automatic load shedding. At the time, the conditions governing the application of the VoLL override had not been satisfied. Therefore, NEMMCO failed to comply with clause 3.9.2 at that time. NEMMCO's failure to comply with clause 3.9.2 on this occasion and on previous occasions emphasizes the difficulty associated with the assessments required to satisfy the terms of and intent underlying that clause.

The spot price in the electricity wholesale market plays an important role in the NEM. In the short-term, the spot price provides signals for generation dispatch and demand-side response. In the long-term, the spot price provides signals for investment in new capacity as well as the type of capacity (base-load or peaking) and its location. The rationale underlying the imposition of VoLL as a result of a supply shortfall and consequent load shedding is to preserve these short and long-term signals.

This rationale underpins the current drafting of clause 3.9.2 of the NER, which prescribes the circumstances when NEMMCO must set the dispatch price to VoLL. A report on the market's performance in extreme conditions, which resulted in the introduction of clauses 3.9.2(e) and 3.9.2(f) into the NER in 2001,[51] made it clear that the dispatch price should only be set to VoLL when there are insufficient supply options to satisfy all of the demand in the energy market.

Applying clause 3.9.2 has proved difficult in practice. Ascertaining whether a supply/demand imbalance exists involves a complex and, potentially, subjective decision-making process. NEMMCO is required to establish prices for each dispatch interval while concurrently assessing on an inter-temporal basis whether the requirements of 3.9.2 have been satisfied. Such decisions will normally be taken in the context of extreme market conditions. It is unsurprising that, in these circumstances, NEMMCO has had difficulties in complying with clauses 3.9.2(e) and 3.9.2(f).

A further problem with the VoLL override provision is that errors can have a significant impact on market participants. On 16 January, there were random winners and losers among Victorian generators, depending upon whether or not they were being dispatched at the time the dispatch price was set to VoLL, their contractual position, and whether or not they were dispatched for FCAS. In addition, there was a period of significant counter-price flows and negative inter-regional settlement residues. Inappropriate use of the VoLL override in the period immediately following a power system disturbance also has the disadvantage that it may provoke a commercial response that is inconsistent with the prevailing dispatch requirements, making management of security even more complex.

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[51] Investigation into the Market's Performance in Extreme Conditions, Final Report, July 2000 - National Electricity Code Changes gazetted 11 October 2001.

The AER considers that the practical problems in applying clause 3.9.2(e)(1)(ii), the history of unsuccessful attempts to satisfy the relevant requirements in the NER since their introduction in 2001, and the impact of errors on market participants warrant removal of the provision.

The AER intends to submit a Rule change proposal to the AEMC recommending that the obligation on NEMMCO to set the dispatch price to VoLL following the shedding of interruptible load as a result of a contingency event be removed from the NER (clauses 3.9.2(e)(ii) and 3.9.2(f)). The effect of the proposed rule change would be that the market would determine the price when automatic load shedding occurs. In the event of removal of these provisions, NEMMCO would be focused on returning the power system to a secure operating state as quickly as possible rather than on assessing fulfilment of conditions contained in clauses 3.9.2(e)(ii) and 3.9.2(f). The proposal would not alter the existing requirement contained in clause 3.9.2(e)(1)(i), which requires NEMMCO to set the price to VoLL in the event of manual load shedding, which, to date, has proved very rare.

9 Intervention pricing

Under the NER, NEMMCO has the power to issue directions to participants if such directions are considered necessary to maintain or re-establish the secure operation of the power system. When the directions relate to a system security issue that affects more than a localised (sub-regional) part of the NEM, NEMMCO is obliged to apply intervention or "what if"[52] pricing to avoid price distortion.

On 16 January, in order to stabilise the power system and enable load to be restored following separation of the NEM into three electrical islands, NEMMCO issued a number of directions to participants in the Victoria and South Australia regions. NEMMCO has acknowledged that it failed to apply intervention pricing in relation to these directions, as required by the NER. This section of the report considers the measures NEMMCO has proposed to ensure intervention pricing is applied as required by the NER in future.

9.1 Relevant NER provisions

Under clause 4.8.9 of the NER, NEMMCO has the power to issue directions to participants if NEMMCO is satisfied that such directions are necessary to maintain or re-establish security of the power system.

Clause 3.9.3(a) of the NER provides that, when NEMMCO issues a direction requiring a participant to take action that is necessary to maintain or re-establish secure operation of the power system, NEMMCO is obliged to declare the next dispatch interval to be an "intervention price dispatch interval".

When an intervention price dispatch interval has been declared, NEMMCO must then determine whether intervention pricing applies. Under clause 3.9.3(a3), normal pricing (non-intervention pricing) must be used when a direction has been issued for a local security issue, such as an issue arising at a remote part of the network. If the condition in clause 3.9.3(a3) has not been met (i.e. the system security issue is region-wide), intervention pricing must be used. In cases when intervention pricing is required, clause 3.9.3(a1) requires NEMMCO to set the intervention price at the value, which in NEMMCO's reasonable opinion, would have applied had the direction not been issued.

The rationale for the intervention pricing provisions in the NER is to ensure that NEMMCO's intervention in the market through directions does not result in price distortion. If the intervention is not likely to change price outcomes in the market (i.e. it is equivalent to issuing a direction to a participant that is remote from the regional reference node), then normal arrangements for pricing apply. If, however, the direction is likely to change price outcomes, then intervention pricing is required.

[52] That is, the price that would have prevailed had the intervention not occurred.

9.2 Details of the incident

The multiple contingency event that occurred at 3.02pm on 16 January resulted in a number of transmission lines in the Victoria and South Australia regions tripping out of service and, consequently, the separation of the power system into three electrical islands. Low system frequency was experienced in Victoria and approximately 2200MW of load was shed. In order to stabilise the power system and enable load to be restored, NEMMCO issued a number of directions to participants in the Victoria and South Australia regions. A summary of the directions issued by NEMMCO is set out in the table below.

Table 4: Directions issued on 16 January

Direction	Details of the service requested	Issued (market time)	Cancelled (market time)
1. VIC region Market Notice 15905	Regulation frequency control to stabilise system frequency	3.15pm	3.55pm
2. SA region Market Notice 15931	Manual frequency control to stabilise system frequency	3.27pm	3.45pm
3. VIC region Market Notice 15907	Regulation frequency control to stabilise system frequency	3.32pm	3.55pm
4. VIC region Market Notice 15909	Energy to provide full available generation from the directed generating units	3.40pm	6.35pm
5. VIC region Market Notice 15911	Energy to provide full available generation from the directed generating units	3.45pm	6.33pm
6. VIC region Market Notice 15913	Energy to provide full available generation from the directed generating units	3.45pm	6.33pm
7. VIC region Market Notice 15915	Energy to synchronise and come to a minimum load	4.50pm	6.53pm

In its Directions report, NEMMCO states that it followed its standard operating procedure[53] in issuing and managing directions on 16 January, with the exception of intervention pricing, which was not initiated as required by clause 3.9.3(a1).[54] According to NEMMCO, it was impractical to set spot prices and ancillary service prices in accordance with clause 3.9.3(a1) as this process involves:

- invoking direction and intervention constraint equations for each directed unit
- revoking non-conformance constraint equations
- revising the direction and intervention constraints regularly (potentially every 5 minutes) to accurately reflect the profile of the estimated dispatch level that would have occurred without the directions and the dispatch level capability of the plant.

53 Intervention, Direction and Clause 4.8.9 Instructions SO_OP3707.

54 Direction Report – Victoria and South Australia Regions 16 January 2007, pp. 3-4.

9.3 Compliance assessment

NEMMCO admits that, pursuant to clause 3.9.3 of the NER, intervention pricing should have been but was not used for the directions it issued on 16 January 2007.[55] Had NEMMCO used intervention pricing, the pricing outcomes in Victoria from NEMDE would have been different (probably higher) and the incidence of counter-price flows between Victoria and South Australia may have been reduced.

In its Power System Incident Report, NEMMCO recommends that it should simplify the user interface for invoking intervention pricing in its central dispatch process so that it is suitable for use in system emergencies.[56] Further, in its replies to the AER's questions, NEMMCO states that it has completed a review of the directions process, including how that process is reflected in the central dispatch process. NEMMCO states that a number of proposals are being developed to ensure that the user interface for the application of intervention pricing is consistent with the NER and with NEMMCO's procedures. NEMMCO also states that the amendments to NEMMCO's processes will be complemented by an ongoing staff training program.

9.4 Outcomes

The AER considers that NEMMCO's failure to use intervention pricing on 16 January amounted to a breach of clause 3.9.3. The AER will seek an undertaking from NEMMCO directed at addressing the problems identified in this report regarding intervention pricing.

The undertaking will oblige NEMMCO to take all steps necessary to ensure that clause 3.9.3 will not be breached in the future and to report back to the AER and to the market in general by the end of 2007 with details of the measures it has taken in this regard. The AER notes that NEMMCO has already undertaken a review of its direction processes and supports the review's recommendations to improve processes and training for intervention pricing. The AER expects the review's outcomes to be covered by the undertaking.

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55 Direction Report – Victoria and South Australia Regions 16 January 2007, p. 3.

56 Power System Incident Report: System Separation and Load Shedding 16 January 2007, p. 92.

10 Technical performance standards

The NER obliges registered participants to comply with certain technical performance standards. Among other things, generators are required to ensure "continuous uninterrupted operation" of their plant and equipment in the event of a power system disturbance. However, generators in particular regions of the NEM benefit from derogations that apply less onerous technical performance standards, including in cases when a power system disturbance has occurred.

This section of the report considers generators' technical performance on 16 January to determine whether the applicable performance standards were met following the disturbance to the power system.

10.1 Relevant NER provisions

Clause 4.15 of the NER requires relevant participants to ensure that the technical performance standards registered for their generating units are met or exceeded. Schedule 5 of the NER effectively requires generators to ensure "continuous uninterrupted operation"[57] of their plant and equipment in the event of a power system disturbance in accordance with the relevant technical performance standards.

On 7 December 2006, the AEMC approved a Rule change to establish arrangements for resolving the performance standards of generators connected to transmission or distribution networks. The National Generators Forum (NGF) and NEMMCO, in conjunction with the AER and AEMC, jointly established a transition process to register the actual capability of all incumbent generators by 30 June 2007.

Chapter 9 of the NER contains jurisdictional derogations that apply to each participating jurisdiction. The derogations in Chapter 9 prevail over all other Chapters of the NER. In Victoria, derogations override various technical performance standards in schedule 5 that apply in the context of a power system disturbance (Chapter 9, Part A). The requirements are less onerous than schedule 5 of the NER.

10.2 Details of the incident and participants' responses

NEMMCO's Power System Incident Report makes a number of statements of fact concerning the technical performance of certain generators on 16 January. NEMMCO's factual findings are set out below together with the relevant generators' responses to those findings.

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[57] As at 16 January, the NER did not include a definition of the term "continuous interrupted operation", which could pose enforcement difficulties, although NECA had successfully prosecuted three generators during 2005 for failing to meet this obligation. A definition of the term was included in the recent National Electricity Amendment (Technical Standards for Wind and Other Generator Connections), which came into effect on 15 March 2007.

10.2.1 Torrens Island A1 and A2

NEMMCO reports that "Torrens Island A1 and A2 generating units experienced difficulties in maintaining their power output during the power system disturbance and tripped".[58] NEMMCO concludes in its report that the tripping of the A1 unit and the reduction of load on the A2 unit was inconsistent with the relevant performance standard.[59] NEMMCO also states in its report that "In terms of effect on the power system, reduction of generation on A1 and A2 units at the time assisted the restoration of high South Australian system frequency back towards the normal operating band".[60]

In response to a question posed by the AER, AGL[61] stated that the unit boiler and turbine governor controls operated as expected in response to the frequency disturbance on 16 January, but that the dynamic response of the boiler feed pump water regulators and the boiler feed pumps were not sufficient to prevent the unit boilers from tripping due to the significant and sudden changes and ultimately low boiler drum water levels. AGL further stated that it intends to carry out tests and recalibrations of units A1 and A2 before December 2007, which is the first available time to take the units out of service.

10.2.2 Port Lincoln

NEMMCO's report states that generating units at Port Lincoln tripped "due to reverse power response to the high frequency following separation of South Australia from Victoria".[62] NEMMCO concludes in its report that the tripping of the Port Lincoln units "was not inconsistent with the relevant performance standards".[63]

In response to a question posed by the AER, International Power stated that each of the Port Lincoln units was loaded at around 5MW and provided an initial increase in output due to the fall in frequency followed by an output reduction as a consequence of the

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58 In particular, NEMMCO's report found that A1 unit was operating at maximum output when the South Australian frequency rose to 50.8Hz immediately following islanding. The unit experienced boiler instability and a boiler trip, resulting in a generating unit run-back and a subsequent trip. The A1 unit remained out of service for the remainder of the day. The A2 unit also experienced boiler instability and reduced output in response to the high frequency deviation at 3.05pm. The unit remained synchronised to the power system but without any significant power export. The A2 unit commenced increasing load steadily at 3.44pm after the boiler was twice purged, burners re-ignited and steam temperatures matched to the turbine metal temperatures. This process took approximately 40 minutes: Power System Incident Report: System Separation and Load Shedding 16 January 2007, p. 57.

59 Power System Incident Report: System Separation and Load Shedding 16 January 2007, p. 58.

60 Power System Incident Report: System Separation and Load Shedding 16 January 2007, p. 58.

61 AGL now owns the assets at Torrens Island. On 16 January, TRUenergy SA Generation owned the assets.

62 In particular, NEMMCO's report found that the generating units in Port Lincoln were generating approximately 5MW at the relevant time and that both tripped at 3.03pm due to reverse power response to the high frequency following separation of South Australia from Victoria. The units were resynchronised at 3.20pm: Power System Incident Report: System Separation and Load Shedding 16 January 2007, p. 58.

63 Power System Incident Report: System Separation and Load Shedding 16 January 2007, p. 58.

high system frequency. The magnitude and speed of the deviation was such that the unit governor control switched to frequency response mode, unloading each unit. Reverse power flows then caused the circuit breaker to open after a time delay of 10 seconds. International Power stated that the performance of the generating units has been reviewed. Although limited data on the performance of the unit at the time was available to assess these units due to technical difficulties associated with recording systems, International Power has stated that the set-up parameters for the governor will continue to be monitored and improvements will be implemented, where necessary.

10.2.3 Hazelwood Unit 6

NEMMCO reports that Unit No. 6 at Hazelwood "experienced difficulties in maintaining power output during the incident".[64] According to NEMMCO, the reduction of the unit's output occurred after recovery of frequency in the Victorian region. At the time the output reduction began, frequency had recovered to about 50.4 Hz. The reduction in output of this generating unit did not cause a low frequency deviation and may have contributed to the return of power system frequency to the normal operating frequency band.[65]

In response to a question posed by the AER, International Power stated that it undertook an investigation to determine the cause of the response of Hazelwood Unit 6 on that day. It concluded that the loss of generation was associated with a boiler master trip triggered by furnace pressure protection. International Power also commissioned an engineering study to determine the likely response of Hazelwood to system events like those that took place on 16 January. The study was undertaken as part of the process to establish revised performance standards for Hazelwood. The study found that the ability to control furnace pressure within acceptable limits is a critical factor in the ability of Hazelwood to ride through such events and that this, in turn, depends upon the loading level and the extent of boiler fouling at the time of the event. Given the findings of the study, International Power has concluded that Hazelwood Unit 6 behaved as could be expected on 16 January.

10.2.4 McKay Creek

NEMMCO's report also states that "all six of AGL's McKay Creek generating units tripped due to the voltage disturbance associated with the loss of synchronism" between the Snowy and Victoria regions.[66] In its replies to questions posed by the AER, NEMMCO states that the loss of the McKay Creek units had a minimal impact since this generation was located north of the point of separation.

In response to a question posed by the AER, AGL stated that the new performance standards had not yet been finalised with NEMMCO on 16 January. AGL also states

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64 Power System Incident Report: System Separation and Load Shedding 16 January 2007, p. 38.

65 Power System Incident Report: System Separation and Load Shedding 16 January 2007, p. 38.

66 In particular, NEMMCO's report found that all six of the McKay Creek generating units tripped at 3.03pm due to voltage disturbances associated with the loss of network synchronism: Power System Incident Report: System Separation and Load Shedding 16 January 2007, p. 40.

that remedial actions to address the performance difficulties of the McKay units were not identified by its investigation; nor were any remedial actions recommended in NEMMCO's report.

10.3 Compliance assessment

The AER's assessment, on the basis of information contained in NEMMCO's Power System Incident Report and relevant replies to the AER's questions, is that the owner of Torrens Island on 16 January (TRUenergy SA Generation Pty Ltd) may have breached its obligations under clause 4.15 of the NER by failing to ensure that Torrens Island A1 and A2 units rode through the disturbance to the power system.

Port Lincoln and McKay Creek generating units also tripped while the output of Hazelwood unit 6 fell to almost zero MW during the power system incident. NEMMCO's Power System Incident report does not clearly indicate whether or not these events amounted to breaches of the relevant performance standards.

In any case, the Hazelwood and McKay Creek generating units in Victoria benefit from derogations under Chapter 9 of the NER. The derogation states that generators are taken to have complied with the obligation of continuous uninterrupted operation if their plant and equipment ride through a disconnection of the single largest generating unit on the power system and the frequency remains above 49.5 Hz.[67] This requirement is less exacting than schedule 5 of the NER, which effectively requires generators to ensure continuous uninterrupted operation of their plant during and following much larger frequency disturbances.

10.4 Outcomes

It appears that at least one generator breached its technical standards on 16 January. However, the events of 16 January occurred during a transitional process for the review and formalisation of technical performance standards, which involved the NGF, AER, NEMMCO and the AEMC. Furthermore, in the case of the possible breach, NEMMCO's report indicates that the generator trip in question actually assisted in re-stabilising the power system.[68]

The AER does not intend to take enforcement action for failure by generators to comply with the technical performance standard requirements in the NER on 16 January. The AER is satisfied that the post-event reviews of the incident by the participants involved, and the commitment to incorporate the lessons learnt from this extreme event into their respective compliance programs, will help reduce the likelihood of under-performance in the future. However, now that the transitional phase has ended, the AER will commence auditing generators' performance standards compliance programs to assess compliance with the relevant provisions of Chapters 4 and 5 of the NER, starting with generators referred to in this section of the report. The audits will include an assessment of compliance with the obligation to ensure continuous uninterrupted

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67 See clause 6 of Schedule 9A3 – Jurisdictional Derogations Granted to Generators in Victoria.

68 Power System Incident Report: System Separation and Load Shedding 16 January 2007, p. 58.

operation during a power system disturbance. The AER will take enforcement action if the audit results indicate that such action is justified.

The events of 16 January 2007 highlight the need for effective ride through provisions in the NER. The application of less exacting technical standards to Victorian generating units through Chapter 9 derogations has the potential to compromise system security. On 16 January, at least one Victorian generating unit – namely, Hazelwood – almost tripped without breaching the performance standards because of the Victorian derogations. Furthermore, now that the new regime of generator technical standards has been established and generators have registered the actual capability of their plant and equipment with NEMMCO, the derogations related to those standards are not necessary. The AER will recommend that the Victorian government remove the Chapter 9 derogations relating to generator technical standards. Given that similar derogations exist in Queensland, the AER will make the same recommendation to the Queensland government.

11 Non-compliance with dispatch instructions

Under the NER, participants are obliged to comply with dispatch instructions unless to do so would be a hazard to public safety or would materially risk damaging equipment. This section of the report considers whether the instances of non-compliance with dispatch instructions that occurred on 16 January amounted to breaches of the relevant provisions of the NER.

11.1 Relevant NER provisions

Clause 4.9.8(a) of the NER provides that participants must comply with NEMMCO's dispatch instructions unless, in the participant's reasonable opinion, to do so would be a hazard to public safety or would materially risk damaging equipment.

Clause 3.8.23(a) of the Rules provides that, if a scheduled generating unit fails to respond to a dispatch instruction within a tolerable time and accuracy, then it is to be declared non-conforming by NEMMCO and cannot be used as the basis for setting spot prices.

11.2 Details of the incident

In its Power System Incident Report, NEMMCO does not specifically mention instances of generator non-compliance with dispatch instructions. However, during the course of 16 January, NEMMCO issued a large number of market non-conformance notices to generators.

11.3 Compliance assessment

The AER has already issued a bulletin regarding compliance with dispatch instructions.[69] In that bulletin, the AER noted that the obligation to comply with dispatch instructions established under clause 4.9.8(a) is clear and applies irrespective of whether or not NEMMCO has issued a market non-conformance notice under clause 3.8.23(a).

In its bulletin, the AER also stated that it will closely monitor compliance with dispatch instructions issued by NEMMCO, recognising that exact compliance with dispatch instructions in every dispatch interval is a physical impossibility. The AER stated that, accordingly, it did not intend to pursue a breach of clause 4.9.8(a) with respect to minor departures from dispatch instructions that occur despite the best endeavours of a participant to comply. The AER assesses material non-compliance with dispatch instructions on a case-by-case basis taking into account the particular circumstances of the events under investigation.

The AER analysed relevant market data to identify whether there were any instances of non-compliance with dispatch instructions on 16 January. The AER excluded instances

[69] AER Compliance Bulletin No. 1 "Complying with dispatch instructions" was issued in December 2006.

of non-compliance in cases where, at the time the non-compliance took place, the relevant participants were acting under NEMMCO's directions.[70]

The AER identified a number of events of more than one 5-minute dispatch intervals where generating units deviated by more than 20MW from their dispatch targets. These generating units include Somerton, Hazelwood Unit No. 6 and Torrens Island A1 and B4.

The AER understands that the Somerton unit was dispatched to zero MW for three dispatch intervals, while simultaneously being requested by the local NSP to maintain output to assist a local network service provider with voltage control. Hazelwood Unit No. 6 and Torrens Island A1 moved away from targets for short periods while attempting to recover from the power system disturbance. Torrens Island B4 was away from its target in the period just prior to the reconnection of the Victorian and South Australian regions.

Given the circumstances experienced at the time that non-compliance with dispatch instructions took place, the AER is satisfied that none of these instances is materially inconsistent with the requirements of clause 4.9.8(a) of the NER.

11.4 Outcomes

The AER will only take action under clause 4.9.8(a) of the NER for non-compliance with dispatch instruction when a material deviation from dispatch instructions has occurred. Moreover, enforcement action will not be taken when the circumstances causing the failure to comply with dispatch instructions are outside the relevant participant's control.

The AER has concluded that, on that day, there were no instances of non-compliance with dispatch instructions that warrant enforcement action.

[70] In other words, these are effectively instances where NEMMCO directed generators not to comply with their dispatch instructions.

12 Provision of frequency control ancillary services

The NER obliges participants that provide frequency control ancillary services (FCAS) to comply with certain technical requirements. In addition, these participants must ensure that they can meet their offers for the provision of FCAS at all times. This section of the report considers whether providers of FCAS on 16 January met their obligations to comply with the applicable technical requirements and that they could fulfil their offers for the provision of FCAS.

12.1 Market customer

12.1.1 Relevant NER provisions

Clause 4.9.9B of the NER provides that a participant that has classified a load as an ancillary service load must notify NEMMCO of any event, which has changed or is likely to change the availability of the service, as soon as the participant becomes aware of the event. Similarly, the participant must notify NEMMCO if the capability of the load to respond in the manner contemplated by the market ancillary service specification changes or is likely to change.

Failure to comply with clause 4.9.9B could mean that NEMMCO relies on invalid offers. Market pricing and system security outcomes could be compromised in such cases.

12.1.2 Details of the incident

On 16 January, 880MW of aluminium smelter load at Point Henry[71] and Portland[72] was interrupted because of commercial decisions regarding some potlines and in response to the low frequency prevailing during the power system disturbance for the others. All of the smelter load was unavailable for the provision of FCAS from 3.10pm for 36 minutes. NEMMCO states in its Power System Incident Report that it did not receive any rebids in respect of those potlines during the period when they were out of service.[73] Accordingly, NEMMCO relied upon the information that had been originally provided by Vicpower Trading through the bidding system for ancillary service loads.[74]

In response to a question posed by the AER requesting clarification as to why rebids were not submitted, Vicpower Trading stated that all of its potlines had been interrupted on 16 January. Potlines PTH02 and PTH03 were interrupted pursuant to a contractual arrangement between Vicpower Trading and another market participant. The other three potlines (PTH01, APD01 and APD02) were interrupted due to the frequency disturbance that resulted from the multiple contingency event.

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71 There are three potlines at Point Henry – PTH01, PTH02 and PTH03.

72 There are two potlines at Portland – APD01 and APD02.

73 Power System Incident Report: System Separation and Load Shedding 16 January 2007, p. 75.

74 Power System Incident Report: System Separation and Load Shedding 16 January 2007, p. 76.

Vicpower Trading states that prior to the event, PTH03 was enabled to provide FCAS, but that this potline was switched off for commercial reasons approximately 15 minutes before the frequency disturbance. When PTH03 was switched off, Vicpower Trading's systems enabled the next potline (PTH02) for the provision of FCAS. According to the participant, rather than perform a rebid, Vicpower Trading systems dispatch/enable the next available potline to perform the service. However, approximately 10 minutes after the occurrence of the frequency disturbance that tripped three potlines (PTH01, APD01 and APD02), the one remaining load (PTH02) was switched off for commercial reasons. The result was that all five potlines (at both the Point Henry and Portland smelters) were offline. Vicpower Trading states that it did not submit a rebid as it considered that the potlines were providing frequency support whilst offline.

12.1.3 Compliance assessment

The failure of Vicpower Trading to rebid the Point Henry potlines appears to amount to a breach of clause 4.9.9B. The AER considers that the provision of contingency FCAS requires the ancillary service load to be able to respond as required by NEMMCO's Market Ancillary Service Specification. It is difficult to understand how Vicpower Trading's offers to provide raise contingency services could have been honoured given that all five potlines were concurrently offline. An additional concern is that offers for raise contingency services from Point Henry were dispatched by the market system without such services being available.

According to NEMMCO's Power System Incident Report, the relevant smelter trader has expressed the view that greater clarity is needed in respect of whether a rebid is required for a non-scheduled load.[75] However, clause 4.9.9B explicitly requires changes in ancillary service loads for FCAS to be notified by the service provider irrespective of whether the load is classified as scheduled or non-scheduled with respect to the energy market.

In its Power System Incident Report, NEMMCO also recommends that use of FCAS offers by NEMMCO and the means of ensuring input data consistency should be reviewed to minimise potential inconsistency between services offered and physical availability of plant.[76] The AER supports NEMMCO's recommendation to improve the process for validating and using FCAS offers.

12.1.4 Outcome

System security and market pricing outcomes are compromised if market participants do not advise NEMMCO of changes in FCAS availability, as required by clause 4.9.9B.

The AER finds that the failure of Vicpower Trading to rebid the ability of Point Henry potlines to provide FCAS after all of its load tripped or was switched off probably amounts to a breach of clause 4.9.9B. The potential breach is particularly significant

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[75] Power System Incident Report: System Separation and Load Shedding 16 January 2007, p. 75. The Rules make no mention of unscheduled loads with respect to ancillary services. Instead a market load that chooses to provided market ancillary service must do so in accordance with clause 2.3.5 of the NER.

[76] Power System Incident Report: System Separation and Load Shedding 16 January 2007, p. 75.

given that Vicpower Trading's FCAS offer, which it failed to honour, was dispatched by the market systems. The AER will pursue this matter directly with Vicpower Trading.

12.2 Generators

12.2.1 Relevant NER provisions

Clause 3.11.2(b) of the NER obliges NEMMCO to make and publish a market ancillary service specification containing a description of each kind of ancillary service as well as the performance requirements applicable to each service. Paragraphs 2.5 and 2.6 of NEMMCO's Market Ancillary Service Specification require participants to have equipment in place to monitor and record the provision of FCAS, including data recorders. In addition, clause 3.11.7(a) provides that:

> … a *Market Participant* which has classified a *generating unit* as an *ancillary service generating unit* or a *market load* as an *ancillary service load* must install and maintain in accordance with the standards referred to in clause 3.11.7(b) monitoring equipment to monitor and record the response of the *ancillary service generating unit* or *ancillary service load* to changes in the *frequency* of the *power system*.

Clause 4.9.8(d) of the NER provides, *inter alia*, that participants that have classified a generating unit as an ancillary service generating unit must ensure that the unit is able to comply with the latest ancillary services offer at all times. Failure to comply with clause 4.9.8 could mean that NEMMCO relies upon FCAS offers even though they are no longer valid because, for example, of changes in availability of the relevant generating plant. System security could be compromised in such cases.

12.2.2 Details of the incident and participants' responses

NEMMCO's Power System Incident Report makes a number of statements concerning the provision of FCAS by certain generators on 16 January. NEMMCO's findings are set out below together with the relevant generators' responses to those findings

Torrens Island B

In its report, NEMMCO stated that "the data recorders for the Torrens Island B units might not have met the requirement specified in section 2.5(x) of the Market Ancillary Services Specification".[77]

In response to a question posed by the AER, AGL[78] stated that the meter for the provision of FCAS on Torrens Island started recording 3 seconds before the system frequency disturbance rather than 5 seconds, as required under NEMMCO's Market Ancillary Services Specification. According to AGL, this defect was caused by an

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[77] NEMMCO's report also states that the data supplied to NEMMCO for Torrens Island units B2, B3 and B4 did not contain sufficient information to make an assessment of their response. Specifically, there is insufficient data provided for the period 5 seconds prior to the event: Power System Incident Report: System Separation and Load Shedding 16 January 2007, p. 55.

[78] As noted above, AGL now owns the assets at Torrens Island. On 16 January, TRUenergy SA Generation owned the assets.

underlying software problem. AGL also stated that rectification of this defect in the FCAS data recorders and database software has been delayed during the recent ownership changes of the Torrens Island power station. Nevertheless testing and, if necessary, alteration of the settings on FCAS recorders, is scheduled to be completed by 14 September 2007.

Yallourn W unit No. 1

NEMMCO's report also referred to Yallourn W unit No. 1, which was enabled for 20MW of slow FCAS raise service. NEMMCO stated in its report that it "should follow up with TRUenergy whether the observed lack of slow contingency raise FCAS delivered by Yallourn W unit No. 1 at 16:12 hrs is indicative of any underlying issues".[79]

In response to a question posed by the AER, TRUenergy stated that there were no mechanical issues "with the governor mechanism that should have prevented operation [of the generator] in response to the frequency disturbance". TRUenergy provided a detailed technical explanation to support its response. The AER intends to seek further clarification from TRUenergy and NEMMCO regarding this explanation.

Loy Yang unit B2

NEMMCO's report indicates that there was a lack of fast FCAS and regulation raise response on Loy Yang Unit B2. NEMMCO states that it should "follow up with IPM Australia Limited whether the observed lack of fast FCAS response on Loy Yang B2 is indicative of any underlying issues".[80]

In response to a question posed by the AER, International Power stated that the failure of Loy Yang Unit 2 to supply dispatched FCAS raise services can be attributed to the action of the vacuum unloader, which overrides the turbine governor speed droop responses to protect the plant from any potential damage. Investigations by International Power found there is a high risk that the vacuum unloader operation will compromise the delivery of FCAS services under periods of high ambient temperatures and consequent high condenser pressures. Accordingly, International Power has stated that all FCAS raise services will be rebid to withdraw those services when ambient temperatures are high.

Northern Power Station unit No. 1

NEMMCO's report notes that Northern Power Station unit No 1 was enabled for regulation raise FCAS service but the unit was generating less than its dispatch target for almost 20 minutes during load restoration.[81] NEMMCO states that it should

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79 Power System Incident Report: System Separation and Load Shedding 16 January 2007, p. 5.

80 In particular, NEMMCO's report states that, although the unit initially responded very quickly, the response lasted for only about one second, despite the fact that the frequency was still falling. The unit was enabled to provide 7MW of fast raise response but the average response over the first six seconds was -0.18MW: Power System Incident Report: System Separation and Load Shedding 16 January 2007, p. 36.

81 Power System Incident Report: System Separation and Load Shedding 16 January 2007, p. 78.

"investigate with Flinders Power the observed shortfall of regulation raise FCAS from the No. 1 unit at Northern Power Station between 16:45hrs and 17:00hrs".[82]

In response to a question posed by the AER, Flinders Power explained that a fault on the remote terminal unit (owned by ElectraNet) meant that there was a difference in the dispatch signals sent and received by NEMMCO and Flinders Power respectively through NEMMCO's Automatic Generation Control (AGC) system. Flinders Power stated that it has agreed upon a series of tests with NEMMCO to confirm the correct operation of controls.

12.2.3 Compliance assessment and outcomes

NEMMCO's factual findings tend to indicate that TRUenergy SA Generation failed to comply with clause 3.11.7(a) and NEMMCO's Market Ancillary Service Specification related to data recording equipment on 16 January. The AER intends to seek further clarification from NEMMCO about the factual circumstances surrounding this and other instances of apparent failures to perform in accordance with FCAS specifications on 16 January.

In the meantime, in light of the system security consequences of failing to comply with FCAS offers, compliance with clause 4.9.8(d) and the relevant provisions of NEMMCO's Market Ancillary Service Specification will be treated as a high priority in the AER's compliance audit program. The AER will commence the program later in 2007. The generators that failed to comply with the relevant FCAS requirements on 16 January will be targeted for such audits in the first instance.

[82] Power System Incident Report: System Separation and Load Shedding 16 January 2007, p. 79.