Australian Energy Market Commission

REVIEW

INTERIM REPORT

Review of the Effectiveness of NEM Security and Reliability Arrangements in light of Extreme Weather Events

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29 May 2009

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Citation

AEMC 2009, *Review of the Effectiveness of NEM Security and Reliability Arrangements in light of Extreme Weather Events*, Interim Report, 29 May 2009, Sydney

About the AEMC

The Council of Australian Governments, through its Ministerial Council on Energy, established the Australian Energy Market Commission (AEMC) in July 2005 to be the Rule maker for national energy markets. The AEMC is currently responsible for Rules and policy advice covering the National Electricity Market and, from 1 July 2008, concerning access to natural gas pipeline services and elements of the broader national gas markets. It is a statutory authority. The AEMC's key responsibilities are to consider Rule change proposals, conduct energy market reviews and provide policy advice to the Ministerial Council on Energy as requested, or on AEMC initiative.

Contents

Abbreviations

AEMC	see Commission
AER	Australian Energy Regulator
Commission	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
APR	Annual Planning Report
CPT	Cumulative price threshold
DNSP	Distribution network service provider
MCE	Ministerial Council on Energy
MCE Direction	Direction from the MCE to the Commission to conduct a review of the effectiveness of the NEM security and reliability arrangements in light of extreme weather events
MNSP	Market Network Service Provider
MPC	Market price cap
MRL	Minimum reserve limit
MTPASA	Medium term projected assessment of system adequacy
MWh	Megawatt hour
NEL	National Electricity Law
NEM	National Electricity Market
NEMMCO	National Electricity Market Management Company
NER	National Electricity Rules
NSP	Network service provider
NTP	National Transmission Planner
NTNDP	National Transmission Network Development Plan
RERT	Reliability and emergency reserve trader
RIT-D	Regulatory Investment Test for Distribution
RIT-T	Regulatory Investment Test for Transmission
SOO	Statement of Opportunities
TNSP	Transmission Network Service Provider
USE	Unserved energy
VoLL	Value of Lost Load

Summary

In late January 2009, South Australia and Victoria experienced heat wave conditions. The maximum demands recorded on 29 January in each region were the highest ever recorded, and maximum demands on 30 January were only slightly lower.[a] Over these two days, generators in both regions experienced progressive reductions in availability and some transmission elements experienced reductions in availability at short notice. As a result, supply to a number of business and residential consumers in both South Australia and Victoria was interrupted on both days.

At its meeting on 6 February 2009, the Ministerial Council on Energy (MCE) noted the significance of these interruptions.[b] The MCE agreed to request the Australian Energy Market Commission (Commission) to review energy market frameworks in light of the impact of the heat wave on electricity supply.

This review

On 28 April 2009, the MCE directed the Commission to conduct a review of the effectiveness of the security and reliability arrangements in the National Electricity Market (NEM) in light of extreme weather events. The weather events the Commission is to have regard to are droughts, heat waves, storms, floods and bushfires.[c]

In essence, this review requires the Commission to consider the following questions:

- Under the scenario that extreme weather events become more frequent, are the current arrangements for managing security and reliability in the NEM appropriate to deliver reliable and secure electricity supply?
- If not, what cost-effective amendments could be made to the market arrangements in the short and longer terms to address any identified risks to security and reliability under that scenario.

The Commission is required to present its advice to the MCE in two stages. The first stage is the advice contained in this Interim Report. The Interim Report describes the measures currently under consideration that would improve system reliability and security. It also identifies any further cost-effective measures that could be taken in the short-term that would impact on system reliability for the summer of 2009-10.

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a NEMMCO, *Power System Incident Report – Actual Lack of Reserve in Victoria and SA on 29-30 January 2009*, 26 May 2009, p. 3.

b Ministerial Council on Energy, *Communiqué*, Canberra, 6 February 2009, p. 1.

c Under section 41(1)(a) of the National Electricity Law, the MCE may give a written direction to the Commission requiring the Commission to conduct a review into any matter relating to the national electricity market.

The Final Report will present the second stage of the Commission's advice to the MCE. The second stage will concentrate on changes to energy market frameworks that could improve reliability in the longer term and contribute to the more effective management of system security and reliability during extreme weather events. The Commission is required to provide the Final Report to the MCE by 30 October 2009.

Key messages

Cause of supply interruptions

Disruptions to distribution networks are responsible for 90% of the duration of interruptions to customers.[d] While the direction from the MCE invites the Commission to make observations about the distribution networks, the direction notes that matters concerning the reliability and security performance of distribution networks in the NEM (including network planning standards) are determined by jurisdictional bodies. The primary focus of the Interim Report is on reliability and security in the generation and transmission sectors of the NEM.

Performance of existing reliability and security mechanisms to date

Under the energy-only market design of the NEM, the primary mechanism for promoting reliable electricity supply is the Reliability Standard. Currently, the Standard requires that no more than 0.002% of annual energy consumption for any region is unmet. To encourage the market to deliver the generation capacity and transmission capability necessary to meet the Reliability Standard, the NEM signals investment opportunities via the price payable for electricity in the wholesale spot market. The NEM manages the risk of wholesale volatility through the market price cap (or MPC formerly called the Value of Lost Load, or VoLL), the cumulative price threshold and the market floor price. The Reliability Standard and reliability settings are supported by NEMMCO's ability to intervene in the market. As the market operator, NEMMCO operates the power system in such a way as to minimise risks to the security of the power system as a whole. This means that sometimes NEMMCO must shed load.

The signals for investment in transmission networks are conveyed through the planning standards and the framework for economic regulation. By requiring minimum levels of redundancy, the planning standards improve the capability of transmission networks to meet peak demand. The financial incentives administered by the Australian Energy Regulator (AER) offer opportunities to improve the profitability of the network by operating efficiently. There are also financial incentives to maintain reliable performance.

Since the commencement of the NEM, the security and reliability of electricity supply has been sound. Technical performance has been maintained and market signals have promoted acceptable performance against the Reliability Standard. However,

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d Australian Energy Regulator, *State of the Energy Market 2008*, Melbourne, 2008, p. 156.

there is also a possibility that the extreme weather events experienced recently may occur on more frequently, placing added stress on the capacity of the power system to maintain secure and reliable energy supply.

Looking to the future, the electricity industry can expect to face a number of challenges. The balance between supply and demand is tightening. Financial markets are adjusting to new conditions. There remains uncertainty for investors about future policy responses to climate change.

Improvements to the existing arrangements

Against this background, and adopting the premise that extreme weather events become more frequent, it is appropriate to test whether the mechanisms currently in place will continue to deliver secure and reliable electricity supply.

Extreme weather events have the potential to impact materially on the security and reliability performance of the NEM. As described in Chapter 3, heat wave conditions may give rise to extreme peak demand which can exceed the generation capacity and transmission capability available at the time. Droughts can restrict generation availability, and storms and floods can damage transmission and distribution networks.

However, the NEM has been designed to incorporate a number of sophisticated features that are likely to assist it to perform effectively during extreme weather conditions. Generators receive dispatch targets every five minutes, allowing near-real time adjustments to be made to reflect changes in demand and to maintain the security of the power system. The price envelope for electricity sold through the wholesale spot market – which consists of the MPC, market floor price and cumulative price threshold – signals the level of investment in new generation that is necessary to satisfy the Reliability Standard. The regulatory framework and planning standards governing transmission networks create incentives for investment in networks sufficient to deliver the electricity required by consumers. These signals are supplemented by information published by NEMMCO about expected future demands on the NEM.

The NEM also provides for the periodic review and refinement of its energy market frameworks. A number of improvements have been implemented recently, while the Commission and the Reliability Panel continue to develop further refinements. These changes are summarised in Table S.1 below.

Amendments have recently been made to realign the price envelope for the wholesale spot market with commercial expectations of risk and reward. Consideration is also being given to other options that may be available to manage demand peaks, for example, by promoting greater demand side participation in the NEM.

The Reliability Panel has commenced an important review of the Reliability Standard and other market signals used to manage reliability. It will report its findings on these matters by April 2010. The Panel is also developing a proposal to manage forecast capacity shortfalls that are identified shortly before they occur. If adopted,

the Panel's proposal is expected to be implemented and operational in advance of summer 2009/2010.

New investment and planning processes for transmission networks are being developed. The new processes, including the National Transmission Network Development Plan (NTNDP) and the Regulatory Investment Test for Transmission (RIT-T), are expected to encourage more timely and efficient investment and thus improve reliability and security. New initiatives are also being progressed that are expected to improve the technical and planning standards that apply to transmission[e] (and distribution) networks[f], although it is likely more needs to be done in this area.

Next steps

Presenting the Interim Report to the MCE marks the completion of the first stage of the review. The Commission will now commence the second stage, which requires it to prepare advice to the MCE about further changes that could be made to energy market frameworks to deliver cost-effective improvements to reliability in the long term. The Commission's advice will be contained in the Final Report, which is to be provided to the MCE by 30 October 2009.

Table S.1: Summary of recent improvements to existing arrangements

Changes to the energy market frameworks	Affected element	Status
Amend the National Electricity Rules (NER) to increase the market price cap to $12,500/MWh	Generator reliability	Changes take effect 1 July 2010
Amend the NER to increase the cumulative price threshold to $187,500	Generator reliability	Changes take effect 1 July 2010
Amend the NER to provide for biennial reviews of the Reliability Standard and reliability settings	Generator reliability	Changes took effect 28 May 2009. The Reliability Panel has commenced its first review under this new framework
Amend the national energy market framework to create the National Transmission Planner (NTP) function	Network reliability	Legislative changes pending for commencement on 1 July 2009. The first NTNDP is scheduled to be completed in 2010
Amend the NER to include the Regulatory Investment Test for Transmission (RIT-T)	Network reliability	The AEMC is considering a Rule change proposal

[e] In September 2008, the Commission provided advice to the MCE about a nationally consistent framework for transmission reliability standards. The MCE is considering the Commission's advice.

[f] The Commission is currently reviewing the distribution network planning and expansion arrangements that currently exist in the regions of the NEM.

Changes to the energy market frameworks	Affected element	Status
Recommendation from the Commission to develop a nationally consistent framework for setting transmission standards	Network reliability	The MCE is considering advice from the Commission dated 30 September 2008
Develop a reliability and emergency reserve trader scheme to operate at short notice	Generator reliability	Currently being developed by the Reliability Panel. The Panel will report as soon as practicable in 2009
Review by the Reliability Panel of the operationalisation of the Reliability Standard	Generator reliability	Reliability Panel is due to report to the Commission by 31 December 2009
Biennial review of the Reliability Standard and reliability settings by the Reliability Panel	Generator reliability	Reliability Panel is due to provide its recommendations to the Commission by 30 April 2010
Amend the NER to improve opportunities for demand-side participation	Generator reliability	Climate Change 2nd Interim Report due 30 June 2009[g]; Demand Side Participation Final Report (Stage 2) due 2nd half of 2009[h]
Recommendation from the Reliability Panel to review generator performance standards	Generator security	Reliability Panel is developing a Rule change proposal. The Commission has deferred the review
Review the electricity distribution network planning and expansion arrangements	Network reliability	The Commission's draft report is due July 2009

g This report will be published as part of the Commission's *Review of Energy Market Frameworks in light of Climate Change Policies*.

h This report will be published as part of the Commission's *Review of Demand Side Participation in the NEM*.

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1 About the Review

1.1 Background to the Review

In late January 2009, South Australia and Victoria experienced extreme temperatures. In Adelaide, maximum temperatures exceeded 35ºC for nine consecutive days, with six consecutive days over than 40ºC.[1] For the first time in history, Melbourne recorded three consecutive days over 43ºC.[2]

The heat wave conditions created high demand for electricity in these regions. The maximum demands recorded on 29 January were the highest ever recorded in the South Australian and Victorian regions. Maximum demands on 30 January were only slightly lower.[3]

Equipment used in the production and delivery of electricity to consumers is designed to operate safely within specific temperature ranges. At temperature extremes the performance of equipment degrades prior to being required to be withdrawn from service. The high temperatures in South Australia and Victoria resulted in reductions in the availability of transmission elements at short notice, including the Basslink interconnector[4], and progressively reduced the availability of the Victorian generators on both days. To restore the balance between supply and demand, NEMMCO instructed that demand be reduced in both South Australia and Victoria, causing supply interruptions to business and residential consumers. Consumers also experienced supply interruptions within the distribution network.

At its meeting on 6 February 2009, the Ministerial Council on Energy (MCE) noted the significance of the interruptions during this period.[5] The MCE agreed to request the Australian Energy Market Commission (Commission) to review energy market frameworks in light of the impact of the heat wave on electricity supply.

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1 ESCOSA, *Performance of ETSA Utilities during January–February 2009 Heatwave*, fact sheet, www.escosa.sa.gov.au/webdata/resources/files/090401-D-PerformancOfETSAJanFeb09Heatwave_df.pdf

2 NEMMCO, *Power System Incident Report – Actual Lack of Reserve in Victoria and SA on 29-30 January 2009*, 26 May 2009, p. 5.

3 ibid, p. 3.

4 Basslink is protected by a thermal protection mechanism that reduces its ability to transfer electricity between Tasmania and the mainland. For example, its availability reduces when temperatures at the George Town Convertor Station in northern Tasmania exceed 33ºC and is reduced to 0 MW when temperatures exceed 35ºC. These protection mechanisms were activated on 29 and 30 January 2009, when temperatures at the George Town Converter Station reached 37.2ºC and 37.5ºC respectively. Accordingly, the reduction in Basslink's availability on 29 and 30 January was consistent with its operational design.

5 Ministerial Council on Energy, *Communiqué*, Canberra, 6 February 2009, p. 1.

1.2 MCE direction to conduct the review

On 28 April 2009, the MCE directed the Commission to conduct a review of the effectiveness of NEM security and reliability arrangements in light of extreme weather events (MCE Direction).[6] The MCE Direction, which includes the terms of reference for the review, is reproduced in Appendix A.

The MCE Direction requires the Commission to, in the context of extreme weather events such as droughts, heatwaves, storms, floods and bushfires:

- examine the current arrangements for maintaining the security and reliability of supply to end users of electricity and assess the capability of those arrangements to maintain adequate, secure and reliable supply;
- provide advice on the effectiveness of, and options for, cost-effective improvements to current security and reliability arrangements; and
- if appropriate, identify any cost-effective changes to the market frameworks that may be available to mitigate the frequency and severity of threats to the security and reliability of the power system.

In essence, this review requires the Commission to consider the following questions:

- Under the scenario that extreme weather events become more frequent, are the current arrangements for managing security and reliability in the NEM appropriate to deliver reliable and secure electricity supply?
- If not, what cost-effective amendments could be made to the market arrangements in the short and longer terms to address any identified risks to security and reliability under that scenario.

The Commission's advice focuses primarily on the security and reliability performance of those elements of the NEM that are currently within the national energy framework, i.e. the generation and transmission elements of NEM. While the MCE Direction invites the Commission to make observations about distribution networks, the Direction notes that matters concerning the reliability and security performance of distribution networks in the NEM (including network planning standards) are determined and monitored by jurisdictional bodies.

1.2.1 Presenting the Commission's advice to the MCE

The Commission is to present its advice to the MCE in two stages. During the first stage, the Commission is to:

6 Under section 41(1)(a) of the National Electricity Law, the MCE may give a written direction to the Commission requiring the Commission to conduct a review into any matter relating to the national electricity market.

- report on measures that are currently under consideration that would improve system reliability and security; and

- identify and report on any further cost-effective measures that could be taken to improve system reliability for the summer of 2009/10.

The first stage of the review focuses on measures that have been developed and are being implemented in the short-term. Excluding any mechanism developed to enable NEMMCO to respond to capacity shortfalls at short notice, there is little opportunity to implement additional cost-effective measures prior to summer 2009/10. The Commission's advice to the MCE in relation to these matters is contained in Chapter 4 of this Interim Report.

The second stage of the review concentrates on longer term solutions. It requires the Commission to investigate and report on cost-effective changes that could be made to energy market frameworks to improve reliability in the longer term and enable reliability to be managed more effectively during future extreme weather events. It is likely that any options identified by the Commission will require a material lead time before improvements in reliability can be observed. The Commission will present its findings in the Final Report, which is to be provided to the MCE by 30 October 2009.

1.3 Key concepts underpinning the review

The NEM aims to deliver reliable and secure electricity supply to consumers. To a substantial proportion of electricity consumers, reliable supply constitutes uninterrupted supply. Although completely uninterrupted electricity supply cannot be achieved cost-effectively, the NEM endeavours to minimise supply interruptions, having regard to the trade-off between high levels of reliability and the associated costs. Minimising interruptions requires the performance of all parts of the electricity supply chain: generators, high voltage transmission networks and local distribution networks.

This section 1.3 summarises the process for producing and delivering electricity to consumers. It explains what is meant by "reliability" and "security" for the purpose of this review. Finally, it identifies the three main causes of supply interruptions, and the impact of load shedding, one of the mechanisms used to respond to these interruptions, on consumers.

1.3.1 Supplying electricity to consumers in the NEM

In broad terms, electricity is produced by generators located across the NEM and fed into the transmission system. The transmission system comprises a network of transmission cables and other elements that transfer energy at high voltages from power stations to the distribution networks located in cities and towns.

At the points of interconnection between a transmission network and a distribution network, the voltage is reduced at a substation, and electricity is transported to homes and businesses.

Transmission networks also allow electricity generation in one region to be transported to consumers in another. Each NEM region has its own transmission network which is connected to the networks in adjacent NEM regions. The transmission line, or group of transmission lines, connecting the two networks are called interconnectors.

As the market operator, NEMMCO is responsible for dispatching sufficient energy to meet consumer demand, subject to the constraint of maintaining the stability of the transmission network. NEMMCO uses short and long term forecasting techniques to ensure the availability of predicted energy requirements plus a reserve margin for credible contingency events.

The physical power system (i.e. the physical assets used to produce and transport electricity) incorporates a level of redundancy. This means the network is built so that electricity can follow multiple paths to travel from the generator to the consumer. A certain level of redundancy is appropriate because it permits electricity to be delivered to consumers even if there is a flow limit on one part of the network. Therefore, network redundancy assists in reducing supply interruptions. However, the benefits of redundancy must be balanced against the cost of constructing and maintaining surplus infrastructure.

1.3.2 Defining power system security and reliability

The design of the NEM incorporates two fundamental mechanisms for facilitating the delivery of continuous electricity supply:

- power system security; and
- capacity adequacy, which is measured in terms of reliability.

A key question for the Commission in this review is whether these arrangements are appropriate to deliver reliable and secure electricity supply in the event that extreme weather events become more frequent.

1.3.2.1 Power system security

Power system security is the ability of the power system to withstand a supply interruption caused by an event that NEMMCO considers credible, without causing wider system interruptions. Credible contingency events include the loss of the largest generating unit or the loss of a single transmission element e.g. a line, or the loss of the largest load.

To achieve and maintain security, NEMMCO must schedule, operate and control the power system:

- within its defined technical limits; and

- in such a way that, if a credible contingency event occurs, the power system will return to operating within its defined technical limits within thirty minutes.[7]

There is no single standard that regulates the technical operation of the power system. Rather, the security standards are set by a combination of the National Electricity Rules (NER) and determinations of the Reliability Panel.[8] With few exceptions, the security standards require that no customer load should be involuntarily interrupted in order to manage power system security following a single credible contingency on the main power system.[9]

The Reliability Panel reports on the NEM's performance against security standards in its Annual Market Performance Review.

1.3.2.2 Capacity adequacy and reliability

Supply interruptions are also managed by maintaining adequate capacity. There is adequate capacity when the power system is able to generate and deliver to a region the volume of electricity required by consumers in that region (plus a reserve safety margin).

The capacity adequacy of the NEM is measured in terms of its reliability. The current standard for reliability is reflected in the Reliability Standard[10], which is set by the Reliability Panel. The Reliability Standard specifies the maximum amount of electricity that is permitted to be at risk of not being supplied to consumers. Energy that is required by, but not supplied to, consumers is called "unserved energy" (USE). Currently, the level of the Standard is 0.002% USE of the annual energy consumption for the associated region or regions per financial year. This means that, for example, based on a ten year average, for every 10,000 MWh required by consumers in a region each year, 9,998 MWh is expected to be supplied.[11]

Historically, the NEM has performed well against the Reliability Standard.[12] Since the NEM commenced in December 1998, averages for USE due to capacity adequacy shortfalls show that New South Wales and Queensland remain within the Reliability

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7 Power system security is defined in Chapter 10 of the Electricity Rules as "[t]he 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."

8 The Reliability Panel is a specialist body within the AEMC and comprises industry and consumer representatives. It is responsible for monitoring, reviewing and reporting on the safety, security and reliability of the national electricity system and advising the AEMC in respect of such matters. The Panel's functions and responsibilities are specified in section 38 of the NEL.

9 Reliability Panel, *Annual Market Performance Review – Final Report*, December 2008, p. 45.

10 A comprehensive description of the reliability standard is available at http://www.aemc.gov.au/pdfs/Reliability%20Panel/NEM%20Reliability%20Standard%20-%20Generation%20and%20Bulk%20Supply%20-%20December%202007.PDF

11 Unserved energy (USE) due to lack of reserves on 29-30 January 2009 on an annual energy basis was 0.004% for Victoria and 0.0032% for South Australia. However, the Reliability Standard is interpreted on a 10 year average since it is based on a low probability event (one in ten years).

12 AEMC Reliability Panel 2008, *Comprehensive Reliability Review – Final Report*, December 2007, p. xi; Reliability Panel, *Annual Market Performance Review – Final Report*, December 2008, p. 9.

Standard. South Australia and Victoria fell outside the Reliability Standard in 2000, but have met the Standard every year since then.[13] However, the supply interruptions that occurred in January 2009 mean that South Australia and Victoria are not expected to meet the Standard in 2009. Since Tasmania joined the NEM in May 2005, it has not experienced a breach of the Reliability Standard.

The Reliability Standard does not reflect the reliability performance of the distribution network. As noted below, distribution networks are subject to performance standards that are set and monitored by jurisdictional bodies.

1.3.3 Causes of supply interruptions

There are three principal causes of supply interruptions:

- faults occurring within the distribution network;
- shortfall in available generation and network capacity; and
- actions taken to maintain power system security.

1.3.3.1 Faults within the distribution network

Disruptions to supply within distribution networks account for over 90 per cent of the duration of all interruptions to supply. Relatively few interruptions originating in the generation and transmission sectors are a direct cause of loss of supply.[14]

Distribution network interruptions generally occur without prior notice. As such, it is generally not possible to give consumers advance warning of a disruption. When a supply interruption does occur, it usually persists until the network is repaired or replaced. Low levels of network redundancy mean the burden of the interruption is unlikely to be able to be shared by other consumers.

Supply interruptions within the distribution network are not assessed against the security and reliability measures contained in the NER, including the Reliability Standard. Matters concerning the reliability and security performance of distribution networks in the NEM (including network planning standards) are determined by jurisdictional bodies.[15]

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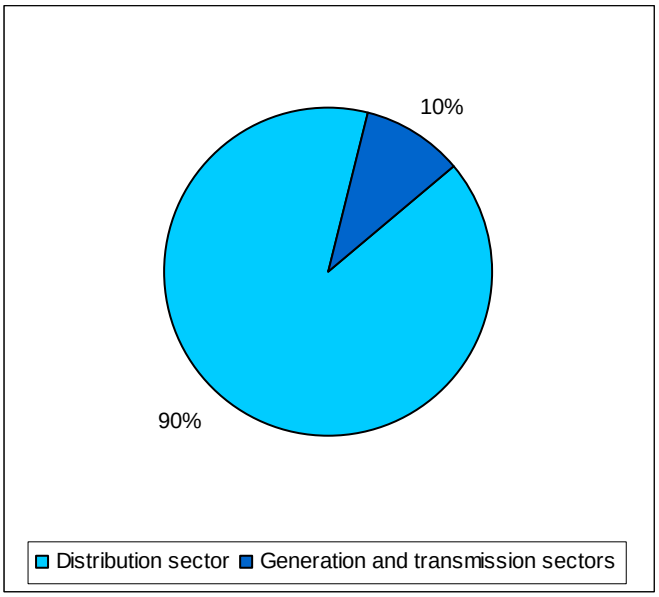
13 The failure of South Australia and Victoria to meet the Reliability Standard in 2000 is attributable to a coincidence of industrial action, high demand and temporary unavailability of generating units in Victoria. Due to this single event, Victoria's long term averages remain outside the Standard: Reliability Panel, *Annual Market Performance Review – Final Report*, December 2008, p. 9.

14 Australian Energy Regulator, *State of the Energy Market 2008*, Melbourne, 2008, p. 156.

15 With the transfer of economic regulation of distribution networks to the national framework, decisions on financing of capital, maintenance programs and the suite of financial incentives to maintain distribution reliability will be made by the AER.

Figure 1.1 Origins of electricity supply interruptions (by duration)



Source: Australian Energy Regulator, *State of the Energy Market 2008*, Melbourne, 2008, p.156

1.3.3.2 Shortfall in available capacity

Consumers' electricity supply can be interrupted if there is a shortfall in available capacity. The shortfall arises where the aggregate demand for electricity exceeds the capacity of the NEM to produce or transport the quantity demanded. The NEM aims to limit the supply interruptions caused by capacity shortfalls occurring in the generation and transmission sectors by specifying the maximum amount of electricity that is permitted to be at risk of not being supplied to consumers. This specification is contained in the Reliability Standard, which is discussed further in Chapter 2.[16]

To minimise the risk of interruptions caused by capacity shortfalls, NEMMCO is required to ensure sufficient generation capacity or interruptible load is available to meet forecast demand plus an amount of "reserve" capacity.[17] The size of the required reserve reflects the additional capacity required to satisfy forecast demand if the largest generator or a transmission element trips.

The NER establish a framework to identify potential supply imbalances months and years in advance. Advance notice of prospective shortfalls signals the need for future investment to alleviate the risk of supply interruptions. NEMMCO also has at its disposal arrangements to secure additional capacity for the short-term or to issue instructions to reduce demand.

16 The reliability performance of the distribution sector is not captured by the Reliability Standard.

17 The "reserve" capacity is the minimum amount of generation capacity available to restore the power system to a satisfactory operating state after a credible contingency.

If NEMMCO is unable to procure the total quantity of generation capacity required, it may need to reduce demand. This can be achieved by instructing network service providers (NSPs) to limit or cease supply to consumers, either unilaterally (via load shedding) or through demand-side participation.

The duration of a supply interruption caused by a capacity shortfall and the extent to which consumers are affected varies with the magnitude of the imbalance. Guidelines maintained by the Reliability Panel provide that interruptions required to restore the balance are to be shared between regions.[18]

1.3.3.3 Actions to maintain power system security

Consumers' supply may be interrupted where a reduction in demand is required in order for NEMMCO to maintain the security of the power system, e.g. maintaining the frequency of the system within the mandated range. Maintaining power system security is necessary to avoid the risk of much larger disruptions, such as a total system failure.

As is the response to a capacity shortfall, a reduction in demand is accomplished by shedding load. To shed load, NEMMCO may direct a transmission network service provider (TNSP) to reduce the amount of electricity delivered to its consumers.

An outage or failure in the transmission network may jeopardise power system security and give rise to a need for load shedding. Although these outages or failures often occur without notice, the redundancy in the physical network can reduce the impact on consumers depending on where the outage or failure occurs, and where the load is located.

1.3.4 Load shedding by NEMMCO

Load shedding occurs when NEMMCO (or an automated system approved by NEMMCO) instructs a transmission network service provider (TNSP) to reduce or disconnect load from the power system. The effect of load shedding is to reduce the amount of electricity that is delivered to consumers.

Load shedding may be necessary in circumstances where demand for electricity exceeds the available supply, or to maintain power system security. For example, load was shed in Victoria and South Australia on 29 and 30 January 2009 to restore the supply/demand balance when it became evident there was insufficient generation capacity available to meet consumer demand.

Load shedding may also be necessary to restore power system security, even though sufficient generation capacity is available. On 30 January 2009, NEMMCO also

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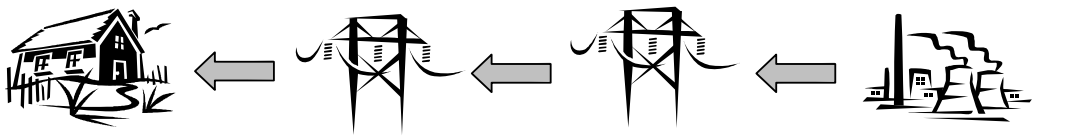
18 NECA, *Guidelines for managing electricity supply shortfall events*, September 1998. Available at www.neca.com.au/ReliabilityPanelb4df.html?CategoryID=35&SubCategoryID=162.

issued directions to shed 1200 MW of load to restore power system security following the failure of the South Morang to Sydenham No 2 500kv line.[19]

Figure 1.2 Supply continuity in the NEM



CONSUMERS	DISTRIBUTION NETWORKS	TRANSMISSION NETWORKS	GENERATION
Homes, offices and factories use electricity for lighting, heating, and appliances and factories use	*Distribution lines carry electricity to consumers*	*Transmission lines carry electricity long distances: inter-regional and intra-regional*	*Power plants generate electricity*
What affects the continuous supply of electricity to consumers?	Network planning and technical standards Economic regulation	Network planning and technical standards Access standards Economic regulation	Reliability Standard Access standards Market price cap Minimum reserve levels (MRLs)
Who influences continuity of supply?	Jurisdictional bodies who set and monitor performance AER	Jurisdictional bodies who set and monitor performance AER	Reliability Panel (Reliability Standard) AEMC (access standards, MPC) NEMMCO (MRLs)
Process for setting standards	Not transparent	Not transparent	Transparent

1.4 Structure of the Interim Report

The Interim Report is structured in the following way:

- **Chapter 2** describes the role of generators and TNSPs in providing sufficient capability to meet the Reliability Standard, and the signals provided by the market to encourage economically efficient investment decisions. Chapter 2 also describes the important roles NEMMCO plays in administering the Reliability Standard and ensuring the NEM meets the security standards.

19 NEMMCO, *Power System Incident Report – Actual Lack of Reserve in Victoria and SA on 29-30 January 2009*, 26 May 2009, p. 30.

- **Chapter 3** describes the extreme weather events that are the focus of this review, and explains how these events can affect the ability of generators and TNSPs to produce and deliver secure and reliable electricity supply.

- **Chapter 4** summarises the recent refinements to existing security and reliability arrangements and the measures that are currently being considered to further improve security and reliability in the short-term.

- **Chapter 5** sets out the Commission's approach to preparing the Final Report, which will contain its advice to the MCE about cost-effective changes that could be made in the longer term to improve system security and reliability during extreme weather events. Chapter 5 also signals some of the matters the Commission is likely to consider in preparing the Final Report.

2 Current Arrangements for Managing Reliability and Security in the NEM

The energy market frameworks of the NEM provide incentives for participants on the supply side and demand side to make appropriate, timely decisions about production and usage in the short-term, and investment in the medium term. The NEM design provides for periodic review of these frameworks to ensure the market signals remain appropriate.

The reliability performance of the NEM, as measured by the Reliability Standard, reflects the adequacy of the levels of the generation capacity and transmission capability available to meet demand for electricity.

This chapter highlights the key features that encourage the market to meet the Reliability Standard. These include: providing appropriate market signals to encourage investment in the required levels of generation capacity; providing financing capacity and incentives to deliver adequate transmission network capability; and the market and power system operation functions performed by NEMMCO. A cornerstone of these features is a framework for decentralised decision-making by market participants to respond to the investment and profit signals sent through market prices and the incentives provided by economic regulation. The chapter also describes how the generation and transmission sectors and NEMMCO contribute to maintaining power system security.

2.1 An "energy-only" market design

The NEM includes the energy market through which buyers and sellers of electricity located in each of its five regions interact.[20] It includes the physical wholesale spot and balancing markets, bilateral trading and trading in financial contracts derived from the physical markets.

Generators connected to the NEM must sell their output through the NEM. All large users and retailers supplying customers serviced via the national grid must buy their electricity from the wholesale spot market (i.e. the physical market). Prices are calculated every thirty minutes for each NEM region.

The NEM is an "energy-only" market. This means that the predominant payment made to generators is based on the amount of energy they produce, and wholesale market customers (e.g. retailers) are charged according to how much energy their customers take from the market. This can result in prices that vary significantly, from tens to thousands of dollars in a matter of hours. Other market designs, such as capacity markets, provide for separate payments to generators for being available to generate, and for providing reserve generation capacity.

[20] The five NEM regions are Queensland, New South Wales (which includes the Australian Capital Territory), Victoria, Tasmania and South Australia.

Retailers and generating businesses both have an interest in managing the risk of price variations in the wholesale spot market. The financial contract market enables both parties to effectively manage these risks. These contracts also underpin most generation investments.

2.2 Encouraging adequate generation capacity

The NEM is a competitive market based on decentralised decision-making by individual companies, complemented by a framework of economic regulation for networks. This design is intended to deliver the performance necessary to meet various standards, including the Reliability Standard.

The Reliability Standard is the primary mechanism for encouraging the market to deliver enough capacity to meet consumers' demand for electricity. The Reliability Standard is a measure of the maximum amount of energy that can be at risk of not being delivered to consumers due to available capacity. Currently, the level of unserved energy (USE) permissible under the Standard is set at 0.002% of annual energy consumption per region.

Box 2.1: Review of the Reliability Standard (2007)

The Reliability Panel is responsible for monitoring, reviewing and reporting on the safety, security and reliability of the national electricity system. It advises the Commission in respect of such matters.

In 2007, the Panel concluded its *Comprehensive Reliability Review* (CRR). Relevantly, the CRR Final Report:

- confirmed the Reliability Standard at 0.002% USE but issued a new version of the Standard incorporating revised wording to more clearly specify how reliability would be measured and targeted;
- recommended that the methodology and process for calculating minimum reserve levels (MRLs) be reviewed, especially where MRLs are applied across more than one jurisdiction (as is the case for Victoria and South Australia)[21];
- found that the form, level and scope of the Reliability Standard reflects Australia's demographics (a small population spread over large distances).

Source: AEMC Reliability Panel 2007, *Comprehensive Reliability Review*, Final Report, December 2007, Sydney, pp. xii-xiii; xv-xvii.

To meet the Reliability Standard, the market must make available a minimum level of generation capacity and transmission capability. The incentives for generation

21 The Reliability Panel is undertaking a review of these matters as part of its 2009 *Review of the Operationalisation of Reliability Standards*. See further Chapter 4 of the Interim Report.

capacity to be available are delivered through the wholesale market and, for transmission capability, through the regulatory framework contained in the NER and administered by the AER.

The principal signal of the need for new capacity is provided by the wholesale spot price. High wholesale prices signal that there may be profitable opportunities to invest in additional generation capacity.

The NER specify the maximum and minimum prices for wholesale electricity in the market. The MPC is set at a level to contribute to providing appropriate incentives for investment in new generation capacity, given the volatility in pricing outcomes in the context of an energy-only market. The MPC is currently set at $10,000/MWh but will increase to $12,500/MWh on 1 July 2010.[22] The NER allow for an administered price cap of $300/MWh to be invoked if there is a sustained period of very high prices in a particular NEM region.[23] The market floor price is -$1,000/MWh.

The MPC, administered price cap and market floor price settings constitute the key price envelope for the NEM. It is within the price confines established by these settings that the wholesale spot market seeks to balance supply and demand and deliver the capacity necessary to meet the Reliability Standard.

Box 2.2: The importance of the market price cap and the market floor price

The market price cap (MPC) (formerly the Value of Lost Load, or VoLL) and the market floor price perform a number of important functions in the NEM:

- They provide a signal to the market to provide investment in new generation.
- They limit price volatility in the wholesale spot market and, by implication, the financial contract market.
- In conjunction with the cumulative price threshold (CPT), the MPC limits the financial burden that can accrue to retailers during periods of high wholesale spot prices.
- The MPC limits the financial risk to retailers, whose prices to consumers are unable to change in real time in line with the wholesale spot price.

In order to monitor the likelihood of achieving the level of reliability required to meet the Reliability Standard, NEMMCO determines the minimum level of capacity

22 With effect from 28 May 2009, the Value of Lost Load (VoLL) was renamed the "market price cap": *National Electricity Amendment (NEM Reliability Settings VoLL, CPT and Future Reliability Review) Rule 2009 No. 13*.

23 The cumulative price threshold (CPT) imposes a maximum limit on the sum of the spot prices charged over a rolling seven-day period. Currently, the CPT is set at $150,000 but will increase to $187,500 from 1 July 2010.

that is required within a region in order meet forecast maximum demand for a given year. This minimum level of capacity is called the minimum reserve level (MRL).

For each region, NEMMCO compares the MRL to the projected level of reserve capacity. In evaluating the available reserves, NEMMCO takes into account the supply contributions made by generators within the region, demand-side response and the generation capacity in other regions that can be imported via the interconnector(s).

NEMMCO publishes information about emerging reserve deficits in the Statement of Opportunities (SOO). Therefore, the SOO is an important source of information for investment decisions.

There are important interactions between the reliability settings and the MRLs that impact on the NEM's performance against the Reliability Standard. For instance, an increase in the MRLs for each region (e.g. to reflect higher demand forecasts) requires greater amounts of reserve capacity. Given the role of the MPC in signalling the profit opportunities for investors, setting MRLs at a higher level may require an increase in the level of the MPC in order to attract additional investment.

Similarly, an increase in the level of the Reliability Standard (i.e. requiring greater reliability, such as 0.0015% USE) is likely to require an increase in the MPC or some other form of generation remuneration in order to signal the appropriate level of investment to meet the higher standard. If the price signal is ineffective at signalling the amount of investment required, NEMMCO may intervene more frequently to contract for additional generation or demand-side response to address any potential reliability shortfalls.

The security performance of generators is governed by technical standards. Each generating unit must comply with specialised technical standards before it is permitted to connect to the national grid. The technical standards reflect the minimum capability of generating units to withstand system disturbances. While they are important to ensuring power system security, generator technical standards have a comparatively small impact on reliability performance.

2.3 Transmission networks

With the exception of Basslink, transmission networks in the NEM are regulated monopolies. The networks are permitted to earn revenue up to an amount that is approved by the AER, and recover this amount by charging users of the network.

The regulatory frameworks rely on financial incentives to encourage efficient behaviour. The revenue allowances are set *ex ante* and there is a financial incentive for each TNSP to out perform the costs implicit in setting the allowance until the allowance is next set. The financial incentives, as determined by the AER, also encourage network availability when it is most valued.

Transmission networks are subject to planning and technical standards. The planning standards specify the minimum level of redundancy required within the network in order that consumers receive reliable electricity supply. By incorporating

a level of redundancy, the network is better placed to withstand system disturbances, allowing it to continue to operate securely.

These standards vary between jurisdictions and are set under jurisdiction-specific frameworks by jurisdictional bodies. In 2008, the Commission recommended a nationally consistent framework for transmission planning standards to the MCE.[24] These recommendations are currently being considered by the MCE.

2.4 Role of NEMMCO

NEMMCO, as the operator of the market and the power system, performs three functions that are central to delivering reliable electricity supply to consumers. The three functions are: dispatching the market; publishing information for use by the market; and, as a last resort, intervening in the market where the market fails to respond. NEMMCO also performs the critical function of ensuring the security of the power system.

2.4.1 Dispatching the market

NEMMCO manages the process that determines which generators will be required to generate electricity, how much they will each be required to generate in order to meet demand, and how much they will be paid for each MWh of electricity they produce. This is the dispatch process. NEMMCO calculates dispatch every five minutes.

When determining what generators will be dispatched and the price per MWh payable in each region, NEMMCO selects the most economically efficient outcome for the whole of the NEM based on the offer and availability information provided. In determining the most efficient outcome, NEMMCO has regard to the need to maintain the balance between supply and demand, and the requirement that the power system be operated within its technical limits.

2.4.2 Publishing information

The energy market requires a well informed market. Providing information to enable generators to develop their bidding strategy and investors to assess the financial returns to possible investments helps achieve this objective. To this end, NEMMCO provides an information interface between the market signals, and the generators and TNSPs. Some of the information provided by NEMMCO includes short and medium term projections of system adequacy and an annual SOO. NEMMCO considers the Reliability Standard when it is assessing the need for additional generation capacity.

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24 AEMC Reliability Panel 2008, *Towards a Nationally Consistent Framework for Transmission Reliability Standards*, Transmission Reliability Standards Review – Final Report, 30 September 2008, Sydney.

2.4.3 Intervening in the market

Where the market fails to respond to signals calling for additional generation capacity, the NER enables NEMMCO to intervene and procure the additional capacity necessary to meet the Reliability Standard. Where time permits, NEMMCO may do this through the reliability and emergency reserve trader (RERT) scheme. The RERT is effective at managing irregular capacity shortfalls but is not designed to manage a long term failure by the market to induce adequate investment. Further, the distortions caused by intervening in the market are such that exercising the RERT is a last resort.

Where there is insufficient notice of the shortfall to exercise the RERT or the costs of exercising the RERT are considered by the jurisdictions to be excessive, NEMMCO may issue directions or instructions to market participants under clause 4.8.9 of the NER.

2.4.4 Managing security

As the market system operator, NEMMCO is required to operate the power system such that it can withstand a credible contingency event without interrupting electricity supply to consumers. In order to maintain power system security, the NER authorises NEMMCO to intervene in the market, for example, by issuing directions or instructions to market participants.

2.5 Distribution networks

The Reliability Standard does not take into account supply interruptions that occur within distribution networks. The reliability and performance standards required of distribution networks are determined and maintained by jurisdictional bodies.

The AER, as the economic regulator of distribution networks, plays an important role in enabling distribution networks to meet the planning and reliability standards set by jurisdictional bodies. Through the framework for economic regulation, the AER provides the financing capacity necessary to meet these standards and the financial incentives to strike a balance between cost minimisation and delivering reliable supply.

3 Effects of Extreme Weather Events on Security and Reliability

Extreme weather is the infrequent events at the high and low end of the range of values of a particular weather variable.[25] Relevant weather variables include temperature, rainfall, sea levels, and the frequency and intensity of weather events such as droughts, tropical cyclones, strong winds and hail.

The effects that weather extremes have on our communities can be profound. In recent years, the potential impacts of extreme weather on the power system have been brought into sharp focus.

This review focuses on the effects that four types of extreme weather can have on the security and reliability of electricity supply: heat waves[26], droughts, storms and floods.

Addressing each weather event in turn, this chapter describes the effects that they can have on demand for electricity, generation availability, bulk transmission networks and, in brief, distribution networks. By understanding how extreme weather can affect the electricity supply chain, it is possible to evaluate the effectiveness of the current arrangements in the NEM for managing security and reliability in light of extreme weather events.

3.1 Heat waves

A heat wave is a period of abnormally hot weather lasting several days.[27] Heat waves were most recently observed in South Australia and Victoria in January and February this year. In Adelaide, maximum temperatures exceeded 35ºC for nine consecutive days. During this period, the temperatures recorded on six consecutive days were greater than 40ºC.[28] For the first time in history, Melbourne recorded three consecutive days over 43ºC.[29] The heat wave conditions in Victoria also exacerbated the bushfires burning throughout the state.

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25 Neville Nicholls, *Australian Climate and Weather Extremes: Past, Present and Future*, A Report for the Department of Climate Change, Canberra, January 2008, p. 4.

26 The impacts of bushfires on the performance of security and reliability arrangements will be considered in the context of heatwaves.

27 Bureau of Meteorology, www.bom.gov.au/lam/glossary/hpagegl.shtml.

28 ESCOSA, *Performance of ETSA Utilities during January–February 2009 Heatwave*, fact sheet, www.escosa.sa.gov.au/webdata/resources/files/090401-D-PerformancOfETSAJanFeb09Heatwave_df.pdf

29 NEMMCO, *Power System Incident Report – Actual Lack of Reserve in Victoria and SA on 29-30 January 2009*, 26 May 2009, p. 5.

3.1.1 Demand

The South Australian and Victorian experiences exemplify the effects that heat waves and bushfires can have on power system performance.

A consequence of heat wave conditions can be very high electricity demand for extended periods. In some cases, peak demand can reach record levels. This occurred in the South Australian and Victorian regions on 29 January, when the recorded maximum demands were the highest ever recorded.[30] High peak demand is often observed in regions where a large proportion of the population relies on electric air conditioning units, as is the case in South Australia.[31]

3.1.2 Generation availability

The principal effect of a heat wave on generating plant is that it restricts the ability of plant to increase its output to meet high levels of demand. There are a number of other reasons why a generating unit may be prevented from increasing production.

- **Reduced thermal capacity:** the efficiency of coal-fired and gas-fired generating units may decline when the ambient temperature increases. This means that during hotter periods a given quantity of fuel will produce less electricity.

- **Access to cooling water:** during hot weather, the output of some thermal generators may be constrained by limited access to sufficient quantities of water to cool the generating units.

- **Increased risk of plant failure:** generating units rely on periods of lower temperatures to cool the unit. Periods of prolonged high temperatures may preclude the plant from cooling adequately, which increases the level of its operating stress. The longer plant is required to operate at levels close to its technical limitations, the greater the risk that it will fail.

- **Technical limitations:** thermal limits comprise part of the technical limits of the power system. The NER do not permit a generating unit to be operated beyond its nameplate rating (i.e. its normal maximum operating rating) or such other technical limit. Accordingly, the technical limitations of a unit constrain its maximum output at any given time such that output cannot be further increased during periods of peak demand.

- **Planned and unplanned maintenance:** a generating unit may be offline for maintenance and cannot be bought online within a suitable timeframe. Maintenance may be planned, or be required without notice in response to unexpected damage to the unit.

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30 ibid, p. 3.

31 ESCOSA, *Performance of ETSA Utilities during the Heatwave of January 2009*, Information Paper, Adelaide, April 2009. Available at www.escosa.sa.gov.au/site/page.cfm?u=4&c=3145.

3.1.3 Transmission network capability

Heat waves and bushfires can also adversely affect the capability of a transmission network to transport electricity to load centres.

- **Thermal limits:** the thermal limit of each transmission line is reflected in its load ratings, which can change depending on the air temperature and associated conditions (e.g. wind direction, humidity etc). NEMMCO has regard to how much electricity each transmission line can transport when it dispatches generators. Overloading a transmission line can damage the line and lead to reduced network capability until the line is repaired.

- **Arcing:** plasma from a fire burning close to a transmission network can conduct electricity between neighbouring transmission lines. When built-in protection mechanisms detect arcing, the line is automatically tripped to protect the equipment, potentially causing a supply interruption.

3.1.4 Distribution network capability

Heat waves and bushfires can also disrupt the ability of distribution networks to supply electricity.

- **Contact with an obstacle:** higher ambient temperatures increase the temperature of the wires in the distribution network. As the wire becomes hotter, it expands and begins to sag. When the line sags and comes into contact with an obstacle on the ground below, the line will trip. Although jurisdictional regulations stipulate minimum clearance levels, distribution wires are prone to coming into contact with obstacles like trees and buildings.

- **Arcing:** as is the case in transmission networks, distribution lines are also prone to arcing during bushfires.

3.2 Droughts

3.2.1 Demand

A drought, of itself, is unlikely to have a direct effect on demand patterns, especially patterns of peak demand. To the extent that droughts increase the frequency or severity of heat waves, the effects on demand are likely to be as described in 3.1.1 above.

3.2.2 Generation availability

Droughts can, however, have serious consequences for generation availability. As noted above, some thermal generators may require fresh water to cool generating units. Where there is insufficient water available for cooling, the output of the generating unit is necessarily constrained.

Droughts also have important effects on the ability of hydro generators to generate electricity. Clearly, the absence of sufficient reservoir capacity will have a direct and practical impact on whether a hydro generating unit is physically able to generate electricity. However, limited water supply will also increase the opportunity cost of producing electricity. Hydro generators may therefore face changed incentives in deciding what price and level of capacity, if any, they will offer into the market.

3.2.3 Transmission and distribution network capability

Droughts tend not to have unique direct impacts on the transmission or distribution network capacity.

3.3 Storms and floods

3.3.1 Demand and generation availability

Storms and floods generally have an immaterial effect on demand levels. Similarly, generation availability is largely unaffected unless the generation unit sustains direct damage, e.g. strong winds damage the building housing a unit and the unit sustains water damage.

3.3.2 Transmission network capability

Supply interruptions caused by storms and flooding occur most commonly because of damage to an element within the transmission network. Lightning strikes during storms can cause arcing between lines in a similar way to bushfires. The built-in protection systems will activate to trip the endangered lines.

Floods and high winds during storm periods and cyclones may also mobilise debris. This debris can damage transmission elements such as wires and substations, causing supply interruptions.

3.3.3 Distribution network capability

The effects of lightning, high winds and floods on distribution networks are similar to the effects on transmission networks. However, distribution networks are more prone to supply interruptions. With a minimum ground clearance that is lower than that for transmission networks, distribution networks are more susceptible to damage or interruption due to falling trees and debris during storms and floods.

4 Measures to Improve Security and Reliability

The MCE Direction requires the Commission to report on the improvements that have been made, and the measures being developed, by the Commission and the Reliability Panel to enhance the security and reliability performance of the NEM. The Direction also requires the Commission to identify any cost-effective measures that could be implemented in the short-term to improve the reliability of the NEM in advance of summer 2009/10.

The preceding chapter described how extreme weather events can affect the NEM and impact on its security and reliability performance. This chapter summarises the arrangements that have been implemented recently, and the proposals that continue to be developed, to enhance the NEM's ability to withstand extreme weather events in the future.

The amendments outlined in this chapter are wide-ranging. Collectively, they are expected to improve the NEM's reliability and security performance during extreme weather events, including in the short-term.

4.1 Overview of recent amendments

The current arrangements to manage security and reliability in the NEM have been enhanced by a suite of recent amendments. These improvements will be supplemented by further refinements that are being developed by the Commission and the Reliability Panel, in consultation with stakeholders. As a package, they should improve the arrangements for managing reliability and security performance of the NEM in the short-term.

The changes reflect the objective of providing stronger incentives to encourage:

- generator capacity required to meet demand (generation reliability);
- generating units to be operated within their technical limits and in a way that maintains power system security (generator security); and
- transmission networks with the necessary capability to deliver the electricity required by consumers (network reliability).

The specific changes are summarised in Table 4.1 below.

Table 4.1: Summary of recent improvements to existing arrangements to manage security and reliability

Changes to the energy market frameworks	Affected element	Status
Amend the National Electricity Rules (NER) to increase the market price cap to $12,500/MWh	Generator reliability	Changes take effect 1 July 2010
Amend the NER to increase the cumulative price threshold to $187,500	Generator reliability	Changes take effect 1 July 2010
Amend the NER to provide for biennial reviews of the Reliability Standard and reliability settings	Generator reliability	Changes took effect 28 May 2009. The Reliability Panel has commenced its first review under this new framework
Develop a reliability and emergency reserve trader scheme to operate at short notice	Generator reliability	Currently being developed by the Reliability Panel. The Panel will report as soon as practicable in 2009
Review by the Reliability Panel of the operationalisation of the Reliability Standard	Generator reliability	Reliability Panel is due to report to the Commission by 31 December 2009
Biennial review of the Reliability Standard and reliability settings by the Reliability Panel	Generator reliability	Reliability Panel is due to provide its recommendations to the Commission by 30 April 2010
Amend the NER to improve opportunities for demand-side participation	Generator reliability	Climate Change 2nd Interim Report due 30 June 2009[32]; Demand Side Participation Final Report (Stage 2) due 2nd half of 2009[33]
Recommendation from the Commission to review generator performance standards	Generator security	Reliability Panel is developing a Rule change proposal. The Commission has deferred the review
Recommendation from the Commission to develop a nationally consistent framework for setting transmission standards	Network reliability	The MCE is considering advice from the Commission dated 30 September 2008
Amend the national energy market framework to create the National Transmission Planner (NTP) function	Network reliability	Legislative changes pending for commencement on 1 July 2009. The first NTNDP is scheduled to be completed in 2010
Amend NER to include the Regulatory Investment Test for Transmission (RIT-T)	Network reliability	The AEMC is considering a Rule change proposal
Review the electricity distribution network planning and expansion arrangements	Network reliability	The Commission's draft report is due July 2009

32 This report will be published as part of the Commission's *Review of Energy Market Frameworks in light of Climate Change Policies*.

33 This report will be published as part of the Commission's *Review of Demand Side Participation in the NEM*.

4.2 Generation reliability

4.2.1 Increases in the levels of the market price cap and cumulative price threshold

On 28 May 2009, the Commission made a Rule that increases the MPC to $12,500/MWh and sets the CPT at an absolute level of $187,500.[34] The new levels take effect from 1 July 2010.

Increasing the levels of the MPC and CPT was considered necessary to maintain the capacity of the NEM to deliver reliable electricity supply in the future. As the MPC has not changed since the start of the NEM in 1998, increasing the MPC better reflects increases in financing and input costs. Market prices for energy must be able to increase to levels sufficient to provide a return on investment that reflects the risks of investing in additional generation capacity and to make those investments commercially attractive. New investment in generation is required over time to satisfy growing demand consistent with meeting the Reliability Standard, and market pricing must remain consistent with the commercial requirements for that investment.

Efficient price signals for generation are also important to encourage the investment required in peaking plant capacity. Peaking plant is required to provide the reserve capacity needed during periods when demand is at its highest, such as the demand peaks observed during a heat wave. Because peaking plant may only be dispatched for a few hours each year (and, in some years, may not be dispatched at all), the maximum price that a generator can charge during these high price periods must be sufficient to allow it to earn an adequate return on investment.

In December 2007, the Reliability Panel concluded that maintaining the MPC at $10,000/MWh was unlikely to be sufficient to encourage new generation capacity given the uncertainty about environmental policy. This risk has since been magnified by the tightening financial climate. The Panel noted that failing to attract new generation capacity would jeopardise the ability of the NEM to meet the Reliability Standard in the future.[35] To improve the integrity of market signals, the Panel submitted a Rule change proposal seeking changes, amongst other things, to the MPC.

The Panel's Rule change proposal also proposed changes to the level of the CPT. The Commission considered that, given its decision to increase the level of the MPC, failing to increase the absolute level of the CPT would increase the frequency of breaches of the threshold. Allowing breaches of the threshold to occur more frequently was likely to undermine the investment signals sent by setting the MPC at

34 *National Electricity Amendment (NEM Reliability Settings: VoLL, CPT and Future Reliability Review) Rule 2009 No. 13.*

35 AEMC Reliability Panel 2007, *Comprehensive Reliability Review*, Final Report, December 2007, Sydney.

a higher level. Accordingly, the Commission determined to increase the absolute level of the CPT from $150,000 to $187,500.[36]

4.2.2 Framework for reviewing the Reliability Standard and reliability settings

In addition to increasing the levels of the MPC and the CPT in the Rule made on 28 May 2009, the Commission also amended the process for reviewing and amending the Reliability Standard and the reliability settings[37].[38] The new process is intended to balance the certainty required by market participants (and prospective investors) against the need for sufficient flexibility to change the market settings as required to reflect changing market conditions.

Under the new framework and in accordance with terms of reference from the AEMC, the Reliability Panel will review the Reliability Standard and the reliability settings every two years and, having consulted with market participants and other stakeholders, submit reports and recommendations to the AEMC based on its findings. The matters that can be reviewed by the Panel in conducting the review are broad and include:

- all matters concerning the Reliability Standard, including the method by which reliability is measured (its form), the amount of unserved energy that is acceptable as a percentage of actual demand (the level) and the supply events that are reflected in or excluded from the reliability performance of the NEM (its scope);

- the levels at which the MPC, the CPT and the minimum floor price are set.

At the conclusion of its review, the Reliability Panel must prepare a report that recommends the Standard and the settings to apply prospectively. The changes recommended by the Panel will form the basis of a Rule change proposal to the AEMC. If accepted, the changes to the NER take effect from 1 July two years after the Panel's review is completed. In determining the level of the MPC under the new framework, the Reliability Panel must have regard to the potential impact of any proposed increase on spot prices, investment in the NEM and on the reliability of the power system.[39]

The new framework will contribute to the capacity of the NEM to deliver supply reliability at the level required by the Reliability Standard in a number of ways. First, the transparency about the timing of the reviews will promote certainty for investors. The clarity about when decisions to change the Standard or the settings

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36 AEMC 2009, *National Electricity Amendment (NEM Reliability Settings: VoLL, CPT and Future Reliability Rule 2009*, Final Rule Determination, 28 May 2009, Sydney. pp. 20-25.

37 The reliability settings are made up of the market price cap, the cumulative price threshold, and the market floor price.

38 *National Electricity Amendment (NEM Reliability Settings: VoLL, CPT and Future Reliability Review) Rule 2009 No. 13*.

39 NER, clause 3.9.4(c).

will be made and when those decisions take effect should improve investor confidence in making appropriately timed investment decisions. Secondly, as the Reliability Standard and the reliability settings are inter-related, it is more efficient to review them at the same time. Finally, the new framework facilitates making smaller, periodic adjustments to respond to changes in market conditions. Making incremental changes over time is preferable to making infrequent, significant amendments.

Where changes to the Reliability Standard or reliability settings are recommended, there will be an appropriate lead time before the NER are amended and the changes take effect. By giving market participants notice of changes to the reliability settings and certainty about when they will commence, participants will have adequate opportunity to amend their risk management arrangements and take such other steps as are necessary. Generators who have adopted risk management strategies that reflect the new settings should be well placed to manage the price and volume volatility often associated with extreme weather events. As discussed in Chapter 3, ensuring capacity adequacy is an important strategy in maintaining reliability during extreme weather events.

4.2.3 2009 Reliability Panel review of the Reliability Standard and associated settings

NEMMCO's market operator role requires it to publish a wide range of information about the NEM, including the NEM's historic reliability performance and prospective supply and demand conditions. In some instances, NEMMCO may be required to intervene in the market. In order to perform these functions, NEMMCO requires processes that translate the Reliability Standard from a performance measure into day-to-day behaviours that, over time, will encourage the NEM to meet the Reliability Standard. It is these processes that "operationalise" the Reliability Standard.

The supply interruptions experienced in South Australia and Victoria in January 2009 highlight the importance of maintaining appropriate settings for monitoring reliability, especially if heat wave conditions become more frequent. To assist the Commission to evaluate the suitability of the current reliability arrangements for the future, it requested the Reliability Panel to review and report to it on a number of aspects of these arrangements.[40]

The Reliability Panel's review, called the *Review of the Operationalisation of the Reliability Standards*, comprises two components. The first component requires the Panel to consider the Reliability Standard and reliability settings to apply from 1 July 2012. This will be the first biennial review to be conducted by the Panel under the new framework outlined in 4.2.2 above. The Reliability Panel is required to report to the Commission on these matters by 30 April 2010.

As part of this review, the Reliability Panel will review the current wording of the Reliability Standard to ensure it clearly reflects the policy objectives identified in the

[40] The terms of reference are available at www.aemc.gov.au/electricity.php?r=20090306.155159.

CRR Final Report.[41] One of the issues the Panel is likely to consider is the balance between the annual performance of each region against the Reliability Standard, and the performance of each region over the long term (i.e. ten years). The Reliability Panel is expected to release an issues paper on this matter in June 2009.

The second component of the review requires the Reliability Panel to consider a number of potential enhancements to the future reliability performance of the NEM, including the way the Reliability Standard is interpreted and applied in practice. In undertaking this assessment, the Panel will consider the following issues:

- **Information inputs for setting minimum reserve levels (MRLs) and assessing short-term reserve capacity:** the MRLs set by NEMMCO rely on assumptions about expected temperatures and corresponding demand estimates. Depending on the MRL that it sets, NEMMCO determines the amount of reserve generation capacity required and whether adequate capacity is available. If MRLs are set on the basis of milder forecast temperatures or lower demand estimates, the reserve capacity may be inadequate to meet extreme summer demand peaks. This will adversely affect the NEM's performance against the Reliability Standard and may impact on NEMMCO's ability to restore the power system to a reliable operating state in the event of a contingency event. However, setting MRLs too high could impose unnecessary costs on the market. If inadequate capacity exists to meet the MRLs, NEMMCO may intervene in the market more frequently in order to procure the necessary additional capacity. Higher wholesale prices may then be required to encourage greater investment in redundant capacity. Although larger capacity reserves may improve the NEM's ability to meet demand peaks during extreme weather events, it is likely that the higher wholesale prices necessary to attract investment will ultimately be passed on to consumers in the form of higher electricity prices.

- I**mproved forecasts of generator availability:** generators submit forecasts of their actual capacity availability under prevailing or forecast temperatures to NEMMCO.[42] The forecasts reflect the technical limits that impact on the efficiency of the generating unit and, in some cases, their ability to operate at all. Incorporating technical limitations of generating units into the pre-dispatch and dispatch systems more effectively may allow NEMMCO to schedule generators more efficiently and predict capacity shortfalls more accurately. It may also allow market participants to respond to information about capacity shortfalls and, in the absence of a response from the market, permit NEMMCO more time to take action to minimise a capacity shortfall.

- **Current arrangements for sharing the burden of load shedding:** the current guidelines for apportioning the burden of load shedding across NEM regions to address imbalances in supply and demand have remained unchanged since their

41 AEMC Reliability Panel 2007, *Comprehensive Reliability Review*, Final Report, December 2007, Sydney, pp. xii-xxiii.

42 NEMMCO is developing its Energy Adequacy Assessment Projection Guidelines, which will provide information about the impact of energy constraints on energy availability over a 24 month period under a range of scenarios.

inception in September 1998.[43] In response to issues raised during the CRR, the Reliability Panel is examining the basis upon which load shedding is allocated between regions. The Panel expects to publish an issue paper on this issue in June 2009.

- **Measures for contracting for reserve capacity at short notice:** there may be scope to introduce a short-term version of the RERT scheme currently in place. The objective of the short-term RERT would be to allow NEMMCO to contract for additional reserves where notice of the capacity shortfall does not permit NEMMCO sufficient time to contract under the existing RERT scheme. Expanding the existing scheme in this way may reduce the impacts of extreme weather events on capacity availability, and therefore preserve the reliability performance of the NEM. The Panel's progress in developing such a scheme is discussed further at 4.2.4 below.

The Reliability Panel is required to complete its review of these matters and to report to the Commission by the end of December 2009.

4.2.4 Short-term reliability and emergency reserve trader

As part of the *Review of the Operationalisation of the Reliability Standards*, the Reliability Panel is considering amendments to the existing RERT to enable NEMMCO to contract for reserve capacity at short notice.[44] The Panel's proposed amendments are referred to as the "short-term RERT".

The changes proposed by the Reliability Panel would enable NEMMCO to enter into contracts with generators and demand-side participants for the purchase of additional generation capacity and demand side response where notice of the shortfall is not adequate to allow NEMMCO to use the RERT scheme as it is currently structured. The Panel's proposed amendments would permit NEMMCO to contract for reserves with as little as 24 hours' notice of a shortfall.

The short-term RERT proposal the Panel is consulting on would also allow NEMMCO to:

- operate a RERT panel and regularly solicit expressions of interest from entities wishing to offer reserves to NEMMCO;

- monitor the results of the medium term PASA, short-term PASA and pre-dispatch processes to assess whether it is necessary to contract for short-term reserves;

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[43] NECA, *Guidelines for managing electricity supply shortfall events*, September 1998. Available at www.neca.com.au/ReliabilityPanelb4df.html?CategoryID=35&SubCategoryID=162.

[44] AEMC Reliability Panel 2009, *NEM Reliability Settings: Improved RERT Flexibility and Short-term Reserve Contracts – Exposure Draft Rule and Guidelines for Consultation*, 1 May 2009, Sydney. Available at: www.aemc.gov.au/electricity.php?r=20090501.125516.

- develop methodologies to select the optimal portfolio of reserve contracts based on a reasonable endeavours basis;

- consult with the affected jurisdictions when determining whether to enter into reserve contracts and how to share the associated costs between the market customers in those regions; and

- develop processes to ensure that reserves that are the subject of a reserve contract are not otherwise available to the market.[45]

While the Panel is yet to finalise its recommendations concerning the merits of, and design for, a short-term RERT, the proposal as currently formulated could improve the reliability performance of the NEM, including during extreme weather events. For example, prolonged high temperatures may not be predicted sufficiently far in advance to allow NEMMCO to invoke the existing RERT scheme. Although it will depend on the size of the capacity shortfall, the inability to invoke the RERT at short notice may jeopardise the reliability of supply. However, a short-term RERT may enable NEMMCO to procure enough reserve capacity to meet the forecast demand (and the reserve margin). Providing NEMMCO with this additional tool is likely to improve the NEM's ability to deliver reliability electricity supply to consumers during a heat wave event.

A short-term RERT (or a similar mechanism) could therefore give NEMMCO a wider range of options to respond to a supply/demand imbalance. Currently, NEMMCO is able to issue directions and instructions under clause 4.8.9 of the NER. Under this clause, NEMMCO can direct a scheduled generator to increase its output, or instruct a TNSP to shed load. The option to initiate the short-term RERT may lower the chance that NEMMCO will need to respond to a supply/demand imbalance by involuntarily interrupting supply to consumers.

However, the RERT and any variation of it that can be exercised in the short-term, are not costless solutions to capacity shortfalls. Exercising the RERT distorts the signals provided by the wholesale spot market and hence the ability of the market to deliver capacity of its own accord. Therefore, exercising the RERT, including in response to shortfalls identified at short notice, should be a last resort.

The Reliability Panel is also seeking views from stakeholders on the feasibility of using a short-term RERT to manage a system security event, including events caused by extreme weather. The utility of a short-term RERT is most likely to be restricted to instances where the security event can be identified more than 24 hours in advance. While advance warning may be available where events such as cyclones, floods and storms signal a credible risk of a multiple contingency event, it may be difficult for NEMMCO to translate that to a specific additional reserve requirement.

The Reliability Panel has foreshadowed that it may submit any Rule change proposal it develops to implement a short-term RERT to the Commission as an urgent rule.[46]

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45 ibid, p. viii.

46 ibid, p. ix.

If the Commission determines to make the proposed Rule, it is intended that the short-term RERT would be in place and operational in time for summer 2009/10.

4.2.5 Increased opportunities for demand side participation

Demand-side participation (DSP) can make a material contribution to reliability management, particularly at times of peak usage because it can be used as a substitute for additional generation capacity. By reducing the consumption in accordance with pre-existing contractual arrangements, DSP can reduce total demand and thus the amount of any capacity shortfall. As such, DSP offers the market an alternative to reduce demand by relying on NEMMCO to issue directions to increase generation output, or contracting with generators for additional reserves. Using demand side responses may also defer the need for unscheduled load shedding following a security event. To the extent that supply/demand imbalances and security events are caused by extreme weather events, DSP could be expected to enhance NEMMCO's ability to maintain security and reliability.

The Commission is examining opportunities to improve DSP in the NEM as part of two reviews: the *Review of Demand-Side Participation in the National Electricity Market* and the *Review of Energy Market Frameworks in light of Climate Change Policies*. These reviews are considering ways to promote increased DSP and are seeking the views of stakeholders on their suggestions.

- **Managing reliability in close to real time:** there are currently no avenues in the existing frameworks for managing reliability that allow DSP at short notice (or close to actual dispatch). The Commission is considering two options to address this deficiency. The first option is to modify the RERT to establish a panel of parties to provide demand-side response at short notice. This option is being considered by the Reliability Panel as part of its *Review of the Operationalisation of the Reliability Standards*. The second option is to create a new category of market participant which would be compensated for responding to directions from NEMMCO, while not being routine participants in the market.

- **Greater transparency about contracted demand-side resources:** accurate demand forecasts allow NEMMCO to schedule the most efficient combination of generation and DSP. The Commission is raising for discussion the possibility of amending the NER to require market participants to provide NEMMCO with full and accurate information about the level of their contracted demand-side resources. The Commission submits that requiring market participants to provide this information may assist NEMMCO to make more informed decisions about the need to intervene in the market using the RERT.

- **Improved utilisation of small embedded generation:** embedded generators include the on-site emergency or stand-by units used by many commercial operations to offset their load and manage energy flows at the point of connection

to the distribution network. The Commission proposes using the idle capacity of embedded generators to reduce region- or NEM-wide capacity shortfalls.[47]

4.3 Generation security

4.3.1 Generator technical standards

Chapter 5 of the NER contains the framework that enables a registered participant (including a generator or network service provider (NSP)) to connect to a transmission network or distribution network, and to access the national grid. A registered participant who does not satisfy the relevant technical standards cannot connect to a network. Examples of the technical standards a generating unit must satisfy include the unit's:

- response to frequency disturbances[48], voltage disturbances[49], disturbances following contingency events[50]; and
- ability to protect generating systems from power system disturbances[51] and systems that impact on power system security[52].

These and other technical standards form the basis of specific performance standards the generator is required to meet.[53] The performance standards are agreed between the generator seeking to connect and the network owner, and are registered with NEMMCO. The technical and performance standards are intended to reflect the ability of the generating unit to operate in the NEM and to withstand power system disturbances. NEMMCO has regard to the performance standards of the equipment to ensure that it operates the power system within its technical limits.

In its recent *Technical Standards Review*, the Reliability Panel identified the possibility that some generators may negotiate a performance standard that is below the capability of its equipment to withstand system disturbances.[54] The Panel noted that registering a lower performance standard does not necessarily mean the user will deliver performance at a level below that which the equipment is capable of

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47 The Commission notes the ongoing work of the SCO and NEMMCO to overcome jurisdictional differences that would facilitate a greater role for embedded generators in delivering DSP solutions.

48 NER, clause S5.2.5.3.

49 ibid, clause S5.2.5.4.

50 ibid, clause S5.2.5.5.

51 ibid, clause S5.2.5.8.

52 ibid, clause S5.2.5.9.

53 The Reliability Panel is currently developing a template to assist generators to develop compliance programs that will enable them to monitor their compliance with performance standards. More information about the *Template for Generator Compliance Programs* is available at www.aemc.gov.au/electricity.php?r=20090122.150903.

54 AEMC Reliability Panel 2009, *Technical Standards Review*, Final Report, 30 April 2009, Sydney.

delivering. This is because, in most cases, the equipment delivers the level of performance it is built to achieve regardless of any agreed performance standard.[55]

However, permitting generators to commit to performance standards that reflect a lower tolerance of system disturbances than the equipment is actually able to withstand may hinder NEMMCO's operation of the power system. For example, NEMMCO may be forced to operate the power system more conservatively than is necessary because it must protect the equipment from damage caused by system disturbances. It could also adversely affect NEMMCO's ability to restore power system security following a contingency event, including those caused by extreme weather. For example, NEMMCO may instruct larger quantities of load to be shed than is necessary because it is unaware that some generating units have greater ability to withstand system disturbances than the applicable performance standard suggests.

The Reliability Panel recommended this issue be examined further as part of the prospective *Comprehensive Review of Technical Standards*. The purpose of this review would be to assess the adequacy and content of the technical standards in the NER. As a number of the standards that would be considered as part of this review have only been in place since March 2007, the review is likely to be deferred.[56] However, submissions to the *Technical Standards Review* did identify specific changes to the technical standards that would improve their clarity. To this end, the Reliability Panel is developing a Rule change package for consultation ahead of submitting a Rule change proposal to the AEMC.

4.4 Network reliability

There are important initiatives in prospect that will enhance the market frameworks governing transmission and distribution networks in the NEM to withstand extreme weather events. The MCE is considering the Commission's advice about a nationally consistent framework for transmission standards. The establishment of the NTP and the introduction of the RIT-T will contribute to achieving transmission security and reliability by facilitating more efficient planning and delivery of transmission investment. The Commission's ongoing review of distribution network planning and expansion arrangements should also identify opportunities to improve the ability of distribution networks to deliver secure and reliable electricity supply.

4.4.1 Nationally consistent framework for transmission standards

Transmission networks are subject to standards that govern their design and operation. The standards seek to ensure that networks are planned and constructed with sufficient redundancy to deliver reliable electricity supply to consumers within the region.

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55 The performance of generating plant may be limited by the operation of the equipment and the power system.

56 *National Electricity Amendment (Technical Standards for Wind Generation and other Generator Connections) Rule 2007 No. 2.* Available at www.aemc.gov.au/electricity.php?r=20060324.143345.

Transmission standards are contained in the NER and a range of jurisdiction-specific legislation, operating licences and regulatory instruments. The inclusion of some standards in the NER requires some inter-regional consistency. However, differences arise where the standards incorporate parameters that specify how the network will be planned and operated so as to deliver reliable electricity supply. The detail contained in the parameters can take into account specific local requirements.

In 2008, the MCE directed the Commission to review transmission standards for reliability across the NEM, with a view to providing for a nationally consistent framework. The Commission requested the Reliability Panel to undertake the review and provide advice to the Commission. The Panel provided its advice to the Commission on 31 August 2008.[57]

The Reliability Panel developed a number of options for a nationally consistent framework for transmission reliability standards. These options were assessed against a set of principles developed by the Panel, and tested through public consultation. The Panel took into account the performance of each option against the principles and the views of stakeholders before recommending a single option to the Commission.

The Commission endorsed the Panel's major recommendations and proposed a number of enhancements to reflect the broader policy reform context, including the introduction of the NTP and the RIT-T. The option recommended by the Commission in its advice to the MCE, which it provided on 30 September 2008, contains the following features:[58]

- Transmission reliability standards would be economically derived using a customer value of reliability or similar measure, and capable of being expressed in a deterministic manner (i.e. a hybrid form of standard);

- Standards would be applied on a jurisdictional basis, by a jurisdictional authority that is separate from the TNSP. Each jurisdiction would also have the option of appointing the Reliability Panel to set that jurisdiction's transmission reliability standards;

- Guidelines would stipulate the common assumptions and the methodology for economic modelling that must be applied when setting the transmission reliability standards for a jurisdiction;

- Each jurisdiction would have pre-set standards. A jurisdiction may apply a flexible application, where the jurisdictional standard setting body could, at its option, allow a TNSP to defer or advance an investment that would otherwise be needed to meet that standard if the TNSP could demonstrate that, under the prevailing circumstances, it would be economic to do so.

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57 AEMC Reliability Panel 2008, *Towards a Nationally Consistent Framework for Transmission Reliability Standards*, Transmission Reliability Standards Review – Final Report, 30 September 2008, Sydney.

58 AEMC 2008, *Transmission Reliability Standards Review*, Final Report to MCE, 30 September 2008, Sydney.

- A national reference standard would be determined by the Reliability Panel to be used as a basis for comparison of the transmission reliability standards applying to broad types of connection points in each jurisdiction. Jurisdictional standard setting bodies would be required to justify any divergence from the national reference standard.

These recommendations remain under consideration by the MCE. In the interim, regional differences in approaches to network planning are likely to be alleviated to some extent by the introduction of the NTP. By approaching transmission network planning from a national perspective, the NTP is well placed to promote a consistent strategy for the whole of the NEM. Further, it will establish an information base of standards applying in the NEM, and identify the reasons for any divergence from the national reference standard.

4.4.2 National Transmission Planner function

On 1 July 2009, the Australian Energy Market Operator (AEMO) commences operation as the new national energy market operator. The AEMO will assume the existing functions of NEMMCO and other jurisdictional gas market operators. In addition, the AEMO will perform the role of the NTP.

The principal task of the NTP is to ensure the strategic, nationally focused and efficient development of the national transmission grid. The core elements of the NTP function include:

- preparing, maintaining and publishing a plan for the development of the national transmission grid (the National Transmission Network Development Plan or NTNDP);

- establishing and maintaining a public database of information relevant to planning the development of the national transmission grid;

- keeping the national transmission grid under review and providing advice on the development of the grid or projects that could affect the grid; and

- providing a national strategic perspective for transmission planning and co-ordination.[59]

The direct focus of the NTP is to strengthen the processes governing transmission investment decisions. The NTP, through its encouragement of timely and efficient network investment, has the potential to contribute materially to the reliability and security performance of the NEM.

The NTP is expected to provide a nationally integrated and long term perspective on transmission requirements, supported by deep and comprehensive scenario planning. The scenarios will take into account various policy, technology and

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[59] *National Electricity (South Australia) (National Electricity Law – Australian Energy Market Operator) Amendment Bill* (SA) (Second Reading).

economic assumptions. The ability of the NTP to enhance the market's ability to identify and respond to investment signals in an economically efficient and timely fashion takes on considerable importance in the context of a tighter supply/demand balance and the uncertain impacts of climate change policies.

The NTNDP is also expected to inform the Annual Planning Reports (APRs)[60] prepared by TNSPs and the revenue determinations of the AER. The NTNDP looks forward 20 years. Therefore, an investment proposal by a TNSP that is consistent with a strategy identified in the NTNDP is likely to have been identified in a number of successive NTNDPs. As such, it will have benefited from substantial refinement and consultation. This should streamline the process of identifying the preferred investment option and obtaining regulatory approval to recover the associated capital expenditure through the TNSP revenue determination process.[61]

Although the commencement of the NTP is imminent, there will likely be a delay before the benefits it brings to investment planning are readily observable. Nevertheless, the strategic and co-ordinated focus that the NTP will bring to the investment decision-making process will assist the network to deliver reliability and security performance required to meet the Reliability Standard in the medium to long term.

4.4.3 Regulatory Investment Test for Transmission

The Commission's final report to the MCE concerning the arrangements for a national transmission planner also recommended changes to the test against which prospective transmission investment is assessed. The RIT-T is expected to help safeguard transmission reliability and security by encouraging investment in transmission to be delivered in the most efficient way. The Commission is currently considering a Rule change proposal from the MCE to amend the NER to incorporate the RIT-T.[62]

The purpose of the RIT-T is to provide a single regulatory framework that the AEMO would apply across the NEM to identify the preferred transmission network investment option. The preferred option would be the option that maximises the present value of net economic benefits (or minimises the present value of net economic costs), subject to meeting any applicable jurisdictional reliability standards.

The RIT-T is intended to encourage efficient investment in transmission networks in a number of ways. First, potential network investment solutions will be assessed against non-network options (generation, DSP and gas) in terms of their ability to

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60 Each TNSP is required to prepare an annual report setting out, amongst other matters, its forecast loads (as advised by the relevant distributor(s)), planning proposals for future connection points, forecast constraints that would preclude it from meeting network performance requirements set out in the NER or in relevant jurisdictional instruments, and proposed network augmentations.

61 There may be good reasons for the TNSP to depart from the NTNDP. These reasons would be set out in both the APR and the revenue determination.

62 Information about the Regulatory Investment Test for Transmission Rule change proposal is available at www.aemc.gov.au/electricity.php?r=20090226.144907.

improve network reliability and provide economic efficiency benefits to the NEM (productive, dynamic and allocative efficiency). Secondly, more efficient decision making will be promoted over time by providing clearer guidance about the market costs and benefits that must be considered and how they are to be assessed. Thirdly, robust and transparent consultation processes should reveal a wider range of efficient investment options, which should also improve decision making efficiency.

The RIT-T process will be complemented by the NTP function and the NTNDP. The NTP will have the ability to make submissions to the AER and RIT-T consultations. The improved information in the NTNDP will be useful to the AER and to TNSPs as a reference point in developing and assessing capital expenditure forecasts. Requiring deep and broad consideration of the market benefits of a range of investment options will encourage TNSPs to assess and undertake the considerable investment necessary to meet growing future demand.

Viewed in combination, the efficiency improvements the RIT-T is expected to deliver to transmission planning should ensure the national grid remains safe and reliable.

4.4.4 Distribution network planning review

The Commission is reviewing the electricity distribution network planning and expansion arrangements that currently exist in the regions of the NEM.[63] The objective of the review is to present recommendations to the MCE with a view to establishing a national framework for distribution network planning and expansion. Two specific outcomes of the national framework will be:

- an annual planning process which requires distribution network service providers (DNSPs) to produce publish an annual planning report which has a five year planning horizon;

- a project assessment and consultation process which establishes the procedures and criteria to be applied by DNSPs in considering investment, currently referred to as the Regulatory Investment Test for Distribution (RIT-D).

Requiring DNSPs to prepare annual planning reports and to assess investment though the RIT-D is expected to promote DSP, increase the transparency of the decision-making processes that DNSPs follow, and promote consistency between transmission and distribution planning. While improving supply reliability and security is not within the scope of the distribution network planning review, the Commission's recommendations are likely to assist distribution networks perform against their applicable performance standards.

More direct improvements in the reliability and security performance of distribution networks could be achieved by harmonising the planning standards that apply in each jurisdiction. Integrated, consistent standards for network planning and expansion may send clearer signals about the investment required to alleviate

[63] Further information about the *Review of National Frameworks for Electricity Distribution Network Planning and Expansion* is available at www.aemc.gov.au/electricity.php?r=20090204.144643.

forecast capacity shortfalls. It may also signal more clearly the need for greater redundancy to reduce supply interruptions to consumers following security events. The Commission notes that work is being undertaken by the MCE Standing Committee of Officials on a national framework for distribution connections and connection charges. While many aspects of distribution performance remain jurisdictional responsibilities, connection arrangements also have implications for the future management of security and reliability. The Commission therefore proposes to consider this matter where appropriate in preparing its final advice to the MCE on the long term measures to improve reliability in light of extreme weather events.

5 Scope of the Final Report

Presenting the Interim Report to the MCE marks the completion of the first stage of the Extreme Weather Events Review. The Commission will now commence the second stage, which requires it to prepare advice to the MCE about cost-effective changes that could be made to energy market frameworks to deliver improvements to reliability in the long term. The Commission's advice will be contained in the Final Report, to be provided to the MCE by 30 October 2009.

In this chapter, the Commission sets out its intended approach to preparing the Final Report. It also identifies five areas the Commission proposes to examine to determine whether changes to the existing energy market frameworks would improve reliability in the long term. This chapter concludes by outlining the Commission's intended approach to public consultation.

5.1 Proposed approach

The MCE Direction provides a broad structure for considering the changes that could be made to energy market frameworks to improve reliability. The Direction requires that any prospective changes the Commission identifies:

- be cost-effective and feasible; and
- improve reliability in the longer term.

In preparing its advice, the Commission will start from the premise that extreme weather events are likely to become more frequent. The Commission also notes the MCE's expectation that the review will not result in a fundamental revision of the current electricity market design.

5.2 Improving reliability over the longer term

The existing regime and the recent and prospective amendments identified in Chapter 4 provide the "business as usual" reliability and security arrangements against which to assess their effectiveness in maintaining security and reliability given a scenario of more regular and intense extreme weather events in the future. In light of recent extreme weather events, it is prudent to consider whether existing energy market frameworks could be enhanced over the medium to long term and thus improve the effectiveness of the current arrangements in managing reliability. In this section, the Commission identifies five key areas in which changes could be considered in the next stage of the review.

5.2.1 Demand and capacity forecasting in the NEM

On the assumption that that extreme weather events may become more frequent in the future, it is appropriate to review whether the current processes for preparing demand and capacity forecasts remain appropriate.

The assumptions underlying forecasts of generation availability for a forecast level of demand can have a material impact on the ability of the NEM to deliver secure and reliable electricity supply. For example, the estimates of generator availability included in the MTPASA in the South Australian and Victorian regions for 29 and 30 January were based on maximum temperatures of 43°C and 41°C respectively. However, the recorded maximum temperatures in those regions for those two days were significantly higher.[64]

If the events of 29 and 30 January are considered likely to occur more frequently (e.g. once every ten years rather than once every century), it may be appropriate that market forecasts take these conditions into account. By revising the basis on which forecasts are prepared, the redundancy necessary to withstand these events will be integrated into the market signals to generators, and the planning standards that apply to networks. The NEM's ability to meet the Reliability Standard would be improved to the extent that the assumptions on which the system is built better reflect expected conditions.

Any proposal to base forecasts on more conservative assumptions must be considered in light of the increase in costs it will likely give rise to. Maintaining the Reliability Standard at 0.002% in light of increased forecast demand peaks will increase the MRLs for each region. Higher MRLs are likely to increase the amount of generation required to meet the Standard. It may only be possible to attract this additional generation by increasing the MPC to provide the necessary price incentive. Higher MRLs may also require additional investment in transmission capacity.

As part of its *Review of the Operationalisation of the Reliability Standards*, the Reliability Panel is reviewing the inputs for setting MRLs and assessing short-term reserve capacity. In addition, NEMMCO has indicated it will review processes for load forecasting, particularly for high temperature periods.[65] However, the Commission considers it is appropriate to consider the processes of preparing forecasts as part of this review to determine whether they are sufficiently robust in the face of extreme weather events, and identify opportunities for standardising and co-ordinating planning functions.

5.2.2 Provision of information to the market

A related area where changes could be made to improve the reliability of electricity supply concerns the information provided to the market.

NEMMCO currently disseminates a large volume of important information that encompasses a broad range of topics. Information is also provided by market participants, such as TNSPs. However, there may be gaps in the information that is currently being made available that, if filled, could improve the NEM's reliability

64 NEMMCO, *Power System Incident Report: Actual Lack of Reserve (LOR3) in Victoria and South Australia Regions on 29-30 January 2009*, pp. 39, 40.

65 ibid, p. 37.

performance. For example, the Statement of Opportunities (SOO) currently describes the supply/demand outlook for each NEM region. It may help inform the market if the SOO were amended to include a supply/demand outlook that reflects only the capacity that is available during ambient temperatures of 44°C and higher. The monthly Drought Scenario Investigation report[66] is one example of a new publication developed to improve information availability.

In evaluating the need for change, the Commission is of the view that market participants should only be required to publish additional information where its publication will realise a benefit to the market, for example, where it improves investment signals or reveals other action that could be taken to enable the Reliability Standard to be met in light of extreme weather events.

5.2.3 Market mechanisms

The NEM is comprised of a number of market mechanisms that could, in theory, be adjusted to change the way reliable electricity supply is provided over the long term. In preparing the Final Report, the Commission will consider the feasibility of amending the market mechanisms having regard to the benefits to reliability performance that would be likely to accrue as a result, and the costs involved in making such changes.

- **Energy-only market design**: under the energy-only design of the NEM, the principal payment made to generators is based on the amount of energy they produce. Varying this design may encourage investment in new generation capacity, thereby improving reliability performance. The Commission notes the MCE's expectation that the Final Report will not result in fundamental revisions to the existing market design.

- **Wholesale market:** there may be scope for reviewing the design and operation of the wholesale market to determine whether the relevant parts of the NER create barriers to improved reliability performance, or could be amended to strengthen signals and incentives that promote reliability.

- **Reserve ancillary service:** a new class of ancillary service mechanism could be developed to "firm up" payments to low utilisation plant that provides reserve generation. The mechanism could offer real time pricing of reserve to any resource that can provide reserve capability at the time. While it would provide reserve plant with a more certain revenue stream than the energy market alone, prices would be expected to be volatile and rise to a high level as the supply/demand balance tightens.

- **Network support:** a TNSP may contract with generators or other market participants (such as demand-side participants) to accept compensation in exchange for taking action that reduces the overall demand on network. By encouraging embedded generators to supply capacity and relying on DSP to

66 See further www.nemmco.com.au/about/drought.html.

reduce demand, network support can assist be used to relieve capacity shortfalls in the short-term.

- **Consumer purchasing behaviours:** the introduction of smart meters, time of use pricing, a more interactive "smart grid" and wider availability for consumers to enter into interruptible contracts may improve the opportunity for DSP, including in contributing to the more cost-effective management of reliability and security.

- **Market interventions by NEMMCO**: the NEM currently provides for NEMMCO to intervene in the market to increase generation output or to reduce consumer demand. While these mechanisms enable NEMMCO to manage the NEM's performance against the Reliability Standard, there may be additional or alternate options for intervening in the wholesale market.

5.2.4 Technical standards

5.2.4.1 Technical standards for generators and networks

Generators are required to meet technical standards in order to connect to the national grid. Transmission and distribution networks are also subject to technical standards that require them to maintain appropriate levels of redundancy. The standards set the minimum technical operating capabilities for each element.

Looking to the future, one policy option to improve reliability performance is to raise standards to require higher operating capability. The higher standard could reflect expectations about the level of performance the power system requires in order to withstand the stress caused by extreme weather events. Noting that this would require an increase in reserve generation capacity and transmission capability, the costs and benefits of such an increase in standards would need to be carefully assessed.

Should the introduction of more stringent technical standards be supported, it is probable that there would be a notable delay before improvements to reliability performance could be observed. This is for two reasons. First, it may be necessary to grant a partial or total exemption from the new standards to existing generators and networks. Secondly, it is possible that substantial new generation capacity or network capability would need to be constructed before material improvements in reliability are observed. The likelihood of a lag time before improvements are observed is increased if all existing plant receives an exemption.

5.2.4.2 Increased transparency of network standards

Another option to improve reliability over the longer term is to increase the transparency surrounding the existing standards governing transmission and

distribution networks.[67] There are two principal areas in which increased openness could be encouraged.

The first area concerns transparency about the standards themselves. Presently, the standards are set by jurisdictional bodies. The transparency and accessibility of the processes for setting and amending the standards vary significantly between jurisdictions. Further, it can be difficult to ascertain precisely what the standard is, and the level of performance that is necessary in order to meet it.

Transparency about the physical environment in which equipment must be able to satisfy the applicable jurisdictional standards could also be improved. Relevant environmental variables may include peak demand, high temperatures (including for an extended period), and the extent to which disturbances to system security are permitted. The reliability performance expected of transmission and distribution networks in various conditions will directly affect the amount of redundancy the network requires. The level of redundancy in turn impacts on the ability of the network to meet the Reliability Standard.

Increasing the availability of information about network standards may encourage open discussion about their appropriateness and what is required to meet the Reliability Standard. More robust discussion may generate incremental change to the standards. In combination with the additional information and analysis produced by the NTP, these changes could improve network reliability during extreme weather events.

5.2.5 Financial network incentives

Transmission and distribution networks are regulated monopolies. The networks are permitted to earn revenue up to an amount approved by the AER and are exposed to financial incentives to encourage efficient behaviour.

The principles and processes that comprise the regulatory framework are specified in the NER. It may be appropriate to amend the framework to create new financial incentives (or sharpen existing incentives) to encourage stronger network reliability performance. For example, regulated networks could be subject to an output measure that links financial reward to a minimum level of reliability performance. The network would be rewarded financially for performance above the minimum level, and subject to a financial cost for failing to meet the minimum. Incentive mechanisms of this kind could operate in addition to, and be enhanced by, the RIT-T and the prospective RIT-D.

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[67] The Commission's advice to the MCE in the Transmission Reliability Standards Review recommended that the transparency of transmission standards be improved: AEMC 2008, *Transmission Reliability Standards Review*, Final Report to MCE, 30 September 2008, Sydney.

5.2.6 Additional measures

The Interim Report identifies the arrangements currently in place to manage security and reliability, the pending changes to enhance them, and provides some indicative observations about areas where further changes could deliver reliability improvements . However, there may be other changes that could be made to deliver greater improvements in reliability and security. The Commission intends to consult with stakeholders to identify other areas where changes may be appropriate.

5.3 Public consultation

In conducting its reviews and Rule change processes, the Commission has found it beneficial to consult with market participants and affected stakeholders. Therefore, the Commission proposes to consult with interested parties in the course of preparing its Final Report to the MCE. While the Commission is yet to finalise the framework for consultation, it expects to invite stakeholders to comment on whether:

- the areas identified by the Commission in this chapter as warranting further investigation are appropriate; and
- there are other changes that could be made to existing energy market frameworks to improve reliability and security.

The Commission notes that, notwithstanding any consultation that it undertakes, the decision concerning the publication of the Final Report remains a matter for the MCE.

A MCE Direction

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MCE

Ministerial Council on Energy

CHAIR
The Hon Martin Ferguson AM MP
Minister for Resources and Energy
Telephone: (02) 6277 7930 Facsimile: (02) 6273 0434

Dr John Tamblyn
Chairman
Australian Energy Market Commission
PO Box H166
AUSTRALIA SQUARE NSW 1215

28 APR 2009

Dear Dr Tamblyn John,

AEMC REVIEW OF THE EFFECTIVENESS OF NEM SECURITY AND RELIABILITY ARRANGEMENTS IN LIGHT OF EXTREME WEATHER EVENTS

At its 6 February 2009 meeting, the Ministerial Council on Energy (MCE) considered the challenges faced by the National Electricity Market (NEM) in light of extreme weather events.

As reflected in the meeting communiqué, the MCE agreed to direct the Australian Energy Market Commission (AEMC) to conduct a review of the effectiveness of NEM security and reliability arrangements.

I am writing on behalf of the MCE to outline the Terms of Reference for this task.

MCE direction to the AEMC

Section 41 of the National Electricity Law (NEL) enables the MCE to direct the AEMC to review any matter relating to the NEM or any other market for electricity.

Pursuant to section 41 of the NEL, the MCE directs the AEMC to conduct a review of the effectiveness of National Electricity Market (NEM) security and reliability arrangements in light of recent extreme weather events. In identifying options for addressing issues raised by these events, the AEMC shall have regard for the need for actions to be proportionate, as well as the value of stability and predictability in the energy market regime.

The AEMC's review is to provide advice in relation to the generation and transmission elements of the power system. While matters relating to the performance standards of distribution networks are the responsibility of jurisdictions, the MCE appreciates any advice the AEMC can provide to ensure network security and reliability. This review should be consistent with, and draw on, a number of reviews and rule change proposals being progressed by the AEMC and the Reliability Panel.

In the context of extreme weather related events such as droughts, heatwaves, storms, floods and bushfires, the AEMC is directed to:

- examine the current arrangements for maintaining the security and reliability of supply to end users of electricity and provide a risk assessment of the capability of those arrangements to maintain adequate, secure and reliable supplies,
- provide advice on the effectiveness of, and options for cost-effective improvements, to current security and reliability arrangements, and, if appropriate,

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- identify any cost-effective changes to the market frameworks that may be available to mitigate the frequency and severity of threats to the security and reliability of the power system.

The MCE considers that any recommendations arising from the review should also identify, where applicable, possible benefits or lessons for the broader energy market framework.

The MCE does not anticipate that this review will result in a fundamental revision of the electricity market design.

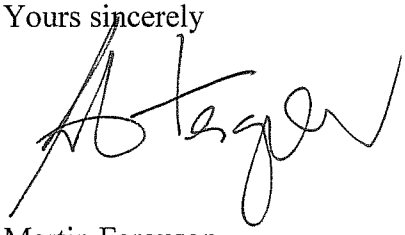
Timing and process

The AEMC is to report by 29 May 2009 on measures that are currently under consideration that would improve system reliability and security and any further cost-effective measures that could be taken in the short term that would impact on system reliability for the summer of 2009-10.

The AEMC is to report by 30 October 2009 on any cost-effective changes that could be made to energy market frameworks that would improve system reliability in the longer term and contribute to the more effective management of system reliability during future extreme weather events.

Copies of both of these reports are to be provided to the Australian Energy Regulator and the National Electricity Market Management Company/Australian Energy Market Operator. The MCE will determine whether the reports are to be published.

Yours sincerely



Martin Ferguson