Australian Energy Market Commission

AEMC Reliability Panel

Towards a Nationally Consistent Framework for Transmission Reliability Standards

Review - Draft Report

24 April 2008

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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. It is a statutory authority. Our key responsibilities are to consider Rule change proposals, conduct energy market reviews and provide policy advice to the Ministerial Council as requested, or on AEMC initiative.

About the AEMC Reliability Panel

The 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 responsibilities are specified in section 38 of the NEL.

Disclaimer

The views and recommendations set out in this document are those of the Reliability Panel and are not necessarily those of the Australian Energy Market Commission.

Foreword

This Draft Report represents the second stage in the Reliability Panel's (the Panel's) work program in the review of transmission reliability standards the National Electricity Market (NEM). The Panel was asked by the Australian Energy Market Commission ("the Commission") to undertake a review of the jurisdictional transmission reliability standards and provide advice to the Commission. The Panel's views will be considered by the Commission in formulating its advice to the Ministerial Council for Energy (MCE) on the development of a nationally consistent framework for transmission reliability standards. The Panel intends to submit a final report to the Commission by 30 July 2008, so that the Commission can consider the Panel's advice in the context of the Commission's other recommendations to the MCE concerning: the role and functions of a National Transmission Planner (NTP); and a new Regulatory Investment Test (RIT) for transmission. The MCE requires the Commission to provide it with recommendations on a framework for nationally consistent transmission reliability standards by 30 September 2008.

The first stage of the Panel's review was the publication of an Issues Paper on 21 December 2007 and a call for submissions. Submissions on the matters raised in the Issues Paper closed on 8 February 2008.

This Draft Report responds to those submissions, puts forward the Panel's draft findings and recommendations, and seeks further comments from interested parties, before a final report to the AEMC is prepared.

This Draft Report is deliberately non-conclusive but canvasses a range of selected options which have emerged during the Panel's analysis to date. The responses of stakeholders are crucially important to the Panel in reaching its conclusions for the Final Report in July 2008.

The options for delivering a nationally consistent framework for transmission reliability standards would all involve significant change. The implementation process for each of the options would require existing jurisdictional arrangements to be changed in a coordinated manner and to a timetable agreed to by jurisdictions. The Panel is keen to hear the views of stakeholders on each of the options, the rationale for adopting each option, and the steps needed for implementation.

The Panel looks forward to receiving stakeholder submissions by 3 June 2008, which will directly contribute to this important review and the Panel's Final Report, recommendations and advice.

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Contents

Abbreviations

ACCC	Australian Competition and Consumer Commission
AEMC	Australian Energy Market Commission
AER	Australian Energy Regulator
capex	Capital Expenditure
CBD	Central Business District
COAG	Council of Australian Governments
Commission	see AEMC
CRR	Comprehensive Reliability Review
DNSP	Distribution Network Service Providers
DSC	Distribution System Code
ERIG	Energy Reform Implementation Group
ESC	Essential Services Commission (Victoria)
ESCOSA	Essential Services Commission of South Australia
ESIPC	Electricity Supply Industry Planning Council
ETC	Electricity Transmission Code
ETSA	ETSA Utilities
FCAS	Frequency Control Ancillary Services
FERC	Federal Energy Regulatory Commission (USA)
IEC	International Electrotechnical Commission
ISO	Independent Systems Operator
JPB	Jurisdictional Planning Body
kV	Kilovolt
MCE	Ministerial Council on Energy
MNSP	Market Network Service Provider
MW	Megawatt
NCAS	Network Control Ancillary Services
NECA	National Electricity Code Administrator
NEL	National Electricity Law
NEM	National Electricity Market
NEMMCO	National Electricity Market Management Company

NER	National Electricity Rules
NERC	North American Electricity Reliability Corporation
NTNDP	National Transmission Network Development Plan
opex	Operating Expenditure
PASA	Projected Assessment of System Adequacy
PJM	Pennsylvania-Jersey-Maryland
QCA	Queensland Competition Authority
RNPP	Tasmanian Reliability and Network Planning Panel
Rules	National Electricity Rules
SCO	Standing Committee of Officials
SVC	Static VAR Compensators
SOO ANTS	Statement of Opportunities Annual National Transmission Statement
TNSP	Transmission Network Service Provider
TUoS	Transmission User of Service
USE	Unserved energy
VCR	Value of Customer Reliability
VESC	Victorian Electricity System Code
VoLL	Value of Lost Load
WACC	Weighted Average Cost of Capital

1 Background

1.1 What led to this Review

On 3 July 2007, the Ministerial Council on Energy (MCE) directed the Australian Energy Market Commission (Commission), under section 41 of the National Electricity Law (NEL), to conduct a review into electricity transmission network reliability standards, with a view to developing a consistent national framework for network security and reliability. The MCE's direction also requires the Commission to conduct a review into the development of a detailed implementation plan for the national electricity transmission planning function and develop a new form of Regulatory Test, which amalgamates the reliability and market benefits criteria of the current Test and expands the definition of market benefits to include national benefits. The Commission viewed the project to establish a National Transmission Planner (NTP) as related to the discrete task of developing a consistent national framework for network security and reliability. The framework of consistent national transmission reliability standards will affect the requirement for transmission development projects considered by the NTP and individual TNSPs. The standards will also affect the technical design, scale, and criteria used to evaluate transmission projects.

On 17 August 2007, the Commission requested that the Reliability Panel, in accordance with section 38 of the NEL, undertake the review of the jurisdictional transmission reliability standards and provide advice to the Commission. The Commission's Terms of Reference to the Panel are provided as an attachment to this Issues Paper. The Terms of Reference require that the Reliability Panel provide its final report to the Commission by 23 September 2008. The Panel's views will be considered by the Commission in formulating its advice to the Ministerial Council for Energy (MCE). The MCE requires the Commission to provide it with recommendations on a framework for nationally consistent transmission reliability standards by 30 September 2008.

However, the working approach adopted by the Panel is to submit a final report to the Commission by 30 July 2008, so that the Commission can consider the Panel's advice in the context of the Commission's other recommendations to the MCE concerning: the role and functions of a National Transmission Planner (NTP); and a new Regulatory Investment Test (RIT) for transmission.

This Transmission Standards Review, together with the NTP Review, are part of a range of reforms agreed to by the Council of Australian Governments (COAG) on 13 April 2007 in response to the Final Report of the Energy Reform Implementation Group (ERIG).[1] The other energy reforms agreed to by COAG in its response to ERIG have implications for the Transmission Standards Review, and their relevance and interaction are discussed below.

[1] See COAG Communiqué, 13 April 2007 and supplementary COAG document, "COAG Reform Agenda – Competition Reform April 2007"; both available at www.coag.gov.au

1.1.1 ERIG Report

The Energy Reform Implementation Group was established by COAG in February 2006 to develop proposals for:

- achieving a fully national electricity transmission grid;
- measures to address structural issues affecting the ongoing efficiency and competitiveness of the electricity sector; and
- measures to ensure transparent and effective financial markets to support energy markets.

ERIG's Final Report was published in January 2007.[2]

In relation to developing an efficient national transmission grid, ERIG concluded that there is a need for a consistent national framework for transmission reliability standards. ERIG concluded that jurisdictionally based transmission reliability standards are the "principle [sic] drivers for investment in transmission"[3] and that a "clear shortcoming…is the different standards to which networks are built in each NEM jurisdiction"[4].

ERIG noted the following range of concerns with existing transmission standards:

- There is a lack of specificity in the reliability standards set out in Schedule 5.1 of the National Electricity Rules and the majority of jurisdictional reliability obligations, which are open to interpretation. The consequence of this is that TNSPs have considerable discretion in the application of reliability obligations at various locations across the network.
- There may be questions about conflicts of interest in circumstances where responsibility for either setting jurisdictional reliability criteria or for interpreting broad criteria contained in transmission licence conditions is delegated to the TNSP. "This conflict is exacerbated where the TNSP's revenue and profitability is also driven by constructing assets to meet their own reliability requirements."[5]
- "There are significant efficiency and investor certainty implications associated with the current transmission planning criteria. The lack of specificity in the current criteria and the diversity of approaches across jurisdictions may create uncertainty for investors in generation."[6]

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[2] ERIG 2007, *Energy Reform – The Way Forward for Australia*, A report to the Council of Australian Governments by the Energy Reform Implementation Group, Canberra, January 2007. (URL http://www.erig.gov.au)

[3] ERIG 2007, p. 167

[4] ERIG 2007, p. 181

[5] ERIG 2007, p. 181

[6] ERIG 2007, p.165

ERIG concluded that there would be benefits from using a consistent national approach to specifying transmission standards across the NEM. It suggested three possible approaches to establishing a consistent national standard for transmission reliability:

1. A probabilistic economic reliability standard;

2. A probabilistic outcomes based standard; or

3. A deterministic redundancy planning criteria.

These three approaches are defined and discussed in Chapter 2.

ERIG recommended that:

- "…reliability standards should at least be clear and specific as to how they are applied, be set by a body independent of the entity responsible for meeting these obligations, and be cast in technology neutral manner."[7]

- "Any technical standard should be defined narrowly and as clearly as possible." [8]

- "A consistent and clear national framework should be implemented through the redrafting schedule 5.1 of the Rules." [9]

- "The Reliability Panel would be the appropriate body to undertake the necessary review and devise such a framework before the actual standards applying to individual connection points are specified by jurisdictions." [10]

- "There may be long term benefits from making this framework consistent with the IEC [International Electrotechnical Commission] standard on reliability centred design of transmission system". [11]

ERIG's recommendations on the development of consistent national framework for reliability standards are linked to its other recommendations concerning the function and form of the Regulatory Test.[12]

Of significance for this review of transmission reliability standards, ERIG warned that the "economic benefits from integrating the two limbs of the Regulatory Test in

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7 ERIG 2007, p.182

8 ERIG 2007, p.182

9 ERIG 2007, p.182

10 ERIG 2007, p.182

11 ERIG 2007, p.182

12 The Regulatory Test made by the AER in accordance with clauses 5.6.5A of the NER is the principal vehicle for transmission project assessment and consultation for the NEM. The Regulatory Test consists of a 'reliability limb' and a 'market benefits limb'. For further information on the Regulatory Test, see AEMC 2007, *National Transmission Planning Arrangements, Issues Paper*, 9 November 2007, Sydney.

any future investment decision making process may be eroded by poorly specified and inconsistent reliability standards and planning criteria”.[13]

The AEMC is currently examining the form and function of the Regulatory Test as part of the NTP Review.

1.1.2 COAG Response to ERIG

COAG agreed with the recommendations by ERIG concerning the establishment of an enhanced planning process for the nation’s electricity transmission network. COAG consider that an enhanced planning process will “ensure a more strategic and nationally coordinated process to transmission network development, providing guidance to public and private investors to help optimise investment between transmission and generation across the power system.”

In relation to the review of jurisdictional electricity network reliability standards, COAG agreed that this review should be progressed, but with appropriate caution noting: the different physical characteristics of the network; existing regulatory treatments in balancing reliability and costs to consumers; and that these standards underpin security of supply.

The Panel notes the cautionary qualifications outlined by COAG, which will be considered by the Panel in this review.

1.2 Panel’s approach to the review

There are five key mechanisms in the NEM which affect the secure and reliable delivery of electricity to end users:

1. the market itself, which seeks to match supply and demand across time, using a transparent spot pricing process and short- and long-term financial contracts;

2. the reliability standard of 0.002% unserved energy (USE), set by the Reliability Panel, and associated reliability mechanisms such as VoLL and the CPT;

3. technical standards specified in the Rules relating to security and reliability in an operational timeframe;

4. jurisdictional transmission reliability standards relating to the design and planning of transmission and distribution networks; and

5. reliability safety net provisions, comprising the Reserve Trader and NEMMCO’s powers of direction for security or reliability. These safety provisions allow NEMMCO to contract for reserves when it projects reserve shortfalls and issue directions to Market Participants in order to maintain power system security or reliability.

[13] ERIG 2007, p.168

This review is focused solely on developing a consistent national framework for reliability standards relating to the design and planning of transmission networks. These transmission reliability standards are primarily set out in jurisdictional instruments, and relate to a planning timeframe, but must conform with the technical standards specified in the Rules relating to security and reliability in an operational timeframe.

The review will not be examining issues concerning the reliability standard of 0.002% unserved energy because the Reliability Panel has recently reviewed this standard as part of its Comprehensive Reliability Review (CRR). For the same reason, the reliability safety net provisions of the Rules will not be re-examined. As a consequence of the CRR, the Panel has recently lodged Rule changes with the AEMC that aim to refine the NEM's reliability safety net mechanism.[14]

Technical standards concerning security and reliability of the bulk power system in an operational timeframe (in Chapter 5, Schedules 5.1a and 5.1 of the NER) and connection standards (Schedules 5.2 to 5.4 of NER) will be the subject of a separate review by the Panel during 2008.

1.3 Issues Paper

The Panel published an Issues Paper on 21 December 2007 that:

- outlined the existing transmission reliability standards in the NEM, which are largely set by each NEM jurisdiction;
- discussed the policy problems that a framework for nationally consistent transmission standards is trying to solve, the size and scope of the problem, and the motivations for changing current jurisdictional standards;
- discussed three potential frameworks that could be used to improve the consistency of transmission reliability standards across the NEM;
- examined the implications arising from any attempt to change the form and/or level of existing jurisdictional transmission standards;
- explored a range of issues associated with the implementation of a nationally consistent transmission reliability standard, including:
  - Who would define the framework?
  - To what level would the framework contain specific standards?
  - What implementation steps are required?
  - What process should be followed?

[14] For details, see http://www.aemc.gov.au/electricity.php?r=20080307.151409

– Inter-dependencies, such as standards for sub-transmission networks, the regulatory incentive regime and regulatory approval cycles

The Panel sought input from interested parties on the matters raised in the Issues Paper.

1.4 Structure of this paper

The remainder of this Draft Report is structured as follows:

- Chapter 2 outlines the range of questions raised in the Issues Paper.
- Chapter 3 sets out areas of consensus which have emerged from submissions on the Issues Paper – as well as the Panel's own analysis – concerning a Nationally Consistent Framework (NCF) for transmission reliability standards. First, there is broad agreement that a NCF is desirable. Second, there is a degree of consensus about a number of high level principles for a national framework. However, establishing a NCF based around these areas of consensus will require significant changes to existing jurisdictional instruments, and potentially the National Electricity Law (NEL) and National Electricity Rules (NER).
- Chapter 4 explores the broad options for change, and the properties of these options.
- Chapter 5 details a range of specific options, and what has been said about them in submissions.
- Chapter 6 discusses a draft implementation regime and a transition plan, which would be required to introduce a NCF.
- Chapter 7 outlines what still needs to be resolved or further assessed before the Final Report is submitted to the AEMC on 30 July 2008.
- Appendix A provides an overview of the NEM and introduces basic concepts relating to power system reliability and security standards and planning methodologies.
- Appendix B outlines the existing transmission reliability standards in the NEM, and briefly compares them to standards in a selection of other electricity markets. Appendix B also discusses the policy problems that a framework for nationally consistent transmission standards is trying to solve, the size and scope of the problem, and the motivations for contemplating changes to current jurisdictional standards.

1.5 Consultation process

The following key dates outline the intended consultation process leading up to the delivery of the Panel's final report to the AEMC on a framework for nationally consistent standards for transmission network security and reliability.

Date	Milestone
21 December 2007	Publish Issues Paper
8 February 2008	Close of submissions on Issues Paper
24 April 2008	Publish Draft Report
30 April 2008	Public forum on Draft Report
3 June 2008	Close of submissions on Draft Report
30 July 2008	Submit Final Report to AEMC
30 July 2008	Publish Final Report

1.6 International review

As mentioned in the Issues Paper, the Panel has commissioned a consultancy report on:

- the transmission reliability standards used in different international electricity markets; and
- the frameworks used in other markets to ensure consistency of transmission reliability standards across multiple political jurisdictions and/or multiple transmission network owners.

A consultancy report, by KEMA Consulting, will soon be published separately. Interested parties can incorporate any comments on KEMA's report into submissions on this draft report. These comments will be taken into account by the Panel in preparing its final report to the AEMC.

1.7 Public forum on Draft Report

The Panel intends holding a public forum on the Draft Report on 30 April 2008 at the Melbourne Airport Hilton Hotel. Further information on the forum, including registration, is available on the AEMC website at http://www.aemc.gov.au/electricity.php?r=20071221.150018 .

1.8 Submissions on the Draft Report

The Panel invites written submissions from interested parties in response to this Draft Report by 5pm (Australian Eastern Standard Time) on 3 June 2008. Submissions may be sent electronically or by mail in accordance with the following requirements.

1.8.1 Lodging a submission electronically

The submission must be sent by email to submissions@aemc.gov.au. The email must contain the phrase "Transmission Reliability Standards – Draft Report" in the subject line or heading. The submission must be on letterhead (if submitted on behalf of an organisation), signed and dated. The submission must be in PDF format, and must also be forwarded to the Panel via ordinary mail.

Upon receipt of the electronic version of the submission, the Panel will issue a confirmation email. If this confirmation email is not received within 3 business days, it is the submitter's responsibility to ensure successful delivery of the submission has occurred.

1.8.2 Lodging a submission by mail

The submission must be on letterhead (if an organisation), signed and dated by the respondent. The submission should be sent by mail to:

The Reliability Panel
Australian Energy Market Commission
PO Box A2449
Sydney South
NSW 1235

The envelope must be clearly marked "Transmission Reliability Standards – Draft Report".

Except in circumstances where the submission has been submitted electronically, upon receipt of the hardcopy submission the Panel will issue a confirmation letter. If this confirmation letter is not received within 3 business days, it is the submitter's responsibility to ensure successful delivery of the submission has occurred.

2 Matters raised in the Issues Paper

This chapter provides a brief overview of the matters raised in the Issues Paper, and provides the context for range of the options discussed in later chapters.

2.1 Main themes of Issues Paper

The reliable and secure supply of electricity is crucial to the Australian economy and public safety. Australia is an advanced, industrialised, 'digital' economy, in which production, commerce and many everyday processes rely on computer technology, and thus a reliable, secure and high quality electricity supply.

Since its inception in 1998, the National Electricity Market (NEM) has provided the eastern seaboard of Australia with reliable and secure supplies of electricity. Over the last ten years, the performance of the NEM has been at least as good as -- and in many cases better than – that provided in the past by the vertically integrated state electricity commissions which existed prior to the NEM. The NEM has achieved this level of reliability via the combination of its market and regulatory arrangements, and the response of its market participants; which include generators, retailers, loads, the system and market operator NEMMCO, and regulated networks service providers (NSPs).

Appendix A provides a general introduction to the NEM, explains what reliability is, how transmission reliability standards are defined in the NEM, and how these fit with other reliability mechanisms in the NEM. Also discussed are key concepts about reliability standards – such as the form and level of standard – which are used throughout the rest of this report.

The transmission network transports power from generators to end users. This network plays a critical role in ensuring sufficient power is available to end use customers, at a quality suitable for their use, at all times, and in the face of equipment failures or weather disruptions (e.g. lightning strikes). Standards for the design and operation of the transmission grid and plant connected to it (e.g. generators, loads) are one critical element for assuring continued reliable supplies of power at each point of the network.

There is a difference in the transmission reliability standards used over operational and planning horizons. Transmission standards can relate to two (overlapping) timeframes:

- Design/planning horizon — which can be from a few months ahead to several decades ahead; and
- Operational horizon — which ranges from the instantaneous through to several months into the future.

Security standards at the design/planning stage are concerned with ensuring that the power system can tolerate the outage of any component or several components.

This entails building a degree of redundancy into the network that allows for equipment outages.

Operational horizon standards are contained in the Rules (Chapter 5 and its schedules), and are tightly related to the power system security and reliability requirements specified in Chapter 4 of the Rules. Planning horizon standards are largely contained in jurisdictional instruments, but do have to be consistent with the operational horizon standards. (See Appendices A and B for further discussion).

This review is focused on the planning standards, specifically the establishment of a framework for nationally consistent transmission reliability standards for planning purposes. During 2008 the Panel will conduct a separate review of the operational standards contained in the body and schedules of Chapter 5 of the Rules.

The existing transmission reliability standards for network planning differ across NEM jurisdictions, as explained in Appendix B. Over the last few years, there have been reviews of transmission standards or sub-transmission standards in four of the five NEM jurisdictions: South Australia, Tasmania, Queensland, and New South Wales. These reviews have led to changes in standards that have affected (or will affect) the level of investment required to comply with the new standards, and regulatory determinations concerning TNSPs' levels of capital and operational expenditure, returns on regulated asset base, and transmission pricing.

Existing transmission reliability standards (for network planning) are largely determined on a jurisdictional basis. This reflects the historical development of transmission networks across the NEM, which were originally designed to meet the needs of each jurisdiction, and the fact that until relatively recently there was little interconnection between jurisdictions.

The form of standards and planning methodology differs across jurisdictions: deterministic, probabilistic, and hybrid approaches are used.[15]

The level of standards differs across and within jurisdictions, as does the degree of specificity in the standards:

- Typically, reliability standards are higher for Central Business Districts (CBDs) in state capitals than they are for metropolitan, urban, and rural areas in a jurisdiction;
- Some jurisdictions specify the level of reliability at each connection point, while others do not.

The process for setting standards and the transparency of the process differs across jurisdictions:

- Set by Government;

[15] See Appendices A and B for further discussion on various forms of standards and planning methodologies.

- Set by Jurisdictional Regulator;
- Set by Government, on advice from TNSP.

The instruments used to give effect to standards also differ across jurisdictions:

- Legislation
- Transmission License conditions
- Transmission Grid Codes
- Planning documents

The increased level of interconnection between jurisdictions is a driver for increased consistency in transmission planning standards.

As mentioned in Chapter 1, ERIG identified a number of reasons for establishing a framework for nationally consistent framework transmission reliability standards. COAG's response to ERIG included supporting the establishment of a framework for nationally consistent transmission standards (with some cautionary concerns), which in turn has resulted in the Panel being asked to conduct this review.

2.2 Specific questions in Issues Paper

The Issues Paper sought views on the following list of questions:

1. What are the potential issues arising from divergent transmission standards across NEM jurisdictions?
2. What is the size and scope of the policy and commercial issues arising from divergent transmission standards across NEM jurisdictions? Which are the most significant? How significant are they?
3. What motivations, if any, are there for greater national consistency of transmission standards across the NEM?
4. Are there other advantages and disadvantages of having transmission standards that are divergent and are set on a jurisdiction specific basis? Do the advantages outweigh the disadvantages? Or vice versa?
5. What does "nationally consistent" framework mean, and what does it not mean?
6. How is the notion of a "nationally consistent" framework best expressed?
7. What are the pros and cons of having jurisdictional transmission standards aligned through:

   (a) Making the operational standards in the Rules more specific, thereby limiting the degree of discretion available to TNSPs in meeting the operational standards contained in the Rules;

(b) Expanding the transmission standards in the Rules to cover the planning horizon, as well as the operational horizon;

(c) Aligning the *form* of jurisdictional transmission standards across the NEM via coordinated changes to the jurisdiction specific instruments that specify the standards.

(d) Aligning *both the form and the level* of jurisdictional transmission standards across the NEM via coordinated changes to the jurisdiction specific instruments that specify the standards.

8. What are the pros and cons of having a uniform transmission standard applied across the NEM?

9. What are the costs and benefits of moving to a common form and level of transmission planning standard?

10. What allowances would have to be made in moving to a uniform standard (e.g. changes to transmission regulatory determinations and connection agreements)?

11. What are the costs and benefits of not moving to a common form and level of transmission planning standard?

12. What are the costs and issues if a common transmission standard leads to an inconsistency with the DNSP sub-transmission standard in the same jurisdiction?

13. Which body is best placed to set any nationally consistent transmission standard and why? To whom, and how, should this body be accountable?

14. What interactions are there between jurisdictional transmission standards and other aspects of the regulatory regime?

15. What linkages are there between jurisdictional transmission standards and other reviews or Rule changes currently under consideration by the AEMC?

16. How should these interactions be taken into consideration in developing a framework for nationally consistent transmission reliability standards?

17. What are the process steps you think will be necessary to establish a transmission reliability framework for the NEM?

18. What difficulties do you see in implementing a nationally consistent transmission reliability framework and how could these best be managed or overcome?

3 Areas of consensus on a nationally consistent framework

This chapter discusses areas of apparent consensus on building a framework for nationally consistent transmission reliability standards for network planning. Based on submissions to the Issues Paper, there appear to be two broad areas of consensus. First, a nationally consistent framework is seen as desirable, compared to existing arrangements. Second, there is a commonality of views on a number of high level policy principles for a national framework.

However, the Panel notes that establishing a NCF based around these areas of consensus will require significant changes to existing jurisdictional instruments, and potentially the National Electricity Law (NEL) and National Electricity Rules (NER).

Also discussed are other criteria that could be used to assess competing frameworks for nationally consistent standards.

3.1 Desirability of a nationally consistent framework

There is consensus on the desirability of a nationally consistent framework for transmission reliability standards. However, there is a divergence on views on the nature of that framework, the degree to which it specifies the level of standards, and the flexibility individual jurisdictions should have in setting standards. These differences of view are discussed in Chapter 5.

Submissions identified a range of motives for shifting towards a nationally consistent framework for transmission reliability standards, and the policy and commerical issues arising from a divergence in transmission standards across NEM jurisdictions. Appendix C lists the submissions, which are available on the AEMC's website.[16]

The National Generators Forum (NGF) identified three potential issues with the NEM's existing arrangements, in which transmission standards diverge across jurisdictions:

1. Regulatory Complexity: There is increased regulatory complexity for investors in new generation or demand side initiatives when assessing longer term network performance, levels of congestion and market access.

2. Equity: Different standards will drive different levels of transmission investment and therefore different costs to consumers across the NEM.

3. Regulatory Overhead: Multiple standards can result in duplication of administration and higher costs."[17]

[16] See http://www.aemc.gov.au/electricity.php?r=20071221.150018

[17] NGF submission — Issues Paper, p. 3

The Group[18] considers the continued use of divergent transmission standards across the NEM results in:

- Lack of competitive neutrality between generation and transmission;
- Needless complexity;
- Needless retention of jurisdictional discretion;
- Potential for undue influence and discretion for TNSPs; and
- Likely retention of simplistic deterministic standards.

The Group questions whether divergent, jurisdictionally based, reliability standards are consistent with the development of a NEM-wide national transmission plan. It is also concerned that TNSPs should be transparent and accountable to network users for network performance, because the enterprise value of market participants can be affected by the combination of: a) the network access regime in the NEM; b) the level of network performance; and c) network investments.

The NGF considers the key motivations for greater national consistency in transmission standards to include "reduced regulatory complexity, better definitions of standards across all jurisdictions, increased transparency of application of standards, lower overall administration costs, and greater ability to review and reset standards as required in the future."[19]

In contrast, the Electricity Transmission Network Owners Forum (ETNOF)[20] views the shortcomings of the current arrangements being primarily related to a lack of transparency in both the process used to set standards and the standards themselves; rather than to differences in the level of standards between jurisdictions.

> "A clear and consistent national framework will be capable of addressing perceptions that TNSPs have a conflict of interest in applying reliability standards by ensuring that there is a clear and unambiguous standard determined by each jurisdiction. Transparency in relation to the applicable reliability standard will also improve investor certainty regarding the level of reliability they can expect from the transmission system and the understanding of reliability standards by generation and other non-network investors. In addition, transparency of the level of reliability the network should be planned to meet and the application of that standard focuses accountability on the TNSPs in meeting that standard."[21]

18 "The Group" comprises. LYMMCO, AGL, International Power, TRUenergy, and Flinders Power.

19 NGF submission — Issues Paper, p. 3

20 ETNOF changed its name to Grid Australia on 2 April 2008.

21 ETNOF submission — Issues Paper, p.11-12

ETNOF considers that a nationally consistent framework for deriving transmission standards "would complement the current regulatory framework, which is based on commercially motivated transmission service providers operating under regulatory incentives." However, ETNOF are strongly of the view that the level of the transmission planning standards should continue to be determined on a jurisdictional basis.

The Australian Energy Regulator (AER) "considers that the most pressing issue facing this review is the lack of transparency and clarity that is inherent in the current arrangements for setting reliability standards. This applies both at a jurisdictional level and at the national level through the National Electricity Rules."[22]

The AER is critical of the ambiguity inherent with deterministic reliability criteria, and the wide degree of scope this allows TNSPs to interpret and apply such standards.

Both the AER and the Electricity Supply Industry Planning Council (ESIPC) note that:

- the transparency of transmission standards could be improved;
- there could be greater clarity in processes used to determine standards; and
- significant linkages exist between the standards and the regulatory processes used to set regulated revenues and to assess network performance. Poorly defined reliability requirements make it difficult for the AER to assess whether the capital expenditure proposals of TNSPs are genuinely required to meet reliability requirements.

The AER also states that when reliability standards are ambiguous, some TNSPs may mitigate the risk of non-compliance by adopting a conservative approach of having "inappropriately high capital expenditure claims".

There is consensus between ETNOF, the Group, the NGF and AER that ambiguity in transmission standards adds to the uncertainty faced by generation investors and investors in non-network responses, such as demand-side management.

The Victorian Energy Networks Corporation (VENCorp) "supports the adoption of a common reliability standard across all jurisdictions" and favours having this standard set out in "one instrument, such as the NER", rather than as now, in a range of jurisdiction-specific legislation, regulations or transmission licenses. However, it recognises that considerable effort will be required to achieve this.

VENCorp tempers its support for common standards by stating "…while having a common standard is important, it is equally, if not more important, to have a transparency of reliability standards and their method of application in a planning environment, in each jurisdiction"

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22 AER, Submission – Issues Paper, p. 2

3.2 High-level principles for a nationally consistent framework

There appears to be a consensus in submissions concerning some of the high level principles that would be incorporated into a framework for nationally consistent transmission reliability standards.

Specific principles around which there is consensus are:

1. Transparency – there should be greater transparency in the processes used for setting standards;

2. Governance — standards should be set by a body that is separate from the body that must apply the standard;

3. Economic efficiency — the framework should result in reliability standards being derived from economic considerations;[23]

4. Specificity of standards — transmission reliability standards should be clearly specified on a connection point basis or on some other readily understandable basis (e.g. by geographic area, such as CBD, large regional city, etc.);

5. "Fit for purpose" standards – the framework should not be a "one size fits" approach. Rather it should allow for reliability standards to differ according to, say, the significance or criticality of the load centre — e.g. between CBD, metro and rural areas of a jurisdiction — or according to explicit customer valuation of reliability at each connection point; and

6. Accountability — TNSPs should be accountable to the appropriate authority for meeting the transmission standards, as well as to the AER for meeting the resultant service standards, as this is an integral part of regulatory incentive regime. If standards were set by a jurisdictional authority, it would most likely follow that the TNSPs would be accountable to that jurisdictional authority.

3.3 Other suggested criteria for assessing alternative frameworks and developing reliability standards

Both the AER and ETNOF have put forward sets of principles to guide the development of frameworks for nationally consistent transmission standards, and the selection of an appropriate framework.

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23 The Panel notes that that the AEMC is currently developing a new Regulatory Investment Test (RIT), as part of the National Transmission Planner Review. The RIT seeks to ensure the selection of the most economically efficient option for meeting a given reliability standard. If standards were derived from economic considerations, the proposed RIT would reinforce incentives to deliver to those standards in an economically efficient manner. This is akin to selecting a design for a "fit for purpose" engineering solution that meets a given standard – taking into account economic factors such as economies of scale and scope, option value, and future growth in demand -- then conducting a competitive tender process to deliver that solution at least cost.

In addition to agreeing with criteria 1 to 5 above, the AER has suggested that standards should be "set in such a way as to be neutral between the technologies that are used to meet a given standard."

ETNOF consider the following five criteria should be adopted in order to assess alternative frameworks for developing reliability standards and selecting a preferred framework:

- **Economic efficiency**. "The framework should result in reliability standards being derived from economic considerations. In particular the framework should provide for an assessment of the benefits of additional reliability compared with the costs of providing it."

- **Transparency.** There should be transparency in the standards resulting from the framework; the process used to derive the standards, and in the application of the standards. The standards should be "sufficiently clear to be understood by market participants that are not necessarily from a transmission planning background". In addition, the "framework will need to be consistently applied across all jurisdictions."

- **Accountability**. "Accountability is intrinsically linked to transparency. A framework that is easily understood makes it possible both to pinpoint the party that is responsible for setting the standard for the service level to electricity consumers and also makes clear the exact standard that the TNSP is required to meet. Accountability requires that outcomes can be readily measured and compared with the specified planning standard."

- **Effectiveness**. "A framework that is effective will enable investment to proceed in a timely manner and will meet customers' expectations for reliability. This criterion is also linked to transparency, as it ensures transparency of both the standard to be adopted and the application of that standard."; and

- **Robustness**. The framework should be robust enough to withstand external scrutiny and criticism. A framework that is similar to that used in other developed countries, comparable to Australia, "is likely to better withstand scrutiny in the event of an investigation following a major reliability failure".

In addition, ETNOF has suggested that a desirable characteristic of any framework is that it should ensure consistency between transmission and distribution network reliability standards and co-ordinated planning of these networks, given that interactions between transmission and the sub-transmission systems (owned by DNSPs) are relatively common in delivering an overall reliability outcome for customers. In that context, it is noted that the setting of standards is for DNSPs is outside the Panel's remit.

The Group also favours consistency in the standards applied to transmission and sub-transmission networks, but does not seeing this necessarily resulting in a change in jurisdictionally mandated distribution network standards. "The retention of jurisdictional network standards at the local distribution level, while potentially inefficient, has a limited impact on the operation of the wholesale NEM as the local network fulfils a different role to the main transmission system. A national standard for the major transmission and sub-transmission network should therefore not create any major inconsistencies."[24]

It is apparent that ETNOF has a different view to the Group on the materiality of the interaction between the transmission networks and the sub-transmission networks owned by DNSPs. Those interactions may be material in some regions of the NEM, but not in others.

3.4 Panel's proposed principles for a nationally consistent framework

The Panel agrees with that the six consensus principles discussed in Section 3.2 should be used to guide the development of a framework nationally consistent transmission planning standards:

1. Transparency;
2. Governance;
3. Economic efficiency;
4. Specificity of standards;
5. "Fit for purpose" standards; and
6. Accountability.

To these six principles, the Panel would propose to add a further three:

7. The maintenance of at least existing levels of network performance;
8. Standards should be technologically neutral, and not be biased towards network solutions where other non-network options can provide a comparable level of reliability; and
9. Desirability for a consistent relationship between transmission and sub-transmission standards.

With regards to the specificity of standards (principle 4), it should be recognised that transmission connection points fall into two broad categories: a) large energy customers, such as smelters, and DNSPs; and b) Generators. The framework for standards will have to account for the fact that these customers can, in some cases, negotiate levels of standards that are above or below the general minimum levels of standards set within the framework.

The Panel suggests that it should also be recognised that transmission networks provide three broad types of service:

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24 The Group's submission — Issues Paper, p.16

- Access to connection services by generators and loads;
- Regional reliability, facilitated through meshing and other forms of redundancy. This is facilitated through the joint planning of transmission and distribution networks within a jurisdiction; and
- Interconnection service between regions, that can enhance reliability and security within and across regions, and greater competition in the supply of electricity than that which would occur without the interconnection in place.

The Panel is seeking views on its suggested criteria. The Panel intends using these criteria in developing and assessing the options for a NCF that will be put to the AEMC.

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4 Options for change

This chapter discusses two broad options for developing a framework for consistent transmission standards across the NEM:

1. Consistency through the alignment of regional standards within a high level framework. This approach allows for regional differences within a common framework; and

2. Uniform standards, universally applied; which represents one end of the spectrum for a nationally consistent framework

Also discussed are two key issues associated with any changes to the form and/or level of existing jurisdictional transmission standards. First, the pros and cons of each broad option are discussed. Second, the costs and benefits of moving away from today's divergent jurisdictional standards to a more consistent national framework.

4.1 Before the NEM there were divergent standards, set regionally

Prior to the start of the NEM, transmission reliability standards were set on a regional (i.e. jurisdictional) basis. There was no formal framework to ensure 'nationally consistent' standards, other than via joint TNSP planning and operation of the interconnectors joining the transmission grids of:

a) NSW and Victoria; and

b) Victoria and South Australia.

Informally, there may have been a degree of consistency provided via requirements on TNSPs to plan and operate their networks in line with 'good industry practice'; and due to some standards (e.g. N-x) being derived from international "custom and practice".

This approach was consistent with the institutional arrangements in place prior to the establishment of the NEM, including the generally low level of interconnection between jurisdictions.

Under this approach, a degree of national consistency could arise by accident, rather than design, if all jurisdictions independently adopted the same form and level of transmission reliability standards, and applied them consistently to customers of similar types.

A somewhat more certain means of reaching a degree of national consistency using this approach would be for jurisdictions to agree to a common set of factors that each would have regard to when unilaterally determining their own standards. Agreeing on a common set of factors in this way could provide a "least change" option for moving towards nationally consistent standards framework.

In reality, there was no accidental alignment of jurisdictional transmission reliability standards, and this remains the case today (see Appendix B).

Since the mid 1990s, in the lead up to the start of the NEM, a range of national standards were developed for some aspects of the interconnected grid. This shift was prompted by the need to operate the NEM in secure and reliable manner as a single control area and by the increased level of interconnection between jurisdictions, which means that electrical disturbances in one jurisdiction can affect the reliability of energy supplies in other jurisdictions.

4.1.1 Advantages

The benefits of a purely jurisdiction specific approach to setting standards include:

1. Accountability – since the jurisdiction "feels the heat" from consumers when there is a reliability failure, the jurisdiction should arguably be able to set the standards.

   In its submission to the AEMC, the Tasmanian Government — in proposing that a "level of general principles" would constitute a nationally consistent framework— states that "Tasmania would argue that reliability standards are legitimately the concern of those they affect and who pay for them".[24]

2. Flexibility - standards can be tailored to local conditions in each jurisdiction, taking into account:

   (a) Historical expectations of reliability and nature of existing network

   (b) Load dispersion, density and growth within region

   (c) Nature of critical loads and economically important loads

   (d) Generation fleet mix and locations

   (e) Degree of interconnection with other NEM regions

   (f) Likelihood of localised critical contingencies — e.g. equipment failure,

   (g) Effects of local climate on network performance envelope – for example, dust on circuits, lightening strikes, wind, heat, cyclones, icing, bush fires, etc.

3. It enables consistency of standards between TNSP and DNSPs within the jurisdiction to be developed and maintained , thereby facilitating least cost development of the network. This is material in those jurisdictions where the DNSP sub-transmission networks interact with the transmission networks to deliver the overall capability.

4. It is evolutionary, requiring few changes to existing networks, and to long term connection agreements. While significant changes to jurisdictional instruments

24 Department of Infrastructure, Energy and Resources (Tasmania) – Submission to AEMC National Transmission Planner Review, p. 2.

and connection agreements will be required, these changes are likely to fewer than those necessary to implement other alternative options.

It should be noted that standards can be tailored to local conditions under a national approach to setting the level of standards. In addition, while achieving consistency between transmission and distribution network standards might be easier under a jurisdictional approach to setting the level of standards, it might also be achieved under a national approach.

4.1.2 Disadvantages

However, there are some potential disadvantages to this approach, including that:

1. It entrenches jurisdiction specific network planning, which is at odds with the MCE's desire for a more co-ordinated development of the National Transmission Grid.

2. It may focus the attention of TNSPs on the development of their own networks in order to deliver reliable supply, potentially overlooking more economic means of meeting reliability standards, such as greater interconnection or network augmentations in other transmission networks that provide increased reliability benefits to loads on their network.

3. The existence of differing jurisdictional transmission standards may result in significantly different transmission network outcomes when the new Regulatory Test is applied similar projects in different jurisdictions. This has the potential to alter the economics of transmission relative to generation investments across the NEM.

4.2 Today's framework for transmission reliability standards

The NEM's existing framework for setting transmission reliability standards provides a degree of national consistency through a range of mechanisms:

1. NEM-wide power system performance standards relating to the operational timescale, which are contained in Schedules 5.1a and 5.1 of the Rules;

2. NEM-wide power system security standards, specified in Chapter 4 of the Rules; and

3. Minimum connection point standards for loads, distribution networks, MNSPs, and generators connected to the transmission grid (Schedules 5.2 to 5.7 of the Rules).

The existing framework also allows transmission reliability standards to diverge across (and within) jurisdictions, through:

4. Allowing jurisdictions to specify network connection point reliability standards or performance standards with greater precision than in the Rules. These jurisdictional transmission standards complement the standards in the Rules and

apply to both the operational time horizon and longer term planning horizons; and

5. Allowing negotiated standards of reliability to be higher or lower than the minimums, with agreed standards specified in connection agreements between network users and TNSPs.

Accountability for the performance of the bulk power system against the reliability standards is ensured via a range of interacting mechanisms:

- Monitoring by the Reliability Panel of the level of USE in each jurisdiction;
- Enforcement of the Rules by the AER;
- Enforcement of transmission licence conditions, including with transmission codes, by the Minister or regulator in a jurisdiction;
- Compliance with regulatory rulings made by AER;
- AER imposed service standards, with performance incentives, and monitoring across the regulatory cycle;
- Financial penalties relating to network performance that are specified in network connection agreements; and
- The exposure of TNSPs to general legal remedies for negligence.

To summarise, the overall framework is one in which there are minimum national standards for network performance and security in an operational timeframe, with a measure of discretion given to jurisdictions in setting specific standards that are consistent with the national minimum standards. The way in which jurisdictional standards are given effect, together with the form and level of those standards, is left to the discretion of the jurisdiction. There is scope for individual energy users to negotiate higher or lower reliability standards. At a broad level, there is degree of national consistency in the accountabilities of TNSPs. All TNSPs have to answer to national institutions, such as the AER, jurisdictional regulators or governments, and network users.

4.3 Issues with existing framework

As discussed in Chapter 1, while the Rules specify a common set of standards for transmission, there are additional standards set at a jurisdictional level which affect the design, construction and operation of transmission networks.

ERIG noted that differences in jurisdiction specific standards and their interpretation could be leading to a pattern of investment in transmission networks across the NEM that is not as efficient as it otherwise could be and that this could be distorting the efficient balance of investment between transmission, demand side response, and generation. A specific issue raised by ERIG is that without a framework for greater national consistency in transmission standards, the projected benefits arising from the establishment of a National Transmission Network Development Plan and the development of a new Regulatory Test, would be significantly diminished. Greater consistency in transmission standards is viewed as key step in facilitating the efficient development of the national transmission network.

In agreeing to this review of jurisdictional transmission reliability standards, COAG stated the development of consistent national framework should proceed "with appropriate caution noting the different physical characteristics of the network, existing regulatory treatments in balancing reliability and costs to consumers, and that these standards underpin security of supply."[25]

Appendix A outlines how both the form and level of existing jurisdiction specific transmission standards differs across the NEM. Furthermore, jurisdictional transmission standards are imposed by a wide variety of legal and regulatory instruments, including: Acts of Parliament, Transmission License conditions, Transmission and Distribution Network Codes, Network Management Plans, Connection Agreements, and Planning processes.

In order to have a nationally consistent framework for transmission reliability standards, there will need to be broad agreement on the specification of the form of standards, and the mechanism by which the detailed standards are determined.

The Issues Paper sought views on:

(a) issues with the current arrangements;

(b) motives for establishing a framework for nationally consistent transmission standards;

(c) the what such a framework means; and

(d) the steps necessary to establish a framework within the confederation of jurisdictions comprising the NEM.

Views on items (a) and (b) in submissions to the Issues Paper were summarised in Chapter 3. This chapter discusses the nature of a nationally consistent framework and the views on that expressed in submissions.

4.4 "Nationally consistent" framework

The notion of a "nationally consistent" framework is open to a range of interpretations, which potentially have very different implications for the design, construction and operation of the network and the costs of reliably and securely delivering power to customers.

A key factor in efficiently designing and operating transmission networks is that the level of reliability accords with the economic and/or social value placed on reliability. Power supply interruptions in a densely populated area will affect a

[25] COAG 2007, "COAG Reform Agenda – Competition Reform April 2007", p.5 (available at www.coag.gov.au)

greater number of businesses, transport networks, households and industries than the same interruption in a sparsely populated area. Also, the consequences of the loss of load in a densely populated area are likely to pose greater public safety issues than the loss of load in a sparsely populated area. Because of this, some loads are treated as critical, with a high level of network redundancy built in to maintain secure and reliable supplies, or in some cases with stand-alone back-up generation that operates when grid supplied power fails. For example, in a metropolitan area, an interruption to power supplies could cause failures of computer systems, telecommunications, railways, traffic lights, and the loss of mains power to critical loads such as hospitals. In contrast, the loss of supply to an isolated farm or a remote load will disrupt a smaller number of people and businesses and will most likely pose fewer public safety issues.

Efficient network design weighs up customers' valuations of reliability against the cost of delivering that reliability. The customers' valuations of reliability can be either explicit (i.e. explicit ex-ante values, expressed in $ by individual customers or groups of customers) or implicit (i.e. an ex-post, implicit value arising from the application of the mandated reliability standards). In instances where the valuation of reliability equals or exceeds the costs of delivery, it is a relatively straightforward decision to upgrade the network or pursue equally reliable non-network solutions that deliver the desired level of reliability. Where the costs of delivering the reliability by network augmentation exceed the customers' valuation of it, several other factors might come into consideration, including: a) government policies on electrification of rural and remote communities; b) potential lower-cost investments by the customer as an alternative to improve reliability, such as connection asset modifications and off-grid power supplies; and c) whether contracted network support and control services could be used to deliver the desired reliability for a cost equal to less than customers' valuation of reliability.

Another important, practical, consideration is that transmission network standards and performance are maintained at levels which are at least as good as in the past, provided customers value it at these levels.[26] Australia's increasing dependence on digital technology is one reason for requiring highly reliable power supplies. Another reason is that businesses have (collectively) made substantial investments in their production capacity based on assumptions about the prevailing level of reliability. The Panel notes that political and policy considerations are likely to be taken into account by the MCE: A deterioration in network performance might be considered an indicator of serious shortcomings in the regulatory regime; or be interpreted, by some, as evidence that the policies which led to the establishment of the NEM have failed to deliver better quality services.

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26 In South Australia, the *Electricity Act 1996* (SA) obliges distribution network licence holders (such as ETSA Utilities) to maintain distribution network standards and performance at levels that are least as good as those that existed prior to the electricity industry reforms of the mid-1990s (see Clause 23(n)(v) of *Electricity Act 1996* (SA), available at http://www.legislation.sa.gov.au). This legislative requirement on distributors directly affects the network design and operational requirements of the SA transmission licence holder (ElectraNet SA) via its network access obligations to distributors. Also, the transmission network standards specified in the South Australian *Electricity Transmission Code* implicitly seek to ensure that network performance is at least equal to that delivered in the past (see http://www.escosa.sa.gov.au/webdata/resources/files/080313-ElecTransCode_ETC05_V2_-Final.pdf) .

Transmission network standards in Australia recognise the differing economic and social impacts of supply reliability in metropolitan and rural areas. In most NEM jurisdictions, the transmission network reliability standards for capital city central business districts are at higher level than in other metropolitan and rural areas. In addition, there is scope for parties connecting to the transmission grid to negotiate a higher or lower standard of reliability than the minimum standards set out in under the Rules and in jurisdictional transmission standards.

The key implication of this is that a "nationally consistent" framework does **not** mean that a single level of reliability ("one size fits all") applies to all locations on the network. For example, developing a "nationally consistent" transmission framework would not mean that the reliability standard for electricity supplies to state capital CBD areas should be the same as the standard for part of the network supplying a modest, relatively remote load.

However, a "nationally consistent" transmission framework may mean that loads of similar size or critical importance should have the same reliability standard regardless of in which jurisdiction (or NEM region) they are located. For example, should the level of reliability for, say, the Adelaide CBD and the Brisbane CBD be identical or not ?

Finally, under any "nationally consistent" transmission framework, there should continue to be scope for parties to negotiate a different standard of service as part of their connection agreement, as long as this does not affect the ability of the network to meet the minimum standards applying to other users.

4.4.1 Elements of a framework

From a policy perspective, a framework for nationally consistent transmission reliability standards for network planning is likely to include:

1. A form of standard that is consistent across jurisdictions. Three forms of standard are possible: Deterministic; Probabilistic; and a Hybrid that allows deterministic standards to be expressed probabilistically or probabilistic standards to be expressed as an equivalent deterministic standard.

2. A clear statement of who is responsible for setting the level of standards;

3. A transparent process for setting and regularly reviewing standards; and

4. The scope of the standards being clear as to their coverage and specificity.

4.4.2 Submissions to Issues Paper

There are divergent views in submissions on the meaning of a nationally consistent framework and the elements that would comprise the framework.

The AER, ESIPC, ETNOF and EnergyAustralia do not consider it necessary for a single, uniform, national standard to be established. "The AER does not consider that this review needs to set a single national reliability standard."[27] ETNOF note that the MCE charged the AEMC with the task of developing a framework for nationally consistent transmission reliability standards, with the setting of the level of standards being carried out on a jurisdictional basis within that framework.

"ETNOF believes that a nationally consistent framework for reliability standards could be represented by a consistent set of provisions, set out either in the National Electricity Law (NEL) or the NER that determines:

- the form of the reliability standard, which should be consistent across jurisdictions;
- the process by which that standard is set and reviewed; and
- the body responsible for determining the standard.

Importantly, a nationally consistent framework does not necessarily mean that there is also a consistent level of reliability standard between jurisdictions."[28]

ESIPC opposes the establishment of a uniform standard, considering it to be unjustified on the basis of economic cost-benefit analysis carried out in South Australia. ESIPC also raise the issue of state sovereignty and the state-based recovery of network costs: "given that each state pays for the level of reliability that its customers receive, the Planning Council sees no reason why each jurisdiction should not continue to be free to determine the level of reliability that is appropriate for its constituents."[29]

The Tasmanian government has similar views to ESIPC. "Tasmania believes that a nationally consistent approach could be at the level of general principles and does not necessarily imply a 'one size fits all' approach. Tasmania would argue that reliability standards are legitimately the concern of those they affect and who pay for them, that it is not yet clear there is a single best way to approach them and that no-one has demonstrated a need or net benefit from a one size fits all approach."[30]

In contrast, both the NGF and Group consider it incumbent on those who support the continued use of jurisdictionally set standards to demonstrate why they are needed in the NEM.

The NGF states: "It is potentially inconsistent to have a national electricity market with divergent state based standards that impact both reliability and security settings in the market. There would need to be a demonstration from the individual

[27] AER, Submission – Issues Paper, p.1

[28] ETNOF submission – Issues Paper, p. 7

[29] ESIPC, Submission – Issues Paper, p. 1

[30] Department of Infrastructure, Energy and Resources (Tasmania) – Submission to AEMC National Transmission Planner Review, p. 2.

jurisdictions as to how having different standards delivers a net benefit compared with a single standard."[31]

The Group's view is that "it is incumbent on those who wish to retain jurisdictionally based standards to demonstrate why the benefits would outweigh the added costs and economic inefficiencies of such a system. This question should be expanded to consider why, since the economic regulation of the TNSPs has been the responsibility of national regulators since the inception of the NEM, we should still persist with State-based transmission codes which usually address quite a number of other issues in addition to transmission planning standards."[32]

The NGF considers that "A 'nationally consistent' framework would define the scope, development, implementation, and administration of reliability standards applied by all transmission planning bodies in the NEM. It would mean that future development of the network should deliver the same average level of reliability, for comparable loads, right across the NEM."[33]

The Group considers that a 'nationally consistent framework' means "a standardised national approach for development, implementation, application and enforcement of policies, procedures and practives in the NEM, particularly where this will enhance the achievement of the NEM objective of optimal economic efficiency in the market."[34]

The Group also has clear views on what a 'nationally consistent framework' **does not** mean. "In our view, it does not mean agreement to the adoption of a broad set of principles at the national level which still allow a wide range of discretion in their interpretation and application at either a jurisdictional or individual NSP level, which aptly describes the current situation in regard to TNSP planning and investment decision making. Equally, it does not mean the automatic adoption of the most stringent jurisdictional standard across the NEM, but a true harmonisation around an economically efficient level of network service provision."[35]

These differing views on what a nationally consistent framework means are reflected in the proposals put forward in submissions. The details of these proposals are discussed in Chapter 5.

4.5 Consistency through the alignment of regional standards

As discussed above, the current NEM framework provides a significant degree of consistency in transmission reliability standards in the operational timeframe, but allows for some jurisdictional differences within that common framework. However, there is less harmonisation of standards over the planning horizon, and hence

31 NGF submission – Issues Paper, p. 3

32 The Group's submission – Issues Paper, p.14.

33 NGF submission – Issues Paper, p. 3

34 The Group's submission – Issues Paper, p. 14

35 The Group's submission – Issues Paper, p. 14

allowance for greater divergence across jurisdictions in the standards that underpin transmission network planning and investment decisions.

A move to a nationally consistent framework of transmission standards is therefore primarily concerned with standards that apply over the planning horizon, rather than the operational horizon.

There are at least four possible ways in which a nationally consistent framework of transmission reliability standards could be achieved through closer alignment of regional standards:

1. Making the operational standards in the Rules more specific, thereby limiting the degree of discretion available to TNSPs in meeting the operational standards contained in the Rules;

2. Expanding the transmission standards in the Rules to cover the planning horizon, as well as the operational horizon; and

3. Aligning *the form* of jurisdictional transmission standards across the NEM via coordinated changes to the jurisdiction specific instruments that specify the standards.

4. Aligning *both the form and the level* of jurisdictional transmission standards across the NEM via coordinated changes to the jurisdiction specific instruments that specify the standards.

Some of the above models for closer alignment of jurisdictional transmission reliability standards are likely to require adjustments to TNSPs' accountabilities, incentives, penalties and regulatory processes and determinations.

4.5.1 Submissions to Issues Paper

There are two broad views expressed in submissions concerning how the framework would provide for a transition towards a more nationally consistent set of transmission planning standards.

First, there is a view that the framework should align the form, but not the level, of jurisdictional transmission standards across the NEM. This would be achieved via coordinated changes to the jurisdiction specific instruments that specify the standards. This first approach is supported by ETNOF, the AER, ESIPC, the Tasmanian Government, and EnergyAustralia.

Second, there is the view that the framework should *both the form and the level* of jurisdictional transmission standards across the NEM via either:

(a) coordinated changes to the jurisdiction specific instruments that specify the standards; or

(b) changes to the National Electricity Rules; or

(c) through a new National Grid Code.

These three options under the second approach are supported, respectively, by VENCorp, the NGF and the Group.

4.6 Uniform standards, universally applied

COAG asked the MCE to "task the AEMC with reviewing transmission network reliability standards with a view to developing a consistent national framework for network security and reliability, for MCE decision"[36]. At one end of the spectrum of "nationally consistent frameworks", lies an approach of uniform standards, universally applied. Uniform standards, applied across the NEM, would ensure national consistency of transmission reliability. Under a uniform transmission reliability standard, the form and level of the standards would the same across the NEM for loads which have the same implicit or explicit value of customer reliability.

For example, a uniform, deterministic, reliability standard could be applied when planning all transmission networks in the NEM, which required that the networks be built to deliver:

- N-0 secure transmission for rural loads on a single circuit line;
- N-1 secure transmission for all remaining areas other than state/territory capital CBD;
- N-2 secure transmission for the state/territory capital CBD; and
- 0.002% reliability for each NEM region over the long term/10-year time horizon.

Alternatively, a uniform standard could have a form that is probabilistic, applied to all connection points with a similar value of customer reliability, and designed to deliver 0.002% reliability to each NEM region over the long term/10-year time horizon.

Any uniform standard could be above or below the existing jurisdictional standards. This could present considerable challenges in implementing the new standard, and have a number of costs and benefits. For example, it may result in a "disconnect" between the reliability standards of the TNSP transmission network and the DNSP sub-transmission network within the same jurisdiction. (Note that DNSP reliability standards lie outside the scope this Reliability Panel review).

4.7 Costs and benefits of moving to a uniform transmission standard

Any move towards a common form and level of "uniform" transmission standard across the NEM is likely to result in changes in the levels of transmission reliability and investment in jurisdictions over time.

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[36] "Council of Australian Governments' Response to final report of the Energy Reform Implementation Group", Attachment A of Ministerial Council of Energy letter to AEMC, 3 July 2007 directing it to conduct the National Transmission Planner Review (Available at http://www.aemc.gov.au/electricity.php?r=20070710.172341)

A shift to a different form of standard could involve significant changes in the resources required for transmission planning. For example, probabilistic standards may require greater modelling and analysis than deterministic standards, but may not deliver any different a level of reliability.

A uniform standard could be above or below the existing standards in various jurisdictions, resulting in a potentially significant change (either increase or decrease) in the capital and operational expenditures required to meet the new standard.

If significantly higher capital expenditure were required, this would contribute to an increase over time in the level of transmission charges faced by those connecting to and using the network. These higher charges may deliver higher level of reliability, consistent with value to customers inherent in the higher standard.

Conversely, the shift to a lower level of transmission standard could see a gradual reduction in capital expenditure and transmission changes, which may be seen as a benefit, consistent with a reduction in transmission reliability. It should be expected that any proposal to reduce the transmission reliability standard in a jurisdiction would likely draw close scrutiny, and a need for a compelling justification, consistent with the reliability needs of customers.

The transition to any new standard is likely to require special allowances to be made in TNSP Regulatory Determinations by the AER, which would flow on into transmission pricing structures.

4.7.1 Submissions to Issues Paper

In submissions to the Issues Paper, there are three areas in which there appears to be a broad degree of consensus:

1. There is no proposal for a regime in which a uniform level of standard is applied to all connection points. All submissions recognise that it is economically efficient to align the level of standards at a connection point with the customer value of load at each point, where the value of load can directly or indirectly reflect the criticality of that load. The consequence of this is that standards can differ across connection points in a jurisdiction.

2. All submissions favour having standards specified on a connection point basis or some other specific basis (e.g. CBD, large regional cities, etc.), with a robust economic framework used to establish those standards.

3. No submissions favour the adoption of the highest level of jurisdictional standards as the uniform standard for the NEM. Conversely, any dilution of existing jurisdictional standards could only occur with the consent of the jurisdiction.

However, there are differences of view, relating to:

1. The costs and benefits of moving towards a common *level* of standards across jurisdictions;

2. Who should be responsible for setting the level of standards and enforcing them;

3. Whether, once the level of standards are established within an economic framework, it is also necessary to apply a full cost-benefit analysis to expenditure proposals that seek to ensure connection point reliability meets the standards; and

4. Accountabilities of TNSPs and the body/bodies who set the standards

Views on the above matters are discussed further in Chapter 5, together with Panel's preliminary position.

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5 Specific options

This chapter outlines a range of specific options for a framework for nationally consistent transmission planning standards. These specific options were put forward in submissions to the Issues Paper, and reflect the different views of touched on in the last chapter. Also outlined is an option developed by the Panel, which draws on a number of the characteristics contained in submissions.

5.1 Summary of options

The submissions on the Issues Paper put forward a range of options for developing a consistent national framework for transmission reliability standards.

The options can be classified into five broad groups, as shown in Table 1. Options A through D were put forward in submissions, while Option E is an additional option developed by the Panel for consultation purposes.

5.2 Common features

Table 1 reveals a degree of consensus on four policy principles:

1. Transmission standards should be set independently from the body that has to comply with the standards.

2. There should be greater transparency in the process used to set standards and the level of standards should be specified on a connection point basis.

3. The level of standards should be economically-derived.

4. The framework should facilitate more efficient investment in transmission, generation and demand-side management.

It is also apparent that there is lot of common ground between Options A and B on one hand, and Options C and D on the other.

Option E is an additional option, developed by the Panel, which is based on the Panel's preliminary analysis. Option E incorporates many of the features on which there is consensus and contains a number of other features. This option is discussed further in Section 5.4 below.

The maintenance of consistency between transmission and sub-transmission standards is one area that distinguishes Options A and E from Options B, C and D. Options A and E appear to clearly allow such consistency to be maintained, while it is ambiguous, at best, whether this will be the case under the other three options.

Table 1: Options for a consistent national framework for transmission reliability standards

Features	Option A	Option B	Option C	Option D	Option E
Form of standard	Deterministic, derived from economic considerations (the 'hybrid' approach). Use consistent terminology. Preferably set out standard at each connection point.	Probablistic, or Deterministic, derived from economic considerations (the 'hybrid' approach). If deterministic standards are used, projects should be subject to scrutiny to assess their economic efficiency.	Probabilistic or deterministic. "The potential benefits of a purely probabilistic approach need to be balanced against the benefits of a deterministic approach which is generally easier to understand."	Probabilistic, with more developed probabilistic assessments than currently used by VENCorp.	Hybrid form, common across NEM..
Scope of standards	Tailored to each jurisdiction. Allowance for connection point reliability standards to differ between CBD, metro and rural areas of a jurisdiction.	Common across NEM jurisdictions. Allowance for connection point reliability standards to differ between CBD, metro and rural areas of a jurisdiction, depending on customer valuation of reliability.	Common form and level of standard across NEM jurisdictions. Location specific standards are required, in which 'there would be limited discretion for planning bodies to deliver different reliability outcomes for generators and consumers across jurisdictions.'	Common across NEM jurisdictions. Allowance for connection point reliability standards to differ between CBD, metro and rural areas of a jurisdiction, depending on customer valuation of reliability.	Allowance for connection point reliability standards to differ between CBD, metro and rural areas of a jurisdiction, depending on criticality of load or an explicit valuation of customer reliability.. Introduction of a national 'reference standard' on a 'for information basis', against which the standard levels in each jurisdiction can be compared.
Where are the standards specified?	Jurisdictional instruments. The standards could be published in the same place and in similar form across all jurisdictions (e.g. Annual Planning Reports).	Contained in a single instrument, such as the National Electricity Rules.	Contained in a single instrument, the National Electricity Rules.	National Transmission/Grid Code, which would replace existing jurisdiction specific transmission codes/license conditions and incorporate the technical standards currently set out in Schedules 5.1, 5.1a and other parts of Chapter 5 of the NER.	Framework expressed in National Electricity Rules. In order to give effect to the framework, it is likely that changes to the NER, NEL and jurisdictional instruments (laws, licenses, regulations, guidelines) will be required.
Process for setting standards	Clear transparent process for setting standards.	Clear transparent process for setting standards.	Regular, transparent reviews of form and level of standards.	Clear transparent process for setting standards.	Clear transparent process for setting standards.

Features	Option A	Option B	Option C	Option D	Option E
Who sets the level of standards?	Determined by each jurisdictional government, or a body appointed by the relevant jurisdictional government, separate from the TNSP. Periodically reviewed, prior to each TNSPs' revenue determination process	Determined by jurisdictional government or body appointed by government that is independent of the jurisdictional TNSP that owns transmission assets.	Determined by the AEMC on the advice of the Reliability Panel and AER.	Determined by the AEMC on the advice of the Reliability Panel and AER.	Determined by a jurisdictional authority separate from the TNSP. Establish an information base of standards, managed in a consistent way by individual jurisdictions or by a central authority, such as the National Transmission Planner. The format, structure and levels of the standards should be reviewed every five years.
Accountability of the standard setting body	To jurisdictional government	To jurisdictional government	To MCE	To MCE	To jurisdictional government
Accountability of TNSPs	To jurisdictional government and AER	To jurisdictional government and AER	To AER	To AER	To jurisdictional authority and AER
Retains consistency between transmission and DNSP sub-transmission standards?	Yes.	Uncertain, depending on whether 'hybrid' or probabilistic form of transmission standard is implemented. No, if framework is probabilistic standards (since DNSP sub-transmission standards are deterministic). Yes, if 'hybrid' form of standards is used.	Possibly, if the transmission standards are also applied to parts of the sub-transmission system that have a significant influence on the operation of the main transmission network. May not be achievable as DNSP sub-transmission standards are set by jurisdictions , and outside the role of the Panel.	No, because proposing probabilistic transmission standards, whereas DNSP sub-transmission standards are deterministic.	Yes
Drawn from submissions by	ETNOF, AER, ESIPC, EnergyAustralia, Tasmanian Government	VENCorp	National Generators Forum (NGF)	The Group	Panel's additional option, based on preliminary analysis
Likely changes	Little or no change in SA; significant changes elsewhere including to State legislation, regulations and licences.	Little or no change in Victoria; significant changes elsewhere including to State legislation, regulations and licences.	Widespread changes, in which the form and level of the standard is specified in a single instrument, rather than in jurisdictional instruments.	Widespread changes, including several items which appear to be outside scope for this review.	Significant changes, including to NER, NEL, State legislation, regulations and licences

5.2.1 Who sets the standards?

All submissions supported a move to having transmission standards set independently from the body that has to comply with the standards. However, there was divergence of views on whether the standards should be set on a jurisdictional basis or a NEM wide basis.

VENCorp governance arrangements whereby the setting of standards is made by a body separate from any TNSP that owns assets in a jurisdiction. VENCorp states that in cases where TNSPs "own assets in the jurisdictions they have planning responsibility for…there seems to be a inherent conflict of interest in giving [those] TNSPs the responsibility for interpreting and applying existing jurisdictional standards."[37]

ETNOF supports transmission reliability standards being set by jurisdictional governments or by bodies appointed by those governments. There are several reasons for this:

- A jurisdictional government, or its appointed proxy, is "in the best position to address the specific requirements of a given jurisdiction given its understanding of specific jurisdictional circumstances."

- "It is also appropriate for the responsibility for determining reliability standards to be jurisdictionally based, given that it is the jurisdictional government that faces the political, social and public safety consequences of any failure in reliability in that jurisdiction. For that reason ETNOF does not support the role of determining the level of reliability standards to be conducted by a national body, including the National Transmission Planner, the AEMC, the Reliability Panel or the MCE."

- DNSP (sub-transmission) standards are currently set on a jurisdictional basis and there are no plans to change this. "The importance of consistency between TNSP and DNSP [sub-transmission] standards is a further factor supporting the determination of the level of reliability standards for transmission also at a jurisdictional level."

"ETNOF does not consider that the TNSP should have any responsibility for determining the reliability planning standard. A framework under which the standards are determined by a body separate to the TNSP is consistent with the current governance arrangements in each jurisdiction and complements the current regulatory framework, which is based on a commercially motivated transmission service provider operating under regulatory incentives."

37 VENCorp, Submission – Issues Paper, p. 2

The Group favours having the transmission reliability standards set by the AEMC "on the advice of both the Reliability Panel and the AER. The AEMC would be accountable to the MCE for this activity in the same way as it is accountable for all of its other functions and responsibilities".

5.2.2 Dynamic efficiency — transmission, generation and demand-side investments

All submissions seek to establish a framework which facilitates efficient investment in transmission, generation and demand-side management.

It is recognised that transmission reliability standards, the interpretation and application of those standards by TNSPs, and the resulting transmission investment programme can all affect investments in generation and demand-side response.

VENCorp considers that the development of a consistent national reliability standard could more effectively harness the potential of non-network alternatives, such as demand-side management and Network Support and Control Services, in ensuring reliable energy supplies.[38] VENCorp also states that having standards specified in a range of jurisdictional instruments makes "compliance difficult and expensive, particularly for prospective investors and those participants that have interests in more than one jurisdiction."[39]

The AER states: "Poorly defined reliability standards also create unnecessary uncertainty for investors in generation. Transmission capacity and congestion is a key determinant of generation location decisions. In making their location decisions investors will need to form a view about changes to transmission congestion over time. Open ended reliability standards make future capital expenditure by the TNSPs less predictable, in turn making future congestion more difficult to predict."

ESIPC note that confusion about reliability standards at specific customer exit points and generator entry points added to the confusion of investors in deciding where to locate new investments for loads or generation.[40]

5.3 Preferred frameworks

5.3.1 AER's framework

The AER's proposed framework is designed to improve the clarity, transparency and independence of the transmission reliability standards used across the NEM.

The AER suggest a framework for nationally consistent reliability standards in which standards:

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38 VENCorp, Submission – Issues Paper, p.2

39 VENCorp, Submission – Issues Paper, p.2

40 ESIPC, Submission – Issues Paper, p. 2.

- "are set following a transparent process, a rigorous cost-benefit assessment and thorough public consultation;

- are set independently of the transmission network service provider;

- are as specific as possible, preferably outlining the reliability standard to be achieved at each connection point; and

- are set in such a way as to be neutral between the technologies that are used to meet the given standard."

"Establishing these high level principles would not require the formation of a one size fits all model. For example, the models currently used in South Australia and Victoria, whilst varying significantly, would still be consistent with the high level principles outlined above."[41]

5.3.2 ESIPC's framework

ESIPC considers "the purpose of any national framework should…concentrate on ensuring that generators, investors and customer can readily identify and understand the reliability standards that apply at various points in the network both within and across states."[42]

Under ESIPC's proposed framework each jurisdiction sets what it considers an appropriate level of transmission reliability, using a consistent terminology, and employing a transparent process for setting the standard. The outcomes of the process should be transparent and published in the same way across all jurisdictions.

In developing such a framework, ESIPC recommend that the Panel focus on:

- *Consistent terminology*. Providing a set of reliability categories that are well defined and that must be used in each jurisdiction.

- *Transparent recording* of connection point reliability standards and the period of time over which conformance with that standard is expected to be maintained. This information should be published in the same place (e.g. the Annual Planning Report) and in a similar form by each jurisdiction.

- *Accountability*. TNSPs should be held accountable for targeting, achieving, and demonstrating that they achieve, the right reliability level. The approach used in South Australia is for ESCOSA to independently review the reliability standards on an economic basis every five years so that the new standards are published prior to the TNSP going through its Revenue Proposal process.

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41 AER, Submission – Issues paper, p. 3

42 ESIPC, Submission – Issues Paper, p.

5.3.3 VENCorp's framework

- VENCorp supports the introduction of a common reliability standard across the NEM. It states that the standard should be:
  - Widely available;
  - Have clear and unambiguous guidelines to enable it to be consistently and easily applied throughout each jurisdiction;
  - Specified in one instrument, such as the NER.
- The setting, interpretation and application of transmission reliability standards should be done by a body that is independent from the TNSP that owns transmission in a jurisdiction.
- The framework for setting deterministic standards should give greater consideration to the economic costs and benefits associated with that standard. VENCorp considers that:
  - "Tying reliability to an 'N – x' standard may lead to uneconomic investment results because to take that standard to it logical extreme would involve the duplication (and triplication and higher) of every component of the transmission system. It is more apt to be described as a 'redundancy standard' rather than a reliability standard. Even if different redundancy standards are adopted for say rural and CBD areas, it is unlikely that on their own they will achieve efficient outcomes."
  - "…no matter what reliability standard is chosen…if the standard is set too high or too low, it will result in allocative inefficiency because it encourages over-building or under-building". Without a cost-benefit analysis of transmission investments, there will be allocative inefficiency because the smearing transmission costs across customers results in a disconnect between value customers assign to reliability and the cost of the reliability delivered by an "arbitrary reliability standard".
- Transmission projects should be subjected to a economic assessment of costs and benefits.
- A standard (be it deterministic or probabilistic) that used economic analysis of costs and benefits would facilitate more efficient planning across the network, by allowing for differing levels of reliability:
  - between CBDs;
  - within a CBD area; and
  - between CBD areas, metropolitan areas and rural areas.
- Reliability and security, while forming part of the NEM objectives, "need to be considered in the context of efficient investment, operation and use of the

national electricity system. In other words, reliability and security are not attributes of the system that are to be achieved at any cost."[43]

5.3.4 ETNOF's framework

- ETNOF consider the framework should specify: the form of the standard; the process by which the standard is derived; and who derives the standard; but not specify the level of the standard.

- ETNOF opposes the adoption of a single national standard because it views it as inconsistent with COAG's directive to the AEMC on the development of a consistent national framework for transmission reliability standards.

- As discussed in Chapter 3, ETNOF suggest the following range of criteria be used in assessing the alternative frameworks for developing reliability standards and selecting a preferred framework:

  – Economic efficiency;

  – Transparency;

  – Accountability;

  – Effectiveness; and

  – Robustness.

- "ETNOF considers that the following framework best meets the assessment criteria …and should be adopted as the consistent, national regime for transmission reliability planning standards:

  – there should be a consistent *form* of reliability standard applied in all jurisdictions;

  – the form of reliability standard should be *deterministic, derived from economic considerations* (the 'hybrid' approach);

  – the level of reliability standard should be determined by each jurisdictional government, or a body appointed by the relevant jurisdictional government, separate from the TNSP; and

  – the level of reliability standard should be periodically reviewed, prior to each TNSPs' revenue determination process."[44]

- "The nationally consistent framework should be set out in the NEL and the NER, as appropriate. The entrenched framework would include the processes for

[43] VENCorp, Submission – Issues Paper, p. 5

[44] ETNOF, Submission – Issues Paper, p.14

setting the standards, the form of the standard and the bodies responsible for reviewing the standards in each jurisdiction."[45]

- "A deterministic standard derived from economic considerations ranks the highest of the alternative forms of reliability standards in terms of providing transparency, enhancing accountability and being robust. It also ranks above deterministic standards per se through the explicit inclusion of a link to the underlying costs and benefits of providing alternative levels of reliability at the time at which the standards are reviewed."[46]

It is understood that ETNOF regards a framework along the lines of the existing South Australian arrangements to be consistent with these criteria.

5.3.5 The Group's framework

- The Group proposes a framework that switches to a probabilistic reliability standard across the NEM and uses a probabilistic planning methodology. "It may be reasonable to apply an economically based deterministic standard in limited circumstances where it is considered a full probabilistic planning assessment is not warranted. In these cases, the deterministic standard would be used as a surrogate for the proper economic value based standard in a much more streamlined planning and investment evaluation methodology."[47]
- "The national focus of the regulatory framework governing the transmission networks should be streamlined and made much more consistent across all jurisdictions in the NEM by:
  - Replacing the state-based transmission/grid codes with a single national transmission/grid code developed by the AEMC as an adjunct to, and complementary with, the Market Rules;
  - Transferring the technical aspects of network requirements and standards from the Market Rules to the new national transmission/grid code;
  - Minimising as much as possible any residual jurisdictional variations from a uniform national approach to all matters covered by the new national grid code;
  - Dispensing entirely with the role of Jurisdictional Planning Bodies under the Market Rules; and

[45] ETNOF, Submission – Issues Paper, p.14
[46] ETNOF, Submission – Issues Paper, pp.14–15
[47] The Group, Submission – Issues Paper, Attachment 1, p. 4

– Establishing an independent National Transmission Planner that performs a broad range of network planning and operations coordination and oversight functions across the NEM."[48]

- "In our view, this regulatory and institutional framework would best meet the needs of market participants and maximize the prospects for achievement of the NEM Objective within the current NEM policy constraints set by the MCE and COAG."[49]

- "It would significantly enhance the transparency of TNSP activities and their accountability to network users, and it would materially improve the future investment climate for all new infrastructure in the main power system."[50]

5.3.6 NGF's framework

The NGF considers that three things are needed before a framework for nationally consistent transmission standards is established:

1. A clear statement of the policy problems that arise from the existing, divergent jurisdictional standards;

2. The development of assessment criteria that can be used to establish a range of potential frameworks and inform the selection of a preferred framework; and

3. Any framework for transmission standards needs to have regard to, and be consistent with, other transmission initiatives currently under development; such as: the establishment of the National Transmission Planner, Australian Energy Market Operator (AEMO), and the Regulatory Investment Test (RIT).

The NGF is open to the form of standards being either probabilistic or deterministic, and suggests the benefits of each need to be weighed up against each other.

Regardless of which form of standard is chosen, the NGF favours greater "transparency of the processes associated with the application of the the standards in the transmission planning and development programs".[51]

The NGF states that the key motivations for establishing greater national consistency of transmission standards across the NEM include: "reduced regulatory complexity, better definitions of standards across all jurisdictions, increased transparency of application of standards, lower overall administration costs, and greater ability to review and reset standards as required in the future."[52]

[48] The Group, Submission – Issues Paper, Attachment 1, p. 4

[49] The Group, Submission – Issues Paper, Attachment 1, p. 4

[50] The Group, Submission – Issues Paper, Attachment 1, p. 4

[51] NGF, Submission – Issues Paper, p.2

[52] NGF, Submission – Issues Paper, p.3

The NGF put that "It is potentially inconsistent to have a national electricity market with divergent state based standards that impact both reliability and security settings in the market. There would need to be a demonstration from the individual jurisdictions as to how having different standards delivers a net benefit compared with a single standard."[53]

"A 'nationally consistent' framework would define the scope, development, implementation, and administration of reliability standards applied by all transmission planning bodies in the NEM. It would mean that future development of the network should deliver the same average level of reliability, for comparable loads, right across the NEM."[54]

"The benefits of moving to consistent standards is likely to be delivered by a single instrument, possibly part of the NER, that defines the nature of the standard (e.g. probabilistic, deterministic or hybrid) and at what locations in the network they are to be applied. In other words, there would be limited discretion for planning bodies to deliver different reliability outcomes for generators and consumers across jurisdictions. A single instrument will facilitate reviews and changes to standards as and when required."[55]

The NGF suggests that four implementation steps are required:

1. "AEMC to undertake the assessment of the net benefits of a national transmission reliability framework against an agreed set of criteria;
2. So long as there are no obvious net costs, the AEMC should develop a national transmission reliability standard framework, consistent with the National Transmission Planner arrangements for jurisdictional stakeholder and MCE approval;
3. Once approved, the Reliability Panel could develop a proposed form and level of a transmission standard – in consultation with the AER and market participants.
4. AEMC to implement the new framework with agreed standards in accordance with a timetable agreed with the transmission planning bodies."[56]

5.3.7 Tasmanian government's framework

The Tasmanian government indicates that there are few benefits from changing its existing arrangements, in which the standards are set by the jurisdiction, and the form of standard is deterministic, within an economic framework.[57]

[53] NGF, Submission – Issues Paper, p.3

[54] NGF, Submission – Issues Paper, p.3

[55] NGF, Submission – Issues Paper, p.4

[56] NGF, Submission – Issues Paper, p.6

5.3.8 EnergyAustralia's framework

EnergyAustralia (EA) supports harmonising the national framework for transmission reliability, noting that "care should be taken to address the differences that exist across States".

EnergyAustralia supports ETNOF's suggestion that a framework include the following three features:

- The Panel is the appropriate body to develop the national framework;
- A Jurisdictional authority should set the standards for each Jurisdiction; and
- The framework should be a deterministic model, with economic considerations.

However, EA is concerned the new framework for transmission standards "might be inadvertently or inappropriately be applied to it" and duplicate and/or overlap with the network reliability framework specified in its DNSP licence and the regular process for reviewing DNSP standards.

5.4 Panel's proposed framework

The Panel has developed a further possible option (Option E) for a framework for nationally consistent transmission reliability standards. This option is based on the Panel's preliminary analysis, draws on many of the features put forward in submissions, and has some additional features.

The Panel's proposed framework includes the following features:

1. A clear statement of the policy principles that underlie the selection of the framework (see Chapter 4). There appears to be a consensus on a number of the principles.

2. The framework to be specified in the Rules. In order to give effect to the framework, it is likely that changes to the Rules, NEL and jurisdictional instruments (laws, licences, regulations, guidelines) will be required.

3. A common form of standard, derived from economic considerations and expressed in deterministic form for ease of understanding (i.e. the 'hybrid' approach);

4. A specification of who will determine the level of standards, with requirements that:

   (a) the process used will be transparent; and

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[57] Department of Infrastructure, Energy and Resources (Tasmania), Submission on National Transmission Planner Review Issues Paper, received by AEMC 16 January 2007, p. 2, Available at http://www.aemc.gov.au/electricity.php?r=20070710.172341

(b) decisions on the level of standards at specific locations on the network should be based on sound principles of economic efficiency.

5. The level of standards would continue to be set on a jurisdictional basis, but:

   (a) using a much more transparent process; and

   (b) having the standards set by a body independent of the TNSP that has to apply the standard.

6. Level of standard should be clearly specified on a connection point basis and the level of standard could differ within and across jurisdictions.

7. The creation of an information base, managed in a consistent way by individual jurisdictions or by a central authority, such as the NTP, which provides a single point of reference on:

   (a) detailed information on reliability standards in each jurisdiction;

   (b) the national reference standard; and

   (c) comparison of connection point standards in a jurisdiction against the relevant national reference standard.

8. The creation of an information mechanism which involves the introduction of a national 'reference standard', on a for information basis, against which the standard levels in each jurisdiction can be compared.

9. The format, structure and levels of the standards should be reviewed every five years.

5.5 What are your views on the options?

The Panel is seeking feedback on its proposed option for a NCF and the other options put forward in submissions to Issues Paper.

Seven specific questions the Panel is seeking views on are:

1. What do you see as the pros and cons of your preferred option against the other options?

2. How could the Panel's proposed option be enhanced?

3. Which of the options would be acceptable? That is, what could you live with, rather than what you would really like?

4. If the level of standards is reviewed every five years, well ahead of the AER's regulatory determination for a TNSP, how much time should be allowed for the new level of standards to be transitioned into effect and the TNSP is held accountable to those standards?

5. What would a national reference standard look like?

6. Which body should set the proposed national reference standard:

   – The National Transmission Planner when formed?

   – The Reliability Panel, which sets and reviews the 0.0002% Unserved Energy (USE) standard?

7. How do you see the NCF for planning standards meshing with the framework for transmission operational standards set out in Schedule 5.1 of the Rules? The Panel will commence a review of these transmission operational standards during 2008.

5.6 What more detailed provisions should be made to your preferred option?

The Panel is seeking input on stakeholders preferred options sufficient to allow it to recommend a practical and implementable NCF. The input should address any areas considered significant in achieving the Panel's proposed principles for a nationally consistent framework set out in section 3.4. In particular, comments are sought on:

1. To what connection points should connection point standards apply?

2. How could standards specified on a connection point basis (or an easily identified clustering of connection points, such as CBD, large metropolitan, rural, etc.) be used to specify the reliability standard applying to the shared network behind those transmission connection points?

3. To what extent are generator dispatch patterns provided for in determining the reliability at a particular connection point?

4. If a probabilistic standard is to be employed, how can performance against the standard be measured and hence network service providers be held accountable?

5. How should the costs and benefits of particular levels of reliability standard be measured? Where several approaches to measurement exist, what reasons are there for preferring one approach over others?

6 Implementation

Implementing a framework for nationally consistent transmission standards presents a number of challenges, which are discussed below. The specifics of the implementation regime and the transition plan will depend on the which of the framework options are pursued, and be subject to changes by the AEMC and MCE.

6.1 Elements of an implementation regime and transition plan

Given the existing arrangements in the NEM, the implementation of any framework for nationally consistent transmission standards will require significant changes to jurisdictional and national laws, regulations, and codes.

An **implementation regime** is likely to require changes to:

1. Jurisdictional laws, which place obligations on transmission companies and jurisdictional regulators;

2. Jurisdictional transmission and distribution network licenses;

3. Jurisdictional transmission network codes;

4. Jurisdictional transmission standards;

5. The National Electricity Law; and

6. The Rules.

Such changes will need to be transitioned, in a co-ordinated manner, across the NEM. Jurisdictional governments and, possibly, the Commonwealth government will have to agree on a **transition plan**, which will have to: a) account for the regulatory regime and its settings; and b) specify the required steps and timetable to fully implement the new framework.

Given that compliance with transmission standards is a critical component in the licensing and regulatory regime faced by TNSPs, any transition plan will have to have regard to how the establishment of a new nationally consistent framework of standards affects the committed investment plans of TNSPs and assessment of future capital and operational expenditures of TNSPs.

If the level of standards is changed, the transition to any new standards is likely to require special allowances to be made in TNSP Regulatory Determinations by the AER, which would flow on into transmission pricing structures.

Similarly, if the form of standards is changed or if there are significant changes in the planning methodologies used, the AER might need to make adjustments to the regulatory allowances of TNSPs. For example, if the planning methodologies used to assess deterministic standards utilised a greater number of scenarios, probabilistic inputs or a more comprehensive contingency list, additional resources might be needed for network planning studies. A switch to probabilistic standards and planning methodologies is likely to require a significant shift in the resources applied by TNSPs to network planning in NSW, Queensland, South Australia and Tasmania. The use of more advanced and comprehensive probabilistic planning methodologies, as suggested by the Group, will require additional resources for network planning even in jurisdictions where such methodologies are currently utilised (e.g. Victoria).

Finally, the Panel notes that both the implementation regime and transition plan would have to have regard to:

- Relevant policy directives by the MCE;
- The emerging governance arrangements of the Australian Energy Market Operator (AEMO), National Transmission Planner (NTP), and TNSPs. Many of these arrangements are currently under consideration by jurisdictions, with the AEMC's NTP Review only making recommendations on the role and functions of the NTP;
- The MCE's response to the AEMC's forthcoming recommendations on a new Regulatory Test, called the Regulatory Investment Test (RIT). These recommendations are due in June 2008, as part of the Commission's NTP Review report to the MCE;
- The findings of NEMMCO's current review of Network Support and Control Services (NSCS). This review might address the question of governance arrangements for the procurement and use of NSCS, for which responsibilities are currently split between NEMMCO and TNSPs; and
- Existing regulatory decisions and the actions taken by TNSPs as a result of those decisions.

6.2 Submissions to Issues Paper

Three submissions to the Panel's Issues Paper made specific comments on implementation issues.

Comments in submissions by ETNOF, the Group and EnergyAustralia:

1. Concurred with the Panel's view that adjustments in AER regulatory determinations might be required. These adjustments could relate to both capital expenditure and the service target incentive scheme for each TNSP;
2. Noted the linkages between a framework for nationally consistent transmission standards and the role and functions of the NTP;
3. Stated that jurisdictions would have to commit appropriate resources in order to review the level of standards;
4. Drew attention to the potential impact that changes in transmission standards could have on existing connection agreements; and

5. Highlighted possible overlaps between nationally consistent transmission standards and the jurisdiction specific frameworks of standards and planning processes used by network companies, such as EnergyAustralia and others, with a mix of transmission, sub-transmission and distribution assets.

6.2.1 ETNOF

- "Any change in the levels of reliability standards applicable to any jurisdiction as a result of the move to a consistent national framework will have cost implications in terms of required network capital expenditure, compared with the levels that underpin the current regulatory determinations for each TNSP. It would therefore be appropriate either for any new levels of planning standard to apply from the start of the new regulatory period for each TNSP or, if they are introduced during a regulatory period, for there to be an explicit adjustment mechanism to allow for the change to be reflected in regulated revenues. ETNOF notes that the current NER make provision for a cost pass through mechanism, which covers 'service standard events' (amongst others)"

- ETNOF also notes the interaction between the mandated level of reliability standard and the service performance incentive mechanism developed by the AER. ETNOF considers that any change to the reliability standards imposed on TNSPs should be fully reflected in the calculation of the service performance incentive mechanism, so that the TNSPs do not face any financial penalty as a result.

- The treatment of existing long-term connection agreements, which may contain references to specific reliability levels, will also be an important transition issue. ETNOF notes that the appropriate treatment of these agreements is likely to depend on particular circumstances, which will differ between jurisdiction and between TNSPs. ETNOF further notes that in reviewing the level of reliability (as distinct from the introduction of a consistent national framework for reliability), the consultation process conducted by ESCOSA in South Australia allows for issues in relation to particular connection agreements to be considered. This appears to be an effective means of ensuring that these issues are addressed.

- Finally it is important to recognise that individual jurisdictions will need to arrange appropriate resources in order to conduct the reviews of the level of reliability standards that are proposed as part of ETNOFs recommended national framework.[…] Transitional issues will arise in relation to timing and resources for the jurisdictions (or the body appointed by the jurisdiction) before they are in a position to conduct the first of these reviews."[58]

6.2.2 The Group

"Transmission standards need to be developed in a form that is consistent with the transmission regulatory framework, the new "nationally consistent" approach to transmission planning which should emerge from the AEMC's NTP Review".[59]

6.2.3 EnergyAustralia

EnergyAustralia noted the potential for a framework for nationally consistent transmission standards to overlap or duplicate the jurisdiction specific network planning framework applied to its transmission, sub-transmission and distribution assets.[60]

6.2.4 NGF

In its submission on the AEMC's NTP Issues Paper, the NGF stated that it would be "quite unrealistic" to expect all three components of the NTP Review (i.e. the National Transmission Planner, Regulatory Investment Test, and a framework for nationally consistent transmission standards) to come into effect at a single point in time.

> "Each component of the new arrangements will have to have a different priority and presumably different implementation timetable.
>
> The 3 key implementation milestones will be:
>
> 1. The changeover to the new RIT process;
>
> 2. The promulgation of the new transmission planning methodologies and processes (and associated reliability standards/investment thresholds);
>
> 3. The preparation of the first National Transmission Network Development Plan (NTNDP).
>
> From the NGF's perspective, implementing (1) and (2) above should be higher priority issues for the new NTP than (3)."[61]

58 ETNOF, Submission – Issues Paper, pp.13–14

59 The Group, Submission – Issues Paper, Attachment 3, p. 18

60 EnergyAustralia, Submission – Issues Paper, p. 2

61 NGF, Submission on the AEMC's National Transmission Issues Paper, p. 46

6.3 Development of an implementation regime and transition plan

The Panel invites comments on the specific implementation issues associated with each of the five options outlined in Chapter 5 and views on any other implementation issues. Table 1 in Chapter 5 noted the likely changes to each of the options:

- **Option A**: little or no change in South Australia, with significant changes elsewhere, including to State legislation, regulations and licences;
- **Option B**: little or no change in Victoria, with significant changes elsewhere, including to State legislation, regulations and licences;
- **Option C**: Widespread changes, in which the form and level of the standard is specified in a single instrument, rather than in jurisdictional instruments;
- **Option D**: Widespread changes, including several items which appear to be outside scope for this review; and
- **Option E**: Significant changes, including to Rules, NEL, State legislation, regulations and licences.

The majority of options have common form of standard, agreed to on a NEM-wide basis, with the level of standards set on a jurisdictional basis. The remaining options have a common form of standard, agreed to on a NEM-wide basis, with the level of standards set on national basis, making appropriate adjustments for location specific reliability requirements.

Three key elements of Option E, put forward by the Panel for comment , are:

1. A national reference standard, on for information basis, against which the standard levels in each jurisdiction can be compared. This national reference standard could be set by the Panel, or another body, following consultation with jurisdictions and other interested parties;
2. A common form of standard that applies NEM-wide; and
3. The level of standards set on a jurisdictional basis, taking account of local reliability requirements.

Any comments and views will be taken into account by the Panel in further assessing these issues and in framing its final recommendations to the AEMC on an implementation regime and transition plan. It is expected that the Panel's recommendations regarding implementation will be subjected to further assessment by the Commission, and further refined, taking into account the Commission's recommendations on the NTP role and functions and RIT. The Commission's recommendations on an implementation regime and transition plan towards a framework for nationally consistent transmission standards will then be put to MCE for its consideration.

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7 Next steps

The next steps in the Panel's consultation process involve further analysing areas of disagreement on a framework for nationally consistent transmission standards, and coming to a view on whether these can be resolved. Submissions on this draft report, a public forum, and a consultancy report reviewing international frameworks for transmission standards, will assist the Panel in forming its recommendations to the AEMC.

7.1 Areas of disagreement

There appear to be three areas where there is disagreement on a framework for nationally consistent transmission standards:

- Form of standard;
- National versus jurisdictional setting of standards; and
- Accountabilities (which flows form the above point).

7.1.1 Form of standard

The adoption of probabilistic standards and a probabilistic planning methodology is advocated by the Group. Most other submissions to the Panel's Issues Paper favoured deterministic standards, derived from economic considerations (i.e. a 'hybrid' form of standard).

Two major reasons are put forward in favour of probabilistic standards and planning methods:

> "A probabilistic approach which incorporates an appropriate value of reliability to electricity users is the only way to ensure that competitive neutrality is preserved between the various competing forms of investment (generation in potentially different locations, network infrastructure, NLCAS and demand management measures). The probabilistic approach enables different forms of investment with potentially different reliability impacts to be assessed against one another and for the option providing the best overall value proposition for the market to be identified.
>
> The probabilistic approach ensures that each investment option is assessed and measured in a way that is totally compatible with the NEM Objective, i.e., each is assessed in terms of its relative economic efficiency from an overall market perspective."[62]

However, the Group also states:

[62] The Group – Submission to Issues Paper, p. 3

> "It may be reasonable to apply an economically based deterministic standard in limited circumstances where it is considered a full probabilistic planning assessment is not warranted. In these cases, the deterministic standard would be used as a surrogate for the proper economic value based standard in a much more streamlined planning and investment evaluation methodology."[63]

Proponents of the use of deterministic planning standards and planning methods consider that they are easier to implement, more readily understood, and result in less contentious investment decisions than would otherwise be the case where probabilistic approaches are applied. The use of deterministic planning standards and planning methodologies also appears to be consistent with international custom and practice.

Submissions acknowledge that deterministic standards utilise planning methods that assess the deterministic standard against a limited set of probabilistic planning scenarios and limited contingency list.

The Panel notes that while probabilistic standards and planning methods for complex systems might have developed considerably over the last fifteen years, as suggested by the Group, as yet few power systems in advanced economies are developed in this way. The jurisdiction of Victoria is an international pioneer in this regard. While the methods used in Victoria might be improved upon, as suggested by the Group, the adoption of such an approach across the NEM would present many challenges. A very compelling case would have to be made to governments and regulators to switch to probabilistic standards and planning methods, given that international history and practice is to use deterministic standards and planning methodologies.

A further consideration is that, in many jurisdictions, the standards for the sub-transmission networks owned by DNSPs are set in a deterministic form. The Panel considers that it may be desirable for there to be a consistent relationship between transmission and sub-transmission standards. This consistency could assist in least cost joint planning of transmission and sub-transmission networks.

The Panel intends carrying out further investigation of this issue, and expects the forthcoming report from KEMA Consulting to provide additional information on the form of standards and planning methodologies employed in electricity markets in Europe and North America.

7.1.2 National versus jurisdictional setting of standards and accountabilities

There is a divergence of views on whether the level of standards should be set on a national or jurisdictional basis. This directly affects the accountabilities of TNSPs, the body setting the standards, and regulators and other bodies that enforce the standards.

[63] The Group – Submission to Issues Paper, p. 4.

These matters are discussed above in Chapters 4 and 5.

7.2 Definitions of system operating states

The Group has suggested that there might be merit in clarifying the use of the terms *secure*, *satisfactory* and *reliable* when used to define planning and operating standards and practices in the NEM.[64]

There are potentially widespread effects arising from such a change to these definitions. These changes are, arguably, outside the scope of this review and not central to the establishment of a framework for nationally consistent transmission standards. Consequently, the Panel suggests consideration of potential changes to the definitions of *secure*, *satisfactory* and *reliable* operating states should be considered within the context of the Panel's forthcoming review of the technical standards in the Schedules to Chapter 5 of the Rules.

7.3 What needs to be further assessed and resolved

Three broad areas need to be further assessed and resolved by the Panel:

1. What should be the policy principles/criteria for establishing a nationally consistent framework, and how should these be weighted in order to choose between alternative options?

2. How will potential changes to transmission policy and the regulatory context in which the framework and standards will apply (e.g. NTP, AEMO, RIT, etc) affect each of the options?

3. Should the form of standards adopted within the national framework be hybrid (deterministic expression derived from economics) or probabilistic? It is noted that:

   (a) Although there were no submissions supporting purely deterministic standards, such standards exist in two jurisdictions (Queensland and NSW), whose amenability to change is not known.

   (b) Purely deterministic standards do have some merits (e.g. consistency with international custom and practice) and will still need to be considered in comparing the pros and cons of the options.

   (c) The Group's submission argues strongly for probabilistic standards versus deterministic (see above). This submission represents the views of generation companies that collectively own one quarter of the installed generation capacity in the NEM, and who are actively seeking to make new generation investments that will contribute to the ongoing reliability of the NEM.

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[64] The Group – Submission to Issues Paper, pp. 5-6 and pp. 9-11

(d) ETNOF's submission argues strongly for the retention of deterministically-expressed standards to, inter alia, preserve consistency with the sub-transmission networks owned by DNSPs, and to preserve the resultant joint least-cost planning and development.

7.4 Next steps in Panel's consultation process

The next step's in the Panel's consultation process are:

- A forum to discuss the Panel's draft report (30 April 2008, Melbourne Airport Hilton). Interested parties will be given the opportunity to present any initial views on the Draft Report and to clarify any matters raised in submissions to the Issues Paper.

- A separate consultancy report on international experience will be published soon. Interested parties will be able to incorporate any comments on the consultancy report into their submissions on the draft report and these will be taken into account by the Panel in preparing its final report to the AEMC.

- Submissions are invited on this draft report. Submissions are due by 5.00 pm (Australian Eastern Standard Time) on 3 June 2008. Submissions may be sent electronically or by mail in accordance with the requirements specified in Section 1.8 of this draft determination.

- The Panel will prepare a final report to AEMC by 30 June 2008.

A NEM transmission reliability standards

This appendix provides a general introduction to the National Electricity Market (NEM), what reliability is, how transmission reliability standards are defined in the NEM, and how these fit in with other reliability mechanisms in the NEM. The appendix also discusses key concepts about reliability standards — such as the form of standard, the level of standard, and planning methodologies — which are used throughout the rest of the paper.

A.1 What is the NEM?

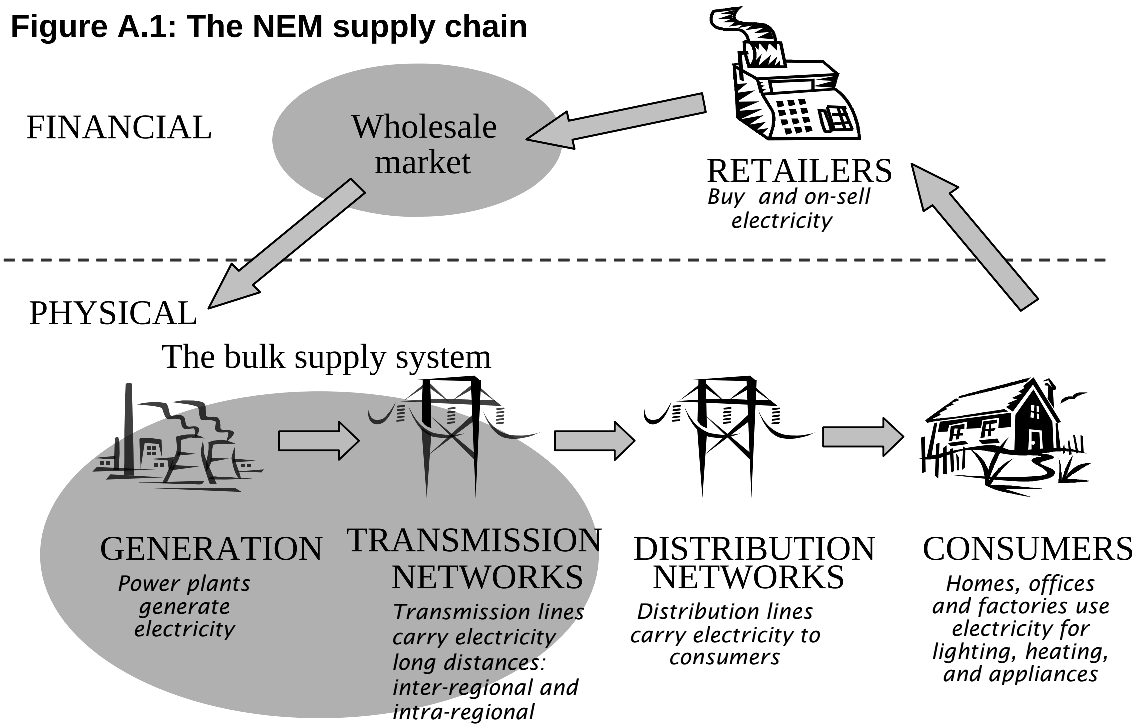
The NEM is the single interconnected power system stretching from Queensland through New South Wales, the Australian Capital Territory, Victoria, and South Australia to Tasmania. It does not currently include the Northern Territory or Western Australia. The NEM is divided into pricing regions which closely align with State borders (the ACT forms part of the NSW region), and there is an additional region encompassing the Snowy Mountains Hydro Electric Scheme.[65]

The NEM comprises a number of elements including (see figure A1):

- A wholesale market for the sale of electricity by generators to wholesale consumers (typically retailers and large consumers), and which allows trading in contracts between generators, wholesale consumers and merchant traders;
- The physical power system used to deliver the electricity from generators via transmission networks (together referred to as the 'bulk supply system') and local distribution networks; and
- Retail arrangements whereby retailers on-sell the energy they purchase to end-user consumers such as households and businesses.

[65] On 27 September 2007 the AEMC made a Rule to abolish the Snowy Region, with effect from 1 July 2008, and alter the boundaries of the NSW and Victoria regions. All other regional boundaries in the NEM remain unchanged.

Figure A.1: The NEM supply chain



The NEM is a partially-regulated market. That is, generators and retailers operate according to competitive market conditions, whereas owners of 'natural monopoly' assets – transmission networks and distribution networks – are largely regulated. An option for market network service providers also exists for specific network assets to operate under competitive market arrangements. This means that if public or private enterprises are to provide adequate generation capacity to meet demand at all times, there needs to be sufficient financial incentives for them to do so. These incentives are delivered through the operation of a wholesale spot market.

Spot electricity prices are calculated for each region every five minutes (known as a dispatch interval). Six dispatch prices are averaged every half-hour (trading interval) to determine the regional spot market price used as the basis for settling the market.

The wholesale spot price can vary considerably, potentially dramatically, in short periods of time. The degree to which the price moves is important to many stakeholders. A large proportion of suppliers and consumers negotiate financial contracts to manage the financial risk associated with market volatility. Those contracts are private arrangements in that the prices are not visible other than to the participants who are party to the contracts.

All electricity generated is traded via the spot market (this is known as a 'gross pool' arrangement) and dispatched centrally by the National Electricity Market Management Company (NEMMCO) – the market and system operator. NEMMCO also manages the security of the power system and provides ongoing information to market participants about forecast and actual supply and demand. NEMMCO and transmission network companies also acquire specific technical or ancillary services from generators and consumers to support the operation of the physical power system.

A.2 What is 'reliability'?

Broadly, the reasons why consumers may not receive a continuous, uninterrupted supply of electricity may fall into two categories. The first is technical: action has been taken to ensure that power system equipment is protected from damage or exceeding operating limits that, if left unchecked, may lead to wider interruptions to supply. This is *security*. Ensuring that the power system is operated securely is the responsibility of NEMMCO and the network operators. The second is non-technical: quite simply there is not enough capacity to generate or transport electricity across the networks to meet all consumer demand. This is *reliability*. This second reason is economic to the extent that it must be cost-effective for generators and networks to have enough capacity to meet demand at all times.

Operational standards for power system security are set in the Rules and by the Panel.[66] Operational standards are concerned with maintaining the integrity of the power system in the short term, following a sudden fault or failure of a component of the system, such as a line, transformer or generator. Such sudden faults or failures of key components of the bulk power system are called contingencies. In technical terms, the formal definition of reliability includes single credible contingencies[67] but excludes non-credible contingencies, including multiple contingencies, which are classified as security events.[68]

These operational standards affect the design and planning of transmission networks, but there are other, longer term, considerations that affect network planning, including: jurisdictional transmission standards; economies of scale and scope in building transmission networks; long term load growth at different points of the network; and the regulatory regime and its incentives.

For security or reliability reasons, or a combination of both, some consumers may be without electricity for some of the time. Most commonly, interruption to supply is caused by unforeseeable events such as storm damage to local distribution networks. Such events are, as explained above, security. From the consumer's perspective, however, there usually appears to be little if any difference between an interruption caused by a reliability issue and one caused by a security issue. But from a market design perspective, the two causes have very different ramifications: security events – managed through standards applied by NEMMCO and network operators –

66 Chapter 4 of the Rules sets out system security standards, while system performance standards are set out in Schedules 5.1 and 5.1a of the Rules and jurisdictional transmission codes, licenses, legislation or network management plans.

67 A credible contingency event is defined in clause 4.2.3(b) of the Rules as "a contingency event the occurrence of which NEMMCO considers to be reasonably possible in the surrounding circumstances including the technical envelope." A contingency event is defined as "an event affecting the power system which NEMMCO expects would be likely to involve the failure or removal from operational service of a generating unit or transmission element."

68 For example, the unserved energy arising from events in NSW on 13 August 2004 was a security event rather than a reliability one.

usually pass quickly, whereas a reliability issue is far more likely to be long term as it may be the symptom of a fundamental problem – a lack of sufficient supply capacity – which will take time to rectify.

There are any number of responses to the question of what degree of reliability is tolerable and how much value is ascribed to increased reliability. One group of consumers may tolerate a different level of reliability, and therefore would be willing to pay a higher price for reliable supply, from another. For example, businesses are likely to be less tolerant of interruption to supply during working hours, whereas families are likely to be less tolerant of power interruptions outside of working hours. Potentially, each individual consumer may have a unique tolerance threshold and there are millions of consumers in the NEM. Thus, the question as to what degree of reliability is tolerable also raises an issue concerning how differing expectations regarding reliability and the cost of that reliability can be communicated most effectively to suppliers.

There is also an important relationship between reliability and security. Security is fundamental to the operation of the power system. However, larger amounts of generation and network capacity generally will make it less likely that interventions will be required to keep the power system secure (although this is subject to how that capacity is distributed throughout the system and how reliable each component is itself).[69] Therefore, the level of reliability tolerated by consumers in respect of a system may impact on the technical risk that the system will be unable to supply electricity.

Transmission reliability standards are therefore concerned with both security and reliability, in both the short (i.e. operational) timeframe and in the long (i.e. planning) timeframe.

A.3 Security and reliability standards

Standards concerning the design and operation of the transmission system play a central role in ensuring the reliable and secure delivery of power to customer loads.

> "Stated simply, the ultimate objective of the transmission system is to deliver power reliably and economically from generators to loads. Power systems are large, highly complex, ever-changing structures that must respond continuously in real time. Electricity must be produced and delivered instantaneously when it is demanded by load [because it is not cost effective to store large volumes of electricity]. Power outages are not acceptable, so the system must also tolerate sudden disruptions caused by equipment failure or

[69] In a large power system with a strongly meshed network, the physical mass and inertia of the system contribute to its resilience a contingency of a given size. If the same sized contingency occurred on a smaller, less meshed, power system, it is likely that a greater level of manual intervention will be required to maintain power system security and reliability.

weather. And the system must perform as economically as possible, with transactions and sales monitored as accurately as possible." [70]

In order to ensure the secure and reliable operation of the power system, there are standards that relate to the design, construction, and operation of the system. These performance standards are critically important because the interconnected nature of the network and the physics of power flows mean that the loss of a single element (e.g. transmission line, generator, transformer) can instantaneously result in changes in power flows through all other elements of the network. The rapid change in flows through the other elements can overload them, resulting in an automatic shutdown of the affected elements. This pattern can continue in such a way that there are cascading blackouts across part of or the whole of the network.

Security standards are concerned with maintaining the integrity of the bulk power supply system (i.e. generation and transmission — see Figure A.1). This means that uncontrolled cascading outages must be prevented by designing and operating the power system in such a way that it will continue to operate normally without major disruption when an component, such as a transmission line or generator, fails. "Normal operation means that (1) the frequency of the system stays within acceptable bounds, (2) all voltages at all locations are within required ranges, (3) no component is overloaded beyond its appropriate rating, and (4) no load is involuntarily disconnected."[71]

Transmission security standards for the NEM are contained in Schedule 5.1 of the Rules and jurisdiction specific laws, transmission licences, and regulatory instruments. These are discussed further in Appendix B. Improving the national consistency of these jurisdictional transmission standards is the subject of this review.

Transmission standards can relate to two (overlapping) timeframes:

- Design/planning horizon — which can be from a few months ahead to several decades ahead; and

- Operational horizon — which ranges from the instantaneous through to several months into the future.

Security standards at the design/planning stage are concerned with ensuring that the power system can tolerate the outage of any component or several components. This entails building a degree of redundancy into the network that allows for equipment outages. A power system comprising N elements that is resistant to a single component being out of service is said to be N-1 secure. This means that all customer loads would continue to be supplied even with one bulk power system element out of service. A higher level of security is provided when the transmission system is planned to be N-2 secure or N-3 secure. With a N-2 secure standard, no

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70 Alvaro, F. and Oren, S. 2002, "Transmission System Operation and Interconnection", in US Department of Energy, *National Transmission Grid Study: Issues Papers*, US DOE, Washington D.C., May 2002, p. A-1.

71 Alvaro, F. and Oren, S. 2002, p. A-3

customers loads will be affected even if two elements are out of service. This is a very high standard of transmission security requiring substantial capital expenditure, and in Australia it is generally only applied to central business districts of state capitals where there are large concentrations of customers with critical loads.

In designing a N-1 secure network, transmission planners also need to take into account limitations that occur in real time operations timeframe. "One way this is sometimes done is by considering the simultaneous failure of any one line and any one generator when doing planning timeframe studies. In an operations timeframe, however, N-1 security means that the current system must be able be able to tolerate the 'next worst' contingency. Because an actual operating system may have already sustained the outage of one or two components, this is tantamount to operating the system in an N-2 or N-3 condition from the planning point of view. Previous contingencies are 'sunk events' from the perspective of system operations. This means that, once a contingency occurs, meeting the N-1 criterion means considering the altered system, not the original system, as the new base case to which the criterion must be applied."[72]

The performance capability of a transmission network can be greatly affected by the significant elements connected to the distribution network (sometimes known as sub-transmission). In these cases, there needs to be compatibility between the reliability standards of the transmission network and distribution networks. This in turn requires considerable interaction between distribution and transmission network planners and operators, to ensure that the most economically efficient network augmentations take place and that transmission network reliability/security is maintained in an operational timeframe through appropriate co-ordination of actions on the transmission and sub-transmission networks.

Maintaining N-1 security in an operational timeframe requires that the system operator maintain sufficient quantities of two types of reserve:

- Spinning reserves — provided by generators that can instantaneously adjust their output up or down in response to fluctuations in load or generation so that system frequency can be continuously maintained in a narrow operating band around 50 Hz; and

- Contingency reserves — which allow the integrity of the power system to be maintained following a contingency. In the NEM, contingency reserves are defined over 6 seconds, 60 seconds and 5 minute timeframes.

Both types of reserve have to be available on a geographically dispersed basis, to ensure secure operation when an outage causes the power system to separate into islands (e.g. when a bush fire or lightening strike causes the electrical separation of two NEM regions). That is, prior to and after a contingency occurs, system operators need to be able to change the level of generation output (and reserves) at different locations around the network, so as to maintain the security of the power system and

[72] Alvaro, F. and Oren, S. 2002, p. A-6

continue supplying loads, even when parts of the system have become electrically separated from one another.

Maintenance of security in an operational timeframe utilises a combination of:

- Real time monitoring of all elements of the power system;
- Communicating information on the current state of the system;
- Estimating the future state of the system;
- Assessing credible contingencies and taking appropriate precautionary or corrective action;
- Controlling the system so it adjusts to changing circumstances and remains secure and reliable.

There are several ways the power system can be controlled:

- Transmission line switching;
- Automatic fault clearance;
- Voltage control — transformer tap changes, Static VAR Compensators (SVCs), capacitor banks, Syncronous Condensors, etc. ;
- Dispatch process;
- Frequency Control Ancillary Services (FCAS);
- Network Control Ancillary Services (NCAS); and
- Directions from the system operator.

In the NEM, during the operational timeframe, the maintenance of power system security is shared between NEMMCO and TNSPs and involves tight co-ordination of their activities.

However, during the planning timeframe, power system security is assured through:

- the design and construction of the transmission network; and
- ensuring that there is sufficient installed generation capacity to meet load, without involuntary load shedding.

The design and construction of transmission networks in the NEM is the responsibility of the Jurisdictional Planning Body (JPB), which in most cases is the jurisdictional TNSP.

The NEM uses a number of market and regulatory mechanisms to ensure that there is sufficient installed generation and network capacity to meet load over the long term, including:

- The supply-demand balance and long term contracts for energy supply;
- Reliability standard of 0.002% USE over the long term;
- The setting of the Value of Lost Load (VoLL), a cap on spot prices;
- Reliability Safety Net — "Reserve Trader" and NEMMCO's powers of direction;
- System performance and security standards contained in the NEM;
- Jurisdictional transmission reliability standards; and
- Regulatory incentives for network owners and operators arising from the combination of (CPI – X) regulation, WACC, asset depreciation rates, the Regulatory Test, allowed capital and operating expenditure, and network performance incentives.

As mentioned in Chapter 1, this review is only focussing on the development of a framework for nationally consistent transmission network reliability standards. Under the existing arrangements in the NEM, there is some degree of national consistency in transmission standards because jurisdictional transmission standards all have to be aligned with the technical standards specified in the Rules relating to security and reliability in an operational timeframe (Schedule 5.1a and 5.1 of the Rules). Increasing the degree of national consistency in transmission reliability standards primarily requires that any new framework allow the alignment of transmission standards used in the planning timeframe.

The Panel has already investigated the 0.002% USE reliability standard, the Reliability Safety Net, and the level of VoLL as part of the Comprehensive Reliability Review.[73]

The AEMC has already completed major reviews of various aspects of the regulatory regime affecting transmission networks, and has implemented changes to Chapter 6 of the Rules,[74] pricing of regulated network services,[75] and the principles underlying the Regulatory Test. [76]

In 2008, the Panel will carry out a separate review of the technical standards in the Rules that relate to power system security and network connections. Nonetheless, one possible framework for nationally consistent transmission reliability standards would be to extend the existing Schedule 5.1 and 5.1a technical standards so that

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

74 AEMC 2006a, *National Electricity Amendment (Economic Regulation of Transmission Services) Rule 2006 No. 18*, Rule Determination, 16 November 2006, Sydney.

75 AEMC 2006c, *National Electricity Amendment (Pricing of Prescribed Transmission Services) Rule 2006 No. 22,* Rule Determination, 21 December 2006, Sydney.

76 AEMC 2006b, *Reform of the Regulatory Test Principles, Final Determination*, 30 November 2006, Sydney.

they cover issues relating to longer term planning timeframes, as recommended by ERIG.[77]

A.4 Form of transmission standard and planning methodologies

There are two main forms in which a transmission reliability standard can be expressed. For a long time, transmission standards in many countries have been expressed in a deterministic form, along the lines of a 'N – x' standard. More recently, transmission standards in some jurisdictions have been expressed in a probabilistic form. Transmission network planners use different analytical techniques to assess whether the network meets these different forms of standard. These analytical approaches and responses they trigger to the network plan constitute the network **planning methodology** (see Table A.1 below).

A.4.1 Deterministic form

A deterministic form of transmission reliability standard requires that the bulk power system can continue to provide adequate and secure supplies of energy to customers after any of a range of contingencies occurs. The contingencies involve outages (i.e. faults, failures) of some important elements of the power system, such as lines, transformers or generators. A deterministic standard does not take into account the probability of an outage. Taking into account these contingencies, planners and operators of the power system aim to incorporate sufficient redundancy so that any system failures can be prevented, either through automatic system protection mechanisms or manual intervention by operators. In the event of a contingency, the power system is required to remain within its performance parameters (e.g. flow limits, voltage levels, stability criteria), system security maintained, and all loads supplied without interruption from the contingency.

The contingency list plays a critical role in determining the level of reliability. The more comprehensive the contingency list, the lower the chance of a system failure from contingencies not listed.

When deterministic standards are used, they are often expressed as 'N – x', where x can be 0, 1 or 2, as discussed above. An N – 0 security standard is often used when there is a radial line serving a load — if the line fails, there is no way the load can continue to be served by the network. Continued supply in this case can be provided by a back-up generator or, if the load is small enough, by stored energy (batteries). Greater reliability is provided by having each load supplied by more than one source, typically via a meshed network, but this is not always cost effective. The need for redundancy is the main reason that transmission networks are meshed. This meshing generally provides N-1 secure or higher levels of reliability.

Deterministic standards have traditionally been used to plan power systems, and have played a key role in the delivery of high levels of power system reliability that people are used to in modern, industrialised economies.

[77] ERIG 2007, p.182

Transmission planners use power flow modelling and other analytical techniques to assess the effects of each contingency on the power system. The effects of the contingency are assessed against the system performance and reliability criteria to determine whether any criteria are breached. Based on this analysis, measures of system reliability, such as loss-of-load probabilities, frequencies and durations can be calculated. This information then feeds into the design, planning and operational processes for the transmission network (see Table A.1 below).

A.4.2 Probabilistic form

A probabilistic form of transmission reliability standard requires that the bulk power system be expected to provide adequate and secure supplies of energy to customers under a wide range of contingencies. A probabilistic form of transmission reliability standard explicitly takes into account the probabilities of contingencies (e.g. transformer failure rates) under a range of possible operating conditions (e.g. electric load levels, system states) that also have probabilities assigned to them. Each contingency is treated as a random event, with some events more likely to occur than others. Probabilistic modelling methods are applied to models of physical power system to calculate expected values of system reliability measures, based on probability distributions regarding power system performance. The results of this modelling inform the design and planning of the transmission network (see Table A.1 below).

A probabilistic transmission standard could, for example, be expressed as the likelihood of a customer at a given supply point being without supply or the likely time without supply. The existing NEM reliability standard of 0.002% USE is a probabilistic form of standard.

Victoria is the only jurisdiction in the NEM which uses a probabilistic transmission planning standard to supplement the operational standards in the Rules.[78] The Victorian transmission planning process treats operator responses to contingencies as deterministic events, but assigns probabilities to system states and contingent events. Probabilistic assessments are then made concerning the level of power system performance, with an economic value assigned to any customer load that is not served. If power system performance does not meet the probabilistic standards or if the estimated value of the lost customer load is greater than the cost of network operational actions (e.g. NCAS contracting) or augmentation, the transmission network plan is reviewed.

A.4.3 Hybrid form

With a hybrid form of standard, the standard is derived from economic considerations, but expressed deterministically, for ease of understanding. The

78 VENCorp 2007, *Victorian Electricity Transmission Network Planning Criteria*, Issue No. 2, VENCorp, Melbourne, 3 May 2007. (URL http://www.vencorp.com.au/index.php?pageID=8070&action=filemanager&folder_id=497&sectionID=8246)

planning methodology used can be either the restricted probabilistic approach employed when deterministic standards are used or the comprehensive probabilistic methodology used with probabilistic standards (see Table A.1 below).

Sometimes a probabilistic standard is expressed in an equivalent, but deterministic manner. For example, the NEM's 0.002% USE reliability standard is operationalised by NEMMCO into a deterministic standard for minimum level of reserve in each NEM region.

In South Australia, the transmission reliability measures are derived using probabilistic methods but expressed deterministically to facilitate understanding and comparison with the deterministic transmission standards in the SA Electricity Transmission Code.[79]

A.5 Level of transmission standard

The level of transmission standard plays a critical role in determining the reliability, security and costs of the network.

When the form of standard is deterministic, if the level of the standard has a greater level of network redundancy, this implies that the security of the network and its capital and/or operational costs will be higher. For example, an N-2 secure network will be more expensive to build and operate than a N-1 secure network.

A level of a probabilistic transmission standard can be set using a range of methods, but again if a high standard of security is set (e.g. a very low probability of power system failure), this implies higher capital and operational expenditure on the network.

Choices about the level of standard can be influenced by a range of factors, including:

- Judgements about the criticality of particular loads;
- Judgements about the economic value of lost load for particular customer classes;
- Public safety;
- Difficulty and cost of restoring the power system to normal operations following shutdown;
- Economic benefits of secure and reliable power supplies;
- Differing costs of network construction, operational actions, and non-network solutions (e.g. demand side response);

79 Electricity Network Owners Forum (ETNOF), Letter to Commissioner Ian Woodward, AEMC, received 5 November 2007.

- Compatibility with standards used in other modern "digital economies", in which production, commerce and many everyday processes rely on computer technology.

There may be little choice on the level of standard, if it is set by state governments, who may wish to take into account a range of other factors.

Existing jurisdictional transmission standards have been set having regard to historical levels of reliability, the factors listed above, and 'good industry practice' concerning the operation of bulk power systems, which has developed internationally over the last 100 years.

Across the NEM, the level of transmission reliability standard is generally 'N-1 secure' for meshed parts of the transmission network, 'N-0 secure' for radial lines serving a single load in rural areas, and the equivalent of 'N-2 secure' in CBD areas.

Table A.1: Forms of standards and associated planning methodologies

Form of standard	Description	Planning methodology used
Deterministic	• A type of redundancy standard. • The bulk power system is designed so that it can continue to provide adequate and secure supplies of energy to customers after any of a range of contingencies occurs. • The contingencies involve outages (i.e. faults, failures) of some important elements of the power system, such as generators, lines or transformers. • The probability of these outages is *not* explicitly taken into account (but may be implicit in the standard). • Standards are typically expressed as an (N – x) redundancy level, where N is the number of elements in service on the bulk power system and x is the number of those elements experiencing an outage.	• Using a range of probabilistic inputs – such as demand forecasts, generation patterns, and electrical flows — a model of the bulk power system is subjected to range of simulated contingencies. • Taking into account these contingencies, planners and operators of the power system aim to incorporate sufficient redundancy so that system failures can be prevented, either through automatic system protection mechanisms or manual intervention by operators. • In the event of a contingency, the power system is required to remain within its performance parameters (e.g. flow limits, voltage levels, stability criteria), system security maintained, and all loads supplied without interruption from the contingency. • In effect, the deterministic standard is applied to a limited, plausible, set of probabilistic planning scenarios, and the deterministic standard needs to be met in all cases. If the standard is not met, the operational and/or investment plans are altered until the standard is met. • An *implicit* value of customer reliability is an *output* of the modelling and planning processes. • The contingency list plays a critical role in determining the level of reliability. The more comprehensive contingency list, the lower the chance of system failure from contingencies not listed. • Note that around the world, deterministic standards and planning methods have traditionally been used to plan bulk power systems.

Form of standard	Description	Planning methodology used
Probabilistic	• The bulk power system is designed so that it can continue to provide adequate and secure supplies of energy to customers following a wide range of contingencies. • The probabilities of contingencies (e.g. transformer failure rates) are explicitly taken into account. • The degree of reliability designed into the system is linked to explicit customer valuations of reliability. Higher valuations of reliability result in a higher level of redundancy, either at particular points of the network or the network as a whole.	• A wide range of probabilistic inputs are used in a model the bulk power system, which is then subjected to wide range of simulated contingencies. • Probabilistic inputs include: demand forecasts, generation patterns, electrical flows, and contingencies (e.g. generation and transmission plant failure rates). • An *explicit* value of customer reliability is a key *input* to the modelling and planning processes. Different values of customer reliability can be used at different connection points, reflecting variations in the criticality of load and the willingness of customer to pay for reliability. • Each contingency is treated as a random event, with some more likely to occur than others. (Low probability, but high impact, contingencies that might be excluded from a contingency list used in deterministic planning approach, are included). • Probabilistic modelling is carried out, involving the repeated random sampling of contingencies and modelling the effects of the contingencies on the physical power system is carried out. . • The results of this probabilistic modelling are used to calculate expected values of system reliability measures, based on probability distributions regarding power system performance. • The results of this modelling inform the operation, design and planning of the transmission network. • In effect, the probabilistic standard is applied to an extensive range of probabilistic planning scenarios. • If the standard is not met at any given point along the probability distribution of outcomes, the operational and/or investment plans are altered only if the explicit value of customer reliability exceeds the costs incurred in meeting the standard.

Form of standard	Description	Planning methodology used
Hybrid	• The bulk power system is designed so that it can continue to provide adequate and secure supplies of energy to customers after any of a range of contingencies occurs. • The standard is derived from economic considerations, but expressed in deterministic terms.	Because the standards are derived from economic considerations, much of the economic analysis which typifies probabilistic planning is part of the standard-setting process. Once the standards are derived, they are expressed in deterministic form. A deterministic planning approach is then applied to those standards

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B Today's transmission standards

This appendix discusses existing transmission reliability standards in the NEM and briefly compares them to standards in a selection of other electricity markets. It also seeks to identify the potential issues that might arise from inconsistencies in jurisdictional transmission standards, the size and scope of any issues, and the motivations for changing to a nationally consistent framework.

B.1 Transmission standards and network planning processes

Jurisdictional transmission planners seek to design their networks to ensure that: a) power system performance is within the technical limits of the system; b) the power system can be controlled by the system operator in such a way that security requirements are met; and c) that demand at all points of the network can be met in accordance with the jurisdictional Reliability Standard of 0.002% USE each year.

The regulatory regime for transmission also requires transmission planners to seek to design the network so these three objectives can be met at least economic cost, taking into account the value placed by customers on reliable supplies of electricity.

System performance standards define the technical limitations of the bulk power system, such as voltage ranges, reactive power limits, stability limits, maximum fault currents and fault clearance times. These performance standards can be thought of as defining a “performance envelope” within which the power system must operate.

System security standards oblige the system operator to take actions to ensure that the power bulk power system operates within its system performance standards, prior to and following a network contingency. The security standards also define the timeframe in which operational actions must be taken to restore the system to a secure state following a contingency. Operational actions include network switching, changes to dispatch of energy and/or ancillary services, and at a last resort, involuntary load shedding.

The focus of this review is on jurisdictional reliability standards, which primarily focus on the transmission planning timeframe. However, the network design and construction also needs to take into account the network performance and security in the operational timeframe set out in Chapter 5 of the NER. The Chapter 5 NER standards provide a nationally consistent benchmark for reliability and security in the operational timeframe. Jurisdictional transmission reliability standards are complementary to those in the NER. They can provide a greater degree of prescription about how reliability and security will be met in the operational timeframe than the standards set out in the NER. In addition, jurisdictional standards specify how the network will be planned and operated to meet specific local requirements.

Therefore, at present, while there is NEM wide consistency of transmission standards in an operational timeframe — albeit with some room for TNSP flexibility in delivering to those operational standards — there is a divergence in the reliability standards applied to planning transmission networks in NEM jurisdictions. It is this difference in transmission reliability standards that the MCE wishes to have addressed through the development of a framework for nationally consistent transmission standards.

B.2 NEM-wide transmission standards[80]

B.2.1 System performance standards

The bulk power system *performance standards* for all transmission networks in the NEM are set out in:

- Schedules 5.1a and 5.1 of the National Electricity Rules; and
- Jurisdiction specific transmission codes, licenses, legislation or network management plans.

In addition, in some cases, there may be location specific transmission system performance requirements, which are related to customer connection agreements. Schedule 5.1 of the Rules recognises that transmission reliability standards can be set in these connection agreements. It is understood that some of these customer connection agreements, where the DNSP is the customer, can have widespread geographical coverage (e.g. all DNSP connections points to be supplied at N-1) , and are long term.

The system performance standards include:

- Frequency operating standards, which are determined by the Reliability Panel;
- Stability criteria;
- Steady state and transient voltage ranges;
- Reactive power limits;
- Fault levels;
- Protection systems and fault clearance times.

Many of these performance standards also apply to Distribution Network Service Providers (DNSPs) because of the strong interactions, in many cases, between the transmission or sub-transmission networks owned by DNSPs and the transmission networks owned by TNSPs.

These clauses of the Rules place explicit obligations on network service providers to design and operate their networks such that the system performance standards are met both before and after credible contingency events. The nature of the credible contingency events and their severity are also specified.

80 Phrases that are italicized in this section have the meaning defined in the National Electricity Rules.

B.2.2 System security standards

System security standards in Chapter 4 of the Rules require NEMMCO and NSPs to take actions to maintain power system security, while keeping the system within the system performance standards specified in Schedules 5.1a and 5.1 of the Rules.

The system security standards specify two lstates of system security — *satisfactory operating state*[81] and *secure operating state*[82] — that are defined in terms of *credible* and *non-credible contingency events*. The *technical envelope,* defined in clause 5.2.5 of the Rules, is used as the basis for categorising credible contingency events. Under Clause 4.2.3 NEMMCO has guided discretion in determining the list of credible contingencies and non-credible contingencies.

The most common types of credible contingencies are loss of the largest generator in a region, fault on a line, and loss of a transformer. Non-credible contingencies, such as lightening strikes or bushfires, are treated as system security events but can be re-classified as credible contingencies, if NEMMCO deems them so.

General principles for maintaining power system security are contained in Clause 4.2.6 of the Rules. Arising from these principles are obligations on NEMMCO and TNSPs to maintain power system security, and to do so within set operational timeframes. First, NEMMCO must operate the power system so that is normally in a *secure state*. Second, following a contingent event, NEMMCO must take reasonable actions to return the system to a *secure state* as soon as practible, but within 30 minutes.

The Rules recognise the strong inter-play between power system security and reliability. A *reliable operating state* (defined in Clause 4.2.7) occurs when all loads are being supplied and are expected to continue being supplied and that there are sufficient levels of *short term* and *medium term capacity reserves* to meet the *power system security and reliability standards*.

B.3 Jurisdictional transmission network standards

Jurisdictional standards for transmission networks exist because transmission networks were developed on a state by state basis, with interconnection between jurisdictions only occurring relatively recently.[83]

When the NEM was established, governments made a policy decision to retain jurisdictionally based transmission network companies and planning arrangements, rather than forming a single national transmission company, which would acquire all the assets of the existing jurisdictional TNSPs and thereafter develop and operate the

[81] Clause 4.2.2 of the Rules defines a *satisfactory operating state*.

[82] A *secure operating state* is defined in Clause 4.2.4 of the Rules.

[83] The first interconnection was that between the NSW and Victorian state transmission grids in November 1959. Other interconnections and their commissioning dates are: Victoria—South Australia (1990), Directlink (July 2000), Queensland–NSW Interconnector (February 2001), Murraylink (October 2003), and Tasmania—Victoria (April 2006).

transmission network to some agreed standards.[84] This decision on the corporate governance framework for transmission allowed jurisdictions to retain tighter control over jurisdictional network reliability standards, pursue corporatisation and privatisation at different paces, and pursue any other state government policy objectives via the pricing of electricity (e.g. "state development" agendas, uniform pricing for urban and rural consumers).

In addition, jurisdictional reliability standards reflect the political reality that if the lights go out in a jurisdiction, it is the government of the jurisdiction that faces the economic and political consequences and manages many of the public safety issues arising from a blackout.

Importantly, jurisdictional transmission reliability standards specify the *minimum standards* for the shared transmission network. A key aspect of the existing framework for transmission network development is the ability for network users to negotiate a standard of network reliability that is higher or lower than the minimum standard. Details of any negotiated standard are generally contained in the connection agreement between the network user and the TNSP, which sets out the terms and conditions of access to the network.[85]

As mentioned in Chapter 2, the form of existing jurisdictional reliability standards is either:

- Deterministic;
- Probabilistic; or
- Hybrid, in which a probabilistic standard is translated into an equivalent deterministic standard.

Table B.1 below sets out for each jurisdiction:

1. The form of the jurisdictional transmission standard;
2. The jurisdictional transmission standard;
3. The jurisdictional source of the standard;
4. Interactions between transmission and distribution network standards;
5. Interactions between transmission standards between interconnected transmission networks; and

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84 For a summary of the policy decisions concerning the corporate structure of transmission in the NEM, see Firecone 2007, *The Evolution of Transmission Planning Arrangements in Australia*, Report to the Australian Energy Market Commission, Firecone Ventures Pty Ltd, Melbourne, October, pp. 2-6. Available at http://www.aemc.gov.au

85 Schedules 5.2 to 5.7 of the Rules specify various technical requirements under three types of transmission access standard: an *automatic access standard*, *a minimum access standard*, and a *negotiated access standard*. These technical requirements are consistent with the power system performance and security obligations contained in Schedules 5.1a and 5.1 and Chapter 4 of the Rules.

6. Interactions between jurisdictional transmission standards and NEMMCO's security and reliability standards.

The following key observations can be made:

- The form of standard differs across NEM jurisdictions. The form of standard is deterministic (N-1) in three out of five jurisdictions. Victoria uses a combination of deterministic and probabilistic standards. SA uses a probabilistic standard, but expresses it in a deterministic fashion (N-1).

- The level of standard varies across NEM jurisdictions. In most jurisdictions, the planning standard is for N-1 secure operations in areas outside CBD, with an equivalent of N-2 secure operations in CBD. These deterministic security levels may be an explicit requirement with penalties (up to and including loss of license) associated with non-compliance. For example, in South Australia, the level of deterministic standards is set out in the *Electricity Transmission Code*[86], while in Queensland the level of standard is specified in an act of parliament and the transmission license.[87] Alternatively, when a probabilistic form of standard is used, such as in Victoria, a higher level of network reliability may be implied if a higher Value of Customer Reliability (VCR) is used for network planning for CBD areas compared to that used for residential areas.[88]

- The source of transmission standards is not uniform across jurisdictions, and is a combination of the NER and jurisdictional instruments. The range of jurisdictional instruments used to specify the standard is diverse, ranging from legislation, transmission licences and system codes, or Network Management Plans.

- There is, in many cases, a strong interaction with local DNSP planning standards. Both the NER and jurisdictional standards require joint planning of transmission (owned by the TNSP) and sub-transmission networks (owned by the DNSP), given that the latter connect to the former and can affect the performance of the transmission network.

- There are few interactions with transmission planning standards in interconnected jurisdictions. Apart from TNSPs jointly planning interconnectors, there is little interaction on the issue of jurisdictional transmission standards.[89] However, there are examples of effective joint reliability planning across jurisdictional boundaries. These include the joint planning by Queensland and

[86] ESCOSA 2006, *Electricity Transmission Code ET/05*, 1 July 2008, ESCOSA, Adelaide. (URL http://www.escosa.sa.gov.au/webdata/resources/files/060906-R-ElecTransCodeET05.pdf)

[87] For details, see Powerlink 2006, *Planning Criteria Policy*, Version 1.0, Powerlink Queensland, Brisbane 23 March 2006 (Available at http://www.aer.gov.au)

[88] See *Transmission Connection Planning Report 2006*, Produced jointly by the Victorian Electricity Distribution Businesses 2006 (URL http://www.sp-ausnet.com.au/CA256FE40021EF93/Lookup/PlanningRep/$file/TCPR2006.pdf)

[89] Recent reviews of transmission standards in South Australia and Tasmania did have regard to standards applied in other NEM jurisdictions. See Section 3.3.1 below.

NSW TNSPs and DNSPs to deliver the requisite reliability (at lowest cost) to the border areas of Gold Coast/Tweed and Goondiwindi.

- There are strong interactions between jurisdictional transmission standards and NEMMCO's security and reliability standards. All jurisdictional planning and operational standards have to be consistent with NER standards applying to NEMMCO in an operational timeframe. Jurisdictional planning standards are generally more prescriptive than NER operational standards relating to reliability and security performance levels for connection points.

Table B.1: Jurisdictional transmission standards

	NSW – TransGrid	QLD – Powerlink	SA – Electranet	TAS — Transend	VIC — VENCorp
Form of standard	Deterministic	Deterministic	Expressed as deterministic, but based on probabilistic analysis	Deterministic – Performance based – limits either the size of customer load that may be interrupted, or the length of interruption, or both.	• Deterministic assessment of operational actions for specific network conditions. • Probabilistic assessment used to account for uncertainty in system conditions.
Transmission reliability standard	N – 1 across jurisdiction, with the exception of modified N – 2 in CBD	N-1 in accordance with good electricity industry practice. No variation across jurisdiction. In addition, as far as technically and economically practicable, the transmission grid is to be augmented or extended to provide enough capacity to provide network services to persons authorised to connect to the grid or take electricity from the grid.	There are 6 categories of reliability standard in SA with a defined category applying to each connection point. The standard categories range from "N" to 'equivalent' "N-2" line and transformer capacity, depending on the load and importance of load at risk at each connection point.	Load interruption standard has two elements: 1. for an intact system • N-1 for connections >25 MW • no asset failure will interrupt > 850MW or cause system black; • unserved energy limits credible contingency 300MWh • any asset failure 3,000MWh 2. for network element out of service • unserved energy limit credible contingency 18,000MWh	Largely based on system performance and system security requirements defined in the NER, with some additional jurisdictional fault level and voltage limit standards contained in clauses 110.1 and 110.2 of the Victorian Electricity System Code (VESC). The transmission reliability standard applied to each connection point is a function of the sector specific Value of Customer Reliability (VCR) used for that point. This approach implies that the Melbourne CBD,

	NSW – TransGrid	QLD – Powerlink	SA – Electranet	TAS — Transend	VIC — VENCorp
					which uses the highest VCR ($62,215/MWh), has a higher level of network redundancy than most other parts of the Victorian transmission network.
Jurisdictional source of standard	Contained in a Network Management Plan which TransGrid is obliged to produce by legislation for acceptance by the Department of Water and Energy.	Transmission Authority (licence) issued to Powerlink by Qld Govt and S.34 of the Queensland *Electricity Act 1994*.	The Essential Services Commission of SA (ESCOSA) determines the reliability standards for SA through the SA Electricity Transmission Code which is published on the ESCOSA website.	Regulations issued by Tas Government. Supplied by Tasmanian Reliability and Network Planning Panel (RNPP). Brought in formally on 3 December 2007.	Victorian Electricity System Code (VESC).
Interaction with local DNSP standards	Via joint planning with each NSW/ACT DNSP. DNSPs expect their standards to be reflected into the transmission system.	Via joint planning with ENERGEX and Ergon, who are required to meet N-1 for their sub-transmission system and for bulk and major zone substations (i.e the distribution "backbone").	Via joint planning with ETSA Utilities. If required by the SA Electricity Transmission Code, contingency supply is provided where available via the distribution network.	Via Joint Planning with Aurora Energy under the NER requirements based on jurisdictional network security & planning criteria	• VIC Distribution System Code (DSC) sets out quality and reliability standards for DNSPs. • DNSPs align the planning process for connection assets to the transmission network with VENCorp's planning approach. • No interaction between NER transmission standards and those in DSC, apart from obligations on VENCorp to address fault levels and

	NSW – TransGrid	QLD – Powerlink	SA – Electranet	TAS — Transend	VIC — VENCorp
					voltage limits at sub-transmission level.
Interaction of standards between connecting TNSPs	Powerlink and TransGrid plan supply to Terranora/NSW Far North Coast and to Goondiwindi in conjunction with the relevant DNSP(s). Joint planning with VENCorp on interconnected assets and interconnector upgrade assessment.	Powerlink and TransGrid plan supply to Terranora/NSW Far North Coast and to Goondiwindi in conjunction with the relevant DNSP(s).	There are no connection points or transmission supplied customers in SA that are affected by directly adjacent TNSP reliability standards. However, as the Murraylink HVDC interconnection is utilised to provide N-1 supply to the Riverland, its continued ability to do so is affected by the available capacity of the adjacent transmission networks.	There are no connection points or transmission supplied customers in Tasmania that are affected by directly adjacent TNSP reliability standards. Tasmania is connected to the NEM by the only MNSP - Basslink.	VENCorp has conducted joint planning studies with TransGrid and ElectraNet when assessing interconnector upgrades. These studies relevant to the technical standards have typically been conducted using the same approach adopted by VENCorp when assessing intra-regional constraints.
Interaction of TNSPs with NEMMCO's system security and reliability standards	NEMMCO operates the power system assuming a credible contingency can occur at any time. • When the system is intact, this is equivalent to N-1. • If there are prior outages (planned or forced) or loss of multiple network elements is assessed as credible, NEMMCO's operation will be more onerous than N-1.				VENCorp's simulation of system operational actions (or security standards) are directly based on NEMMCO's system operation obligations, as defined in Ch. 4 of the NER, particularly clauses 4.2.2, 4.2.3, 4.2.4 and 4.2.6.

	NSW – TransGrid	QLD – Powerlink	SA – Electranet	TAS — Transend	VIC — VENCorp
Comparison with standards under the Rules	The jurisdictional standards specify the level of **redundancy for planning** (not explicit in the NER). The jurisdictional standards are consistent with, and rely on, the technical planning standards prescribed in the NER.		The jurisdictional standards specify the level of **redundancy for connection points** (not explicit in the NER). The jurisdictional standards are consistent with, and rely on, the technical planning standards prescribed in the NER.	The jurisdictional standards specify the level of **performance for connection points** (not explicit in the NER). The jurisdictional standards are consistent with technical planning standards prescribed in the NER.	Additional jurisdictional standards are complementary and additional to the NER standards. They add constraints on the planning process in areas that are more discretionary under the NER. VESC standards on fault levels are about co-ordinated planning with asset owners and DNSPs, while the voltage targets are not a limit but rather a desired operating level that would not constrain planning.

Sources: Correspondence from ETNOF, ESCOSA, VenCorp

B.3.1 Reviews of jurisdictional transmission standards

In recent years, there have been reviews of the jurisdictional transmission standards in both South Australia and Tasmania, and indirectly via the review of sub-transmission standards in Queensland as part of the Electricity Distribution and Service Delivery (Somerville) report. Sub-transmission standards have also been revised in New South Wales.

B.3.1.1 Tasmania

The Tasmanian review, completed in June 2006 by the Tasmanian Energy Regulator, aimed to align the transmission planning standards in Tasmania with the operational security standards specified in the National Electricity Rules and set minimum network performance standards against which proposals can be assessed under the reliability limb of the Regulatory Test.

[90] The new transmission standards seek to maintain the same level of performance that Tasmanians are accustomed to.

The Tasmanian Energy Regulator accepted the advice of the Tasmanian Reliability and Network Planning Panel (RNPP), including:

- Retaining a form of deterministic (N-1) transmission standard, rather than moving to a probabilistic form of standard like that used in Victoria;
- The transmission security and planning criteria are "performance based", meaning that they specify limits on either the size of customer load that may be interrupted, or the length of interruption, or both. The criteria do not prescribe the particular technical solutions the TNSP should use to meet the performance criteria. Instead, the TNSP is allowed discretion to determine the least cost means of meeting the transmission standard, in line with the reliability limb of the Regulatory Test.
- The transmission security and planning standards do not apply to energy intensive customers connected directly to the transmission grid (e.g. smelters, pulp mills). The standards for these large customers are set in power supply agreements or connection agreements.
- Additional capital expenditure, over and above that allowed for in the AER's current regulatory allowance, is required for the transmission network to meet the new minimum transmission standards. This capital expenditure is estimated to total $31–38 million over 5 years if transmission solutions, such as new transformers or lines, are used to bring the existing network up to the new standards.

The Tasmanian Government has informed that AEMC:

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[90] OTTER (Office of the Tasmanian Energy Regulator) 2006, *Transmission Network Security and Planning Criteria*, Final Report, Reliability and Network Planning Panel, OTTER, Hobart July.

"Tasmania has just instituted Tasmanian Transmission Network Performance Requirements through Regulations under the Electricity Supply Industry Act (1996), proclaimed on 3 December 2007 and would not want to see these interfered with without good reason.

The Tasmanian network performance requirements (also known as security and reliability planning criteria) were developed with regard to the long term interests of Tasmanian electricity consumers and took note of approaches in other States. The Tasmanian approach can be described as a deterministic approach based on an assessment of unserved energy at risk. Where the investments are large, there is an additional requirement for a cost benefits test to be done, to the satisfaction of the Tasmanian Minister for Energy

It is hard to see what national benefit might arise from changes to Tasmania's network performance requirements. The Tasmanian system is a small "cul de sac" at the end of a long DC cable. It is unusual in having a large number of small generators serving a few large industrial loads and in having a small and dispersed population."[91]

B.3.1.2 South Australia

A 2006 review of South Australian transmission standards by the Essential Services Commission of South Australia (ESCOSA) decided to retain the deterministic standard used in the SA Electricity Transmission Code (ETC).[92] ESCOSA's determination was informed by a 2004-05 review of transmission connection point reliability standards, carried out by the Electricity Supply Industry Planning Council (ESIPC) at the request of ESCOSA.[93]

ESCOSA's final decision sets out new transmission standards for the ETC, which will take effect on 1 July 2008.

Under the new standards, Clause 2.2.2 of the ETC specifies six categories of transmission reliability standard, with a defined category applying to each connection point.[94] The standard categories range from "N secure" to 'equivalent' "N-2 secure" for transmission line and transformer capacity, depending on the load and importance of load at risk at each connection point. The highest transmission

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[91] Department of Infrastructure, Energy and Resources (Tasmania), Submission on National Transmission Planner Review Issues Paper, received by AEMC 16 January 2007, p. 2, Available at http://www.aemc.gov.au/electricity.php?r=20070710.172341

[92] ESCOSA 2006, *Review of the Reliability Standards specified in Clause 2.2.2 of the Electricity Transmission Code*, Final Decision, Essential Services Commission of South Australia (ESCOSA), Adelaide, September.

[93] ESIPC 2005, *Transmission Code Review*, Electricity Supply Industry Planning Council (ESIPC), Adelaide, October.

[94] ESCOSA 2006, *Electricity Transmission Code ET/05*, 1 July 2008, ESCOSA, Adelaide. (URL http://www.escosa.sa.gov.au/webdata/resources/files/060906-R-ElecTransCodeET05.pdf)

standard (equivalent to N-2 secure) applies to the Adelaide CBD, reflecting an implicit high value of customer load in that area.

The new transmission standards also specify:

- Time limits for the 'best endeavours' restoration of secure supplies in the event of a contingency affecting a transformer or line;
- Grace periods allowing the TNSP up to 3 years to address breaches of the transmission standards;
- Standards for and limits on the use of non-network solutions, such as transmission network support provided by DNSPs, generation or voluntary load reduction;
- Timeframes for replacing or repairing transformers that have failed; and
- Obligations on the South Australian TNSP to hold an inventory of spare transformers.

B.3.1.3 Queensland

There has been an indirect review of Queensland's transmission standards, via the review of sub-transmission standards carried out as part of the Electricity Distribution and Service Delivery (EDSD) Review, chaired by Mr Darryl Somerville.[95]

In Queensland, the DNSPs own sub-transmission networks which interact with the TNSP's transmission network to deliver the total transmission capability.

The EDSD (Somerville) report on distribution networks in July 2004 followed a series of distribution network problems in the previous summer.

The Queensland government adopted the EDSD recommendations, which included a requirement for the DNSPs to plan their sub-transmission networks and distribution "backbone" to an N-1 standard. [96,97] This aligned with, and effectively affirmed, the N-1 standard which existed in the TNSP's licence.

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[95] State of Queensland (Office of Energy) 2004, *Electricity Distribution and Service Delivery for the 21st Century, Queensland, Summary Report of the Independent Panel* (Chairman: D. Somerville), Department of Natural Resources, Mines and Energy, Brisbane, July. (Available at http://www.dme.qld.gov.au/Energy/independent_report.cfm)

[96] Premier of Queensland (Hon Peter Beattie), "Electricity Fact Sheet Available for all Queenslanders", Media Release, 18 August 2004 (URL http://statements.cabinet.qld.gov.au/MMS/StatementDisplaySingle.aspx?id=36920)

[97] Minister of Energy, Queensland (Hon. John Mickel), "Energy Minister Establishes Review Implementation Team", Media Release, 15 September 2004, (URL http://statements.cabinet.qld.gov.au/MMS/StatementDisplaySingle.aspx?id=37277)

B.3.1.4 New South Wales

It is understood that in 2005 the NSW government subsequently adopted the same sub-transmission and distribution network standards as Queensland and made them part of the license conditions of NSW DNSPs from 1 August 2005.[98],[99]

TransGrid's *Network Management Plan 2007-2011* provides details on the transmission planning approach and standards used in NSW.[100]

B.4 International transmission standards

A brief comparison of transmission reliability standards in five wholesale electricity markets is presented in Table 3.2. The markets covered are:

- Ontario;
- Pennsylvania-Jersey-Maryland (PJM);
- Great Britain (England, Wales and Scotland);
- New Zealand; and
- Nordpool (Norway, Sweden, Denmark and Finland).

In all of these markets, a deterministic form of transmission standard is used. All networks are planned to an N-x secure standard, with two (Ontario and PJM) also utilising probabilistic criteria relating to loss of load.

The US Government's Federal Energy Regulatory Commission (FERC) recently published a new set of standards for power system operations that apply to continental North America (USA and Canada).[101] These standards were developed for FERC by the North American Electricity Reliability Corporation (NERC).[102] This action arose from the 14 August 2003 blackout in the northeast part of continental North America that affected over 50 million people and 61,800 megawatts of load. A

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[98] Minister of Energy (NSW) 2007, *Design, Reliability and Performance Licence Conditions imposed on Distribution Network Service Providers by the Minister for Energy*, Published August 2005 and amended on 1 December 2007 (URL http://www.ipart.nsw.gov.au/electricity/documents/DesignReliabilityandPerformanceLicenceConditionsforDNSPs-23November2007.PDF)

[99] TransGrid 2007a, "APR 2007 Outline" (Garrie Chubb, Manager Network Planning), NSW Annual Planning Report 2007 Public Forum (URL http://www.transgrid.com/trim/trim261655.pdf)

[100] TransGrid 2007b, *Network Management Plan 2007-2011*, TransGrid, Sydney (URL http://www.transgrid.com.au/trim/trim211409.pdf)

[101] FERC (Federal Energy Regulatory Commission) 2007, *Order No. 693 – Mandatory Reliability Standards for the Bulk-Power System* (Docket No. RM06-16-000; Order No. 693), Issued 16 March 2007, FERC, Washington DC (http://www.ferc.gov/industries/electric/indus-act/reliability/standards.asp)

[102] NERC (North American Electric Reliability Corporation) 2007a, *Reliability Standards for the Bulk Electric Systems of North America*, NERC, 23 October. (URL http://www.nerc.com/~filez/standards/Reliability_Standards.html) .

key objective of FERC has been to improve planning process between separately owned, interconnected, transmission networks by giving Regional Transmission Organisations (RTOs) greater responsibility for network planning and harmonising operational standards. FERC has also changed the role of the North American NERC and the regional reliability councils. In the past, regional reliability councils would set standards and report those standards and compliance with them to NERC. Under the new arrangements, which took effect on 13 July 2007, NERC has set mandatory, enforceable reliability standards.

NERC's new standards specify how the system should perform, not how it should be designed. Network planning criteria to meet the NERC standards is left to individual RTOs, transmission owners, and users of the bulk power system. The NERC standards specify minimum criteria for network security and reliability, with regional Electric Reliability Organisations (EROs) empowered to develop more stringent regional reliability standards.[103] The eight EROs across North America replace the electricity regional reliability councils, established after 1968. These EROs are currently reviewing existing regional reliability standards.[104]

Consequently, a number of the NERC standards appear to correspond to the technical standards specified in Schedules 5.1 to 5.4 of the NER, and the system performance and security standards specified in Chapter 4 of the Rules. Other NERC standards establish a national framework for establishing transmission reliability over the planning horizon.[105]

Further information on international approaches to transmission planning is contained in a report to the AEMC by consultancy firm, the Brattle Group.[106] This study provides a factual description of transmission planning arrangements in international markets with similar characteristics to Australia.

The Panel has commissioned a consultancy report from KEMA Consulting to provide further analysis of:

- the transmission reliability standards used in different international electricity markets; and
- the frameworks used in other markets to ensure consistency of transmission reliability standards across multiple political jurisdictions and/or multiple transmission network owners.

The selected markets are: PJM, Alberta, California, Great Britain, Germany, and Nordpool. KEMA's report will soon be published separately, in time for comments on it to be incorporated into submissions on this Draft Report.

103 http://www.nerc.com/~filez/regional_standards/

104 NERC 2007b, *Reliability Standards Development Plan: 2008–2010, Volume I, Work Plan and Schedule*, October 5, 2007 (URL https://standards.nerc.net/)

105 See in particular, NERC 2007a, "Transmission Planning" standards TPL-001-0 through TPL-006-0

106 Brattle Group 2007, *International Review of Transmission Planning Arrangements*, A report to the Australian Energy Market Commission, The Brattle Group, Bruxelles (URL http://www.aemc.gov.au/pdfs/reviews/National%20Transmission%20Planner/brattle.pdf)

Table 3.2: Transmission reliability standards in selected foreign electricity markets

Market	Form of transmission standard	Level of standard	Application to network planning and operations	Planning and operational responsibilities
Ontario	Deterministic N-1 standard set by NERC Probabilistic standard regarding loss of load, set by Northeast Power Coordinating Council (NPCC)	N-1	Transmission planned to NERC/NPCC and local area criteria, which include N-2 and multiple contingencies.	Independent Electricity System Operator (IESO) and TSO, Hydro One.
PJM	Deterministic N-1 standard set by NERC Probabilistic standard regarding loss of load, set by Mid Atlantic Area Council (MAAC).	N-1	Transmission planned to NERC/MAAC reliability criteria which include N-2 and multiple contingencies.	Office of the Interconnection (Independent System Operator) and TSOs in area covered by PJM market.
Great Britain	Deterministic N-1 standard	N-1	Transmission planned and operated to deterministic N-1 criterion.	National Grid Company (NGC) and TSOs for England & Wales, Southern Scotland, Northern Scotland.
New Zealand	Deterministic, N-x, with x varying with the size and criticality of load	N-0 for loads < 10MW on single radial line N-1 for loads between 10 and 300MW N-2 for loads between 10 and 300MW in the CBD N-2 for loads between 300 and 600MW N-2 for loads greater than 600MW		Transpower New Zealand
Nordpool	Deterministic	N-1	Transmission planned and operated to deterministic N-1 criterion	Nordel and TSOs: Stattnet (Norway), Fingrid (Finland), Eltra (Western Denmark), Elkraft System (Eastern Denmark), Svenska Kraftnat (Sweden).

B.5 Potential issues arising from divergent transmission standards

It has been suggested that there are issues that may arise from divergent jurisdictional transmission standards, including:

- Sub-optimal development and use of the national transmission grid arising from the application of the Regulatory Test to networks with differing standards;
- Poor balance between transmission and generation investments within and across NEM jurisdictions, and relatively low level of interconnection; and
- Technological bias in meeting jurisdictional transmission reliability criteria through network solutions rather than non-network solutions.

The Panel intends to investigate issues that have been observed in overseas electricity markets in which transmission planning standards vary across jurisdictions. This investigation is to be informed by KEMA Consulting's report.

B.6 Size and scope of problems

As discussed above, there appears to be considerable variation in the form and level of transmission planning standards across the NEM.

However, this lack of uniformity of jurisdictional transmission standards does not appear to have manifested itself in the form of noticeably different levels of delivered power system reliability across the NEM.

[107] Arguably, jurisdiction specific transmission standards, together with NEM-wide system performance and security standards, appear to have continued to deliver power system reliability in line with that experienced in the years before the start of the NEM in 1998. The differences in transmission standards do not appear to have led to materially different reliability outputs. Thus, on what basis should changes to the transmission reliability standards be pursued?

What is the relative importance of having the same transmission reliability standards for, say, the Adelaide CBD and the Brisbane CBD? How does that compare with the relative importance of having the same network standards for the TNSP/DNSP jointly responsible for delivering reliability to those respective CBDs?

B.7 Motivations of changing existing jurisdictional transmission standards

Since the creation of the NEM, there are at least three motivating reasons for changing the existing jurisdictional transmission standards.

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[107] See AER (Australian Energy Regulator) 2007, *State of the Energy Market 2007*, AER, Melbourne, pp.45–47 and pp.132–134 (URL http://www.aer.gov.au/content/index.phtml/itemId/713232)

First, the transmission network is an increasingly interconnected system. The number of interconnections across jurisdictions has increased significantly since the start of the market, and this has resulted in greater financial trading and physical power flows across jurisdictions. These increased physical flows, together with market related changes in power flows, have required system planners and operators to pay greater attention to physical interactions that affect system security and reliability. The construction or augmentation of an interconnector can dramatically alter the economics of alternative projects, such as transmission or generation, that deliver the same level of reliability. Given the significant sunk capital costs associated with power generation and transmission projects, and their long asset lives, there are potentially significant dynamic efficiency benefits in optimising the timing, scale and use of transmission and generation assets. Conversely, there are likely to be significant, on-going, economic costs from having a poorly balanced mixture of transmission and generation assets.

Second, there is a need to derive an optimal balance between transmission and generation investments over space and time using a combination of market incentives and regulatory incentives. Power system reliability and security is no longer solely determined by a system planner, that designs, builds, owns and operates all the generation and transmission assets within a jurisdiction, with little or no regard to what occurs in other jurisdictions. Instead, generation investments are driven by a range of market-related factors concerning financial risks and payoffs, and the co-ordination of generation expansion with transmission planning augmentation occurring primarily through information disclosure in Transmission Annual Planning Reports, the SOO ANTS, connection applications, and public consultations on major transmission upgrades.

Third, it is claimed by ERIG that prospective benefits arising from any new National Transmission Planning arrangements and Reliability Test will be significantly diminished if divergent jurisdictional transmission standards continue to be used instead of nationally consistent standards.

B.8 Submissions to Issues Paper

There is broad consensus on the range of problems created by the existing arrangements for setting transmission planning standards across the NEM and motivations for change. As discussed in detail in Chapter 3, submissions stated that the shortcomings of today’s approach to transmission planning standards and methods include:

- A lack of transparency in both the level of standards and the ways in which those standards are set. This has a detrimental impact on the accountability of parties who set the level of standards and TNSPs that must apply and demonstrate compliance with the standards;

- Regulatory complexity for investors in new generation or demand side management capacity when seeking to assess long term levels of network performance, congestion and access; and

- Concerns over potential perceptions of conflicts of interest and poor governance in cases where a TNSP is involved in setting the standards it subsequently is required to meet.

Different views on the size and scope of problems with today’s standards and the motivations for changing them are reflected in the various options put forward for a NCF, which are discussed in Chapters 4 and 5.

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C List of submissions

C.1 Issues Paper

Eight submissions were received in response to the Issues Paper:

Organisation	Abbreviation
Australian Energy Regulator	AER
Electricity Supply Industry Planning Council	ESIPC
Electricity Transmission Network Owners Forum	ETNOF
EnergyAustralia	EA
Loy Yang Marketing Management Company (LYMMCO), AGL Hydro, International Power, TRUenergy, Flinders Power	The Group
National Generators Forum	NGF
Powerlink Queensland	Powerlink
Victorian Energy Networks Corporation	VENCorp

All of the above submissions are available on the AEMC's website.[108]

In addition, the Tasmanian Government's Department of Infrastructure, Energy and Resources commented on the Transmission Reliability Standards Review Issues Paper in its submission on the National Transmission Planner Review's Issue Paper.[109]

108 See http://www.aemc.gov.au/electricity.php?r=20071221.150018

109 Department of Infrastructure, Energy and Resources (Tasmania), Submission on National Transmission Planner Review Issues Paper, received by AEMC 16 January 2007, Available at http://www.aemc.gov.au/electricity.php?r=20070710.172341